

# Certificate of Calibration

## Calibration Certification Information

Cal. Date: October 28, 2022      Rootsmeter S/N: 438320      Ta: 297 °K  
Operator: Jim Tisch      Pa: 751.1 mm Hg  
Calibration Model #: TE-5025A      Calibrator S/N: **4088**

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4470	3.2	2.00
2	3	4	1	1.0270	6.4	4.00
3	5	6	1	0.9160	8.0	5.00
4	7	8	1	0.8740	8.8	5.50
5	9	10	1	0.7230	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)	$\sqrt{\Delta H \left( Ta/Pa \right)}$ (y-axis)
0.9874	0.6824	1.4083	0.9957	0.6881	0.8893
0.9831	0.9573	1.9916	0.9915	0.9654	1.2577
0.9810	1.0710	2.2266	0.9893	1.0801	1.4061
0.9800	1.1212	2.3353	0.9883	1.1308	1.4747
0.9747	1.3481	2.8165	0.9830	1.3596	1.7786
<b>QSTD</b>	m=	<b>2.11365</b>	<b>QA</b>	m=	<b>1.32353</b>
	b=	<b>-0.03408</b>		b=	<b>-0.02152</b>
	r=	<b>0.99999</b>		r=	<b>0.99999</b>

## 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=	$1/m \left( \left( \sqrt{\Delta H \left( Ta/Pa \right)} \right) - b \right)$

## Standard Conditions

Tstd:	298.15 °K
Pstd:	760 mm Hg
<b>Key</b>	
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



## TE-5170 Calibration Worksheet

### Site Information

Location: AM3A      Zones 2A at West      Date: 25-Mar-23  
Site ID: Kowloon Cultural  
Sampler: TE-5170      Serial No: 4340      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.92      Corrected Pressure (mm Hg): 760  
Temperature (deg F): 74      Temperature (deg K): 296  
Average Press. (in Hg): 29.92      Corrected Average (mm Hg): 760  
Average Temp. (deg F): 74      Average Temp. (deg K): 296

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.11365  
Model: TE-5025A      Qstd Intercept: -0.03408  
Serial#: 4088      Date Certified: 28-Oct-22

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.60	1.700	53.0	53.14	Slope: 31.5355
2	10.50	1.553	48.0	48.13	Intercept: -0.2941
3	7.20	1.289	41.0	41.11	Corr. Coeff: 0.9981
4	4.60	1.034	33.0	33.09	
5	2.50	0.766	23.0	23.06	# of Observations: 5

### 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 response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 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

Average I (chart): 4.0

Average Flow Calculation m3/min

1.268412317

Average Flow Calculation in CFM

44.78763893

Sample Time (Hrs): 1.0

Total Flow in m3/min

76.10473904

Total Flow in CFM

2687.258336

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM4A      Site ID: Kowloon Cultural      Date: 25-Mar-23  
Sampler: TE-5170      Serial No: 3998      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.92      Corrected Pressure (mm Hg): 760  
Temperature (deg F): 74      Temperature (deg K): 296  
Average Press. (in Hg): 29.92      Corrected Average (mm Hg): 760  
Average Temp. (deg F): 74      Average Temp. (deg K): 296

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.11365  
Model: TE-5025A      Qstd Intercept: -0.03408  
Serial#: 4088      Date Certified: 28-Oct-22

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.60	1.700	53.0	53.14	Slope: 30.6173
2	10.80	1.575	48.0	48.13	Intercept: 0.7903
3	7.40	1.307	41.0	41.11	Corr. Coeff: 0.9978
4	4.50	1.022	33.0	33.09	
5	2.40	0.751	23.0	23.06	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sqrt}(H_2O(P_a/P_{std})(T_{std}/T_a))-b]$$
$$IC = I[\text{Sqrt}(P_a/P_{std})(T_{std}/T_a)]$$

Qstd = standard flow rate

IC = corrected chart response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Average I (chart): 4.0

Average Flow Calculation m3/min

1.271030074

Average Flow Calculation in CFM

44.88007191

Sample Time (Hrs): 1.0

Total Flow in m3/min

76.26180444

Total Flow in CFM

2692.804315

NOTE: Ensure calibration orifice has been certified within 12 months of use



## TE-5170 Calibration Worksheet

### Site Information

Location: AM5A      Site ID: Kowloon Cultural      Date: 25-Mar-23  
Sampler: TE-5170      Serial No: 4344      Tech: CS Tang

### Site Conditions

Barometric Pressure (in Hg): 29.92      Corrected Pressure (mm Hg): 760  
Temperature (deg F): 74      Temperature (deg K): 296  
Average Press. (in Hg): 29.92      Corrected Average (mm Hg): 760  
Average Temp. (deg F): 74      Average Temp. (deg K): 296

### Calibration Orifice

Make: Tisch      Qstd Slope: 2.11365  
Model: TE-5025A      Qstd Intercept: -0.03408  
Serial#: 4088      Date Certified: 28-Oct-22

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	12.30	1.680	53.0	53.14	Slope: 32.1727
2	10.80	1.575	48.0	48.13	Intercept: -1.3359
3	7.30	1.298	41.0	41.11	Corr. Coeff: 0.9971
4	4.70	1.045	33.0	33.09	
5	2.60	0.781	23.0	23.06	# of Observations: 5

### 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 response

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 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

Average I (chart): 40

Average Flow Calculation m3/min

1.27567246

Average Flow Calculation in CFM

45.04399455

Sample Time (Hrs): 1.0

Total Flow in m3/min

76.54034758

Total Flow in CFM

2702.639673

NOTE: Ensure calibration orifice has been certified within 12 months of use





INTERNATIONAL  
ACCREDITATION  
SERVICE®

# CERTIFICATE OF ACCREDITATION

*This is to attest that*

## **AQUALITY TESTCONSULT LIMITED**

11A&B, KAI FONG GARDEN, PING CHE ROAD  
FANLING, HONG KONG

### **Calibration Laboratory CL-207**

has met the requirements of AC204, *IAS Accreditation Criteria for Calibration Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories*. This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date December 17, 2021

Expiration Date December 1, 2022



A handwritten signature in black ink, reading "Raj Nathan".

**President**

# SCOPE OF ACCREDITATION

International Accreditation Service, Inc.

3060 Saturn Street, Suite 100, Brea, California 92821, U.S.A. | [www.iasonline.org](http://www.iasonline.org)

## AQUALITY TESTCONSULT LIMITED

**Contact Name** Lee Mei Yee

**Contact Phone** + 852-6309-2280

**Accredited to** ISO/IEC 17025:2017

**Effective Date** December 17, 2021

### CALIBRATION AND MEASUREMENT CAPABILITY (CMC)\*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
<i>Dimensional</i>			
Caliper -Vernier, Dial & Electronic <sup>3</sup>	0 mm to 300 mm	30 µm	Checker by comparison method (BS 887:1982)
Steel Ruler <sup>3</sup>	1 mm to 1000 mm	280 µm	Reference Steel Rule by comparison method (BS 4372:1968)
Dial Indicator/Gauge (Plunger) <sup>3</sup>	0 mm to 50 mm	8 µm	Reference micrometer head by comparison method (BS 907:2008)
Feeler Gauge <sup>3</sup>	0.01 mm to 1 mm	8 µm	Reference Dial Gauge by comparison method (BS 957: 2008)
Measuring tape <sup>3</sup>	0 m to 5 m	1200 µm	Reference steel ruler by comparison method (BS 4035:1966)
Engineering Square <sup>3</sup>	Length: 0 mm to 160 mm	20 µm	Reference engineering square and Feeler Gauge (BS 939:2007)
Slump cone <sup>3</sup>	Diameter: 0 mm to 200 mm  Thickness: 1.5 mm  Height: 0 mm to 300 mm	560 µm  100 µm  560 µm	Reference Caliper & Reference Steel ruler by direct measurement (Verification in accordance with in-house method for the dimensional requirements as specified CS1:1990 Vol.1 A4; CS1: 2010 Vol. 1, A5)

\* If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Tamping rod <sup>3</sup>	Diameter: 0 mm to 16 mm Length: 600 mm	600 µm 950 µm	Reference steel ruler & Reference Caliper by direct measurement (Verification in accordance with in-house method for the dimensional requirements as specified CS1:1990 Vol.1 A5; CS1: 2010 Vol. 1, A6)
Cube mould <sup>3</sup>	(Max dimensions 150 mm per side) Dimension Flatness Perpendicularity Parallelism	50 µm 10 µm 10 µm 50 µm	Reference Caliper, straight edge & feeler gauge by direct measurement. (Verification in accordance with in-house method for the dimensional requirements as specified in BS1881: Part 108:1983; CS1:1990 Vol1, A21; CS1:2010 Vol 1, A25; BS EN 12390-2:2000)
Compacting Bar <sup>3</sup>	Ramming Face: 25 mm Length: 380 mm Weight: 1.8 kg	100 µm 560 µm 1 g	Reference Caliper & Steel ruler by direct measurement. (Verification in accordance with in-house method for the dimensional & mass requirements as specified in BS 1881: Part 105:1984 Cl 3.3; CS1:1990 Vol 2, E3 CS1:2010 Vol 1, A15.3; BS EN 12350 -5:2000 Cl 4.3.)
Covermeter	20 mm to 103 mm	2.9 mm	Reference concrete block (Verification in accordance with in-house method for the dimensional requirements as specified in BS 1881-204:1988 Cl.6.4- Method C)
Flow table <sup>3</sup>	15 kg to 17 kg 1 mm up to 71 mm	12 g 600 µm	Weighing Balance, Reference caliper & Reference steel ruler by direct measurement
Test Sieve <sup>3</sup>	4 mm to 50 mm	50 µm	Reference Caliper by direct measurement
<b>Mechanical</b>			
Force Measuring Machine <sup>3</sup> (Compression Mode)	1 kN to 3000 kN	0.4 %	Reference Load cell by direct measurement BS 1610: Part 1:1985; BS 1610: Part 1:1992; BS EN ISO 12390-4:2000 Annex B; BS EN ISO 7500-1:2004

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Laser Dust Meter <sup>3</sup>	Dust particles 0.001 mg/m <sup>3</sup> to 10.00 mg/m <sup>3</sup>	0.9 mg/m <sup>3</sup>	By comparison method by using reference laser dust meter
Rebound Hammer <sup>3</sup>	80 unit (hardness)	1.6 rebound count	Reference Rebound count by comparison method. BS1881: Part 202:1986; BS EN 12504-2:2001; BS EN 12504-2:2012
Mass (F2 class and coarser)	0 g to 200 g 200 g to 5 kg 5 kg to 10 kg 10 kg to 50 kg	1.3 mg 0.5 g 0.88 g 3 g	Standard Weight E2/ F1 Class & Weighing Balances by comparison method (OIML-R-111)
Weighing Scale & Balance <sup>3</sup>	0 g to 200 g 0 kg to 5 kg 0 kg to 50 kg	0.8 mg 0.13 g 7.7 g	Standard weight of E2/F1 Grade by direct measurement (OIML-R-111)
Volumetric Glassware	1 mL to 100 mL 100 mL to 1000 mL	0.004 mL 0.09 mL	Standard weight E2 Class, Weighing Balances & Distilled water by gravimetric method
<b>Thermal</b>			
Digital/Liquid in Glass Thermometers & RTD/ Thermocouples with or without Indicators	15 °C to 55 °C 55 °C to 95 °C	0.4 °C 0.9 °C	Water Baths, Reference Sensor and Indicator by Comparison Method (OIML R133)
Curing Tank <sup>3</sup>	(Calibration at 20 °C & 27 °C @ 30 min)  20 °C Temperature distribution  27 °C Temperature distribution  Efficiency of circulation	  0.4 °C  0.8 °C  5 s	Reference Temperature datalogger by Mapping Method & Reference Stop Watch (Verification in accordance with in-house method for the Temp & Time requirements as specified in BS1881-111:1983 CS1:1990 Vol 1 App A24 CS1:2010 Vol 1 App A28 BE EN 12390-2:2000
Oven <sup>3</sup>	40.0 °C to 180.0 °C	1.5 °C	Reference Temperature datalogger by Mapping Method (AS 2853:1986)
Furnace <sup>3</sup>	200 °C to 1300 °C	6 °C	Reference Thermocouple with Indicator By single point Calibration (AS 2853:1986)
Water bath <sup>3</sup>	15 °C to 95 °C	0.2 °C	Reference Temperature datalogger by Mapping Method (AS 2853:1986)

# SCOPE OF ACCREDITATION

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MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY <sup>1,2</sup> (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
<i>Time and Frequency</i>			
Stop Watch / Timer <sup>3</sup>	0 s to 3600 s 0 s to 21600 s (6 hours) 0 s to 86400 s (24 hours)	0.2 s 0.6 s 0.61 s	Reference stop watch
Grout Flow Cone <sup>3</sup>	7 s to 9 s	0.2 s	Reference stop watch by direct method (ASTM C939-10 Cl.9)

<sup>1</sup>The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

<sup>2</sup>When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

<sup>3</sup>Also available as site calibration. Note that actual measurement uncertainties achievable at a customer's site can normally be expected to be larger than the uncertainties listed on this Scope of Accreditation



# FAQ / Information

## Mutual Recognition Arrangements (MRA) / Multilateral Recognition Arrangements (MLA)

### Mutual Recognition Arrangement (MRA) Partners for HOKLAS ^

Every effort is made to promote acceptance of test data from accredited laboratories, both internationally and locally. HKAS has concluded mutual recognition arrangements with accreditation bodies listed below by being one of the signatories of the [International Laboratory Accreditation Cooperation Mutual Recognition Arrangement \(ILAC MRA\)](#) and the [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for testing, calibration, medical testing, Proficiency Testing Providers (PTP) and Reference Material Producers (RMP). Click [here](#) to view the up-to-date signatories of ILAC and [here](#) to access the up-to-date signatories of APAC.

Visitors checking the names, logos and accreditation symbols shown on an endorsed certificate or report should note that some of our MRA partners may have their names, logos or accreditation symbols changed recently and test reports or certificates endorsed by displaying their old accreditation symbols may still be valid during the change-over period. For details, please visit their websites or contact them directly.

» [Mutual Recognition Arrangement \(MRA\) Partners for HOKLAS](#)

HKAS MRA partners will recognise HOKLAS endorsed test certificates as having the same technical validity as certificates endorsed by their respective schemes.

### Multilateral Recognition Arrangements (MLA) for HKCAS ^

HKAS has been a signatory of [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for Quality Management System (QMS), Environmental Management System (EMS), Food Safety Management System (FSMS), Energy Management System (EnMS), Occupational Health and Safety Management System (OHSMS) certifications, product certifications, and Greenhouse Gas (GHG) validation and verification.

HKAS has also been a signatory of the [International Accreditation Forum Multilateral Recognition Arrangement \(IAF MLA\)](#) for Quality Management System (QMS), Environmental Management System (EMS), Food Safety Management System (FSMS), Energy Management System (EnMS), Occupational Health and Safety Management System (OHSMS) certifications, product certifications, and Greenhouse Gas (GHG) validation and verification.

Click [here](#) to view the up-to-date signatories of IAF and [here](#) to access the up-to-date signatories of APAC.


» [Mutual / Multilateral Recognition Arrangements \(MRA / MLA\) Partners for HKCAS](#)

### Mutual Recognition Arrangement (MRA) Partners for HKIAS ^






HKAS has concluded mutual recognition arrangements with accreditation bodies listed below by being one of the signatories of the [International Laboratory Accreditation Cooperation Mutual Recognition Arrangement \(ILAC MRA\)](#) and [Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement \(APAC MRA\)](#) for inspection. Click [here](#) to view the up-to-date signatories of ILAC and [here](#) to access the up-to-date signatories of APAC.

HKAS MRA partners will recognise HKIAS endorsed inspection reports or certificates having the same technical validity as reports or certificates endorsed by their respective schemes.

» [Mutual Recognition Arrangement \(MRA\) Partners for HKIAS](#)

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## Hong Kong Laboratory Accreditation Scheme (HOKLAS) - Mutual Recognition Arrangement (MRA) Partners

Economy	Logo	Name of Partner	URL	Test Area
United States of America		International Accreditation Service Inc. (IAS)	<a href="http://www.iasonline.org">www.iasonline.org</a>	Calibration, Non-medical Testing
United States of America		National Voluntary Laboratory Accreditation Program (NVLAP)	<a href="http://www.nist.gov/nvlap">www.nist.gov/nvlap</a>	Calibration, Non-medical Testing
United States of America		Perry Johnson Laboratory Accreditation, Inc. (PJLA)	<a href="http://www.pjlabs.com">www.pjlabs.com</a>	Calibration, Medical Testing, Non-medical Testing, Proficiency Testing Provider, Reference Material Producer
Uruguay		Organismo Uruguayo de Acreditación (OUA)	<a href="http://www.organismourugua.yodeacreditacion.org">www.organismourugua.yodeacreditacion.org</a>	Calibration, Non-medical Testing
Viet Nam		Accreditation Office for Standards Conformity Assessment Capacity (AOSC)	<a href="http://aosc.vn/">aosc.vn/</a>	Calibration, Medical Testing, Non-medical Testing
Viet Nam		Bureau of Accreditation (BoA)	<a href="http://www.boa.gov.vn">www.boa.gov.vn</a>	Calibration, Medical Testing, Non-medical Testing



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

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No. 11A&B, KAI FONG GARDEN, PING CHE ROAD, FANLING, NEW TERRITORIES, HONG KONG

TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-166F  
 Date of Report : 10-Sep-22  
 Page Number : 1 of 2  
 Customer \* : Apex Testing & Certification Ltd.  
 Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
 Customers Ref. \* : A005

#### Item Under Calibration (IUC)\*

Equipment No. : N/A  
 Manufacturer : Sibata Scientific Technology Ltd  
 Model No. : LD-3B  
 Serial No. : 235811  
 Scale Division : 0.001 mg/m<sup>3</sup>  
 Range : 0.001 to 1 mg/m<sup>3</sup>  
 Condition of Item : Normal

Date Item Received : 8-Sep-22  
 Date Calibrated : 8-Sep-22  
 Calibration Location : AQuality Calibration Lab.  
 Date of Next Calibration : 7-Sep-23  
 Calibrated By : Jessica Liu

#### Test Environment

Ambient Temperature : 25.7 °C to 33.8 °C  
 Relative Humidity : 46 % to 83 %

### Calibration Results

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.167	-0.008	5.1%	0.020	2.0
5.164	5.647	-0.484	8.5%	0.463	2.0
10.100	11.141	-1.041	9.3%	0.904	2.0

#### Remarks :

- \* Denotes information supplied by customer.
- The results relate only to the items calibrated.
- The results apply to the items as received.
- Correction = Average of (Ref reading - IUC reading)
- The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by: \_\_\_\_\_

LEE Mei Yee, Julia  
 Managing Director

The results shown in this certificate are metrologically traceable to the International System of Units (SI) or recognised measurement standards.

The certificate shall not be reproduced except in full without approval of the laboratory.



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

No. 11A&11B, KAI FONG GARDEN, PING CHE ROAD, FANLING, NEW TERRITORIES, HONG KONG

TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-166F  
Date of Report : 10-Sep-22  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### Details of Calibration

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202101714	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -





東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

No. 11A&11B, KAI FONG GARDEN, PING CHE ROAD, FANLING, N.T., HONG KONG

TEL : 852-3582-9589

FAX : 852-2674-1177

EMAIL : cal.aqtl@gmail.com

WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd. Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Test Report No.	220908MCA-166F
	Date of Issue	10-Sep-22
	Date of Testing	8-Sep-22
	Page	1 of 1

#### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 235811

#### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 3476 / 3543
Last Calibration	: 6-SEP-22 / 20-OCT-21

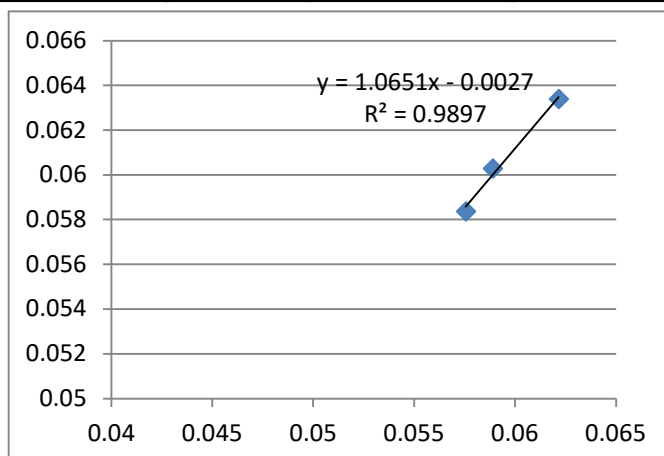
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m3)	Concentration Calibrated Equipment (mg/m3)
8-Sep-22	19:00	29.8	1013.8	0.0622	0.0634
8-Sep-22	20:05	29.8	1013.8	0.0576	0.0584
8-Sep-22	21:10	29.8	1013.8	0.0589	0.0603

By Linear Regression of Y or X

Slope (K-factor) : 1.0651

Correlation Coefficient : 0.9897

Validity of Calibration : 7-Sep-23



Recorded by : Jessica Liu

Signature:

Date: 8-Sep-22

Checked by : S Tang

Signature:

Date: 8-Sep-22



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

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### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-163F  
 Date of Report : 10-Sep-22  
 Page Number : 1 of 2  
 Customer \* : Apex Testing & Certification Ltd.  
 Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
 Customers Ref. \* : A005

#### Item Under Calibration (IUC)\*

Equipment No. : N/A  
 Manufacturer : Sibata Scientific Technology Ltd  
 Model No. : LD-3B  
 Serial No. : 336338  
 Scale Division : 0.001 mg/m<sup>3</sup>  
 Range : 0.001 to 1 mg/m<sup>3</sup>  
 Condition of Item : Normal

Date Item Received : 8-Sep-22  
 Date Calibrated : 8-Sep-22  
 Calibration Location : AQuality Calibration Lab.  
 Date of Next Calibration : 7-Sep-23  
 Calibrated By : Jessica Liu

#### Test Environment

Ambient Temperature : 25.7 °C to 33.8 °C  
 Relative Humidity : 46 % to 83 %

### Calibration Results

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.168	-0.010	5.7%	0.026	2.0
5.164	5.562	-0.398	7.1%	0.462	2.0
10.100	10.936	-0.837	7.6%	0.905	2.0

#### Remarks

- :
- \* Denotes information supplied by customer.
  - The results relate only to the items calibrated.
  - The results apply to the items as received.
  - Correction = Average of (Ref reading - IUC reading)
  - The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by:

LEE Mei Yee, Julia  
 Managing Director

The results shown in this certificate are metrologically traceable to the International System of Units (SI) or recognised measurement standards.

The certificate shall not be reproduced except in full without approval of the laboratory.



東恒測試顧問有限公司

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TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-163F  
Date of Report : 10-Sep-22  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### Details of Calibration

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202101714	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

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### CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd. Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Test Report No.	220908MCA-163F
	Date of Issue	10-Sep-22
	Date of Testing	8-Sep-22
	Page	1 of 1

#### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 336338

#### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 3476 / 3543
Last Calibration	: 6-SEP-22 / 20-OCT-21

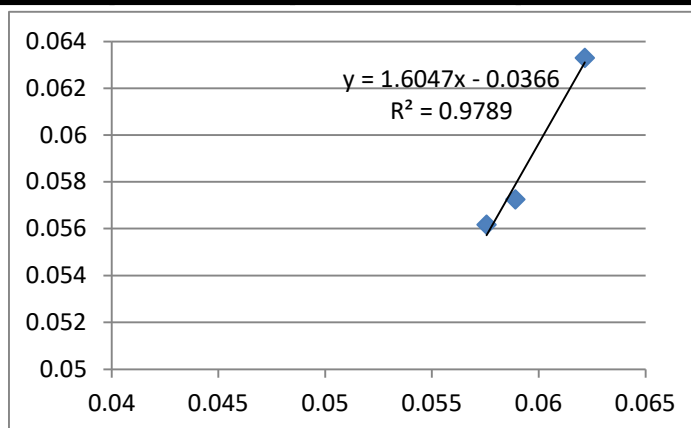
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m3)	Concentration Calibrated Equipment (mg/m3)
8-Sep-22	19:00	29.8	1013.8	0.0622	0.0633
8-Sep-22	20:05	29.8	1013.8	0.0576	0.0562
8-Sep-22	21:10	29.8	1013.8	0.0589	0.0573

By Linear Regression of Y or X

Slope (K-factor) : 1.6047

Correlation Coefficient : 0.9789

Validity of Calibration : 7-Sep-23

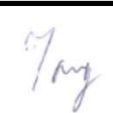


Recorded by : Jessica Liu

Signature: 

Date: 8-Sep-22

Checked by : S Tang

Signature: 

Date: 8-Sep-22



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

No. 11A&B, KAI FONG GARDEN, PING CHE ROAD, FANLING, NEW TERRITORIES, HONG KONG

TEL : 852-3582-9589 FAX : 852-2674-1177 EMAIL : cal.aqtl@gmail.com WEBSITE: www.aqtlgroup.com

### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-165F  
 Date of Report : 10-Sep-22  
 Page Number : 1 of 2  
 Customer \* : Apex Testing & Certification Ltd.  
 Customer Address\* : Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK  
 Customers Ref. \* : A005

#### Item Under Calibration (IUC)\*

Equipment No. : N/A  
 Manufacturer : Sibata Scientific Technology Ltd  
 Model No. : LD-3B  
 Serial No. : 567188  
 Scale Division : 0.001 mg/m<sup>3</sup>  
 Range : 0.001 to 1 mg/m<sup>3</sup>  
 Condition of Item : Normal

Date Item Received : 8-Sep-22  
 Date Calibrated : 8-Sep-22  
 Calibration Location : AQuality Calibration Lab.  
 Date of Next Calibration : 7-Sep-23  
 Calibrated By : Jessica Liu

#### Test Environment

Ambient Temperature : 25.7 °C to 33.8 °C  
 Relative Humidity : 46 % to 83 %

### Calibration Results

Reference True Reading (mg/m <sup>3</sup> )	Average IUC Reading (mg/m <sup>3</sup> )	Correction (mg/m <sup>3</sup> )	Error of IUC Reading (%)	Expanded Uncertainty (mg/m <sup>3</sup> )	Coverage Factor K
0.158	0.167	-0.008	4.9%	0.023	2.0
5.164	5.693	-0.530	9.3%	0.463	2.0
10.100	11.045	-0.945	8.6%	0.905	2.0

#### Remarks

- :
- \* Denotes information supplied by customer.
  - The results relate only to the items calibrated.
  - The results apply to the items as received.
  - Correction = Average of (Ref reading - IUC reading)
  - The technical requirement of laser dust meter. +/- 20% error for the particles concentration.

Approved by:

LEE Mei Yee, Julia  
 Managing Director

The results shown in this certificate are metrologically traceable to the International System of Units (SI) or recognised measurement standards.

The certificate shall not be reproduced except in full without approval of the laboratory.





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### CERTIFICATE OF CALIBRATION

Report Number : 220908MCA-165F  
Date of Report : 10-Sep-22  
Page Number : 2 of 2  
Customer \* : Apex Testing & Certification Ltd.  
Customers Ref. \* : A005

#### Details of Calibration

1. The calibration was performed in accordance with AQuality Testconsult Procedure Number ENV-L-003 (in-house method), by comparison with the laboratory's reference equipment which have traceable international standards of measurement.
2. The item under calibration (IUC) was allowed to stabilize in the laboratory for 0.25 hour before commencement of calibration.
3. A set of readings were made at each calibration concentration. The values quoted in the results are the average of each set of readings.
4. The values given in this calibration certificate only relate to the values measured at the time of calibration. Any uncertainties quoted do not include allowance for the capability of any other laboratory to repeat the measurement. The uncertainty quoted relate only to item at time of calibration. AQuality Testconsult Limited is not liable for any loss or damage resulting from the use of this equipment.
5. The identification, calibration certificate numbers for the reference equipment used were as follows :

<u>Equipment Number</u>	<u>Certificate Number</u>	<u>Description</u>
CH-LDM-1	HBW202101714	粉尘测试仪

6. Copies of the Calibration certificates of the reference equipment used in this calibration may be obtained from AQuality Testconsult Limited, if necessary.

- End of Report -



東恒測試顧問有限公司

AQUALITY TESTCONSULT LIMITED

香港新界粉嶺坪輦路啟芳園11A&11B號

No. 11A&11B, KAI FONG GARDEN, PING CHE ROAD, FANLING, N.T., HONG KONG

TEL : 852-3582-9589

FAX : 852-2674-1177

EMAIL : cal.aqtl@gmail.com

WEBSITE: www.aqtlgroup.com

## CERTIFICATE OF CALIBRATION

Apex Testing & Certification Ltd. Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T., HK	Test Report No.	220908MCA-165F
	Date of Issue	10-Sep-22
	Date of Testing	8-Sep-22
	Page	1 of 1

### Item for Calibration

Description	: Laser Dust Monitor
Manufacturer	: Sibata Scientific Technology Ltd
Model No.	: LD-3B
Serial No.	: 567188

### Standard Equipment

Description	: High Volume Sampler / Calibration Orifice
Manufacturer	: Tisch Environmental, Inc.
Model No.	: TE-5170 / TE-5025A
Serial No.	: 3476 / 3543
Last Calibration	: 6-SEP-22 / 20-OCT-21

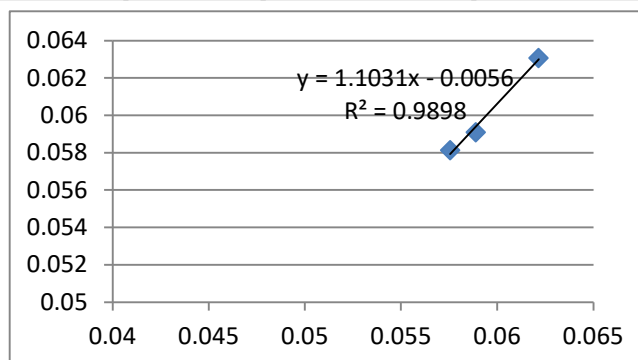
Date	Time	Mean Temp (°C)	Mean Pressure (hPa)	Concentration Standard Equipment (mg/m3)	Concentration Calibrated Equipment (mg/m3)
8-Sep-22	19:00	29.8	1013.8	0.0622	0.0631
8-Sep-22	20:05	29.8	1013.8	0.0576	0.0581
8-Sep-22	21:10	29.8	1013.8	0.0589	0.0591

By Linear Regression of Y or X

Slope (K-factor) : 1.1031

Correlation Coefficient : 0.9898

Validity of Calibration : 7-Sep-23



Recorded by : Jessica Liu

Signature: Jessica

Date: 8-Sep-22

Checked by : S Tang

Signature: S Tang


Date: 8-Sep-22

## Certificate of Calibration


Certificate No.: A220075

<b>Description:</b>	<b>Sound level meter</b>	<b>Microphone</b>	<b>Preamplifier</b>
<b>Make:</b>	Hangzhou Aihua	Hangzhou Aihua	Hangzhou Aihua
<b>Model:</b>	AWA5661	AWA14421	-
<b>Serial No.:</b>	301135	102497	-
<b>Type:</b>	1	-	-
<b>Customer:</b>	Apex Testing & Certification Ltd		
<b>Department:</b>	-		
<b>Address:</b>	Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T. Hong Kong		
<b>Date of receipt the calibration item:</b>	2022-09-26		
<b>Environmental conditions:</b>			
<b>Pressure:</b>	(100.45 $\pm$ 0.50) kPa		
<b>Temperature:</b>	(24.7 $\pm$ 1.0) °C		
<b>Humidity:</b>	(32.3 $\pm$ 2.0)%RH		
<b>Date of calibration:</b>	2022-10-11		
<b>Date of issue:</b>	2022-10-11		


Prepared by:

  
\_\_\_\_\_  
Wong Hau Chun

Checked by:

  
\_\_\_\_\_  
Choi Pui Sum

Approved Signatory:

  
\_\_\_\_\_  
Choi Pui Sum

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (Reg. No. HOKLAS 302) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Unit (SI) or recognised measurement standards. This certificate shall not be reproduced except in full.



*Certificate No.: A220075*

**Preconditioning:**

The equipment was preconditioned for more than 12 hours at the measurement conditions of pressure, temperature and humidity.

**Measurement method:**

A description of the in-house test procedure (ESG-NOISE-001) is available separately from the calibration laboratory.

**Test Specification:**

The Sound Level Meter has been calibrated in accordance with the requirements as specified the electrical tests in IEC 61672-3:2013 (Clause 11.2, 13, 14, 15, 16, 17(If necessary) \*, 18, 19, 20 and 21).

\*The application of Clause 17 is based on the more than one level range of Sound Level Meter.

**Reference equipment used in the calibration:**

Description:	Model:	Serial No.	Calibration Date:	Traceable to:
Signal generator	DS 360	123901	29-Jul-2021	The Government of HKSAR Standards and Calibration Laboratory
Meteo Station HM30	HM30	J120806	20-Aug-2021	Huber Instrumente Calibration Laboratory

**Uncertainty:**

The measurement uncertainty evaluation has been carried out in accordance with principles in the Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement, JCGM 100:2008. The expanded measurement uncertainty  $U$ , with its coverage factor  $k$ , corresponds to an approximate 95% probability that the value of measurand  $Y$  lies within the interval  $y-U$  to  $y+U$ . The combined standard measurement uncertainty  $u_c$  can be calculated as  $u_c = U/k$  and its degree of freedom  $V_{\text{eff}}$  is given by the t-distribution with the respective  $k$  value.

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (Reg. No. HOKLAS 302) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Unit (SI) or recognised measurement standards. This certificate shall not be reproduced except in full.



*Certificate No.: A220075*

**Summary of Measurement Results**

Self-generated noise - IEC 61672-3 Ed.2.0 Clause 11  
Frequency weightings: A Network - IEC 61672-3 Ed.2.0 Clause 13.3  
Frequency weightings: C Network - IEC 61672-3 Ed.2.0 Clause 13.3  
Frequency weightings: Z Network - IEC 61672-3 Ed.2.0 Clause 13.3  
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.2.0 Clause 14  
Long term stability test - IEC 61672-3 Ed.2.0 Clause 15  
Level linearity on the reference level range - IEC 61672-3 Ed.2.0 Clause 16  
Level linearity including the level range control - IEC 61672-3 Ed.2.0 Clause 17  
Toneburst response - IEC 61672-3 Ed.2.0 Clause 18  
Peak C sound level - IEC 61672-3 Ed.2.0 Clause 19  
Overload indication - IEC 61672-3 Ed.2.0 Clause 20  
High level stability test - IEC 61672-3 Ed.2.0 Clause 21

**Verification:**

The verification measurements have been performed using the calibration system Nor1504A with software SImCal62Y8.exe.

Detailed measurement results are printed on the following pages.

**Comment:**

The values given in this Certificate of Calibration only relate to values measured at the time of the test and any measurement uncertainties quoted will not include allowances for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, or the capability of any other laboratory to repeat the measurement. The results apply to the item as received.

The results in this Certificate of Calibration only apply to the sample / calibration item as received.

---

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (Reg. No. HOKLAS 302) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Unit (SI) or recognised measurement standards. This certificate shall not be reproduced except in full.

ESG Matters Limited – Acoustic Calibration Centre  
Unit 1818-19, 18/F, Tower A, Regent Centre, 63 Wo Yi Hop Road, Kwai Chung, Hong Kong  
Tel : 2525 8033 Website : [www.esgmatters.asia](http://www.esgmatters.asia) Email : [email@esgmatters.asia](mailto:email@esgmatters.asia)



Certificate No.: A220075

## Measurement results

Self-generated noise test - IEC 61672-3:2013 Clause 11		
Description: Relevant tests were carried out in accordance with Section 11 of IEC 61672-3:2013. The noise test is performed in the most sensitive of the SLM with the microphone replaced by an equivalent impedance.		
Noise level in A weighting network	16.6	dB
Noise level in C weighting network	19.0	dB
Noise level in Z (Lin) weighting network	25.4	dB

Frequency weighting test - IEC 61672-3:2013 Clause 13.3								
Description:								
Relevant tests were carried out in accordance with Section 13.3 of IEC 61672-3:2013. The frequency response of the weighting networks are tested at octave intervals over the frequency ranges 63.1Hz to 15848.9 Hz.								
On the reference level range and for each frequency weighting to be tested, the level of a 1 kHz input signal shall be adjusted to yield an indication that is 45 dB less than the upper boundary stated in the Instruction Manual for the linear operating range at 1 kHz on the reference level range.								
Frequency weighting A:								
Frequency	Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
Hz	dB	dB	dB		dB	+	-	dB
63.1	95.0	94.9	0.1	1.96	-0.1	1.0	1.0	0.6
125.9	95.0	95.0	0.1		0.0	1.0	1.0	
251.2	95.0	94.9	0.1		-0.1	1.0	1.0	
501.2	95.0	95.0	0.1		0.0	1.0	1.0	
1000.0	95.0	95.0	0.1		0.0	0.7	0.7	
1995.3	95.0	95.1	0.1		0.1	1.0	1.0	
3981.1	95.0	95.2	0.1		0.2	1.0	1.0	
7943.3	95.0	95.7	0.1		0.7	1.5	2.5	0.7
15848.9	95.0	92.0	0.1		-3.0	2.5	16	1.0
Frequency weighting C:								
Frequency	Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
Hz	dB	dB	dB		dB	+	-	dB
63.1	95.0	94.9	0.1	1.96	-0.1	1.0	1.0	0.6
125.9	95.0	95.0	0.1		0.0	1.0	1.0	
251.2	95.0	94.9	0.1		-0.1	1.0	1.0	
501.2	95.0	95.0	0.1		0.0	1.0	1.0	
1000.0	95.0	95.0	0.1		0.0	0.7	0.7	
1995.3	95.0	95.0	0.1		0.0	1.0	1.0	
3981.1	95.0	95.2	0.1		0.2	1.0	1.0	
7943.3	95.0	95.6	0.1		0.6	1.5	2.5	0.7
15848.9	95.0	91.9	0.1		-3.1	2.5	16	1.0

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (Reg. No. HOKLAS 302) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Unit (SI) or recognised measurement standards. This certificate shall not be reproduced except in full.

Certificate No.: A220075

Frequency weighting Z:								
Frequency	Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
Hz	dB	dB	dB		dB	+	-	dB
63.1	95.0	95.0	0.1	1.96	0.0	1.0	1.0	0.6
125.9	95.0	95.0	0.1		0.0	1.0	1.0	
251.2	95.0	95.0	0.1		0.0	1.0	1.0	
501.2	95.0	95.0	0.1		0.0	1.0	1.0	
1000.0	95.0	95.0	0.1		0.0	0.7	0.7	
1995.3	95.0	95.0	0.1		0.0	1.0	1.0	
3981.1	95.0	94.9	0.1		-0.1	1.0	1.0	0.7
7943.3	95.0	95.0	0.1		0.0	1.5	2.5	
15848.9	95.0	94.8	0.1		-0.2	2.5	16	

#### Frequency and time weighting test at 1kHz- IEC 61672-3:2013 Clause 14

##### Description:

Relevant tests were carried out in accordance with Section 14 of IEC 61672-3:2013. For a steady sinusoidal electrical input signal at 1 kHz on the reference level range and with an input signal that yields an indication of the reference sound pressure level with frequency weighting A, C and Z, with the sound level meter set to display F-time-weighted sound level, or time averaged sound level, as available. In addition, the indications with frequency weighting A shall be recorded with the sound level meter set to display F-time-weighted sound level, S-time-weighted sound level, and time-averaged sound level.

Parameter setting	Reference level	Measured Level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance Limits (dB)		Maximum permitted uncertainty
	dB	dB	dB		dB	+	-	dB
L <sub>AF</sub> SPL	94.0	94.0	0.1	1.96	0.0	0.2	0.2	0.2
L <sub>C</sub> F SPL	94.0	94.0	0.1		0.0			
L <sub>Z</sub> F SPL	94.0	94.0	0.1		0.0			
L <sub>As</sub> SPL	94.0	94.0	0.1		0.0	0.1	0.1	
L <sub>A</sub> eq	94.0	94.0	0.1		0.0			
L <sub>A</sub> E	114.0	114.1	0.1		0.1			

#### Long term stability test - IEC 61672-3:2013 Clause 15

##### Description:

Relevant tests were carried out in accordance with Section 15 of IEC 61672-3:2013. The long-term stability of a sound level meter is evaluated from the difference between the A-weighted sound levels indicated in response to steady 1 kHz signals applied at the beginning and end of a period of operation. The period of continuous operation shall be between 25 min and 35 min are performed.

Test signal: Sine wave at 1 kHz

Time interval	Reading at beginning	Reading at Ending	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance Limits (dB)		Maximum permitted uncertainty
mm:ss	dB	dB	dB		dB	+	-	dB
25:10	94.0	94.0	0.1	1.96	0.0	0.1	0.1	0.1

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Certificate No.: A220075

Level linearity on the reference level range test - IEC 61672-3:2013 Clause 16							
Description: Relevant tests were carried out in accordance with Section 16 of IEC 61672-3:2013. Level linearity shall be tested with steady sinusoidal electrical signals at a frequency of 8 kHz with the sound level meter set for frequency-weighting A. Level linearity shall be measured in 5 dB steps of increasing input signal level from the starting point up to within 5 dB of the upper boundary stated in the Instruction Manual for the linear operating range at 8 kHz, then at 1 dB steps of increasing input signal level up to, but not including, the first indication of overload. The test of level linearity shall then be continued at 5 dB steps of decreasing input signal level from the starting point down to within 5 dB of the specified lower boundary, then at 1 dB steps of decreasing input signal level down to, but not including, the first indication of an under-range condition.							
Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
dB	dB	dB		dB	+	-	dB
94.0	93.9	0.1	1.96	-0.1	0.8	0.8	0.3
99.0	98.9	0.1		-0.1			
104.0	103.9	0.1		-0.1			
109.0	108.9	0.1		-0.1			
114.0	113.9	0.1		-0.1			
119.0	118.8	0.1		-0.2			
124.0	123.8	0.1		-0.2			
129.0	128.8	0.1		-0.2			
134.0	133.8	0.1		-0.2			
136.0	135.8	0.1		-0.2			
137.0	136.8	0.1		-0.2			
138.0	137.8	0.1		-0.2			
139.0	138.8	0.1		-0.2			
140.0	139.8	0.1		-0.2			
94.0	93.9	0.1		-0.1			0.3
89.0	88.9	0.1		-0.1			
84.0	83.8	0.1		-0.2			
79.0	78.8	0.1		-0.2			
74.0	73.8	0.1		-0.2			
69.0	68.8	0.1		-0.2			
64.0	63.8	0.1		-0.2			
59.0	58.9	0.1		-0.1			
54.0	53.9	0.1		-0.1			
50.0	50.1	0.1		0.1			
49.0	49.1	0.1		0.1			
45.0	45.5	0.1		0.5			

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Certificate No.: A220075

**Level linearity including the level range control test - IEC 61672-3:2013 Clause 17**

**Description:**

Relevant tests were carried out in accordance with Section 17 of IEC 61672-3:2013. For sound level meters that have more than one level range, tests of level linearity deviations including deviations introduced by the level range control shall be performed with steady sinusoidal electrical input signals at a frequency of 1 kHz and with the sound level meter set for frequency weighting A.

For each level range, the level of the input signal shall then be adjusted to yield a signal level that is expected to be 5 dB greater than the signal level that first causes an indication of under-range on a level range.

Full Scale	Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
dB	dB	dB	dB		dB	+	-	dB
Measured at 1 kHz								
The following measurements are SPL measurements								
Measuring the reference level on the available ranges								
140.0	94.0	94.0	0.1	1.96	0.0	0.3	0.3	0.3
120.0	94.0	94.1	0.1		0.1			
Measuring 5 dB below full scale on all available ranges								
140.0	135.0	135.0	0.1	1.96	0.0	0.8	0.8	0.3
120.0	115.0	115.0	0.1		0.0			

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Certificate No.: A220075

## Toneburst response test - IEC 61672-3:2013 Clause 18

### Description:

Relevant tests were carried out in accordance with Section 18 of IEC 61672-3:2013. For the toneburst signals, indications of the sound level meter to be recorded are maximum F-time-weighted sound level, maximum S-time-weighted sound level, and sound exposure level. The level of the steady input signal shall be adjusted to display an F-time-weighted, S time-weighted, or time-averaged sound level, as appropriate, that is 3 dB less than the upper boundary stated in the Instruction Manual for the linear operating range at 4 kHz on the reference level range.

For tests with the F time weighting, the indication shall be recorded of the maximum F time-weighted sound level in response to tonebursts having durations of 200 ms, 2 ms, and 0.25 ms.

For tests with the S time weighting, the indication shall be recorded of the maximum S time-weighted sound level in response to tonebursts having durations of 200 ms and 2 ms.

For measurements of sound exposure level (or time-averaged sound level for an averaging time that includes the toneburst), the indications in response to tonebursts having durations of 200 ms, 2 ms, and 0.25 ms.

Parameter setting	Burst duration	Reference level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
	ms	dB	dB	dB		dB	+	-	y dB
L <sub>AF</sub> MAX	200	136.0	136.0	0.1	1.96	0.0	0.5	0.5	0.3
	2	119.0	118.7	0.1		-0.3	1.0	1.5	
	0.25	110.0	109.8	0.1		-0.2	1.0	3.0	
L <sub>AS</sub> MAX	200	129.6	129.6	0.1		0.0	0.5	0.5	
	2	110.0	110.0	0.1		0.0	1.0	3.0	
LAE	200	130.0	130.1	0.1		0.1	0.5	0.5	
	2	110.0	110.0	0.1		0.0	1.0	1.5	
	0.25	101.0	100.9	0.1		-0.1	1.0	3.0	

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Certificate No.: A220075

**Peak C sound level test - IEC 61672-3:2013 Clause 19**

**Description:**

Relevant tests were carried out in accordance with Section 19 of IEC 61672-3:2013. Indications of C-weighted peak sound level shall be tested on the least-sensitive level range. The test signals consist of (a) a single complete cycle of an 8 kHz sinusoid starting and stopping at zero crossings and (b) positive and negative half cycles of a 500 Hz sinusoid that also start and stop at zero crossings.

The level of the steady sinusoidal 8 kHz electrical input signal, from which a single complete cycle is extracted, shall be adjusted to yield an indication of C-weighted, F-time-weighted sound level, or C-weighted, time-averaged sound level, that is 8 dB less than the upper boundary stated in the Instruction Manual for the peak level range at 8 kHz on the least sensitive level range.

The level of the steady sinusoidal 500 Hz electrical input signal, from which positive and negative half cycles are extracted, shall be adjusted to yield an indication of C-weighted, F time-weighted sound level, or C-weighted, time-averaged sound level, that is 8 dB less than the upper boundary stated in the Instruction Manual for the peak level range on the least-sensitive level range.

Pulse type	Pulse frequency	Reference Peak level	Measured level	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
	Hz	dB	dB	dB		dB	+	-	
1 cycle	8000	138.40	137.90	0.10	1.96	-0.50	2.00	2.00	0.35
Positive cycle	500	140.40	139.60	0.10		-0.80	1.00	1.00	
Negative cycle	500	140.40	139.50	0.10		-0.90			

**Overload indication test - IEC 61672-3:2013 Clause 20**

**Description:**

Relevant tests were carried out in accordance with Section 20 of IEC 61672-3:2013. The sound level meter set to display A-weighted, time-averaged sound level. Positive and negative one-half cycle sinusoidal electrical signals at a frequency of 4 kHz.

The test shall begin at an indicated time-averaged level for the steady input signal that corresponds to 1 dB less than the upper boundary specified for the linear operating range at 4 kHz. The level of the single positive one-half-cycle input signal shall be increased to the first indication of overload, to a resolution of 0,1 dB. The process shall be repeated for the single negative one-half-cycle signal.

Overload indication at 4 kHz		Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance limit (dB)		Maximum permitted uncertainty
Positive one-half-cycle	Negative one-half-cycle				+	-	
dB	dB	dB		dB			dB
146.70	147.10	0.10	1.96	0.40	1.50	1.50	0.25

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Certificate No.: A220075

High level stability test - IEC 61672-3:2013 Clause 21							
Description:							
Relevant tests were carried out in accordance with Section 21 of IEC 61672-3:2013. The ability of a sound level meter to operate continuously in response to high signal levels without significant change in sensitivity is evaluated from the difference between the A weighted sound levels indicated in response to a steady 1 kHz electrical signal at the beginning and end of a 5 min period of continuous exposure to the signal.							
The level of the steady electrical input signal shall be that which is required to display the sound level that is 1 dB less than the upper boundary of the 1 kHz linear operating range on the least-sensitive level range.							
Reading at beginning	Reading at Ending	Expanded Measurement Uncertainty U	Coverage Factor k	Deviation	Acceptance Limits (dB)		Maximum permitted uncertainty
dB	dB	dB		dB	+	-	dB
139.0	139.0	1.0	1.96	0.0	0.1	0.1	0.1

**Remark:**

Acoustical levels are stated relative to 20μPa. Other dB levels are relative values.

- END -

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## Certificate of Calibration

Certificate No.: B220032

<b>Description:</b>	Sound calibrator
<b>Make:</b>	Quest
<b>Model:</b>	QC-10
<b>Serial No.:</b>	QI9010183
<b>Class:</b>	1
<b>Customer:</b>	Apex Testing & Certificate Ltd
<b>Department:</b>	-
<b>Address:</b>	Unit D6A, 10/F, TML Tower, 3 Hoi Shing Road, Tsuen Wan, N.T.

Date of receipt the calibration item: 2022-09-26

**Environmental conditions:**

<b>Pressure:</b>	(100.34 $\pm$ 0.50) kPa
<b>Temperature:</b>	(21.6 $\pm$ 1.0) °C
<b>Humidity:</b>	(57.0 $\pm$ 2.0)%RH

Date of calibration: 2022-10-05

Date of issue: 2022-10-05

Prepared by:

A handwritten signature in blue ink, appearing to read 'Thomas Ho'.

Ho Tsz Chun

Checked by:

A handwritten signature in black ink, appearing to read 'Pui Sum'.

Choi Pui Sum

Approved Signatory:

A handwritten signature in black ink, appearing to read 'Pui Sum'.

Choi Pui Sum

Hong Kong Accreditation Service (HKAS) has accredited this laboratory (Reg. No. HOKLAS 302) under the Hong Kong Laboratory Accreditation Scheme (HOKLAS) for specific calibration activities as listed in the HOKLAS directory of accredited laboratories. The results shown in this certificate are traceable to the International System of Unit (SI) or recognised measurement standards. This certificate shall not be reproduced except in full.

*Certificate No.: B220032*

**Preconditioning:**

The equipment was preconditioned for more than 12 hours at the measurement conditions of pressure, temperature and humidity.

**Measurement method:**

A description of the in-house test procedure (ESG-NOISE-003) is available separately from the calibration laboratory.

**Test Specification:**

The Sound Calibrator has been calibrated in accordance with the requirements as specified the in-house test procedure ESG-NOISE-003.

The verification measurements were performed using the calibration system Nor1504A with software CalCal62NCL.exe. As acoustical reference was used WSM - Nor1225-215371 with sensitivity: 54.76 mV/Pa.

**Reference equipment used in the calibration:**

Description:	Model:	Serial No.	Calibration Date:	Traceable to:
Signal generator	DS 360	123901	2021-07-30	The Government of HKSAR Standards and Calibration Laboratory
Multimeter	Agilent 34401A	MY41030277	2021-08-03	The Government of HKSAR Standards and Calibration Laboratory
Meteo Station HM30	HM30	J120806	2021-08-20	Huber Instrumente Calibration Laboratory
Reference microphone	Nor 1225	215371	2021-06-28	The Government of HKSAR Standards and Calibration Laboratory
Reference Calibrator	B&K 4231	3014997	2021-08-03	The Government of HKSAR Standards and Calibration Laboratory
Audio Analyzer	8903B	3011A11797	2021-08-13	China Ceprei Laboratory Calibration & Testing Centre

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*Certificate No.: B220032*

**Uncertainty:**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

The measurement uncertainty evaluation has been carried out in accordance with principles in the Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement, JCGM 100:2008. The expanded measurement uncertainty  $U$ , with its coverage factor  $k$ , corresponds to an approximate 95% probability that the value of measurand  $Y$  lies within the interval  $y-U$  to  $y+U$ . The combined standard measurement uncertainty  $u_c$  can be calculated as  $u_c = U/k$  and its degree of freedom  $V_{\text{eff}}$  is given by the t-distribution with the respective  $k$  value.

**Comment:**

The values given in this Certificate of Calibration only relate to values measured at the time of the test and any measurement uncertainties quoted will not include allowances for the equipment long term drift, variations with environmental changes, vibration and shock during transportation, or the capability of any other laboratory to repeat the measurement. The results apply to the item as received.

All tests are performed according to in-house test procedure ESG-Noise-003.

The results in this Certificate of Calibration only apply to the sample / calibration item as received.

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ESG Matters Limited – Acoustic Calibration Centre  
Unit 1818-19, 18/F, Tower A, Regent Centre, 63 Wo Yi Hop Road, Kwai Chung, Hong Kong  
Tel: 2525 8033 Website: [www.esgmatters.asia](http://www.esgmatters.asia) Email: [email@esgmatters.asia](mailto:email@esgmatters.asia)

Certificate No.: B220032

**Table 1**

**Sound Pressure Level Test Results**

Description:

Performance tests were carried out in accordance with Annex B.3.4.3.2 of IEC 60942:2003. The sound pressure level generated by the equipment was compare to the reference sound pressure level by the reference equipment B&K 4231 (Equipment No.:3014997).

Quest QC-10			Measured Deviation (b) – (a)			Acceptance Limits	Maximum Permitted Uncertainty
Frequency Setting	Sound Pressure Level		Value y	Measurement Uncertainty			
	Expected Reading (a)	Measured Reading (b)		Expanded Measurement Uncertainty U (dB)	Coverage Factor k		
(Hz)	(dB)	(dB)	(dB)			(dB)	(dB)
1000.00	114.00	113.85	-0.15	0.13	1.96	±0.40	0.15

The calibrator was placed on top of the reference microphone, only held in place by gravity. At least three repetitions have been performed. No adapter ring was needed to obtain half inch configuration.

The calibrator level was not adjusted.

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Certificate No.: B220032

**Table 2**  
**Frequency Test Results**

Description:							
Relevant tests were carried out in accordance with Annex B.3.5 of IEC 60942:2003. The frequency of sound pressure level generated by the equipment was measured by the multimeter (Equipment No.: MY41030277).							
Quest QC-10			Measured Deviation [ =([b] – [a])/[a] x 100%]			Acceptance Limits	Maximum Permitted Uncertainty
Sound Pressure Level Setting	Frequency		Value y	Measurement Uncertainty			
	Expected Reading (a)	Measured Reading (b)		Expanded Measurement Uncertainty U	Coverage Factor k		
(dB)	(Hz)	(Hz)	(%)	(%)		(%)	(%)
114.00	1000.00	998.68	-0.13	0.14	1.96	±1.00	0.30

The calibrator was placed on top of the reference microphone, only held in place by gravity. At least three repetitions have been performed. No adapter ring was needed to obtain half inch configuration.

The calibrator level was not adjusted.

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Certificate No.: B220032

**Table 3**

**Total Distortion Test Results**

Description:						
Relevant tests were carried out in accordance with Annex B.3.6 of IEC 60942:2003. The total distortion of the acoustic signal generated by the equipment was measured by the Laboratory's audio analyzer (Equipment No.: 3011A11797).						
Quest QC-10		Measured Total Distortion			Acceptance Limits	Maximum Permitted Uncertainty
Frequency Setting	Sound Pressure Level Setting	Value y	Measurement Uncertainty			
			Expanded Measurement Uncertainty U	Coverage Factor k		
(Hz)	(dB)	(%)	(%)		(%)	(%)
1000.00	114.00	0.43	0.21	1.96	±3.00	0.50

The calibrator was placed on top of the reference microphone, only held in place by gravity. At least three repetitions have been performed. No adapter ring was needed to obtain half inch configuration.

The calibrator level was not adjusted.

The stated levels are relative to 20μPa. The distortion value (in %) is the signal to total noise ratio.

- END -

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