

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR8(A)
Calibrated by : P.F. Yeung
Date : 28/01/2017

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) : 1020
Ta(K) : 291

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.4	3.429	1.662	56	56.87
2	13 holes	9.5	3.130	1.520	52	52.80
3	10 holes	6.8	2.648	1.291	44	44.68
4	7 holes	4.8	2.225	1.090	38	38.59
5	5 holes	2.7	1.669	0.825	28	28.43

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): 33.913 Intercept(b): 0.950 Correlation Coefficient(r): 0.9990

Checked by: Magnum Fan

Date: 04/02/2017

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR9
Calibrated by : P.F.Yeung
Date : 28/01/2017

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) : 1020
Ta(K) : 291

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.8	3.488	1.690	55	55.85
2	13 holes	9.2	3.080	1.496	48	48.74
3	10 holes	6.6	2.609	1.272	42	42.65
4	7 holes	4.4	2.130	1.045	35	35.54
5	5 holes	2.7	1.669	0.825	28	28.43

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): 31.156 Intercept(b): 2.809 Correlation Coefficient(r): 0.9992

Checked by: Magnum Fan

Date: 04/02/2017

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR8(A)
Calibrated by : P.F.Yeung
Date : 28/03/2017

Sampler

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

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
Service Date : 20 Mar 2017
Slope (m) : 2.08464
Intercept (b) : -0.03684
Correlation Coefficient(r) : 0.99994

Standard Condition

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

Calibration Condition

Pa (hpa) : 1015
Ta(K) : 293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.9	3.482	1.688	54	54.51
2	13 holes	9.6	3.128	1.519	48	48.46
3	10 holes	7.0	2.671	1.302	42	42.40
4	7 holes	4.5	2.141	1.050	34	34.32
5	5 holes	2.5	1.596	0.791	26	26.25

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): 31.202 Intercept(b): 1.567 Correlation Coefficient(r): 0.9994

Checked by: Magnum Fan

Date: 01/04/2017

High-Volume TSP Sampler
5-Point Calibration Record

Location : ASR9
Calibrated by : P.F.Yeung
Date : 28/03/2017

Sampler

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

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454
Service Date : 20 Mar 2017
Slope (m) : 2.08464
Intercept (b) : -0.03684
Correlation Coefficient(r) : 0.99994

Standard Condition

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

Calibration Condition

Pa (hpa) : 1015
Ta(K) : 293

Resistance Plate		dH [green liquid] (inch water)	Z	X=Qstd (cubic meter/min)	IC (chart)	Y (corrected)
1	18 holes	11.6	3.438	1.667	58	58.55
2	13 holes	9.2	3.062	1.488	51	51.48
3	10 holes	6.8	2.632	1.283	44	44.42
4	7 holes	4.4	2.118	1.039	36	36.34
5	5 holes	2.6	1.628	0.806	27	27.26

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): 35.784 Intercept(b): -1.348 Correlation Coefficient(r): 0.9995

Checked by: Magnum Fan

Date: 01/04/2017

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 = $\text{SQRT}[\text{H}_2\text{O}(\text{Pa}/760)(298/\text{Ta})]$			y axis = $\text{SQRT}[\text{H}_2\text{O}(\text{Ta}/\text{Pa})]$		

CALCULATIONS

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

$$\text{Qstd} = \text{Vstd}/\text{Time}$$

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

$$\text{Qa} = \text{Va}/\text{Time}$$

For subsequent flow rate calculations:

$$\text{Qstd} = 1/\text{m}\{[\text{SQRT}(\text{H}_2\text{O}(\text{Pa}/760)(298/\text{Ta}))] - b\}$$

$$\text{Qa} = 1/\text{m}\{[\text{SQRT} \text{H}_2\text{O}(\text{Ta}/\text{Pa})] - b\}$$



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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 20, 2017 Rootsmeter S/N 0438320 Ta (K) - 293
 Operator Tisch Orifice I.D. - 2454 Pa (mm) - 759.46

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER	ORFICE
					DIFF Hg (mm)	DIFF H2O (in.)
1	NA	NA	1.00	1.4390	3.2	2.00
2	NA	NA	1.00	1.0240	6.4	4.00
3	NA	NA	1.00	0.9170	7.9	5.00
4	NA	NA	1.00	0.8730	8.8	5.50
5	NA	NA	1.00	0.7200	12.8	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0120	0.7033	1.4257		0.9958	0.6920	0.8784
1.0078	0.9842	2.0163		0.9916	0.9683	1.2423
1.0057	1.0967	2.2543		0.9895	1.0791	1.3889
1.0045	1.1507	2.3643		0.9884	1.1322	1.4567
0.9992	1.3878	2.8514		0.9831	1.3654	1.7568
Qstd slope (m) = 2.08464				Qa slope (m) = 1.30537		
intercept (b) = -0.03684				intercept (b) = -0.02270		
coefficient (r) = 0.99994				coefficient (r) = 0.99994		
y axis = SQRT[H2O(Pa/760) (298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

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

$$Qstd = Vstd/Time$$

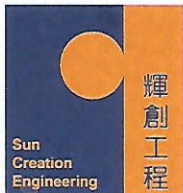
$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg})/Pa]$$

$$Qa = Va/Time$$

For subsequent flow rate calculations:

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

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



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. : C163248

證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-1307)

Date of Receipt / 收件日期 : 10 June 2016

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.

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 : 15 June 2016

TEST RESULTS / 測試結果

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

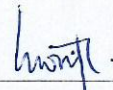
The results do not exceed manufacturer's specification.

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

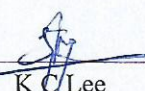
The test equipment used for calibration are traceable to National Standards via :

- 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
Technical Officer

Certified By
核證


K C Lee
Project Engineer

Date of Issue
簽發日期

17 June 2016

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。

Sun Creation Engineering Limited - Calibration & Testing Laboratory

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Page 1 of 2

Certificate of Calibration

校正證書

Certificate No. : C163248

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	C153519
CL281	Multifunction Acoustic Calibrator	PA160023
TST150A	Measuring Amplifier	C161175

- Test procedure : MA100N.

- Results :

5.1 Sound Level Accuracy

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

5.2 Frequency Accuracy

UUT Nominal Value (kHz)	Measured Value (kHz)	Mfr's Spec.	Uncertainty of Measured Value (Hz)
1	0.985	1 kHz $\pm 2\%$	± 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.

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. : C163758
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-1465)

Date of Receipt / 收件日期 : 29 June 2016

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.
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 : $(23 \pm 2)^{\circ}\text{C}$
Line Voltage / 電壓 : ---

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

TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 11 July 2016

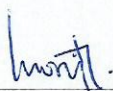
TEST RESULTS / 測試結果

The results apply to the particular unit-under-test only.
The results do not exceed 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
Technical Officer

Certified By :
核證


K C Lee
Project Engineer

Date of Issue : 12 July 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. : C163758
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	C160077
CL281	Multifunction Acoustic Calibrator	PA160023

- Test procedure : MA101N.

- Results :

6.1 Sound Pressure Level

6.1.1 Reference Sound Pressure Level

UUT Setting				Applied Value		UUT Reading	IEC 61672 Class 1 Spec.
Range (dB)	Mode	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)	(dB)	(dB)
30 - 120	L _A	A	Fast	94.00	1	93.4	± 1.1

6.1.2 Linearity

UUT Setting				Applied Value		UUT Reading
Range (dB)	Mode	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)	(dB)
30 - 120	L _A	A	Fast	94.00	1	93.4 (Ref.)
				104.00		103.4
				114.00		113.4

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	IEC 61672 Class 1 Spec.
Range (dB)	Mode	Frequency Weighting	Time Weighting	Level (dB)	Freq. (kHz)	(dB)	(dB)
30 - 120	L _A	A	Fast	94.00	1	93.4	Ref.
			Slow			93.4	± 0.3

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Certificate of Calibration

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Certificate No. : C163758
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 _A	A	Fast	94.00	63 Hz	67.1	-26.2 ± 1.5
					125 Hz	77.1	-16.1 ± 1.5
					250 Hz	84.7	-8.6 ± 1.4
					500 Hz	90.1	-3.2 ± 1.4
					1 kHz	93.4	Ref.
					2 kHz	94.7	+1.2 ± 1.6
					4 kHz	94.5	+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 _C	C	Fast	94.00	63 Hz	92.5	-0.8 ± 1.5
					125 Hz	93.2	-0.2 ± 1.5
					250 Hz	93.4	0.0 ± 1.4
					500 Hz	93.4	0.0 ± 1.4
					1 kHz	93.4	Ref.
					2 kHz	93.3	-0.2 ± 1.6
					4 kHz	92.7	-0.8 ± 1.6
					8 kHz	90.5	-3.0 (+2.1 ; -3.1)
					12.5 kHz	87.6	-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.

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Performance Check of Turbidity Meter

Equipment Ref. No. : ET/0505/012 Manufacturer : HACH

Model No. : 2100Q Serial No. : 12060 C 018447

Date of Calibration : 24/12/2016 Due Date : 23/03/2017

Ref. No. of Turbidity Standard used (4000NTU)

005/6.1/001/9

Theoretical Value of Turbidity Standard (NTU)	Measured Value (NTU)	Difference % *
20	20.2	1.0
100	98.5	-1.5
800	780	-2.5

(*) 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 :



Performance Check of Turbidity Meter

Equipment Ref. No. : ET/0505/014 Manufacturer : HACH

Model No. : 2100Q Serial No. : 13110C029448

Date of Calibration : 25/02/2017 Due Date : 24/05/2017

Theoretical Value of Turbidity Standard (NTU)	Measured Value (NTU)	Difference % *
20	20.4	2.0
100	98.2	-1.8
800	775	-3.1

(*) 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 : B. Leung

Checked by : AL



Internal Calibration & Performance Check of pH Meter

Equipment Ref. No. : ET/EW007/005 Manufacturer : HANNA
Model No. : HI 8314 Serial No. : 08246095
Date of Calibration : 27/02/2017 Calibration Due Date : 26/03/2017

Liquid Junction Error

003/5.2/002/09 (20°C)

Primary Standard Solution Used : Phosphate Ref No. of Primary Solution: 003/5.2/002/08 (25°C)
Temperature of Solution : 25.0 / 20.0 $\Delta\text{pH}_{1/2} =$ 0.080 / 0.080
pH value of diluted buffer : 6.98 / 6.99 $\text{pH (S)} =$ 6.865 / 6.881
 $\Delta\text{pH} = \text{pH(S)} - \text{pH of diluted buffer} =$ 0.115 / 0.109 (Observed Deviation)
Liquid Junction Error (ΔpH_j) = $\Delta\text{pH} - \Delta\text{pH}_{1/2} =$ 0.04 / 0.03

Shift on Stirring

pH of buffer solution (with stirring), $\text{pH}_s =$ 6.91 / 6.92
Shift on stirring, $\Delta\text{pH}_s = \text{pH}_s - \text{pH(S)} - \Delta\text{pH}_j =$ 0.01 / 0.01

Noise

Noise, ΔpH_n = difference between max and min reading : 0.01 / 0.01

Verification of ATC

Ref. No. of reference thermometer used: ET/0521/018 / ET/0521/019
Temperature record from the reference thermometer (T_R): 25.0 / 20.0 °C
Temperature record from the ATC (T_{ATC}): 24.8 / 19.9 °C
Temperature Difference, $|T_R - T_{\text{ATC}}|$ 0.2 / 0.1 °C
Correction +0.2 / +0.1 °C

Acceptance Criteria

Performance Characteristic		Acceptable Range
Liquid Junction Error	ΔpH_j	≤ 0.05
Shift on Stirring	ΔpH_s	≤ 0.02
Noise	ΔpH_n	≤ 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:

Bianco

Checked by :

LA



Internal Calibration & Performance Check of pH Meter

Equipment Ref. No. : ET/EW/007/005 Manufacturer : HANNA
Model No. : HI 8314 Serial No. : 08246095
Date of Calibration : 27/03/2017 Calibration Due Date : 26/04/2017

Liquid Junction Error

003/5.2/002/09 (20°C)

Primary Standard Solution Used : Phosphate Ref No. of Primary Solution: 003/5.2/002/10 (25°C)
Temperature of Solution : 25.0 / 20.0 $\Delta pH_{1/2} =$ 0.080 / 0.080
pH value of diluted buffer : 6.97 / 6.98 $pH(S) =$ 6.865 / 6.881
 $\Delta pH = pH(S) - pH \text{ of diluted buffer} =$ 0.105 / 0.099 (Observed Deviation)
Liquid Junction Error (ΔpH_j) = $\Delta pH - \Delta pH_{1/2} =$ 0.02 / 0.02

Shift on Stirring

pH of buffer solution (with stirring), $pH_s =$ 6.90 / 6.92
Shift on stirring, $\Delta pH_s = pH_s - pH(S) - \Delta pH_j =$ 0.01 / 0.02

Noise

Noise, $\Delta pH_n =$ difference between max and min reading : 0.01 / 0.01

Verification of ATC

Ref. No. of reference thermometer used: ET/0521/018 / ET/0521/019
Temperature record from the reference thermometer (T_R): 25.0 / 20.0 °C
Temperature record from the ATC (T_{ATC}): 24.8 / 19.9 °C
Temperature Difference, $|T_R - T_{ATC}|$ 0.2 / 0.1 °C
Correction +0.2 / +0.1 °C

Acceptance Criteria

Performance Characteristic		Acceptable Range
Liquid Junction Error	ΔpH_j	≤ 0.05
Shift on Stirring	ΔpH_s	≤ 0.02
Noise	ΔpH_n	≤ 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. : ET/EW/008/005
Model No. : Pro 2030
Date of Calibration : 19/01/2017

Manufacturer : YSI
Serial No. : 12A 100353
Calibration Due Date : 18/04/2017

Temperature Verification

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

Ref. No. of Water Bath : ---

Temperature (°C)				
Reference Thermometer reading	Measured	20.3	Corrected	19.8
DO Meter reading	Measured	19.9	Difference	-0.1

Standardization of sodium thiosulphate ($\text{Na}_2\text{S}_2\text{O}_3$) solution

Reagent No. of $\text{Na}_2\text{S}_2\text{O}_3$ titrant	CPE/012/4.5/001/15	Reagent No. of 0.025N $\text{K}_2\text{Cr}_2\text{O}_7$	CPE/012/4.4/002/16
		Trial 1	Trial 2
Initial Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)		0.00	10.35
Final Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)		10.35	20.70
Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ used (ml)		10.35	10.35
Normality of $\text{Na}_2\text{S}_2\text{O}_3$ solution (N)		0.02415	0.02415
Average Normality (N) of $\text{Na}_2\text{S}_2\text{O}_3$ solution (N)		0.02415	
Acceptance criteria, Deviation		Less than $\pm 0.001\text{N}$	

Calculation: Normality of $\text{Na}_2\text{S}_2\text{O}_3$, $N = 0.25 / \text{ml } \text{Na}_2\text{S}_2\text{O}_3 \text{ used}$

Linearity Checking

Determination of dissolved oxygen content by Winkler Titration *

Purging Time (min)	2		5		10	
Trial	1	2	1	2	1	2
Initial Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	0.00	11.40	23.00	0.00	6.10	9.90
Final Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	11.40	23.00	29.60	6.10	9.90	13.80
Vol. (V) of $\text{Na}_2\text{S}_2\text{O}_3$ used (ml)	11.40	11.60	6.60	6.10	3.80	3.90
Dissolved Oxygen (DO), mg/L	7.39	7.52	4.28	3.95	2.46	2.53
Acceptance criteria, Deviation	Less than + 0.3mg/L		Less than + 0.3mg/L		Less than + 0.3mg/L	

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

Purging time, min	DO meter reading, mg/L			Winkler Titration result *, mg/L			Difference (%) of DO Content
	1	2	Average	1	2	Average	
2	7.35	7.42	7.39	7.39	7.52	7.46	0.94
5	4.24	4.13	4.19	4.28	3.95	4.12	1.68
10	2.51	2.58	2.55	2.46	2.53	2.50	1.98
Linear regression coefficient				0.9998			



Internal Calibration Report of Dissolved Oxygen Meter

Zero Point Checking

DO meter reading, mg/L	0.00
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Salinity Checking

Reagent No. of NaCl (10ppt)	CPE/012/4.7/003/33	Reagent No. of NaCl (30ppt)	CPE/012/4.8/003/33
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Determination of dissolved oxygen content by Winkler Titration **

Salinity (ppt)	10		30	
Trial	1	2	1	2
Initial Vol. of Na ₂ S ₂ O ₃ (ml)	0.00	10.90	21.80	31.20
Final Vol. of Na ₂ S ₂ O ₃ (ml)	10.90	21.80	31.20	40.60
Vol. (V) of Na ₂ S ₂ O ₃ used (ml)	10.90	10.90	9.40	9.40
Dissolved Oxygen (DO), mg/L	7.07	7.07	6.09	6.09
Acceptance criteria, Deviation	Less than + 0.3mg/L		Less than + 0.3mg/L	

Calculation: DO (mg/L) = V x N x 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	7.21	7.18	7.2	7.07	7.07	7.07	1.82
30	6.13	6.18	6.16	6.09	6.09	6.09	1.14

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

: Biano

Approved by:

[Signature]



Internal Calibration Report of Dissolved Oxygen Meter

Equipment Ref. No. : ET/EW/008/007
Model No. : Pro 2030
Date of Calibration : 18/02/2017

Manufacturer : YSI
Serial No. : 12H101061
Calibration Due Date : 17/05/2017

Temperature Verification

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

Ref. No. of Water Bath : ---

	Temperature (°C)			
Reference Thermometer reading	Measured	20.4	Corrected	19.9
DO Meter reading	Measured	20.1	Difference	-0.2

Standardization of sodium thiosulphate ($\text{Na}_2\text{S}_2\text{O}_3$) solution

Reagent No. of $\text{Na}_2\text{S}_2\text{O}_3$ titrant	CPE/012/4.5/001/15	Reagent No. of 0.025N $\text{K}_2\text{Cr}_2\text{O}_7$	CPE/012/4.4/002/17
	Trial 1		Trial 2
Initial Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	0.00		10.30
Final Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	10.30		20.65
Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ used (ml)	10.30		10.35
Normality of $\text{Na}_2\text{S}_2\text{O}_3$ solution (N)	0.02427		0.02415
Average Normality (N) of $\text{Na}_2\text{S}_2\text{O}_3$ solution (N)	0.02421		
Acceptance criteria, Deviation	Less than $\pm 0.001\text{N}$		

Calculation: Normality of $\text{Na}_2\text{S}_2\text{O}_3$, $N = 0.25 / \text{ml } \text{Na}_2\text{S}_2\text{O}_3 \text{ used}$

Linearity Checking

Determination of dissolved oxygen content by Winkler Titration *

Purging Time (min)	2		5		10	
Trial	1	2	1	2	1	2
Initial Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	0.00	11.40	22.60	0.00	6.70	11.10
Final Vol. of $\text{Na}_2\text{S}_2\text{O}_3$ (ml)	11.40	22.60	29.40	6.70	11.10	15.40
Vol. (V) of $\text{Na}_2\text{S}_2\text{O}_3$ used (ml)	11.40	11.20	6.80	6.70	4.40	4.30
Dissolved Oxygen (DO), mg/L	7.41	7.28	4.42	4.35	2.86	2.79
Acceptance criteria, Deviation	Less than + 0.3mg/L		Less than + 0.3mg/L		Less than + 0.3mg/L	

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

Purging time, min	DO meter reading, mg/L			Winkler Titration result *, mg/L			Difference (%) of DO Content
	1	2	Average	1	2	Average	
2	7.54	7.49	7.52	7.41	7.28	7.35	2.29
5	4.28	2.89	3.59	4.42	4.35	4.39	20.05
10	2.95	2.89	2.92	2.86	2.79	2.83	3.13
Linear regression coefficient				0.9965			



Internal Calibration Report of Dissolved Oxygen Meter

Zero Point Checking

DO meter reading, mg/L	0.00
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Salinity Checking

Reagent No. of NaCl (10ppt)	CPE/012/4.7/003/34	Reagent No. of NaCl (30ppt)	CPE/012/4.8/003/34
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Determination of dissolved oxygen content by Winkler Titration **

Salinity (ppt)	10		30	
Trial	1	2	1	2
Initial Vol. of Na ₂ S ₂ O ₃ (ml)	0.00	10.80	21.70	31.00
Final Vol. of Na ₂ S ₂ O ₃ (ml)	10.80	21.70	31.00	40.20
Vol. (V) of Na ₂ S ₂ O ₃ used (ml)	10.80	10.90	9.30	9.20
Dissolved Oxygen (DO), mg/L	7.02	7.08	6.04	5.98
Acceptance criteria, Deviation	Less than + 0.3mg/L		Less than + 0.3mg/L	

Calculation: DO (mg/L) = V x N x 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	7.12	7.08	7.1	7.02	7.08	7.05	0.71
30	6.02	6.03	6.03	6.04	5.98	6.01	0.33

Acceptance Criteria

- (1) Differenc 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

: Brian

Approved by :

ALC



Performance Check of Salinity Meter

Equipment Ref. No. : ET/EW/008/005 Manufacturer : YSI

Model No. : Pro 2030 Serial No. : 12A 100353

Date of Calibration : 19/01/2017 Due Date : 18/04/2017

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

S/001/9

Salinity Standard (ppt)	Measured Salinity (ppt)	Difference * (%)
30.0	30.3	1.00

(*) 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 : Bianco

Approved by : [Signature]



Performance Check of Salinity Meter

Equipment Ref. No. : ET/EW/008/007 Manufacturer : YSI
Model No. : Pro 2030 Serial No. : 12H 101061
Date of Calibration : 18/02/2017 Due Date : 17/05/2017

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

S/001/9

Salinity Standard Value (ppt)	Measured Salinity (ppt)	Difference * (%)
30.0	29.6	-1.33

(*) 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 : Brian

Approved by : 12

Certificate of Calibration

校正證書

Certificate No. : C165934
證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC16-2438) Date of Receipt / 收件日期 : 26 October 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 : $(23 \pm 2)^{\circ}\text{C}$
Line Voltage / 電壓 : ---

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

TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 27 October 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


T L Shek
Assistant Engineer

Certified By
核證


H C Chan
Engineer

Date of Issue : 28 October 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.

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所書面批准。

Certificate of Calibration

校正證書

Certificate No. : C165934

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 :

Equipment ID
CL386

Description
Multi-function Measuring Instrument

Certificate No.
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
4.0	3.8	+0.2	0.2	2.0
6.0	5.8	+0.2	0.3	2.0
8.1	8.0	+0.1	0.3	2.0
10.0	10.0	0.0	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 :

Only the original copy or the laboratory's certified true copy is valid.

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。

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輝創工程有限公司 – 校正及檢測實驗室

c/o 香港新界屯門興安里一號青山灣機樓四樓

Tel/電話: 2927 2606

Fax/傳真: 2744 8986

E-mail/電郵: callab@suncreation.com

Website/網址: www.suncreation.com

ENVIROTECH SERVICES CO.

Calibration Report of Wind Meter

Date of Calibration : 1 November 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 Wate (m/s)	Anemomete (m/s)
1.18	1.3
0.99	1.1
0.67	0.7

Wind Direction Test

Global Wate (o)	Marine Compass (o)
270.46	270
0.07	0
90.25	90
181.13	180

Calibrated by:

Fai
Yeung Ping Fai
(Technical Officer)

Checked by :

Fat
Ho Kam Fat
(Senior Technical Officer)