

**APPENDIX C
COPIES OF CALIBRATION
CERTIFICATES**



Calibration Certificate

Certificate No. : CSA33530

Page : 1 of 2

Information Provided by Customer

Customer : ETS - Testconsult Limited
Address : 8/F., Block B, Veristrong Industrial Centre, 34 - 36 Au Pui Wan Street, Fotan, Shatin, Hong Kong

Information of Unit-under-test (UUT)

Description : Sound Level Calibrator
Manufacturer : Castle
Type : GA607
Equipment I.D. : ET/EN/002/07
Serial No. : 038641

Laboratory Information

Lab. Ref. No. : Q/CAL/23/4006/1
Date of Calibration : 19-May-2023
Date of Issue : 19-May-2023
Procedure : CQS/002/A
Date of Receipt : 17-May-2023
Calibration Location : Calibration Laboratory

Calibration Condition

Ambient Temperature : (20 ± 3) °C
Stabilizing Time : 30 minutes
Ambient Pressure : (1000 ± 50) hPa
Relative Humidity : (50±20) %
Sampling : As received

Reference equipment

- Multi-function sound calibrator, ET/2801/01
- Measuring Amplifier, ET/2702/01/01
- Signal generator, ET/2503/01
- Reference Oscilloscope, ET/2502/01

Calibration specification

- To perform the calibration of sound level calibrator.

Calibration result

- The results are detailed on the subsequent pages.

Remarks

- The calibration results apply to the particular unit-under-test only.
- The values given in this calibration certificate only to the values measured at the time of test & any uncertainties quoted will not include allowance for the equipment long term drift, verifications with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement.

Calibrated By : Tony MA
(Technician)

Approved By: CHAN Chi Wai



Calibration Certificate

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Calibration Result:

1. Measured Sound Pressure Level:

Nominal Frequency (Hz)	Nominal Output Sound Pressure (dB)	Measured Output (dB)	Expanded Uncertainty (dB)	Coverage Factor
1000	94.0	94.1	0.13	2.0
1000	104.0	104.0	0.13	2.0

2. Actual Output Frequency:

Nominal Frequency (Hz)	Nominal Output Sound Pressure (dB)	Measured Output (Hz)	Expanded Uncertainty (Hz)	Coverage Factor
1000	94.0	1000.020	0.057	2.0
1000	104.0	1000.017	0.057	2.0

Remark:

- The uncertainty quoted is based on 95 % confidence level.
- Measured output are mean of three measurements.

End of certificate



Calibration Certificate

Certificate No. : CSA34546
Page : 1 of 3

Information Provided by Customer

Customer : ETS - Testconsult Limited
Address : 8/F., Block B, Veristrong Industrial Centre, 34 - 36 Au Pui Wan Street, Fotan, Shatin, Hong Kong

Information of Unit-under-test (UUT)

	Sound Level Meter	Microphone	Pre-amplifier
Manufacturer	RION	RION	RION
Type	NL-52	UC-59	NH-25
Equipment I.D. no.	ET/EN/003/17	-	-
Serial No.	00264519	03558	64644
Adaptors used	-	-	-
Resolution	0.1 dB	-	-

Laboratory Information

Lab. Ref. No. : Q/CAL/23/5141/I
Date of Calibration : 28-Jun-2023
Date of Issue : 28-Jun-2023
Procedure : CQS/001/A
Date of Receipt : 21-Jun-2023
Calibration Location : Calibration Laboratory

Calibration Condition

Ambient Temperature : (20 ± 3) °C
Stabilizing Time : 30 minutes
Ambient Pressure : (1000 ± 50) hPa
Relative Humidity : (50 ± 20) %
Sampling : As received

Reference equipment

- Multi-function sound calibrator, ET/2801/01
- Signal generator, ET/2503/01

Calibration specification

- To perform the calibration of linearity and frequency response by multi-function sound calibrator.

Calibration result

- The results are detailed on the subsequent pages.

Remarks

- The calibration results apply to the particular unit-under-test only.
- The values given in this calibration certificate only to the values measured at the time of test & any uncertainties quoted will not include allowance for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement.

Calibrated By : Tony MA
(Technician)

Approved By: CHAN Chi Wai



Calibration Certificate

Certificate No. : CSA34546

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Calibration Result:

1 Reference Sound Pressure Level : (Unit in: dB)

Range / Mode			Reference Level	REF Frequency (kHz)	UUT Reading	Deviation	Expanded Uncertainty	Coverage Factor
A-Weighting	Self-cal	Before	94.0	1	93.7	-0.3	0.13	2.0
	Range	30 to 130	104.0		103.7	-0.3	0.13	2.0
	Mode	Fast	114.0		113.7	-0.3	0.13	2.0
A-Weighting	Self-cal	After	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Fast	114.0		114.1	0.1	0.13	2.0
	Self-cal	After	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Slow	114.0		114.1	0.1	0.13	2.0
C-Weighting	Self-cal	-	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Fast	114.0		114.0	0.0	0.13	2.0
	Self-cal	-	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Slow	114.0		114.0	0.0	0.13	2.0
Z-Weighting	Self-cal	-	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Fast	114.0		114.1	0.1	0.13	2.0
	Self-cal	-	94.0	1	94.0	0.0	0.13	2.0
	Range	30 to 130	104.0		104.1	0.1	0.13	2.0
	Mode	Slow	114.0		114.0	0.0	0.13	2.0

Remark:

- The uncertainty quoted is based on 95 % confidence level.
- UUT reading are mean of three measurements.
- Deviation = UUT Reading - Reference Level
- Laboratory reference multi-function sound calibrator was used to adjust the "Self cal" reading of UUT.



Calibration Certificate

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Calibration Result:

Acoustic Sensitivity and Frequency Response:

2 Frequency Response A-Weighting (Unit in: dB)

Range	Mode	Applied Level	Frequency (Hz)	Reference Level	UUT Reading	Deviation	Expanded Uncertainty	Coverage Factor
30 to 130	Fast	94	31.5	54.6	40.5	-14.1	0.29	2.6
			63	67.8	57.2	-10.6	0.22	2.3
			125	77.9	72.2	-5.7	0.13	2.0
			250	85.4	83.6	-1.8	0.12	2.0
			500	90.8	90.9	0.1	0.12	2.0
			1000 (Ref.)	94.0	94.0	0.0	0.13	2.0
			2000	95.1	94.0	-1.1	0.13	2.0
			4000	94.9	92.3	-2.6	0.13	2.0
			8000	92.9	85.4	-7.5	0.14	2.0
			12500	89.7	76.0	-13.7	0.14	2.0
16000	87.5	71.6	-15.9	0.16	2.0			

3 Frequency Response C-Weighting (Unit in: dB)

Range	Mode	Applied Level	Frequency (Hz)	Reference Level	UUT Reading	Deviation	Expanded Uncertainty	Coverage Factor
30 to 130	Fast	94	31.5	91.0	74.6	-16.4	0.22	2.3
			63	93.2	82.4	-10.8	0.15	2.0
			125	93.8	88.1	-5.7	0.15	2.0
			250	94.0	92.2	-1.8	0.14	2.0
			500	94.0	94.1	0.1	0.12	2.0
			1000 (Ref.)	94.0	94.0	0.0	0.13	2.0
			2000	93.7	92.6	-1.1	0.13	2.0
			4000	93.1	90.5	-2.6	0.13	2.0
			8000	91.0	83.5	-7.5	0.14	2.0
			12500	87.8	74.1	-13.7	0.16	2.0
16000	85.6	69.8	-15.8	0.20	2.2			

4 Frequency Response Z-Weighting (Unit in: dB)

Range	Mode	Applied Level	Frequency (Hz)	Reference Level	UUT Reading	Deviation	Expanded Uncertainty	Coverage Factor
30 to 130	Fast	94	31.5	94.0	77.6	-16.4	0.14	2.0
			63	94.0	83.2	-10.8	0.15	2.0
			125	94.0	88.3	-5.7	0.13	2.0
			250	94.0	92.2	-1.8	0.14	2.0
			500	94.0	94.0	0.0	0.12	2.0
			1000 (Ref.)	94.0	94.0	0.0	0.13	2.0
			2000	94.0	92.8	-1.2	0.13	2.0
			4000	94.0	91.3	-2.7	0.13	2.0
			8000	94.0	86.4	-7.6	0.14	2.0
			12500	94.0	80.7	-13.3	0.14	2.0
16000	94.0	79.4	-14.6	0.14	2.0			

Remark:

- Signal level at 1000 Hz is set as indication of reference sound pressure level.
- The uncertainty quoted is based on 95 % confidence level with coverage factor k=2.0.
- UUT reading are mean of three measurements.
- Deviation = UUT Reading - Reference Level

End of certificate



Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 17, 2023	Rootsmeter S/N: 438320	Ta: 294	°K
Operator: Jim Tisch		Pa: 741.4	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 4128		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4370	3.2	2.00
2	3	4	1	1.0170	6.4	4.00
3	5	6	1	0.9140	8.0	5.00
4	7	8	1	0.8640	8.8	5.50
5	9	10	1	0.7170	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)
0.9846	0.6852	1.4063	0.9957	0.6929	0.8905
0.9803	0.9639	1.9888	0.9914	0.9748	1.2594
0.9782	1.0702	2.2235	0.9892	1.0823	1.4081
0.9771	1.1309	2.3321	0.9881	1.1437	1.4768
0.9718	1.3553	2.8126	0.9827	1.3706	1.7811
QSTD	m=	2.09676	QA	m=	1.31296
	b=	-0.03027		b=	-0.01917
	r=	0.99991		r=	0.99991

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



TEST REPORT

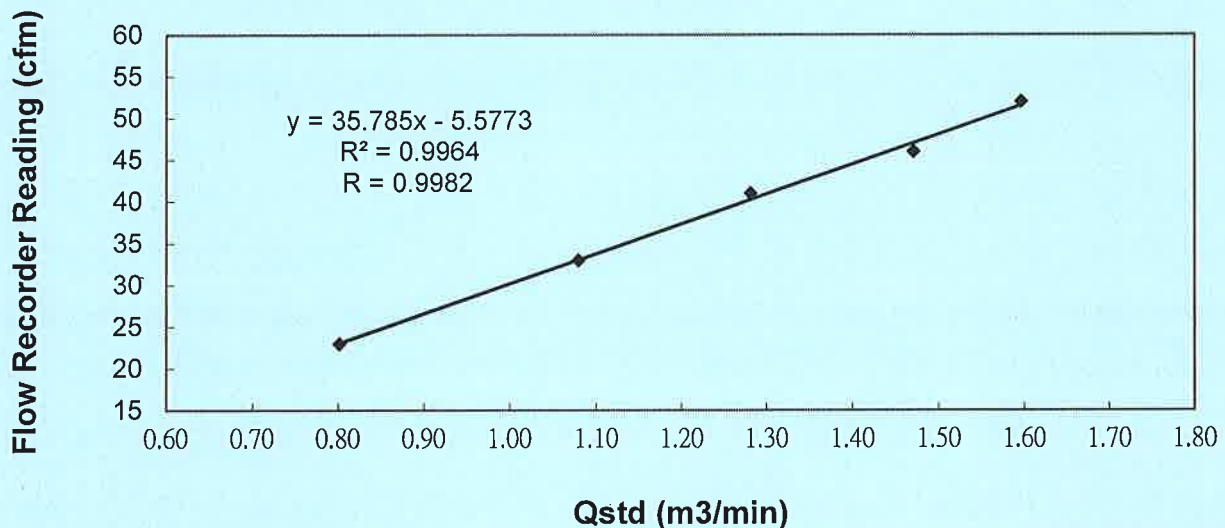
**Calibration Report
of
High Volume Air Sampler**

Manufacturer : Graseby GMW Date of Calibration : 22 August 2023
Serial No. : 1180 (ET / EA / 003 / 04) Calibration Due Date : 21 October 2023
Method : Based on Operations Manual for the 5-point calibration using standard calibration kit manufactured by Tisch TE-5025 A

Results :

Flow recorder reading (cfm)	52	46	41	33	23
Qstd (Actual flow rate, m ³ /min)	1.60	1.47	1.28	1.08	0.80
Pressure :	754.64 mm Hg		Temp. :	303 K	

**Sampler 1180 Calibration Curve
Site: Tuen Mun (TM-RA2)**



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies* / ~~does not comply*~~ with the specified requirements and is deemed acceptable* / unacceptable* for use.

Calibrated by : MAK, Kei Wai
MAK, Kei Wai
(Assistant Supervisor)

Checked by : LAU, Chi Leung
LAU, Chi Leung
(Environmental Team Leader)



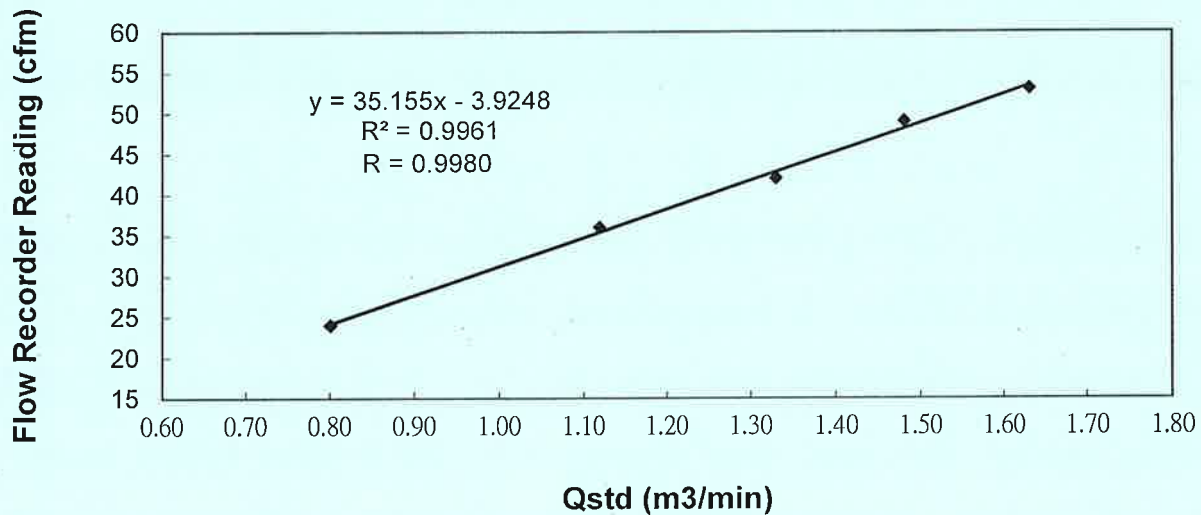
TEST REPORT

Calibration Report
of
High Volume Air Sampler

Manufacturer : Graseby GMW Date of Calibration : 21 October 2023
 Serial No. : 1180 (ET / EA / 003 / 04) Calibration Due Date : 20 December 2023
 Method : Based on Operations Manual for the 5-point calibration using standard calibration kit
 manufactured by Tisch TE-5025 A

Results	Flow recorder reading (cfm)	53	49	42	36	24
	Qstd (Actual flow rate, m ³ /min)	1.63	1.48	1.33	1.12	0.80
	Pressure : 763.86 mm Hg	Temp. : 296 K				

Sampler 1180 Calibration Curve
Site: Tuen Mun (TM-RA2)



Acceptance Criteria : Correlation coefficient (r) of the calibration curve greater than 0.990 after a 5-point calibration

The high volume sampler complies* / does not comply* with the specified requirements and is deemed acceptable* unacceptable* for use.

Calibrated by : Mak Kei Wai
MAK, Kei Wai
(Assistant Supervisor)

Checked by : LAU, Chi Leung
LAU, Chi Leung
(Environmental Team Leader)



TEST REPORT

**Internal Calibration Report
of
Dust Monitor**

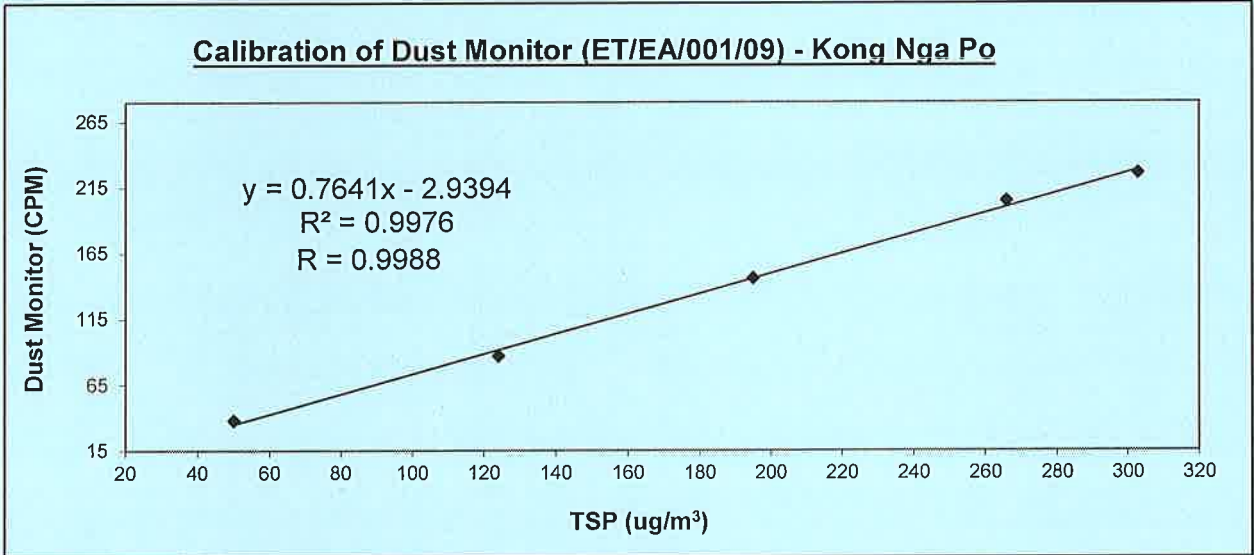
Manufacturer : SIBATA (LD-3B) **Date of Calibration :** 29 September 2023

Serial No. : 155331 (ET/EA/001/09) **Calibration Due Date :** 28 November 2023

Method : Parallel measurement (Five-point calibration) by placing the Dust Monitor and High Volume Air Samper together under the same environmental condition

Results :

Dust Monitor (CPM)	38	87	146	205	226
TSP (ug/m ³)	50	124	195	266	303
High Volume Air Sampler Serial No.: 1180	Calibration Due Date: 21 October 2023				



Acceptance Criteria : Correlation coefficient (R) of the calibration curve greater than 0.990 after a five-point calibration

The Dust Trak Monitor complies * / ~~does not comply~~ * with the internal calibration procedures and is deemed acceptable * / ~~unacceptable~~ * for use.

Calibrated by :
CHENG, Hei Man
(Technician)

Checked by :
LAU, Chi Leung
(Environmental Team Leader)



TEST REPORT

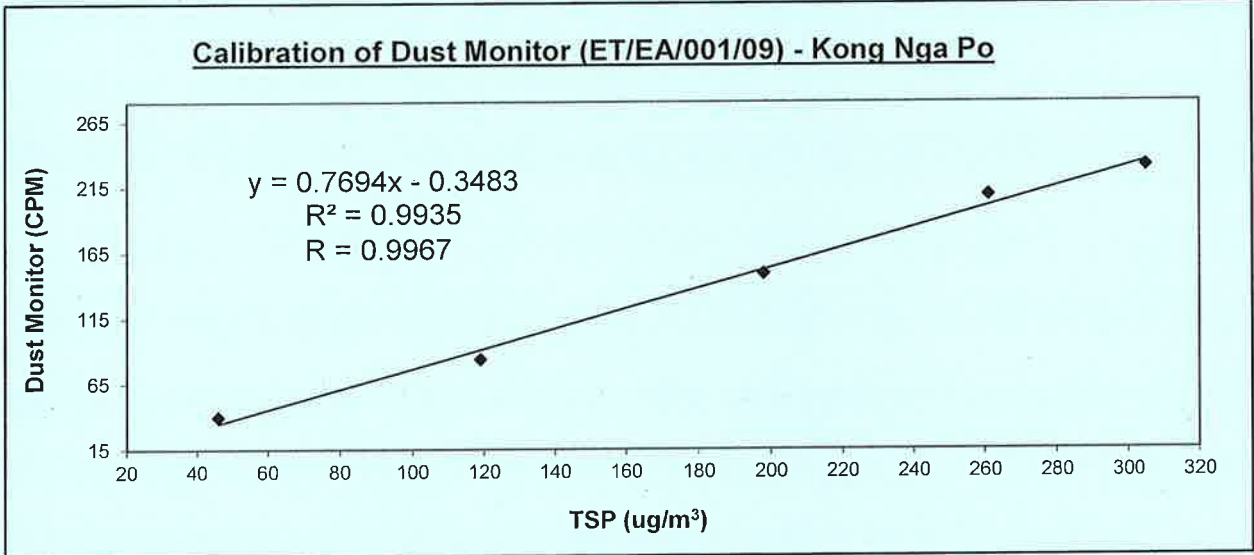
**Internal Calibration Report
of
Dust Monitor**

Manufacturer : SIBATA (LD-3B) Date of Calibration : 28 November 2023

Serial No. : 155331 (ET/EA/001/09) Calibration Due Date : 27 January 2024

Method : Parallel measurement (Five-point calibration) by placing the Dust Monitor and High Volume Air Sampler together under the same environmental condition

Results	Dust Monitor (CPM)	40	84	149	209	231
	TSP (ug/m ³)	46	119	198	261	305
	High Volume Air Sampler Serial No.: 1180	Calibration Due Date: 20 December 2023				



Acceptance Criteria : Correlation coefficient (R) of the calibration curve greater than 0.990 after a five-point calibration

The Dust Trak Monitor complies * / does not comply * with the internal calibration procedures and is deemed acceptable * / unacceptable * for use.

Calibrated by :
CHENG, Hei Mah
(Technician)

Checked by :
LAU, Chi Leung
(Environmental Team Leader)



TEST REPORT

**Internal Calibration Report
of
Dust Monitor**

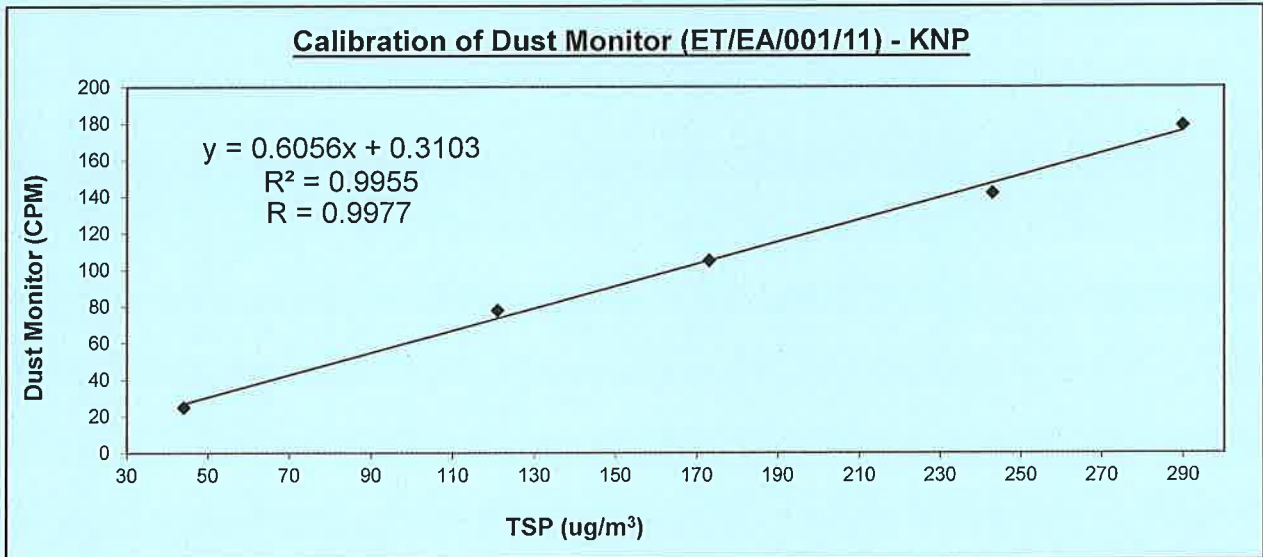
Manufacturer : SIBATA (LD-3B) Date of Calibration : 29 September 2023

Serial No. : 255863 (ET/EA/001/11) Calibration Due Date : 28 November 2023

Method : Parallel measurement (Five-point calibration) by placing the Dust Monitor and High Volume Air Samper together under the same environmental condition


Results :

Dust Monitor (CPM)	25	78	105	142	179
TSP (ug/m ³)	44	121	173	243	290
High Volume Air Sampler Serail No.:1180	Calibration Due Date: 21 October 2023				



Acceptance Criteria : Correlation coefficient (R) of the calibration curve greater than 0.990 after a five-point calibration

The Dust Trak Monitor complies * / ~~does not comply~~ * with the internal calibration procedures and is deemed acceptable * / ~~unacceptable~~ * for use.

Calibrated by : 
CHENG, Hei Man
(Technician)

Checked by : 
LAU, Chi Leung
(Environmental Team Leader)



TEST REPORT

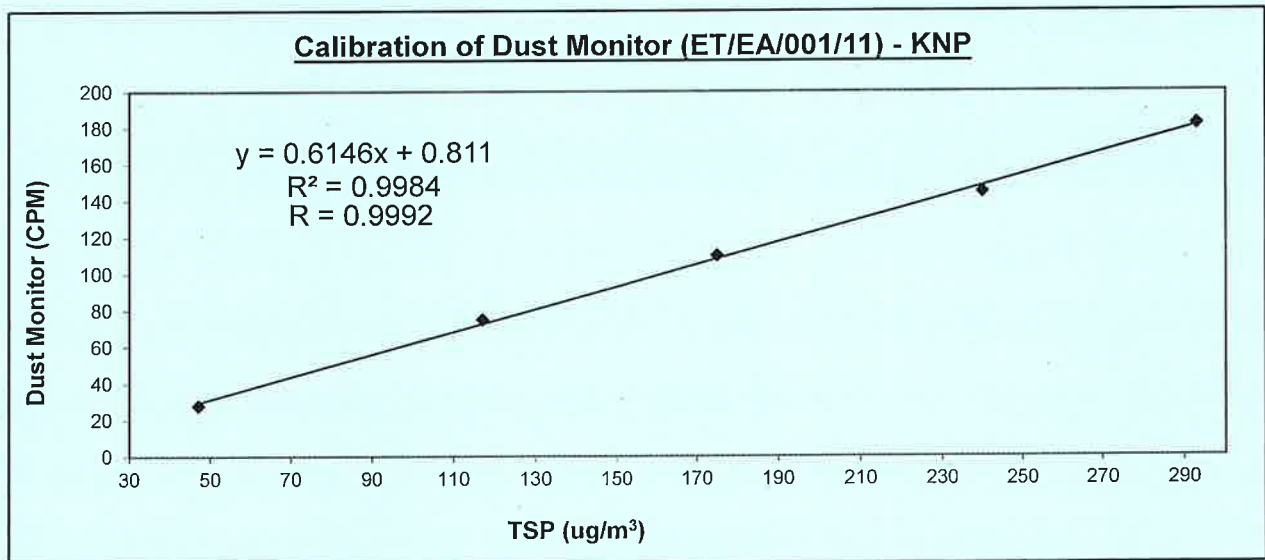
**Internal Calibration Report
of
Dust Monitor**

Manufacturer : SIBATA (LD-3B) Date of Calibration : 28 November 2023

Serial No. : 255863 (ET/EA/001/11) Calibration Due Date : 27 January 2024


Method : Parallel measurement (Five-point calibration) by placing the Dust Monitor and High Volume Air Sampler together under the same environmental condition

Results	Dust Monitor (CPM)	28	75	110	145	182
	TSP (ug/m ³)	47	117	175	240	293
	High Volume Air Sampler Serial No.:1180	Calibration Due Date: 20 December 2023				



Acceptance Criteria : Correlation coefficient (R) of the calibration curve greater than 0.990 after a five-point calibration

The Dust Trak Monitor complies * / does not comply * with the internal calibration procedures and is deemed acceptable * / unacceptable * for use.

Calibrated by : 
CHENG, Hei Man
(Technician)

Checked by : 
LAU, Chi Leung
(Environmental Team Leader)