

Appendix D. Calibration Certificates



SUB-CONTRACTING REPORT

CONTACT	: VANIA CHU	WORK ORDER	: HK2117719
CLIENT	: MOTT MACDONALD HONG KONG LIMITED		
ADDRESS	: 3/F INTERNATIONAL TRADE TOWER, 348 KWUN TONG ROAD, KWUN TONG, KOWLOON, HONG KONG	SUB-BATCH	: 1
		DATE RECEIVED	: 3-MAY-2021
		DATE OF ISSUE	: 18-MAY-2021
PROJECT	: CALIBRATION/PERFORMANCE CHECK OF DUST METER(S/N: 597337)	NO. OF SAMPLES	: 1
		CLIENT ORDER	: ---

General Comments

- Sample(s) was/ were submitted by client. Sample(s) arrived laboratory in ambient condition. The result(s) related only to the item(s) tested.
- Sample information (Project name, Sample ID, Sampling date/time, etc.) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

Managing Director

This is the Final Report and supersedes any preliminary report with this batch number.

All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd
Part of the **ALS Laboratory Group**

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WORK ORDER : HK2117719
SUB-BATCH : 1
CLIENT : MOTT MACDONALD HONG KONG LIMITED
PROJECT : CALIBRATION/PERFORMANCE CHECK OF DUST METER(S/N: 597337)



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK2117719-001	S/N: 597337	Equipments	03-May-2021	S/N: 597337

Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust monitor
 Manufacturer: Sibata LD-3B
 Serial No. 597337
 Equipment Ref: Nil
 Job Order HK2117719

Standard Equipment:

Standard Equipment: Higher Volume Sampler
 Location & Location ID: AUES office (calibration room)
 Equipment Ref: HVS 018
 Last Calibration Date: 26 April 2021

Equipment Verification Results:

Testing Date: 10&11 May 2021

Hour	Time	Mean Temp °C	Mean Pressure (hPa)	Concentration in µg/m ³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count/Minute (Total Count/min)
2hr01min	09:17 ~ 11:18	28.4	1008.8	26	1410	11.6
2hr	11:20 ~ 13:20	28.4	1008.8	21	1513	12.6
2hr01min	13:22 ~ 15:23	28.4	1008.8	27	1481	12.3
2hr01min	09:24 ~ 11:25	29.2	1008.4	28	1615	13.4
2hr01min	11:26 ~ 13:27	29.2	1008.4	30	1772	14.6

Linear Regression of Y or X

Slope (K-factor): 2.0308 (µg/m³)/CPM

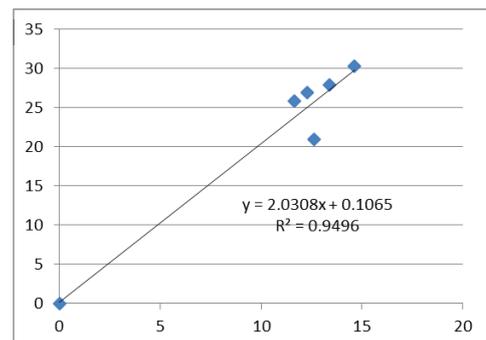
Correlation Coefficient 0.9745

Date of Issue 17 May 2021

Remarks:

- Strong** Correlation ($R > 0.8$)
- Factor 2.0308 (µg/m³)/CPM should be applied for TSP monitoring

*If $R < 0.5$, repair or re-verification is required for the equipment



Operator : Fai So Signature :  Date : 17 May 2021

QC Reviewer : Ben Tam Signature :  Date : 17 May 2021

TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location :	Gold King Industrial Building, Kwai Chung	Date of Calibration: 26-Apr-21
Location ID :	Calibration Room	Next Calibration Date: 26-Jul-21

CONDITIONS

Sea Level Pressure (hPa)	1013.7	Corrected Pressure (mm Hg)	760.275
Temperature (°C)	23.4	Temperature (K)	296

CALIBRATION ORIFICE

Make->	TISCH	Qstd Slope ->	2.10574
Model->	5025A	Qstd Intercept ->	-0.00985
Calibration Date->	19-Jan-21	Expiry Date->	18-Jan-22

CALIBRATION

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC corrected	LINEAR REGRESSION
18	6.9	6.9	13.8	1.774	56	56.16	Slope = 39.9922 Intercept = -13.7742 Corr. coeff. = 0.9961
13	5.5	5.5	11.0	1.584	50	50.14	
10	4.2	4.2	8.4	1.385	42	42.12	
8	2.7	2.7	5.4	1.111	32	32.09	
5	1.9	1.9	3.8	0.933	22	22.06	

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 responses

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pstd = actual pressure during calibration (mm Hg)

For subsequent calculation of sampler flow:

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

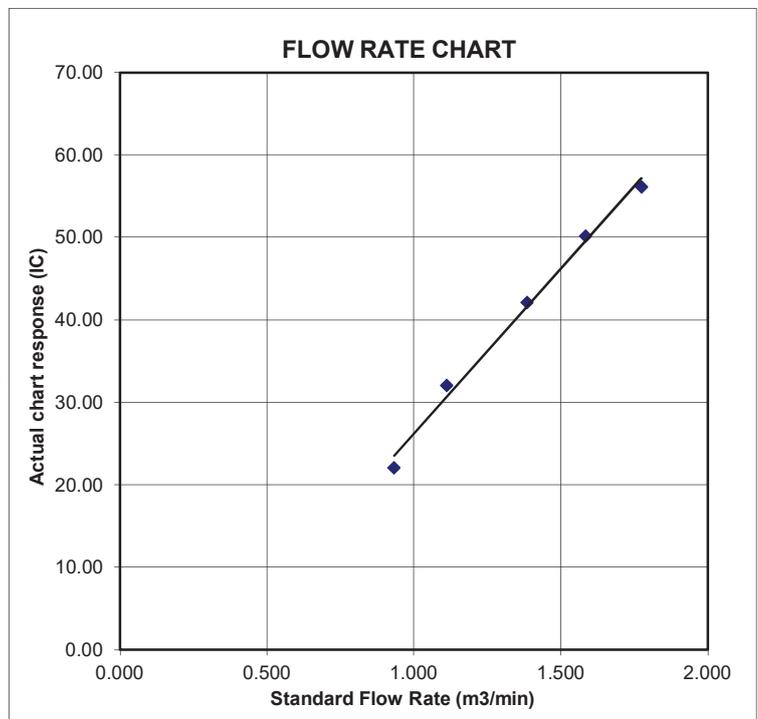
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure



Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 19, 2021	Rootsmeter S/N: 438320	Ta: 294	°K
Operator: Jim Tisch		Pa: 755.1	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 1941		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4830	3.2	2.00
2	3	4	1	1.0420	6.4	4.00
3	5	6	1	0.9290	8.0	5.00
4	7	8	1	0.8840	8.8	5.50
5	9	10	1	0.7340	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
1.0029	0.6762	1.4192	0.9958	0.6715	0.8824
0.9986	0.9583	2.0071	0.9915	0.9516	1.2479
0.9965	1.0726	2.2440	0.9894	1.0650	1.3952
0.9954	1.1260	2.3535	0.9883	1.1180	1.4633
0.9899	1.3487	2.8385	0.9829	1.3391	1.7648
QSTD	m=	2.10574	QA	m=	1.31858
	b=	-0.00985		b=	-0.00612
	r=	0.99992		r=	0.99992

Calculations			
Vstd=	$\Delta Vol / ((Pa - \Delta P) / Pstd) (Tstd / Ta)$	Va=	$\Delta Vol / ((Pa - \Delta P) / Pa)$
Qstd=	$Vstd / \Delta Time$	Qa=	$Va / \Delta Time$
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$	Qa=	$1/m \left(\left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} \right) - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



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CALIBRATION REPORT

Test Report No. : BA050103
Date of Issue : 24 May 2021
Page No. : 1 of 2

PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.
Flat 2207, Yu Fun House,
Yu Chui Court, Shatin,
New Territories, Hong Kong
Attn: Mr. Thomas Wong

PART B – SAMPLE INFORMATION

Description of Samples : Titrette® bottle-top burette, 50mL
Brand Name : BRAND
Model Number : 1224B90
Serial Number : 10N64701
Date of Received : May 24, 2021
Date of Calibration : May 24, 2021
Date of Next Calibration^(a) : Aug 23, 2021

PART C – CALIBRATION REQUESTED

<u>Parameter</u> ^(b)	<u>Reference Method</u>
Accuracy Test	In-house Method (Gravimetric Method)

~ CONTINUED ON NEXT PAGE ~

Remark(s): -

^(a) The "Date of Next Calibration" is recommended according to best practice principals as practiced by QPT or quoted from relevant international standards.

^(b) All chemical and microbiological tests were performed at unit 10-5/F and unit 10-14/F respectively of the company address stated above.


LEE Chun-ning Desmond
Senior Chemist



CALIBRATION REPORT

Test Report No. : BA050103
Date of Issue : 24 May 2021
Page No. : 2 of 2

PART D – RESULT^{(e),(d)}

Water temperature: 24.7°C

Environmental conditions of the calibration:

Relative humidity: 54%

Z-Factor: 1.0030

Nominal volume: 3.0ml

Trial	Range: (1-4)	Range: (16-19)	Range: (23-26)	Range: (34-37)	Range: (42-45)
1	2.9954	2.9972	2.9875	3.0062	2.9965
2	2.9976	2.9952	2.9867	3.0042	2.9957
3	2.9951	2.9952	2.9876	3.0042	2.9966
4	2.9948	2.9926	2.9753	3.0016	2.9842
5	2.9908	2.9944	2.9786	3.0034	2.9875
6	2.9842	2.9867	2.9825	2.9957	2.9914
7	2.9875	2.9895	2.9825	2.9985	2.9914
8	2.9877	2.9865	2.9850	2.9955	2.9940
9	2.9854	2.9877	2.9877	2.9967	2.9967
10	2.9851	2.9866	2.9867	2.9956	2.9957
Average (g)	2.9904	2.9912	2.9840	3.0001	2.9930
Standard deviation	0.0050	0.0042	0.0043	0.0000	0.0000
Converted volume (mL)	2.9993	3.0001	2.9930	2.9878	2.9954
Error (%)	-0.0223	0.0044	-0.2346	-0.4054	-0.1530
RSD (%)	0.1669	0.1400	0.1426	0.1336	0.0657

Acceptance Criteria^(e)

Accuracy (%Error)	< ±1%	< ±1%	< ±1%	< ±1%	< ±1%
Precision (%RSD)	< 1%	< 1%	< 1%	< 1%	< 1%

~ END OF REPORT~

Remark(s): -

- ^(c) The results relate only to the tested sample as received
^(d) The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.
^(e) The "acceptance criteria" is applicable for similar equipment used by QPT or quoted from relevant international standards.



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REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : BA050076
Date of Issue : 21 May 2021
Page No. : 1 of 2

PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.
Flat 2207, Yu Fun House,
Yu Chui Court, Shatin
New Territories, Hong Kong
Attn: Mr. Thomas WONG

PART B – DESCRIPTION

Name of Equipment : YSI ProDSS (Multi-Parameters)
Manufacturer : YSI (a xylem brand)
Serial Number : 16H104233
Date of Received : May 20, 2021
Date of Calibration : May 20, 2021
Date of Next Calibration^(a) : Aug 19, 2021

PART C – REFERENCE METHODS/ DOCUMENTS FOR THE CALIBRATION

Parameter	Reference Method
pH at 25°C	APHA 21e 4500-H ⁺ B
Dissolved Oxygen	APHA 21e 4500-O G
Conductivity at 25°C	APHA 21e 2510 B
Salinity	APHA 21e 2520 B
Turbidity	APHA 21e 2130 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^(b,c)

(1) pH at 25°C

Target (pH unit)	Displayed Reading ^(d) (pH Unit)	Tolerance ^(e) (pH Unit)	Results
4.00	4.03	0.03	Satisfactory
7.42	7.44	0.02	Satisfactory
10.01	9.98	-0.03	Satisfactory

Tolerance of pH should be less than ± 0.20 (pH unit)

(2) Temperature

Reading of Ref. thermometer (°C)	Displayed Reading (°C)	Tolerance (°C)	Results
10	10.05	0.05	Satisfactory
25	24.96	-0.04	Satisfactory
50	49.92	-0.08	Satisfactory

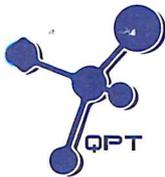
Tolerance limit of temperature should be less than ± 2.0 (°C)

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Remark(s): -

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

LEE Chun-ning, Desmond
Senior Chemist



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REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : BA050076
Date of Issue : 21 May 2021
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
0.01	0.30	0.29	Satisfactory
1.30	1.20	-0.10	Satisfactory
4.34	4.44	0.10	Satisfactory
7.53	7.60	0.07	Satisfactory

Tolerance limit of dissolved oxygen should be less than ± 0.50 (mg/L)

(4) Conductivity at 25°C

Conc. of KCl (M)	Expected Reading ($\mu\text{S}/\text{cm}$)	Displayed Reading ($\mu\text{S}/\text{cm}$)	Tolerance (%)	Results
0.001	146.9	152.8	4.02	Satisfactory
0.01	1412	1452	2.83	Satisfactory
0.1	12890	12834	-0.43	Satisfactory
0.5	58670	58016	-1.11	Satisfactory
1.0	111900	110890	-0.90	Satisfactory

Tolerance limit of conductivity should be less than ± 10.0 (%)

(5) Salinity

Expected Reading (g/L)	Displayed Reading (g/L)	Tolerance (%)	Results
10	9.89	-1.10	Satisfactory
20	20.51	2.55	Satisfactory
30	29.87	-0.43	Satisfactory

Tolerance limit of salinity should be less than ± 10.0 (%)

(6) Turbidity

Expected Reading (NTU)	Displayed Reading ^(f) (NTU)	Tolerance ^(g) (%)	Results
0	0.11	--	Satisfactory
10	10.08	0.80	Satisfactory
20	19.33	-3.35	Satisfactory
100	97.88	-2.12	Satisfactory
800	813.47	1.68	Satisfactory

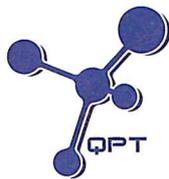
Tolerance limit of turbidity should be less than ± 10.0 (%)

~ END OF REPORT ~

Remark(s): -

^(f) "Displayed Reading" presents the figures shown on item under calibration/ checking regardless of equipment precision or significant figures.

^(g) 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.



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REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : BA050075
Date of Issue : 21 May 2021
Page No. : 1 of 2

PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.
Flat 2207, Yu Fun House,
Yu Chui Court, Shatin
New Territories, Hong Kong
Attn: Mr. Thomas WONG

PART B – DESCRIPTION

Name of Equipment : YSI 6920V2 (Multi-Parameters)
Manufacturer : YSI (a xylem brand)
Serial Number : 0001CF6C
Date of Received : May 20, 2021
Date of Calibration : May 20, 2021
Date of Next Calibration^(a) : Aug 19, 2021

PART C – REFERENCE METHODS/ DOCUMENTS FOR THE CALIBRATION

Parameter	Reference Method
pH at 25°C	APHA 21e 4500-H ⁺ B
Dissolved Oxygen	APHA 21e 4500-O G
Conductivity at 25°C	APHA 21e 2510 B
Salinity	APHA 21e 2520 B
Turbidity	APHA 21e 2130 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^(b,c)

(1) pH at 25°C

Target (pH unit)	Displayed Reading ^(d) (pH Unit)	Tolerance ^(e) (pH Unit)	Results
4.00	4.05	0.05	Satisfactory
7.42	7.45	0.03	Satisfactory
10.01	10.03	0.02	Satisfactory

Tolerance of pH should be less than ± 0.20 (pH unit)

(2) Temperature

Reading of Ref. thermometer (°C)	Displayed Reading (°C)	Tolerance (°C)	Results
10	10.1	0.1	Satisfactory
25	24.9	-0.1	Satisfactory
50	49.8	-0.2	Satisfactory

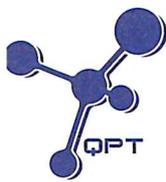
Tolerance limit of temperature should be less than ± 2.0 (°C)

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Remark(s): -

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

LEE Chun-ning, Desmond
Senior Chemist



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REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : BA050075
Date of Issue : 21 May 2021
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
0.01	0.31	0.30	Satisfactory
1.30	1.21	-0.09	Satisfactory
4.34	4.38	0.04	Satisfactory
7.53	7.62	0.09	Satisfactory

Tolerance limit of dissolved oxygen should be less than ± 0.50 (mg/L)

(4) Conductivity at 25°C

Conc. of KCl (M)	Expected Reading ($\mu\text{S/cm}$)	Displayed Reading ($\mu\text{S/cm}$)	Tolerance (%)	Results
0.001	146.9	153.0	4.15	Satisfactory
0.01	1412	1387	-1.77	Satisfactory
0.1	12890	12809	-0.63	Satisfactory
0.5	58670	57942	-1.24	Satisfactory
1.0	111900	110923	-0.87	Satisfactory

Tolerance limit of conductivity should be less than ± 10.0 (%)

(5) Salinity

Expected Reading (g/L)	Displayed Reading (g/L)	Tolerance (%)	Results
10	9.8	-2.0	Satisfactory
20	20.4	2.0	Satisfactory
30	29.8	-0.7	Satisfactory

Tolerance limit of salinity should be less than ± 10.0 (%)

(6) Turbidity

Expected Reading (NTU)	Displayed Reading ^(f) (NTU)	Tolerance ^(g) (%)	Results
0	0.1	--	Satisfactory
10	9.8	-2.0	Satisfactory
20	19.2	-4.0	Satisfactory
100	99.4	-0.6	Satisfactory
800	816.2	2.0	Satisfactory

Tolerance limit of turbidity should be less than ± 10.0 (%)

~ END OF REPORT ~

Remark(s): -

^(f) "Displayed Reading" presents the figures shown on item under calibration/ checking regardless of equipment precision or significant figures.

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