

HIVOL SAMPLER CALIBRATION DATA SHEET (TSP)

Site Information

Location:	Man Cheong Building	Site ID:	W-A6	Date:	17-Aug-2024
Serial No:	1050	Model:	TE-5170X	Operator:	Andy Li

Ambient Condition

Actual Pressure during Calibration (P_a) (mm Hg):	755.1	Actual Temperature during Calibration (T_a) (deg K):	300.5
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Calibration Orifice

Model:	TE-5025A	Slope (m_c):	2.06920
Serial No.:	3465	Intercept (b_c):	-0.02547
Calibration Due Date:	15-Jan-25	Corr. Coeff:	0.99999

Calibration Data

Plate or Test #	ΔH_2O (in)	Q_a , X-Axis (m^3/min)	I, CFM (chart)	IC, Y-Axis (corrected)
18	11.80	1.660	61.0	60.55
13	8.90	1.444	55.0	54.60
10	6.40	1.226	49.0	48.64
7	4.10	0.984	44.0	43.68
5	3.50	0.910	41.0	40.70

Sampler Calibration Relationship (Q_a on x-axis, IC on y-axis)

$m = 25.6837$ $b = 17.6667$ Corr. Coeff: 0.9981

Calculations

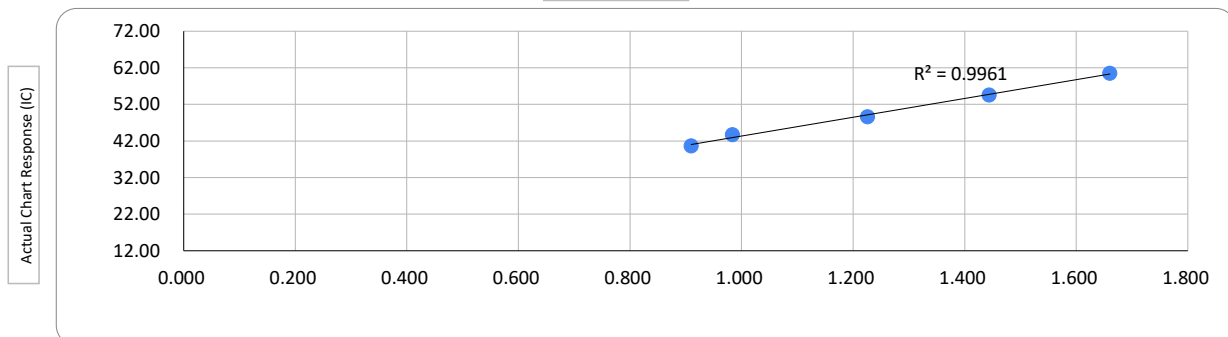
$$Q_a = 1/m_c [\text{Sqrt}(\Delta H_2O * (P_a/P_{Std}) * (T_{Std}/T_a)) - b_c]$$

$$IC = I * (\text{Sqrt}(P_a/P_{Std}) * (T_{Std}/T_a))$$

Q_a = actual flow rate
 IC = corrected chart response
 I = actual chart response
 m_c = calibrator slope
 b_c = calibrator intercept

m = sampler slope
 b = sampler intercept
 T_{Std} = 298 deg K
 P_{Std} = 760 mm Hg
 T_a = actual temperature during calibration (deg K)
 P_a = actual pressure during calibration (mm Hg)

Flow Rate Chart



Standard Flow Rate (m3/min)

Checked by: Andy Li
 Project Technician, Environmental

Date: 17-Aug-2024

Certificate of Calibration

Calibration Certification Information

Cal. Date: January 15, 2024 Rootsmeter S/N: 438320 Ta: 294 °K
Operator: Jim Tisch Pa: 755.9 mm Hg
Calibration Model #: TE-5025A Calibrator S/N: 3465

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4350	3.3	2.00
2	3	4	1	1.0180	6.4	4.00
3	5	6	1	0.9090	8.0	5.00
4	7	8	1	0.8670	8.9	5.50
5	9	10	1	0.7150	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)	$\sqrt{\Delta H (Ta/Pa)}$ (y-axis)
1.0037	0.6995	1.4200	0.9956	0.6938	0.8820
0.9996	0.9819	2.0081	0.9915	0.9740	1.2473
0.9975	1.0973	2.2452	0.9894	1.0885	1.3945
0.9963	1.1491	2.3547	0.9882	1.1398	1.4626
0.9909	1.3859	2.8399	0.9829	1.3747	1.7639
QSTD	m=	2.06920	QA	m=	1.29570
	b=	-0.02547		b=	-0.01582
	r=	0.99999		r=	0.99999

Calculations

Vstd=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
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= $1/m \left(\left(\sqrt{\Delta H (Ta/Pa)} \right) - b \right)$	

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

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	17-Aug-24	to	18-Aug-24	Next Verification Test Date:	17-Aug-25
Unit-under-Test- Model No.:	Sibata LD-5R				
Unit-under-Test Serial No.:	467356				
Our Report Reference No.:	RPT-24-HVS-0080				
Calibration Location:	Man Cheong Building				

Standard Equipment Information

Verification Equipment Type:	Tisch TSP HVS	Tisch HVS Calibrator
Standard Equipment Model No.:	TE-5170X	TE-5025A
Equipment serial no.:	1050	3465
Last Calibration Date:	17-Aug-24	15-Jan-24
Next Calibration Date:	30-Aug-24	15-Jan-25

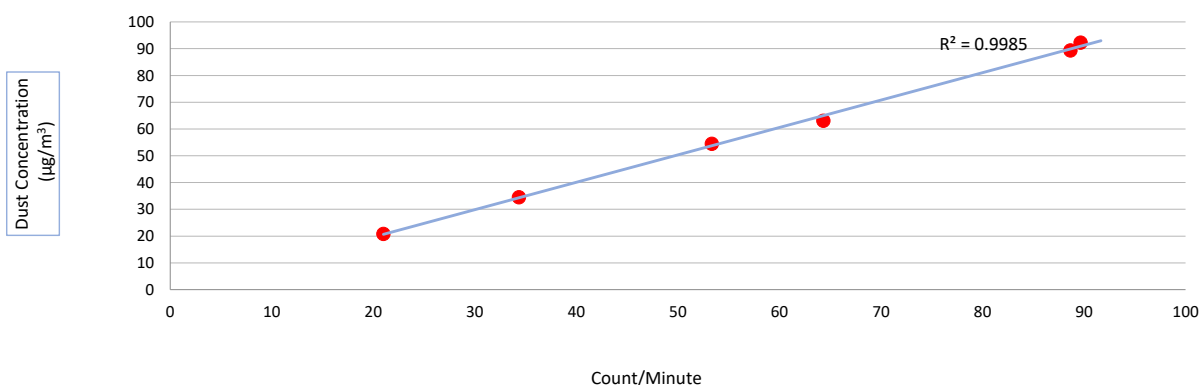
Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
1	17/08/2024	11832.91	11835.91	180.00	16140	90	92
2	17/08/2024	11835.91	11838.91	180.00	9600	53	54
3	17/08/2024	11838.91	11841.91	180.00	15960	89	89
4	18/07/2024	11841.94	11844.94	180.00	6180	34	34
5	18/07/2024	11844.94	11847.94	180.00	3780	21	21
6	18/07/2024	11847.94	11850.94	180.00	11580	64	63

Linear Regression of y on x

Slope, K factor:	<u>1.0232</u>	Intercept:	<u>-0.8300</u>	*Correlation Coefficient, R:	<u>0.9992</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	

Verification Curve



Operated By: Andy Li
Project Technician, Environmental

Date: 23-08-2024

Checked By: Tandy Tse
Senior Consultant, Environmental

Date: 23-08-2024

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	17-Aug-24	to	18-Aug-24	Next Verification Test Date:	17-Aug-25
Unit-under-Test- Model No.:	Sibata LD-5R				
Unit-under-Test Serial No.:	467357				
Our Report Reference No.:	RPT-24-HVS-0081				
Calibration Location:	Man Cheong Building				

Standard Equipment Information

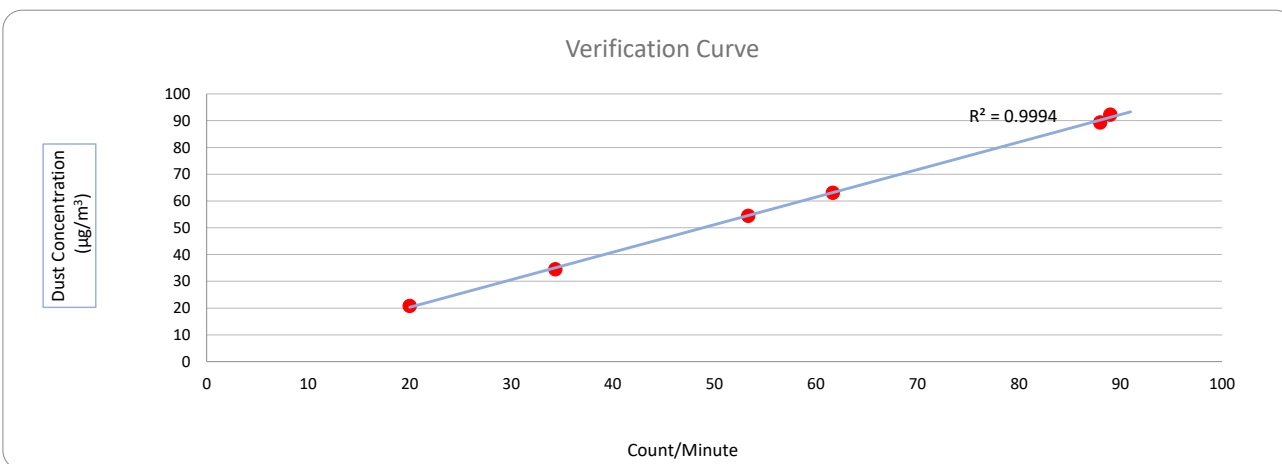
Verification Equipment Type:	Tisch TSP HVS	Tisch HVS Calibrator
Standard Equipment Model No.:	TE-5170X	TE-5025A
Equipment serial no.:	1050	3465
Last Calibration Date:	17-Aug-24	15-Jan-24
Next Calibration Date:	30-Aug-24	15-Jan-25

Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
1	17/08/2024	11832.91	11835.91	180.00	16020	89	92
2	17/08/2024	11835.91	11838.91	180.00	9600	53	54
3	17/08/2024	11838.91	11841.91	180.00	15840	88	89
4	18/07/2024	11841.94	11844.94	180.00	6180	34	34
5	18/07/2024	11844.94	11847.94	180.00	3600	20	21
6	18/07/2024	11847.94	11850.94	180.00	11100	62	63

Linear Regression of y on x

Slope, K factor:	<u>1.0280</u>	Intercept:	<u>-0.2511</u>	*Correlation Coefficient, R:	<u>0.9997</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	



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Date: 23-08-2024

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	17-Aug-24	to	18-Aug-24	Next Verification Test Date:	17-Aug-25
Unit-under-Test- Model No.:	Sibata LD-5R				
Unit-under-Test Serial No.:	467358				
Our Report Reference No.:	RPT-24-HVS-0082				
Calibration Location:	Man Cheong Building				

Standard Equipment Information

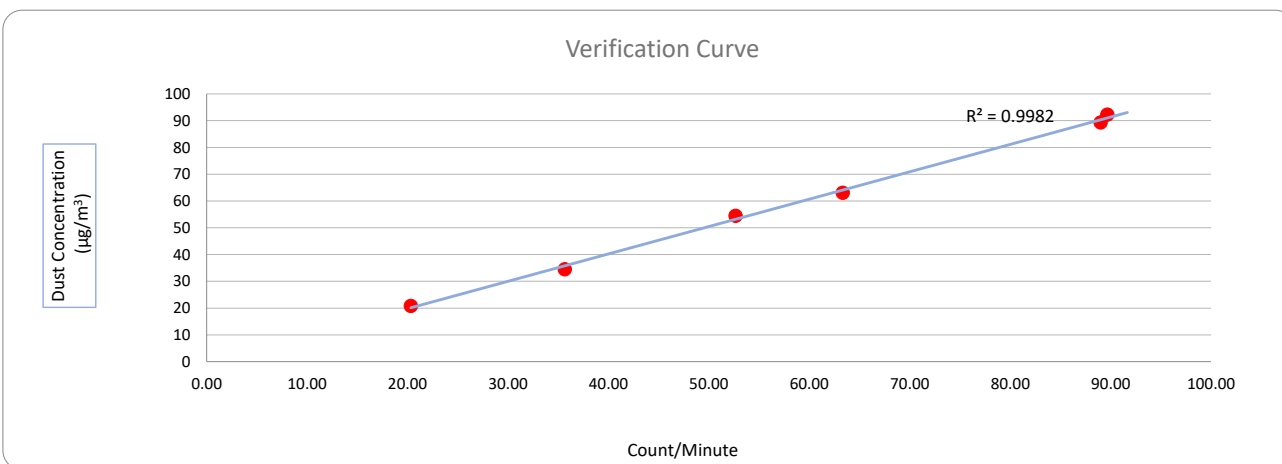
Verification Equipment Type:	Tisch TSP HVS	Tisch HVS Calibrator
Standard Equipment Model No.:	TE-5170X	TE-5025A
Equipment serial no.:	1050	3465
Last Calibration Date:	17-Aug-24	15-Jan-24
Next Calibration Date:	30-Aug-24	15-Jan-25

Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
1	17/08/2024	11832.91	11835.91	180.00	16140	89.67	92
2	17/08/2024	11835.91	11838.91	180.00	9480	52.67	54
3	17/08/2024	11838.91	11841.91	180.00	16020	89.00	89
4	18/07/2024	11841.94	11844.94	180.00	6420	35.67	34
5	18/07/2024	11844.94	11847.94	180.00	3660	20.33	21
6	18/07/2024	11847.94	11850.94	180.00	11400	63.33	63

Linear Regression of y on x

Slope, K factor:	<u>1.0225</u>	Intercept:	<u>-0.6726</u>	*Correlation Coefficient, R:	<u>0.9991</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	



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Checked By: Tandy Tse
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Date: 23-08-2024

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	<u>17-Aug-24</u>	to	<u>18-Aug-24</u>	Next Verification Test Date:	<u>17-Aug-25</u>
Unit-under-Test- Model No.:	<u>Sibata LD-5R</u>				
Unit-under-Test Serial No.:	<u>467359</u>				
Our Report Reference No.:	<u>RPT-24-HVS-0083</u>				
Calibration Location:	<u>Man Cheong Building</u>				

Standard Equipment Information

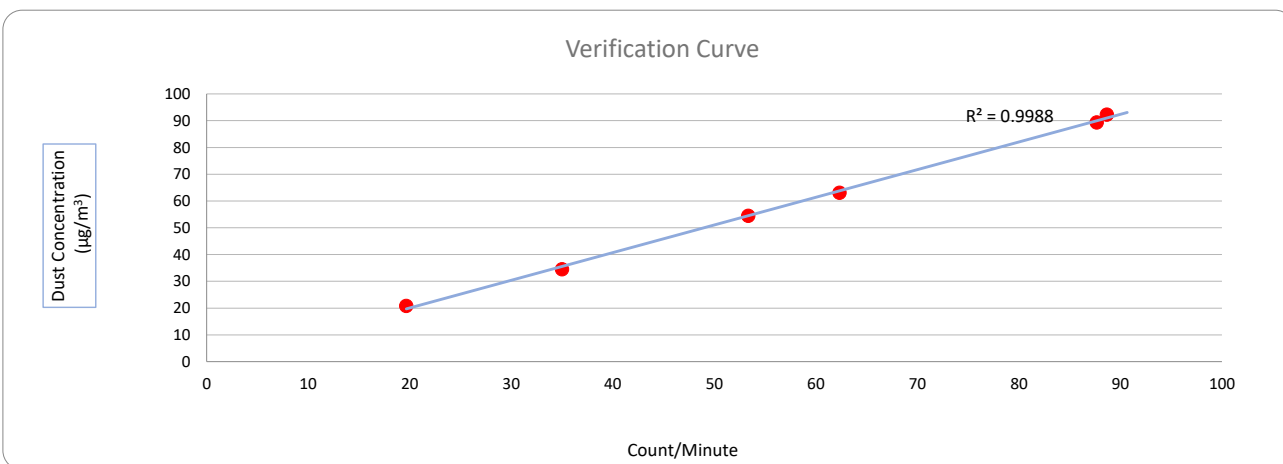
Verification Equipment Type:	<u>Tisch TSP HVS</u>	<u>Tisch HVS Calibrator</u>
Standard Equipment Model No.:	<u>TE-5170X</u>	<u>TE-5025A</u>
Equipment serial no.:	<u>1050</u>	<u>3465</u>
Last Calibration Date:	<u>17-Aug-24</u>	<u>15-Jan-24</u>
Next Calibration Date:	<u>30-Aug-24</u>	<u>15-Jan-25</u>

Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
1	17/08/2024	11832.91	11835.91	180.00	15960	89	92
2	17/08/2024	11835.91	11838.91	180.00	9600	53	54
3	17/08/2024	11838.91	11841.91	180.00	15780	88	89
4	18/07/2024	11841.94	11844.94	180.00	6300	35	34
5	18/07/2024	11844.94	11847.94	180.00	3540	20	21
6	18/07/2024	11847.94	11850.94	180.00	11220	62	63

Linear Regression of y on x

Slope, K factor:	<u>1.0331</u>	Intercept:	<u>-0.6022</u>	*Correlation Coefficient, R:	<u>0.9994</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	



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Date: 23-08-2024

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	<u>17-Aug-24</u>	to	<u>18-Aug-24</u>	Next Verification Test Date:	<u>17-Aug-25</u>
Unit-under-Test- Model No.:	<u>Sibata LD-5R</u>				
Unit-under-Test Serial No.:	<u>467360</u>				
Our Report Reference No.:	<u>RPT-24-HVS-0084</u>				
Calibration Location:	<u>Man Cheong Building</u>				

Standard Equipment Information

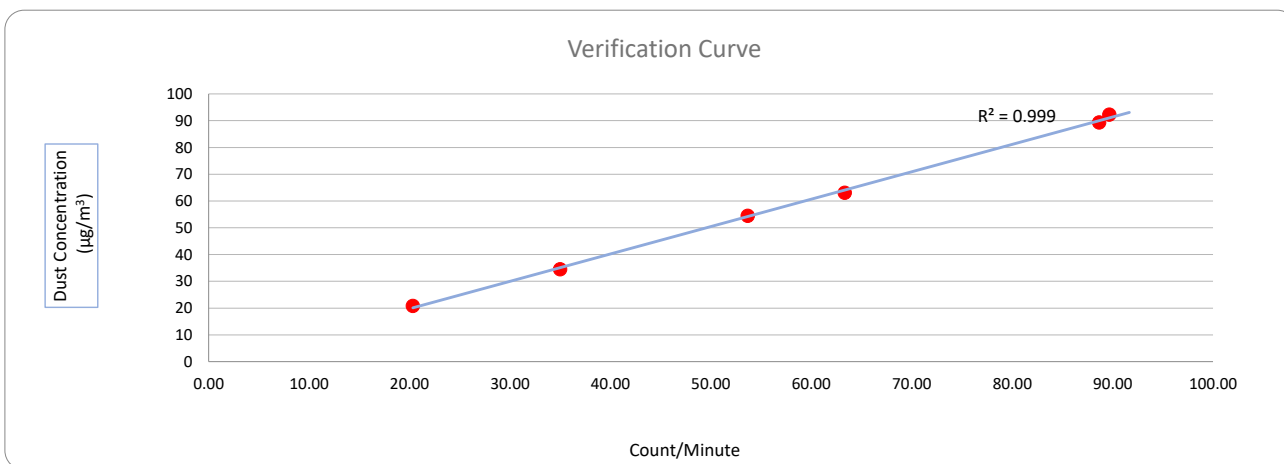
Verification Equipment Type:	<u>Tisch TSP HVS</u>	<u>Tisch HVS Calibrator</u>
Standard Equipment Model No.:	<u>TE-5170X</u>	<u>TE-5025A</u>
Equipment serial no.:	<u>1050</u>	<u>3465</u>
Last Calibration Date:	<u>17-Aug-24</u>	<u>15-Jan-24</u>
Next Calibration Date:	<u>30-Aug-24</u>	<u>15-Jan-25</u>

Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
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2	17/08/2024	11835.91	11838.91	180.00	9660	53.67	54
3	17/08/2024	11838.91	11841.91	180.00	15960	88.67	89
4	18/07/2024	11841.94	11844.94	180.00	6300	35.00	34
5	18/07/2024	11844.94	11847.94	180.00	3660	20.33	21
6	18/07/2024	11847.94	11850.94	180.00	11400	63.33	63

Linear Regression of y on x

Slope, K factor:	<u>1.0229</u>	Intercept:	<u>-0.6982</u>	*Correlation Coefficient, R:	<u>0.9995</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	



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Date: 23-08-2024

Sibata LD-5R K-Factor Verification Test by Total Suspended Particulates HVS Test Report

Information of Calibrated Equipment

Verification Test Date:	17-Aug-24	to	18-Aug-24	Next Verification Test Date:	17-Aug-25
Unit-under-Test- Model No.:	Sibata LD-5R				
Unit-under-Test Serial No.:	467361				
Our Report Reference No.:	RPT-24-HVS-0085				
Calibration Location:	Man Cheong Building				

Standard Equipment Information

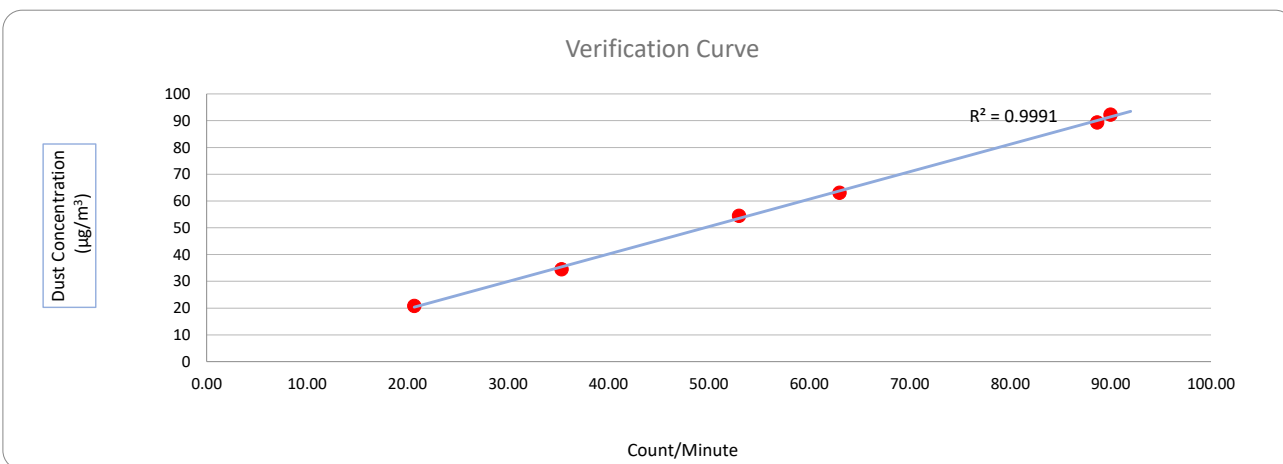
Verification Equipment Type:	Tisch TSP HVS	Tisch HVS Calibrator
Standard Equipment Model No.:	TE-5170X	TE-5025A
Equipment serial no.:	1050	3465
Last Calibration Date:	17-Aug-24	15-Jan-24
Next Calibration Date:	30-Aug-24	15-Jan-25

Equipment Verification Result

Verification Test No.	Date	Duration			Results from Calibrated Equipment		Results from Standard Equipment
		Start-time	End-time	Elapsed Time (in min)	Total Counts	Counts/ Minute x-axis	Dust Concentration ($\mu\text{g}/\text{m}^3$) y-axis
1	17/08/2024	11832.91	11835.91	180.00	16200	90.00	92
2	17/08/2024	11835.91	11838.91	180.00	9540	53.00	54
3	17/08/2024	11838.91	11841.91	180.00	15960	88.67	89
4	18/07/2024	11841.94	11844.94	180.00	6360	35.33	34
5	18/07/2024	11844.94	11847.94	180.00	3720	20.67	21
6	18/07/2024	11847.94	11850.94	180.00	11340	63.00	63

Linear Regression of y on x

Slope, K factor:	<u>1.0251</u>	Intercept:	<u>-0.8237</u>	*Correlation Coefficient, R:	<u>0.9996</u>
Verification Test Result: <u>Strong Correlation, Results were accepted.</u>				* If the Correlation Coefficient, R is <0.5. Checking and Re-verification are required.	



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