

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR8(A)  
 Calibrated by : P.F.Yeung  
 Date : 28/01/2016

Sampler

Model : TE-5170  
 Serial Number : S/N 3956

Calibration Office and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 24 Mar 2015  
 Slope (m) : 2.09532  
 Intercept (b) : -0.03812  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1018  
 Ta(K) : 289

| Resistance Plate | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1   18 holes     | 11.6                              | 3.467 | 1.673                       | 56            | 57.01            |
| 2   13 holes     | 9.6                               | 3.154 | 1.523                       | 50            | 50.90            |
| 3   10 holes     | 7.0                               | 2.693 | 1.304                       | 44            | 44.79            |
| 4   7 holes      | 4.6                               | 2.183 | 1.060                       | 36            | 36.65            |
| 5   5 holes      | 2.8                               | 1.703 | 0.831                       | 28            | 28.50            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 33.142 Intercept(b): 1.206 Correlation Coefficient(r): 0.9989

Checked by: Magnum Fan

Date: 04/02/2016

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR9  
 Calibrated by : P.F.Yeung  
 Date : 28/01/2016

Sampler

Model : TE-5170  
 Serial Number : S/N 3958

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 24 Mar 2015  
 Slope (m) : 2.09532  
 Intercept (b) : -0.03812  
 Correlation Coefficient(r) : 0.99994

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1018  
 Ta(K) : 289

| Resistance Plate | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1   18 holes     | 11.4                              | 3.437 | 1.659                       | 57            | 58.02            |
| 2   13 holes     | 9.2                               | 3.088 | 1.492                       | 51            | 51.92            |
| 3   10 holes     | 6.5                               | 2.595 | 1.257                       | 44            | 44.79            |
| 4   7 holes      | 4.4                               | 2.135 | 1.037                       | 36            | 36.65            |
| 5   5 holes      | 2.6                               | 1.641 | 0.802                       | 28            | 28.50            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 34.260 Intercept(b): 1.178 Correlation Coefficient(r): 0.9996

Checked by: Magnum Fan

Date: 04/02/2016

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR8(A)  
 Calibrated by : P.F. Yeung  
 Date : 30/03/2016

Sampler

Model : TE-5170  
 Serial Number : S/N 3956

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 14 Mar 2016  
 Slope (m) : 2.10326  
 Intercept (b) : -0.06696  
 Correlation Coefficient(r) : 0.99989

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1014  
 Ta(K) : 295

| Resistance Plate |          | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1                | 18 holes | 11.2                              | 3.365 | 1.632                       | 55            | 55.31            |
| 2                | 13 holes | 9.2                               | 3.050 | 1.482                       | 51            | 51.28            |
| 3                | 10 holes | 7.0                               | 2.660 | 1.297                       | 45            | 45.25            |
| 4                | 7 holes  | 4.6                               | 2.157 | 1.057                       | 38            | 38.21            |
| 5                | 5 holes  | 2.8                               | 1.683 | 0.832                       | 30            | 30.17            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 31.363 Intercept(b): 4.528 Correlation Coefficient(r): 0.9991

Checked by: Magnum Fan

Date: 04/04/2016

High-Volume TSP Sampler  
5-Point Calibration Record

Location : ASR9  
 Calibrated by : P.F. Yeung  
 Date : 30/03/2016

Sampler

Model : TE-5170  
 Serial Number : S/N 3958

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
 Service Date : 14 Mar 2016  
 Slope (m) : 2.10326  
 Intercept (b) : -0.06696  
 Correlation Coefficient(r) : 0.99989

Standard Condition

Pstd (hpa) : 1013  
 Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1014  
 Ta(K) : 295

| Resistance Plate |          | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1                | 18 holes | 11.6                              | 3.425 | 1.660                       | 58            | 58.32            |
| 2                | 13 holes | 9.0                               | 3.017 | 1.466                       | 51            | 51.28            |
| 3                | 10 holes | 6.8                               | 2.622 | 1.279                       | 44            | 44.25            |
| 4                | 7 holes  | 4.6                               | 2.157 | 1.057                       | 36            | 36.20            |
| 5                | 5 holes  | 2.8                               | 1.683 | 0.832                       | 26            | 26.14            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 38.511 Intercept(b): -5.238 Correlation Coefficient(r): 0.9992

Checked by: Magnum Fan

Date: 04/04/2016



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

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2015 Rootmeter S/N 0438320 Ta (K) - 292  
 Operator Tisch Orifice I.D. - 2454 Pa (mm) - 756.92

| 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             | 1.4460          | 3.2                | 2.00                  |
| 2              | NA                | NA               | 1.00             | 1.0300          | 6.4                | 4.00                  |
| 3              | NA                | NA               | 1.00             | 0.9180          | 7.9                | 5.00                  |
| 4              | NA                | NA               | 1.00             | 0.8780          | 8.7                | 5.50                  |
| 5              | NA                | NA               | 1.00             | 0.7240          | 12.6               | 8.00                  |

DATA TABULATION

| Vstd                                | (x axis) Qstd | (y axis) | Va                        | (x axis) Qa | (y axis) |
|-------------------------------------|---------------|----------|---------------------------|-------------|----------|
| 1.0121                              | 0.6999        | 1.4258   | 0.9958                    | 0.6886      | 0.8784   |
| 1.0078                              | 0.9785        | 2.0163   | 0.9916                    | 0.9627      | 1.2422   |
| 1.0057                              | 1.0955        | 2.2543   | 0.9895                    | 1.0779      | 1.3888   |
| 1.0047                              | 1.1443        | 2.3644   | 0.9885                    | 1.1258      | 1.4566   |
| 0.9994                              | 1.3805        | 2.8515   | 0.9833                    | 1.3582      | 1.7568   |
| Qstd slope (m) = 2.09532            |               |          | Qa slope (m) = 1.31205    |             |          |
| intercept (b) = -0.03812            |               |          | intercept (b) = -0.02349  |             |          |
| coefficient (r) = 0.99994           |               |          | coefficient (r) = 0.99994 |             |          |
| y axis = SQRT[H2O(Pa/760) (298/Ta)] |               |          | y axis = SQRT[H2O(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 }



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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 14, 2016 Rootsmeter S/N 0438320 Ta (K) - 295  
 Operator Tisch Orifice I.D. - 2454 Pa (mm) - 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              | NA                | NA               | 1.00             | 1.4020          | 3.2                | 2.00                  |
| 2              | NA                | NA               | 1.00             | 1.0060          | 6.4                | 4.00                  |
| 3              | NA                | NA               | 1.00             | 0.9010          | 7.9                | 5.00                  |
| 4              | NA                | NA               | 1.00             | 0.8590          | 8.8                | 5.50                  |
| 5              | NA                | NA               | 1.00             | 0.7090          | 12.8               | 8.00                  |

DATA TABULATION

| Vstd                                | (x axis) Qstd | (y axis) | Va                        | (x axis) Qa | (y axis) |
|-------------------------------------|---------------|----------|---------------------------|-------------|----------|
| 0.9866                              | 0.7037        | 1.4078   | 0.9957                    | 0.7102      | 0.8896   |
| 0.9824                              | 0.9765        | 1.9909   | 0.9914                    | 0.9855      | 1.2581   |
| 0.9803                              | 1.0880        | 2.2259   | 0.9893                    | 1.0980      | 1.4066   |
| 0.9792                              | 1.1399        | 2.3345   | 0.9882                    | 1.1504      | 1.4753   |
| 0.9738                              | 1.3735        | 2.8155   | 0.9828                    | 1.3862      | 1.7792   |
| Qstd slope (m) = 2.10326            |               |          | Qa slope (m) = 1.31703    |             |          |
| intercept (b) = -0.06696            |               |          | intercept (b) = -0.04232  |             |          |
| coefficient (r) = 0.99989           |               |          | coefficient (r) = 0.99989 |             |          |
| y axis = SQRT[H2O(Pa/760) (298/Ta)] |               |          | y axis = SQRT[H2O(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}





輝創工程有限公司

Sun Creation Engineering Limited

Calibration and Testing Laboratory

# Certificate of Calibration

## 校正證書

Certificate No. : C153241

證書編號

ITEM TESTED / 送檢項目 ( Job No. / 序引編號 : IC15-1330 )

Date of Receipt / 收件日期 : 10 June 2015

Description / 儀器名稱 : Sound Level Calibrator

Manufacturer / 製造商 : Rion

Model No. / 型號 : NC-73

Serial No. / 編號 : 10997142

Supplied By / 委託者 : Envirotech Services Co.

Shop 6, G/F., Casio Mansion, 209 Shaukeiwan Road,  
Hong Kong

### TEST CONDITIONS / 測試條件

Temperature / 溫度 :  $(23 \pm 2)^{\circ}\text{C}$

Relative Humidity / 相對濕度 :  $(55 \pm 20)\%$

Line Voltage / 電壓 : ---

### TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 14 June 2015

### TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.

All results are within manufacturer's specification.

The results are detailed in the subsequent page(s).


The test equipment used for calibration are traceable to National Standards via :

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory
- Agilent Technologies / Keysight Technologies
- Rohde & Schwarz Laboratory, Germany
- Fluke Everett Service Center, USA

Tested By

測試

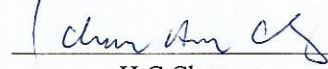
:

  
K C Lee  
Project Engineer

Certified By

核證

:

  
H C Chan  
Engineer

Date of Issue

簽發日期

:

16 June 2015

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Sun Creation Engineering Limited - Calibration & Testing Laboratory

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# Certificate of Calibration

## 校正證書

Certificate No. : C153241

證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
- The results presented are the mean of 3 measurements at each calibration point.
- Test equipment :

| Equipment ID | Description                       | Certificate No. |
|--------------|-----------------------------------|-----------------|
| CL130        | Universal Counter                 | C143868         |
| CL281        | Multifunction Acoustic Calibrator | DC130171        |
| TST150A      | Measuring Amplifier               | C141558         |

- Test procedure : MA100N.

- Results :

### 5.1 Sound Level Accuracy

| UUT<br>Nominal Value | Measured Value<br>(dB) | Mfr's Spec.<br>(dB) | Uncertainty of Measured Value<br>(dB) |
|----------------------|------------------------|---------------------|---------------------------------------|
| 94 dB, 1 kHz         | 93.7                   | ± 0.5               | ± 0.2                                 |

### 5.2 Frequency Accuracy

| UUT Nominal Value<br>(kHz) | Measured Value<br>(kHz) | Mfr's<br>Spec. | Uncertainty of Measured Value<br>(Hz) |
|----------------------------|-------------------------|----------------|---------------------------------------|
| 1                          | 0.986                   | 1 kHz ± 2 %    | ± 1                                   |

Remark : The uncertainties are for a confidence probability of not less than 95 %.

### Note :

The values given in this 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 environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.





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Sun Creation Engineering Limited

Calibration and Testing Laboratory

# Certificate of Calibration

## 校正證書

Certificate No. : C153940

證書編號

ITEM TESTED / 送檢項目 ( Job No. / 序引編號 : IC15-1557 )

Date of Receipt / 收件日期 : 13 July 2015

Description / 儀器名稱 : Sound Level Meter

Manufacturer / 製造商 : Rion

Model No. / 型號 : NL-31

Serial No. / 編號 : 00603867

Supplied By / 委託者 : Envirotech Services Co.

Shop 6, G/F., Casio Mansion, 209 Shaukeiwan Road,  
Hong Kong

### TEST CONDITIONS / 測試條件

Temperature / 溫度 :  $(23 \pm 2)^{\circ}\text{C}$

Relative Humidity / 相對濕度 :  $(55 \pm 20)\%$

Line Voltage / 電壓 : ---

### TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 22 July 2015

### TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.

All results are within manufacturer's specification.

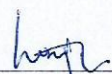
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :

- The Government of The Hong Kong Special Administrative Region Standard & Calibration Laboratory
- Agilent Technologies / Keysight Technologies
- Rohde & Schwarz Laboratory, Germany
- Fluke Everett Service Center, USA

Tested By

測試

  
H T Wong  
Assistant Technical Officer

Certified By

核證

  
K Q Lee  
Project Engineer

Date of Issue

簽發日期

22 July 2015

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Website/網址: www.suncreation.com



# Certificate of Calibration

## 校正證書

Certificate No. : C153940

證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours, and switched on to warm up for over 10 minutes before the commencement of the test.
- Self-calibration was performed before the test.
- The results presented are the mean of 3 measurements at each calibration point.
- Test equipment :

| Equipment ID | Description                         | Certificate No. |
|--------------|-------------------------------------|-----------------|
| CL280        | 40 MHz Arbitrary Waveform Generator | C150014         |
| CL281        | Multifunction Acoustic Calibrator   | DC130171        |

- Test procedure : MA101N.

- Results :

### 6.1 Sound Pressure Level

#### 6.1.1 Reference Sound Pressure Level

| UUT Setting |                |                     |                | Applied Value |             | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|-------------|------------------|------------------------------|
| Range (dB)  | Mode           | Frequency Weighting | Time Weighting | Level (dB)    | Freq. (kHz) |                  |                              |
| 30 - 120    | L <sub>A</sub> | A                   | Fast           | 94.00         | 1           | 93.5             | ± 1.1                        |

#### 6.1.2 Linearity

| UUT Setting |                |                     |                | Applied Value |             | UUT Reading (dB) |
|-------------|----------------|---------------------|----------------|---------------|-------------|------------------|
| Range (dB)  | Mode           | Frequency Weighting | Time Weighting | Level (dB)    | Freq. (kHz) |                  |
| 30 - 120    | L <sub>A</sub> | A                   | Fast           | 94.00         | 1           | 93.5 (Ref.)      |
|             |                |                     |                | 104.00        |             | 103.5            |
|             |                |                     |                | 114.00        |             | 113.5            |

IEC 61672 Class 1 Spec. : ± 0.6 dB per 10 dB step and ± 1.1 dB for overall different.

### 6.2 Time Weighting

| UUT Setting |                |                     |                | Applied Value |             | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|-------------|------------------|------------------------------|
| Range (dB)  | Mode           | Frequency Weighting | Time Weighting | Level (dB)    | Freq. (kHz) |                  |                              |
| 30 - 120    | L <sub>A</sub> | A                   | Fast           | 94.00         | 1           | 93.5             | Ref.                         |
|             |                |                     | Slow           |               |             | 93.5             | ± 0.3                        |

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# Certificate of Calibration

## 校正證書

Certificate No. : C153940

證書編號

### 6.3 Frequency Weighting

#### 6.3.1 A-Weighting

| UUT Setting |                |                     |                | Applied Value |          | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|----------|------------------|------------------------------|
| Range (dB)  | Mode           | Frequency Weighting | Time Weighting | Level (dB)    | Freq.    |                  |                              |
| 30 - 120    | L <sub>A</sub> | A                   | Fast           | 94.00         | 63 Hz    | 67.1             | -26.2 ± 1.5                  |
|             |                |                     |                |               | 125 Hz   | 77.2             | -16.1 ± 1.5                  |
|             |                |                     |                |               | 250 Hz   | 84.7             | -8.6 ± 1.4                   |
|             |                |                     |                |               | 500 Hz   | 90.2             | -3.2 ± 1.4                   |
|             |                |                     |                |               | 1 kHz    | 93.5             | Ref.                         |
|             |                |                     |                |               | 2 kHz    | 94.7             | +1.2 ± 1.6                   |
|             |                |                     |                |               | 4 kHz    | 94.6             | +1.0 ± 1.6                   |
|             |                |                     |                |               | 8 kHz    | 92.4             | -1.1 (+2.1 ; -3.1)           |
|             |                |                     |                |               | 12.5 kHz | 89.5             | -4.3 (+3.0 ; -6.0)           |

#### 6.3.2 C-Weighting

| UUT Setting |                |                     |                | Applied Value |          | UUT Reading (dB) | IEC 61672 Class 1 Spec. (dB) |
|-------------|----------------|---------------------|----------------|---------------|----------|------------------|------------------------------|
| Range (dB)  | Mode           | Frequency Weighting | Time Weighting | Level (dB)    | Freq.    |                  |                              |
| 30 - 120    | L <sub>C</sub> | C                   | Fast           | 94.00         | 63 Hz    | 92.5             | -0.8 ± 1.5                   |
|             |                |                     |                |               | 125 Hz   | 93.3             | -0.2 ± 1.5                   |
|             |                |                     |                |               | 250 Hz   | 93.4             | 0.0 ± 1.4                    |
|             |                |                     |                |               | 500 Hz   | 93.5             | 0.0 ± 1.4                    |
|             |                |                     |                |               | 1 kHz    | 93.5             | Ref.                         |
|             |                |                     |                |               | 2 kHz    | 93.4             | -0.2 ± 1.6                   |
|             |                |                     |                |               | 4 kHz    | 92.8             | -0.8 ± 1.6                   |
|             |                |                     |                |               | 8 kHz    | 90.5             | -3.0 (+2.1 ; -3.1)           |
|             |                |                     |                |               | 12.5 kHz | 87.7             | -6.2 (+3.0 ; -6.0)           |

Remarks : - UUT Microphone Model No. : UC-53A & S/N : 316987

- Mfr's Spec. : IEC 61672 Class 1

- Uncertainties of Applied Value : 94 dB : 63 Hz - 125 Hz : ± 0.35 dB  
 250 Hz - 500 Hz : ± 0.30 dB  
 1 kHz : ± 0.20 dB  
 2 kHz - 4 kHz : ± 0.35 dB  
 8 kHz : ± 0.45 dB  
 12.5 kHz : ± 0.70 dB  
 104 dB : 1 kHz : ± 0.10 dB (Ref. 94 dB)  
 114 dB : 1 kHz : ± 0.10 dB (Ref. 94 dB)

- The uncertainties are for a confidence probability of not less than 95 %.

#### Note :


The values given in this 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 environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited 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 the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

本證書所載校正用之測試器材均可溯源至國際標準。局部複印本證書需先獲本實驗室書面批准。



## Performance Check of Turbidity Meter

Equipment Ref. No. : ET/0505/014                      Manufacturer : HACH  
Model No. : 2100Q                                      Serial No. : 13110C029448  
Date of Calibration : 26/02/2015 <sup>2016</sup>                       Due Date : 25/05/2016

| Theoretical Value of Turbidity Standard (NTU) | Measured Value (NTU) | Difference % * |
|---|----------------------|----------------|
| 20  | 20.4                 | 2.00           |
| 100   | 98.5                 | -1.50          |
| 800   | 780                  | -2.50          |

(\*) Difference = (Measured Value – Theoretical Value) / Theoretical Value x 100

Acceptance Criteria

Difference : -5 % to 5 %

The turbidity meter complies \* / ~~does not comply~~ \* with the specified requirements and is deemed acceptable \* / ~~unacceptable~~ \* for use. Measurements are traceable to national standards.

Prepared by : 

Checked by : 





## Internal Calibration & Performance Check of pH Meter

Equipment Ref. No. : ET/EW007/004      Manufacturer : Thermo Scientific  
 Model No. : Orion 2 Star      Serial No. : B29792  
 Date of Calibration : 05/02/2016      Calibration Due Da: 04/03/2016

### Liquid Junction Error

003/5.2/001/30 (20°C)

Primary Standard Solution Used : Phosphate      Io. of Primary Solution: 003/5.2/001/31 (31°C)  
 Temperature of Solution : 25.0 / 20.0       $\Delta\text{pH}_{1/2} = +0.01 / +0.01$   
 pH value of diluted buffer : 6.91 / 6.91       $\text{pH (S)} = 6.86 / 6.88$   
 $\Delta\text{pH} = \text{pH(S)} - \text{pH of diluted buffer} = 0.05 / 0.03$  (Observed Deviation)  
 Liquid Junction Error ( $\Delta\text{pH}_j$ ) =  $\Delta\text{pH} - \Delta\text{pH}_{1/2} = 0.04 / 0.02$

### Shift on Stirring

pH of buffer solution (with stirring),  $\text{pH}_s = 6.90 / 6.91$   
 Shift on stirring,  $\Delta\text{pH}_s = \text{pH}_s - \text{pH(S)} - \Delta\text{pH}_j = 0.00 / 0.01$

### Noise

Noise,  $\Delta\text{pH}_n =$  difference between max and min reading : 0.01 / 0.01

### Verification of ATC

Ref. No. of reference thermometer used: ET/0521/019  
 Temperature record from the reference thermometer ( $T_R$ ): 25 / 20.0 °C  
 Temperature record from the ATC ( $T_{ATC}$ ): 24.8 / 19.8 °C  
 Temperature Difference,  $|T_R - T_{ATC}|$  : 0.2 / 0.2 °C  
 Correction : +0.2 / +0.2 °C

### Acceptance Criteria

| Performance Characteristic                      | Acceptable Range         |
|---|--------------------------|
| Liquid Junction Error $\Delta\text{pH}_j$       | $\leq 0.05$              |
| Shift on Stirring $\Delta\text{pH}_s$           | $\leq 0.02$              |
| Noise $\Delta\text{pH}_n$                       | $\leq 0.02$              |
| Verification of ATC      Temperature Difference | $\leq 0.5^\circ\text{C}$ |

The pH meter complies \* / does not comply\* with the specified requirements and is deemed acceptable \* / unacceptable\* for use. Measurements are traceable to national standards.

\* Delete as appropriate

Calibrated by: \_\_\_\_\_

Checked by : \_\_\_\_\_



## Internal Calibration & Performance Check of pH Meter

Equipment Ref. No. : ET/EW007/004      Manufacturer : Thermo Scientific  
 Model No. : Orion 2 Star      Serial No. : B29792  
 Date of Calibration : 05/03/2016      Calibration Due Date : 04/04/2016

### Liquid Junction Error

003/5.2/002/01 (20°C)

Primary Standard Solution Used : Phosphate      Io. of Primary Solution: 003/5.2/002/02 (25°C)  
 Temperature of Solution : 25.0 / 20.0       $\Delta\text{pH}_{1/2} = \underline{+0.01 / +0.01}$   
 pH value of diluted buffer : 6.90 / 6.92       $\text{pH (S)} = \underline{6.86 / 6.88}$   
 $\Delta\text{pH} = \text{pH(S)} - \text{pH of diluted buffer} = \underline{0.04 / 0.04}$       (Observed Deviation)  
 Liquid Junction Error ( $\Delta\text{pH}_j$ ) =  $\Delta\text{pH} - \Delta\text{pH}_{1/2} = \underline{0.03 / 0.03}$

### Shift on Stirring

pH of buffer solution (with stirring),  $\text{pH}_s = \underline{6.90 / 6.91}$   
 Shift on stirring,  $\Delta\text{pH}_s = \text{pH}_s - \text{pH(S)} - \Delta\text{pH}_j = \underline{0.01 / 0.00}$

### Noise

Noise,  $\Delta\text{pH}_n = \text{difference between max and min reading} : \underline{0.01 / 0.01}$

### Verification of ATC

Ref. No. of reference thermometer used: ET/0521/019  
 Temperature record from the reference thermometer ( $T_R$ ): 25 / 20.0 °C  
 Temperature record from the ATC ( $T_{ATC}$ ): 24.8 / 19.8 °C  
 Temperature Difference,  $|T_R - T_{ATC}|$  : 0.2 / 0.2 °C  
 Correction : +0.2 / +0.2 °C

### Acceptance Criteria

| Performance Characteristic                      | Acceptable Range         |
|---|--------------------------|
| Liquid Junction Error $\Delta\text{pH}_j$       | $\leq 0.05$              |
| Shift on Stirring $\Delta\text{pH}_s$           | $\leq 0.02$              |
| Noise $\Delta\text{pH}_n$                       | $\leq 0.02$              |
| Verification of ATC      Temperature Difference | $\leq 0.5^\circ\text{C}$ |

The pH meter complies \* / ~~does not comply~~ \* with the specified requirements and is deemed acceptable \* / ~~unacceptable~~ \* for use. Measurements are traceable to national standards.

\* Delete as appropriate

Calibrated by: \_\_\_\_\_

Checked by : \_\_\_\_\_



### Internal Calibration Report of Dissolved Oxygen Meter

|   |  |
|---|--|
| Equipment Ref. No. : <u>ET/EW/008/004</u>                 | Manufacturer : <u>YSI</u>                                  |
| Model No. : <u>Pro 2030</u>                               | Serial No. : <u>10F 101978</u>                             |
| Date of Calibration : <u>30/01/2016</u><br><i>25/1/16</i> | Calibration Due Date : <u>29/04/2016</u><br><i>25/1/16</i> |

**Temperature Verification**

Ref. No. of Reference Thermometer : ET/0521/017

Ref. No. of Water Bath : ---

|                               |          | Temperature (°C) |            |      |
|-------------------------------|----------|------------------|------------|------|
| Reference Thermometer reading | Measured | 19.9             | Corrected  | 19.8 |
| DO Meter reading              | Measured | 20.0             | Difference | -0.2 |

**Standardization of sodium thiosulphate (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>) solution**

|   |                    |   |                    |
|---|--------------------|---|--------------------|
| Reagent No. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> titrant                | CPE/012/4.5/001/13 | Reagent No. of 0.025N K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> | CPE/012/4.4/002/06 |
|   |                    | Trial 1   | Trial 2            |
| Initial Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)                  |                    | 0.00  | 10.20              |
| Final Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)                    |                    | 10.20   | 20.50              |
| Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> used (ml)                     |                    | 10.20   | 10.30              |
| Normality of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> solution (N)             |                    | 0.02451   | 0.02427            |
| Average Normality (N) of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> solution (N) |                    | 0.02439   |                    |
| Acceptance criteria, Deviation  |                    | Less than ± 0.001N  |                    |

Calculation: Normality of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, N = 0.25 / ml Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> used

**Linearity Checking**

**Determination of dissolved oxygen content by Winkler Titration \***

| Purging Time (min)  | 2                   |       | 5                   |      | 10                  |       |
|---|---------------------|-------|---------------------|------|---------------------|-------|
|   | 1                   | 2     | 1                   | 2    | 1                   | 2     |
| Trial   |                     |       |                     |      |                     |       |
| Initial Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)  | 0.00                | 11.10 | 22.00               | 0.00 | 6.90                | 10.40 |
| Final Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)    | 11.10               | 22.00 | 28.80               | 6.90 | 10.40               | 14.20 |
| Vol. (V) of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> used (ml) | 11.10               | 10.90 | 6.80                | 6.90 | 3.50                | 3.80  |
| Dissolved Oxygen (DO), mg/L   | 7.27                | 7.14  | 4.45                | 4.52 | 2.29                | 2.49  |
| Acceptance criteria, Deviation                                      | Less than + 0.3mg/L |       | Less than + 0.3mg/L |      | Less than + 0.3mg/L |       |

Calculation: DO (mg/L) = V x N x 8000/298

| Purging time, min             | DO meter reading, mg/L |      |         | Winkler Titration result *, mg/L |      |         | Difference (%) of DO Content |
|-------------------------------|------------------------|------|---------|----------------------------------|------|---------|------------------------------|
|                               | 1                      | 2    | Average | 1                                | 2    | Average |                              |
| 2                             | 7.48                   | 7.55 | 7.52    | 7.27                             | 7.14 | 7.21    | 4.21                         |
| 5                             | 4.44                   | 4.31 | 4.38    | 4.45                             | 4.52 | 4.49    | 2.48                         |
| 10                            | 2.25                   | 2.31 | 2.28    | 2.29                             | 2.49 | 2.39    | 4.71                         |
| Linear regression coefficient |                        |      |         | 0.9984                           |      |         |                              |



## Internal Calibration Report of Dissolved Oxygen Meter

### Zero Point Checking

|                        |      |
|------------------------|------|
| DO meter reading, mg/L | 0.00 |
|------------------------|------|

### Salinity Checking

|                             |                    |                             |                    |
|-----------------------------|--------------------|-----------------------------|--------------------|
| Reagent No. of NaCl (10ppt) | CPE/012/4.7/003/14 | Reagent No. of NaCl (30ppt) | CPE/012/4.8/003/14 |
|-----------------------------|--------------------|-----------------------------|--------------------|

### Determination of dissolved oxygen content by Winkler Titration \*\*

| Salinity (ppt)  | 10                  |       | 30                  |       |
|---|---------------------|-------|---------------------|-------|
|   | 1                   | 2     | 1                   | 2     |
| Initial Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)  | 0.00                | 11.40 | 22.80               | 32.50 |
| Final Vol. of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (ml)    | 11.40               | 22.80 | 32.50               | 42.10 |
| Vol. (V) of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> used (ml) | 11.40               | 11.40 | 9.70                | 9.60  |
| Dissolved Oxygen (DO), mg/L   | 7.46                | 7.46  | 6.35                | 6.29  |
| Acceptance criteria, Deviation                                      | Less than + 0.3mg/L |       | Less than + 0.3mg/L |       |

Calculation:  $DO (mg/L) = V \times N \times 8000/298$

| Salinity (ppt) | DO meter reading, mg/L |      |         | Winkler Titration result**, mg/L |      |         | Difference (%) of DO Content |
|----------------|------------------------|------|---------|----------------------------------|------|---------|------------------------------|
|                | 1                      | 2    | Average | 1                                | 2    | Average |                              |
| 10             | 7.28                   | 7.25 | 7.27    | 7.46                             | 7.46 | 7.46    | 2.58                         |
| 30             | 6.58                   | 6.54 | 6.56    | 6.35                             | 6.29 | 6.32    | 3.73                         |

### Acceptance Criteria

- (1) Difference between temperature readings from temperature sensor of DO probe and reference thermometer : < 0.5 °C
- (2) Linear regression coefficient : >0.99
- (3) Zero checking: 0.0mg/L
- (4) Difference (%) of DO content from the meter reading and by winkler titration : within ± 5%

The equipment complies # / ~~does not comply~~ # with the specified requirements and is deemed acceptable # / unacceptable # for use.

# Delete as appropriate

Calibrated by : \_\_\_\_\_

Approved by : \_\_\_\_\_





## Performance Check of Salinity Meter

Equipment Ref. No. : ET/EW/008/004      Manufacturer : YSI  
Model No. : Pro 2030      Serial No. : 10F 101978  
Date of Calibration : 30/01/2016      Due Date : 29/04/2016  
*26/1/16*      *25/4/16*

Ref. No. of Salinity Standard used (30ppt)

S/001/5

| Salinity Standard (ppt) | Measured Salinity (ppt) | Difference * (%) |
|-------------------------|-------------------------|------------------|
| 30.0                    | 29.7                    | -3.00            |

(\* ) Difference (%) = (Measured Salinity – Salinity Standard value) / Salinity Standard value x 100

Acceptance Criteria

Difference : -10 % to 10 %

The salinity meter complies \* / ~~does not comply~~ \* with the specified requirements and is deemed acceptable \* / ~~unacceptable~~ \* for use. Measurements are traceable to national standards.

Checked by : *[Signature]*

Approved by : *[Signature]*

**ENVIROTECH SERVICES CO.**

**Calibration Report of Wind Meter**

Date of Calibration : 28 January 2016

Brand of Test Meter: Global Water

Model: Speed Sensor: WE550 (S/N:E1337005099 )

Direction Sensor: WE570 (S/N:153500564)

Location : Pak Mong, Siu Ho Wan

Procedures :

- 1. Wind Still Test: The wind speed sensor was hold by hand until it keep still
- 2. Wind Speed Test: The wind meter was on-site calibrated against the Anemometer
- 3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

Results:

Wind Still Test

| Wind Speed (m/s) |
|------------------|
| 0.00             |

Wind Speed Test

| Global Water (m/s) | Anemometer (m/s) |
|--------------------|------------------|
| 0.27               | 0.2              |
| 1.18               | 1.3              |
| 1.46               | 1.6              |

Wind Direction Test

| Global Water (o) | Marine Compass (o) |
|------------------|--------------------|
| 270.88           | 270                |
| 0.07             | 0                  |
| 90.81            | 90                 |
| 181.39           | 180                |

Calibrated by:

Fai  
Yeung Ping Fai  
(Technical Officer)

Checked by :

Fat  
Ho Kam Fat  
(Senior Technical Officer)



# Certificate of Calibration 校正證書

Certificate No. : C160461  
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-0158)      Date of Receipt / 收件日期 : 19 January 2016

Description / 儀器名稱 : Anemometer  
Manufacturer / 製造商 : Lutron  
Model No. / 型號 : AM-4201  
Serial No. / 編號 : AF.27513  
Supplied By / 委託者 : Envirotech Services Co.  
Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,  
New Territories, Hong Kong

## TEST CONDITIONS / 測試條件

Temperature / 溫度 :  $(23 \pm 2)^{\circ}\text{C}$       Relative Humidity / 相對濕度 :  $(55 \pm 20)\%$   
Line Voltage / 電壓 : ---

## TEST SPECIFICATIONS / 測試規範


Calibration check

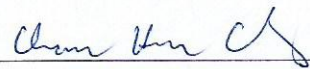
DATE OF TEST / 測試日期 : 27 January 2016

## TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.  
The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :  
- Testo Industrial Services GmbH, Germany

Tested By :   
測試 : M T Leung  
Assistant Technical Officer

Certified By :   
核證 : H C Chan  
Engineer

Date of Issue : 27 January 2016  
簽發日期

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.  
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# Certificate of Calibration

## 校正證書

Certificate No. : C160461

證書編號

1. The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
2. The results presented are the mean of 10 measurements at each calibration point.
3. Test equipment :

| <u>Equipment ID</u> | <u>Description</u>                  | <u>Certificate No.</u> |
|---------------------|-------------------------------------|------------------------|
| CL386               | Multi-function Measuring Instrument | S12109                 |

4. Test procedure : MA130N.

5. Results :

### Air Velocity

| Applied Value (m/s) | UUT Reading (m/s) | Measured Correction |                            |                 |
|---------------------|-------------------|---------------------|----------------------------|-----------------|
|                     |                   | Value (m/s)         | Measurement Uncertainty    |                 |
|                     |                   |                     | Expanded Uncertainty (m/s) | Coverage Factor |
| 2.0                 | 1.8               | +0.2                | 0.2                        | 2.0             |
| 4.1                 | 3.9               | +0.2                | 0.3                        | 2.0             |
| 6.0                 | 5.9               | +0.1                | 0.3                        | 2.0             |
| 8.0                 | 8.0               | 0.0                 | 0.3                        | 2.0             |
| 10.0                | 10.2              | -0.2                | 0.4                        | 2.0             |

Remarks : - The Measured Corrections are defined as :  
Value = Applied Value - UUT Reading

- The expanded uncertainties are for a level of confidence of 95 %.

### Note :

The values given in this 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 environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.

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