

Appendix E. Calibration Certificates



SUB-CONTRACTING REPORT

CONTACT	: NICK SIN	WORK ORDER	: HK2335498
CLIENT	: MOTT MACDONALD HONG KONG LIMITED		
ADDRESS	: 3/F, MANULIFE PLACE, 348 KWUN TONG ROAD KWUN TONG, KOWLOON, HONG KONG	SUB-BATCH	: 1
		DATE RECEIVED	: 6-SEP-2023
		DATE OF ISSUE	: 18-SEP-2023
PROJECT	: CALIBRATION/PERFORMANCE CHECK OF DUST METER	NO. OF SAMPLES	: 1
		CLIENT ORDER	: ---

General Comments

- Sample(s) was/ were submitted by client. Sample(s) arrived laboratory in ambient condition.
 - Sample information (Project name, Sample ID, Sampling date/time, etc.) is provided by client.
 - Result(s) of sample(s) is/are reported on as received basis, unless otherwise specified. The result(s) is/are related only to the item(s) tested.
 - Calibration was subcontracted to and analysed by Action-United Environmental Services & Consulting (AUES).
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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 report supersedes any previous report(s) with the same work order number.

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

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

WORK ORDER : HK2335498
SUB-BATCH : 1
CLIENT : MOTT MACDONALD HONG KONG LIMITED
PROJECT : CALIBRATION/PERFORMANCE CHECK OF DUST METER



ALS Lab ID	Client's Sample ID	Sample Type	Sample Date	External Lab Report No.
HK2335498-001	S/N:296098	Equipments	06-Sep-2023	S/N:296098

Equipment Verification Report (TSP)

Equipment Calibrated:

Type: Laser Dust monitor
 Manufacturer: Sibata LD-3B
 Serial No. 296098
 Equipment Ref: Nil
 Job Order HK2335498

Standard Equipment:

Standard Equipment: Higher Volume Sampler
 Location & Location ID: AUES office (calibration room)
 Equipment Ref: HVS 018
 Last Calibration Date: 11 September 2023

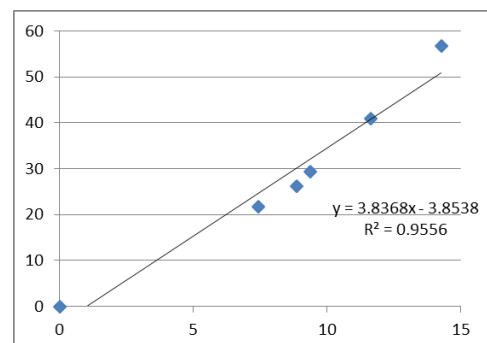
Equipment Verification Results:

Testing Date: 14 & 15 September 2023

Hour	Time	Mean Temp °C	Mean Pressure (hPa)	Concentration in µg/m ³ (Standard Equipment)	Total Count (Calibrated Equipment)	Count/Minute (Total Count/min)
2hr02min	09:20 ~ 11:22	26.9	1007.7	29.3	1149	9.4
2hr01min	11:27 ~ 13:28	26.9	1007.7	40.9	1403	11.6
2hr00min	09:15 ~ 11:15	27.3	1009.5	26.2	1062	8.9
2hr07min	11:20 ~ 13:27	27.3	1009.5	21.7	940	7.4
2hr02min	13:36 ~ 15:38	27.3	1009.5	56.6	1746	14.3

Linear Regression of Y or X

Slope (K-factor): 3.8368 (µg/m³)/CPM
 Correlation Coefficient 0.9775
 Date of Issue 18 September 2023



Remarks:

- Strong** Correlation ($R > 0.8$)
- Factor 3.8368 (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 : 18 September 2023

QC Reviewer : Ben Tam Signature :  Date : 18 September 2023

TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location :	Gold King Industrial Building, Kwai Chung	Date of Calibration: 11-Sep-23
Location ID :	Calibration Room - TISCH Higher Volume Sampler (Model TE-5170) S/N:1260	Next Calibration Date: 10-Dec-23

CONDITIONS

Sea Level Pressure (hPa)	1007.3	Corrected Pressure (mm Hg)	755.475
Temperature (°C)	26.5	Temperature (K)	300

CALIBRATION ORIFICE

Make->	TISCH	Qstd Slope ->	2.10977
Model->	5025A	Qstd Intercept ->	-0.03782
Calibration Date->	15-Dec-22	Expiry Date->	15-Dec-23

CALIBRATION

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m3/min)	I (chart)	IC corrected	LINEAR REGRESSION
18	5.9	5.9	11.8	1.637	53	52.71	Slope = 32.7794 Intercept = -0.7928 Corr. coeff. = 0.9963
13	4.6	4.6	9.2	1.448	46	45.75	
10	3.5	3.5	7.0	1.265	42	41.77	
8	2.6	2.6	5.2	1.093	36	35.80	
5	1.4	1.4	2.8	0.807	25	24.86	

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:

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

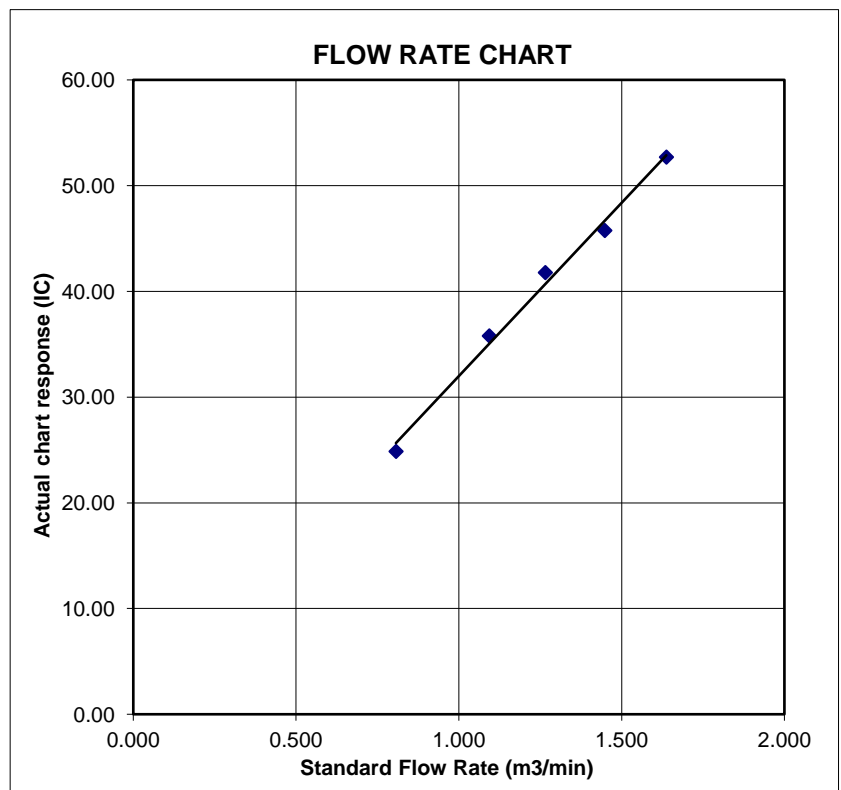
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure





Certificate of Calibration

Calibration Certification Information			
Cal. Date: December 15, 2022	Rootsmeter S/N: 438320	Ta: 295	°K
Operator: Jim Tisch		Pa: 748.0	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 4064		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4430	3.2	2.00
2	3	4	1	1.0210	6.4	4.00
3	5	6	1	0.9170	7.9	5.00
4	7	8	1	0.8730	8.8	5.50
5	9	10	1	0.7210	12.8	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)
0.9900	0.6861	1.4101	0.9957	0.6900	0.8881
0.9858	0.9655	1.9943	0.9914	0.9711	1.2560
0.9838	1.0728	2.2296	0.9894	1.0790	1.4042
0.9826	1.1255	2.3385	0.9882	1.1320	1.4728
0.9772	1.3554	2.8203	0.9829	1.3632	1.7762
QSTD	m=	2.10977	QA	m=	1.32110
	b=	-0.03782		b=	-0.02382
	r=	0.99998		r=	0.99998

Calculations			
Vstd=	$\Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$	Va=	$\Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
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