



**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**Information supplied by customer:**

**CONTACT:** SAM LAM **WORK ORDER:** HK1510067  
**CLIENT:** LAM GEOTECHNICS LIMITED  
**DATE RECEIVED:** 25/02/2015  
**DATE OF ISSUE:** 04/03/2015  
**ADDRESS:** 11/F, CENTRE POINT, 181-185, GLOUCESTER ROAD,  
WANCHAI, HONG KONG  
**PROJECT:** ---

**METHOD OF PERFORMANCE CHECK/ CALIBRATION:**

Ref: APHA22nd ed 2130B

**COMMENTS**

It is certified that the item under performance check/calibration has been calibrated/checked by corresponding calibrated equipment in the laboratory.  
Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.

<b>Scope of Test:</b>	Turbidity
<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1203010
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	25-Feb-15

**Remarks:**

This is the Final Report. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

Mr. Peter Lee  
Director

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**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**WORK ORDER:** HK1510067  
**DATE OF ISSUE:** 04/03/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1203010
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	25-Feb-15
<b>Date of next Calibration:</b>	25-May-15

**Parameters:****Turbidity**Method Ref: APHA 22<sup>nd</sup> ed. 2130B

Expected Reading (NTU)	Display Reading (NTU)	Tolerance (%)
0	0.00	---
4	3.98	-0.5
10	10.8	8.4
40	39.8	-0.4
100	100	0.2
400	373	-6.7
1000	964	-3.6
	<b>Tolerance Limit (±%)</b>	<b>10.0</b>

Remark: "Displayed Reading" presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.

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**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**Information supplied by customer:**

**CONTACT:** SAM LAM **WORK ORDER:** HK1510002  
**CLIENT:** LAM GEOTECHNICS LIMITED  
**DATE RECEIVED:** 06/01/2015  
**DATE OF ISSUE:** 13/01/2015  
**ADDRESS:** 11/F, CENTRE POINT, 181-185, GLOUCESTER ROAD,  
WANCHAI, HONG KONG  
**PROJECT:** ---

**METHOD OF PERFORMANCE CHECK/ CALIBRATION:**

Ref: APHA22nd ed 2130B

**COMMENTS**

It is certified that the item under performance check/calibration has been calibrated/checked by corresponding calibrated equipment in the laboratory.

Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.

<b>Scope of Test:</b>	Turbidity
<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1203015
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	08/01/2015

**Remarks:**

This is the Final Report. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

Mr. Peter Lee  
Director

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**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**WORK ORDER:** HK1510002  
**DATE OF ISSUE:** 13/01/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1203015
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	08/01/2015
<b>Date of next Calibration:</b>	08/04/2015

**Parameters:****Turbidity**Method Ref: APHA 22<sup>nd</sup> ed. 2130B

Expected Reading (NTU)	Display Reading (NTU)	Tolerance (%)
0	0.00	---
4	4.20	5.0
10	9.80	-2.0
40	41.0	2.5
100	100	0.0
400	420	5.0
1000	990	-1.0
	Tolerance Limit ( $\pm\%$ )	10.0

Remark: "Displayed Reading" presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.

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**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**Information supplied by customer:**

**CONTACT:** SAM LAM **WORK ORDER:** HK1510003  
**CLIENT:** LAM GEOTECHNICS LIMITED  
**DATE RECEIVED:** 06/01/2015  
**DATE OF ISSUE:** 13/01/2015  
**ADDRESS:** 11/F, CENTRE POINT, 181-185, GLOUCESTER ROAD,  
WANCHAI, HONG KONG  
**PROJECT:** ---

**METHOD OF PERFORMANCE CHECK/ CALIBRATION:**

Ref: APHA22nd ed 2130B

**COMMENTS**

It is certified that the item under performance check/calibration has been calibrated/checked by corresponding calibrated equipment in the laboratory.

Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.

<b>Scope of Test:</b>	Turbidity
<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1309192
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	08/01/2015

**Remarks:**

This is the Final Report. Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

Mr. Peter Lee  
Director

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**REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION**

**WORK ORDER:** HK1510003  
**DATE OF ISSUE:** 13/01/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type:</b>	Turbidimeter
<b>Brand Name:</b>	Xin Rui
<b>Model No.:</b>	WGZ-3B
<b>Serial No.:</b>	1309192
<b>Equipment No.:</b>	---
<b>Date of Calibration:</b>	08/01/2015
<b>Date of next Calibration:</b>	08/04/2015

**Parameters:****Turbidity**Method Ref: APHA 22<sup>nd</sup> ed. 2130B

Expected Reading (NTU)	Display Reading (NTU)	Tolerance (%)
0	0.00	---
4	3.91	-2.3
10	10.2	2.0
40	40.0	0.0
100	103	3.0
400	413	3.3
1000	988	-1.2
	<b>Tolerance Limit (±%)</b>	<b>10.0</b>

Remark: "Displayed Reading" presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.

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## EQUIPMENT PERFORMANCE CHECK / CALIBRATION REPORT

**Report No.** : HK1510049  
**Project Name** : EQUIPMENT PERFORMANCE CHECK/CALIBRATION REPORT  
**Date of Issue** : 13/02/2015  
  
**Customer** : LAM GEOTECHNICS LIMITED  
**Address** : 11/F., CENTRE POINT, 181-185 GLOUCESTER ROAD, WAN CHAI, HONG KONG

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**Calibration Job No.** : HK1510049  
**Test Item No.** : HK1510049-01  
**Test Item Details**  
**Test Item Description** : Multifunctional Meter  
**Manufacturer** : YSI  
**Model No.** : Professional Plus  
**Serial No.** : 11F100597  
**Performance Method** : Checked according to in-house method CAL005  
 (References: Temperature (Section 6 of International Accreditation New Zealand Technical Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure), pH value (APHA 21e 4500H:B), Salinity (Refer to Conductivity APHA 19e 2510B ) , Dissolved oxygen (APHA 19e 4500-O,C))  
  
**Test Item Receipt Date** : 12-Feb-15  
**Test Item Calibration Date** : 13-Feb-15  
**Test Period** : 12/02/2015 - 13/02/2015

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- Notes :
1. This report shall not be reproduced, except in full, without prior approval from Pilot Testing Limited.
  2. Results relate to item(s) as received.
  3.  $\pm$  indicates the tolerance limit
  4. N/A = Not applicable
  5. APHA - American Public Health Association, American Water Works Association and Water Environment Federation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WEF. USA
  6. DO, pH, salinity and temperature performance check was conducted by Pilot Testing Limited.
  7. Because of high sensitivity and ease of measurement, the conductivity method (according to APHA 19e 2510) is used to determine salinity.

Approved Signatory

  
 \_\_\_\_\_  
 Mr. Peter Lee  
 (Director)

Issue Date:

13/02/2015




**REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION**

**WORK ORDER:** HK1510049  
**DATE OF ISSUE:** 13/02/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type</b>	Multifunctional Meter
<b>Manufacturer</b>	YSI
<b>Model No.</b>	Professional Plus
<b>Serial No.</b>	11F100597
<b>Date of Calibration</b>	13-Feb-15
<b>Date of next Calibration</b>	13-May-15

**Parameters:**

**Temperature (Method Ref: Section 6 of International Accreditation New Zealand Technical Guide No.3 Second edition March 2008: Working Thermometer Calibration Procedure)**

Reference Reading (°C)	Display Reading (°C)	Deviation (°C)
10.8	10.8	0.0
20.2	20.3	+0.1
30.1	30.6	+0.5
Tolerance Limit		±2.0

**pH Value (Method Ref: APHA21e, 4500H:B)**

Expected Reading (pH unit)	Reference Reading (pH unit)	Display Reading (pH unit)	Deviation (pH unit)
4.0	4.05	4.06	+0.01
7.0	7.03	7.04	+0.01
10.0	9.98	9.96	+0.02
Tolerance Limit			±0.20

**Conductivity (Method Ref: APHA 19e, 2510)**

KCl concentration (mol/L)	Reference Reading (ms/cm)	Display Reading (ms/cm)	Deviation (%)
0.0000	0.00	0.00	--
0.1000	12.89	12.81	-0.63
0.2000	24.80	25.20	+1.60
0.5000	58.67	59.33	+1.12
Tolerance Limit			±2.0

**Dissolved Oxygen (DO) (Method Ref: APHA 19e, 4500-O, C)**

Reference DO reading (mg/L)	DO reading od DO probe (mg/L)	Deviation (mg/L)
7.49	7.60	+0.11
4.56	4.67	+0.11
1.86	1.83	-0.03
Tolerance Limit		±0.20

- Remarks:
- (1) Maxium tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.
  - (2) Displayed reading presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.
  - (3) Because of high sensitivity and ease of measurement, the conductivity method (accorng to APHA 19e 2510) is used to determine salinity.

- End of Report -





## EQUIPMENT PERFORMANCE CHECK / CALIBRATION REPORT

**Report No.** : HK1510021  
**Project Name** : EQUIPMENT PERFORMANCE CHECK/CALIBRATION REPORT  
**Date of Issue** : 23/01/2015  
  
**Customer** : LAM GEOTECHNICS LIMITED  
**Address** : 11/F., CENTRE POINT, 181-185 GLOUCESTER ROAD, WAN CHAI, HONG KONG

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**Calibration Job No.** : HK1510021  
**Test Item No.** : HK1510021-01  
**Test Item Details**  
**Test Item Description** : Multifunctional Meter  
**Manufacturer** : YSI  
**Model No.** : Professional Plus  
**Serial No.** : 14E100105  
**Performance Method** : Checked according to in-house method CAL005  
 (References: Temperature (Section 6 of International Accreditation New Zealand Technical Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure), pH value (APHA 21e 4500H:B), Salinity (Refer to Conductivity APHA 19e 2510B ) , Dissolved oxygen (APHA 19e 4500-O,C))  
  
**Test Item Receipt Date** : 15-Jan-15  
**Test Item Calibration Date** : 16-Jan-15  
**Test Period** : 16/01/2015 - 23/01/2015

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- Notes :
1. This report shall not be reproduced, except in full, without prior approval from Pilot Testing Limited.
  2. Results relate to item(s) as received.
  3.  $\pm$  indicates the tolerance limit
  4. N/A = Not applicable
  5. APHA - American Public Health Association, American Water Works Association and Water Environment Federation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WEF. USA
  6. DO, pH, salinity and temperature performance check was conducted by Pilot Testing Limited.
  7. Because of high sensitivity and ease of measurement, the conductivity method (according to APHA 19e 2510) is used to determine salinity.

Approved Signatory :

Mr. Peter Lee  
(Director)

Issue Date:

23/01/2015


**REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION**

**WORK ORDER:** HK1510021  
**DATE OF ISSUE:** 23/01/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type</b>	Multifunctional Meter
<b>Manufacturer</b>	YSI
<b>Model No.</b>	Professional Plus
<b>Serial No.</b>	14E100105
<b>Date of Calibration</b>	16-Jan-15
<b>Date of next Calibration</b>	16-Apr-15

**Parameters:**

**Temperature (Method Ref: Section 6 of International Accreditation New Zealand Technical Guide No.3 Second edition March 2008: Working Thermometer Calibration Procedure)**

Reference Reading (°C)	Display Reading (°C)	Deviation (°C)
10.0	10.4	+0.4
19.4	19.6	+0.2
30.0	30.1	+0.1
	<b>Tolerance Limit</b>	<b>±2.0</b>

**pH Value (Method Ref: APHA21e, 4500H:B)**

Expected Reading (pH unit)	Reference Reading (pH unit)	Display Reading (pH unit)	Deviation (pH unit)
4.0	4.06	4.02	-0.04
7.0	7.01	7.09	+0.08
10.0	9.99	10.03	+0.04
	<b>Tolerance Limit</b>		<b>±0.20</b>

**Conductivity (Method Ref: APHA 19e, 2510)**

KCl concentration (mol/L)	Reference Reading (ms/cm)	Display Reading (ms/cm)	Deviation (%)
0.0000	0.00	0.00	--
0.1000	12.89	12.69	-1.55
0.2000	24.80	25.25	1.82
0.5000	58.67	57.50	-1.99
	<b>Tolerance Limit</b>		<b>±2.0</b>

**Dissolved Oxygen (DO) (Method Ref: APHA 19e, 4500-O, C)**

Reference DO reading (mg/L)	DO reading od DO probe (mg/L)	Deviation (mg/L)
8.18	8.14	-0.04
5.89	5.90	0.01
4.42	4.26	-0.16
	<b>Tolerance Limit</b>	<b>±0.20</b>

- Remarks:
- (1) Maxium tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.
  - (2) Displayed reading presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.
  - (3) Because of high sensitivity and ease of measurement, the conductivity method (accoriding to APHA 19e 2510) is used to determine salinity.

- End of Report -



## EQUIPMENT PERFORMANCE CHECK / CALIBRATION REPORT

Report No. : HK1510022  
 Project Name : EQUIPMENT PERFORMANCE CHECK/CALIBRATION REPORT  
 Date of Issue : 26/01/2015

Customer : LAM GEOTECHNICS LIMITED  
 Address : 11/F., CENTRE POINT, 181-185 GLOUCESTER ROAD, WAN CHAI, HONG KONG

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Calibration Job No. : HK1510022  
 Test Item No. : HK1510022-01  
 Test Item Details : Multifunctional Meter  
 Test Item Description : Multifunctional Meter  
 Manufacturer : YSI  
 Model No. : Professional Plus  
 Serial No. : 14M100277  
 Performance Method : Checked according to in-house method CAL005  
 (References: Temperature (Section 6 of International Accreditation New Zealand Technical Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure), pH value (APHA 21e 4500H:B), Salinity (Refer to Conductivity APHA 19e 2510B ) , Dissolved oxygen (APHA 19e 4500-O,C))

Test Item Receipt Date : 19-Jan-15  
 Test Item Calibration Date : 19-Jan-15  
 Test Period : 19/01/2015 - 26/01/2015

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- Notes :
1. This report shall not be reproduced, except in full, without prior approval from Pilot Testing Limited.
  2. Results relate to item(s) as received.
  3.  $\pm$  indicates the tolerance limit
  4. N/A = Not applicable
  5. APHA - American Public Health Association, American Water Works Association and Water Environment Federation, Standard Methods for the Examination of Water and Wastewater, APHA-AWWA-WEF. USA
  6. DO, pH, salinity and temperature performance check was conducted by Pilot Testing Limited.
  7. Because of high sensitivity and ease of measurement, the conductivity method (according to APHA 19e 2510) is used to determine salinity.

Approved Signatory

Mr. Peter Lee  
 (Director)

Issue Date:

26/01/2015




**REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION**

**WORK ORDER:** HK1510022  
**DATE OF ISSUE:** 26/01/2015  
**CLIENT:** LAM GEOTECHNICS LIMITED

<b>Equipment Type</b>	Multifunctional Meter
<b>Manufacturer</b>	YSI
<b>Model No.</b>	Professional Plus
<b>Serial No.</b>	14M100277
<b>Date of Calibration</b>	19-Jan-15
<b>Date of next Calibration</b>	19-Apr-15

**Parameters:**

**Temperature (Method Ref: Section 6 of International Accreditation New Zealand Technical Guide No.3 Second edition March 2008: Working Thermometer Calibration Procedure)**

Reference Reading (°C)	Display Reading (°C)	Deviation (°C)
10.4	10.8	+0.4
19.9	20.1	+0.2
30.2	30.0	-0.2
Tolerance Limit		±2.0

**pH Value (Method Ref: APHA21e, 4500H:B)**

Expected Reading (pH unit)	Reference Reading (pH unit)	Display Reading (pH unit)	Deviation (pH unit)
4.0	4.05	4.07	+0.02
7.0	7.02	7.04	+0.02
10.0	9.99	10.18	+0.19
Tolerance Limit			±0.20

**Conductivity (Method Ref: APHA 19e, 2510)**

KCl concentration (mol/L)	Reference Reading (ms/cm)	Display Reading (ms/cm)	Deviation (%)
0.0000	0.00	0.00	--
0.1000	12.89	12.99	+0.74
0.2000	24.80	24.91	+0.43
0.5000	58.67	59.21	+0.93
Tolerance Limit			±2.0

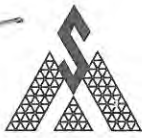
**Dissolved Oxygen (DO) (Method Ref: APHA 19e, 4500-O, C)**

Reference DO reading (mg/L)	DO reading od DO probe (mg/L)	Deviation (mg/L)
8.28	8.22	-0.06
4.67	4.59	-0.08
1.42	1.48	+0.06
Tolerance Limit		±0.20

- Remarks:
- (1) Maxium tolerance and calibration frequency stated in the report, unless otherwise stated, the internal acceptance criteria of Pilot Testing Limited will be followed.
  - (2) Displayed reading presents the figures shown on item under calibration/checking regardless of equipment precision or significant figures.
  - (3) Because of high sensitivity and ease of measurement, the conductivity method (accoriding to APHA 19e 2510) is used to determine salinity.

- End of Report -





## CERTIFICATE OF CALIBRATION

Certificate No.: 14CA0320 04

Page: 1 of 2

### Item tested

Description: Acoustical Calibrator (Class 1)  
Manufacturer: B & K  
Type/Model No.: 4230  
Serial/Equipment No.: 1411076  
Adaptors used: Yes

### Item submitted by

Customer: Lam Geotechnics Limited  
Address of Customer: -  
Request No.: -  
Date of receipt: 20-Mar-2014

Date of test: 21-Mar-2014

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Lab standard microphone	B&K 4180	2341427	17-Apr-2014	SCL
Preamplifier	B&K 2673	2239857	16-Apr-2014	CEPREI
Measuring amplifier	B&K 2610	2346941	24-Apr-2014	CEPREI
Signal generator	DS 360	61227	15-Apr-2014	CEPREI
Digital multi-meter	34401A	US36087050	17-Dec-2014	CEPREI
Audio analyzer	8903B	GB41300350	15-Apr-2014	CEPREI
Universal counter	53132A	MY40003662	15-Apr-2014	CEPREI

### Ambient conditions

Temperature:  $22 \pm 1$  °C  
Relative humidity:  $60 \pm 10$  %  
Air pressure:  $1000 \pm 10$  hPa

### Test specifications

- The Sound Calibrator has been calibrated in accordance with the requirements as specified in IEC 60942 1997 Annex B and the lab calibration procedure SMTP004-CA-156.
- The calibrator was tested with its axis vertical facing downwards at the specific frequency using insert voltage technique.
- The results are rounded to the nearest 0.01 dB and 0.1 Hz and have not been corrected for variations from a reference pressure of 1013.25 hectoPascals as the maker's information indicates that the instrument is insensitive to pressure changes.

### Test results

This is to certify that the sound calibrator conforms to the requirements of annex B of IEC 60942: 1997 for the conditions under which the test was performed. This does not imply that the sound calibrator meets IEC 60942 under any other conditions.

Details of the performed measurements are presented on **page 2** of this certificate.

Approved Signatory:

  
Huang Jian-Min/Feng Jun Qi

Date: 21-Mar-2014

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 14CA0320 04

Page: 2 of 2

### 1, Measured Sound Pressure Level

The output Sound Pressure Level in the calibrator head was measured at the setting and frequency shown using a calibrated laboratory standard microphone and insert voltage technique. The results are given in below with the estimated uncertainties.

Frequency Shown Hz	Output Sound Pressure Level Setting dB	Measured Output Sound Pressure Level dB	(Output level in dB re 20 $\mu$ Pa)
			Estimated Expanded Uncertainty dB
1000	94.00	94.01	0.10

### 2, Sound Pressure Level Stability - Short Term Fluctuations

The Short Term Fluctuations was determined by measuring the maximum and minimum of the fast weighted DC output of the B&K 2610 measuring amplifier over a 20 second time interval as required in the standard. The Short Term Fluctuation was found to be:

At 1000 Hz **STF = 0.002 dB**  
Estimated expanded uncertainty 0.005 dB

### 3, Actual Output Frequency

The determination of actual output frequency was made using a B&K 4180 microphone together with a B&K 2673 preamplifier connected to a B&K 2610 measuring amplifier. The AC output of the B&K 2610 was taken to an universal counter which was used to determine the frequency averaged over 20 second of operation as required by the standard. The actual output frequency at 1 KHz was:

At 1000 Hz **Actual Frequency = 961.1 Hz**  
Estimated expanded uncertainty 0.1 Hz Coverage factor k = 2.2

### 4, Total Noise and Distortion

For the Total Noise and Distortion measurement, the unfiltered AC output of the B&K 2610 measuring amplifier was connected to an Agilent Type 8903 B distortion analyser. The TND result at 1 KHz was:

At 1000 Hz **TND = 0.8 %**  
Estimated expanded uncertainty 0.7 %

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

Calibrated by:

Date: 21-Mar-2014

Fung Chi Yip

- End -

Checked by:

Date: 21-Mar-2014

Feng Jun Qi

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.





## CERTIFICATE OF CALIBRATION

Certificate No.: 14CA1213 01 Page 1 of 2

### Item tested

Description:	Sound Level Meter (Type 1)	Microphone
Manufacturer:	B & K	B & K
Type/Model No.:	2236	4188
Serial/Equipment No.:	2100736	2288941
Adaptors used:	-	-

### Item submitted by

Customer Name: Lam Geotechnics Limited  
Address of Customer: -  
Request No.: -  
Date of receipt: 13-Dec-2014

Date of test: 13-Dec-2014

### Reference equipment used in the calibration

Description:	Model:	Serial No.	Expiry Date:	Traceable to:
Multi function sound calibrator	B&K 4226	2288444	20-Jun-2015	CIGISMEC
Signal generator	DS 360	33873	09-Apr-2015	CEPREI
Signal generator	DS 360	61227	09-Apr-2015	CEPREI

### Ambient conditions

Temperature:  $21 \pm 1$  °C  
Relative humidity:  $60 \pm 5$  %  
Air pressure:  $1010 \pm 5$  hPa

### Test specifications

- 1, The Sound Level Meter has been calibrated in accordance with the requirements as specified in BS 7580: Part 1: 1997 and the lab calibration procedure SMTP004-CA-152.
- 2, The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of  $\pm 20\%$ .
- 3, The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure response of the Sound Level Meter.

### Test results

This is to certify that the Sound Level Meter conforms to BS 7580: Part 1: 1997 for the conditions under which the test was performed.

Details of the performed measurements are presented on page 2 of this certificate.

Actual Measurement data are documented on worksheets.

Approved Signatory:

  
Huang Jian Min/Feng Jun Qi

Date: 15-Dec-2014

Company Chop:



Comments: The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the long-term stability of the instrument.



## CERTIFICATE OF CALIBRATION

(Continuation Page)

Certificate No.: 14CA1213 01 Page 2 of 2

### 1, Electrical Tests

The electrical tests were performed using an equivalent capacitance substituted for the microphone. The results are given in below with test status and the estimated uncertainties. The "Pass" means the result of the test is inside the tolerances stated in the test specifications. The "-" means the result of test is outside these tolerances.

Test:	Subtest:	Status:	Expanded Uncertainty (dB)	Coverage Factor
Self-generated noise	A	Pass	0.3	2.1
	C	Pass	1.0	
	Lin	Pass	2.0	
Linearity range for Leq	At reference range, Step 5 dB at 4 kHz	Pass	0.3	2.2
	Reference SPL on all other ranges	Pass	0.3	
	2 dB below upper limit of each range	Pass	0.3	
	2 dB above lower limit of each range	Pass	0.3	
Linearity range for SPL	At reference range, Step 5 dB at 4 kHz	Pass	0.3	
	A	Pass	0.3	
	C	Pass	0.3	
Frequency weightings	Lin	Pass	0.3	
	Single Burst Fast	Pass	0.3	
	Single Burst Slow	Pass	0.3	
Peak response	Single 100µs rectangular pulse	Pass	0.3	
	R.M.S. accuracy	Crest factor of 3	Pass	
Time weighting I	Single burst 5 ms at 2000 Hz	Pass	0.3	
	Repeated at frequency of 100 Hz	Pass	0.3	
Time averaging	1 ms burst duty factor 1/10 <sup>3</sup> at 4kHz	Pass	0.3	
	1 ms burst duty factor 1/10 <sup>4</sup> at 4kHz	Pass	0.3	
Pulse range	Single burst 10 ms at 4 kHz	Pass	0.4	
	Sound exposure level	Single burst 10 ms at 4 kHz	Pass	
Overload indication	SPL	Pass	0.3	
	Leq	Pass	0.4	

### 2, Acoustic tests

The complete sound level meter was calibrated on the reference range using a B&K 4226 acoustic calibrator with 1000Hz and SPL 94 dB. The sensitivity of the sound level meter was adjusted. The test result at 125 Hz and 8000 Hz are given in below with test status and the estimated uncertainties.

Test:	Subtest	Status	Expanded Uncertainty (dB)	Coverage Factor
Acoustic response	Weighting A at 125 Hz	Pass	0.3	
	Weighting A at 8000 Hz	Pass	0.5	

### 3, Response to associated sound calibrator

N/A

The expanded uncertainties have been calculated in accordance with the ISO Publication "Guide to the expression of uncertainty in measurement", and gives an interval estimated to have a level of confidence of 95%. A coverage factor of 2 is assumed unless explicitly stated.

- End -

Calibrated by:		Checked by:	
Date:	Fung Chi Yip 13-Dec-2014	Date:	Lam Tze Wai 15-Dec-2014

The standard(s) and equipment used in the calibration are traceable to national or international recognised standards and are calibrated on a schedule to maintain the required accuracy level.





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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Jul 14, 2014 Rootsmeter S/N 0438320 Ta (K) - 298  
 Operator Tisch Orifice I.D. - 0005 Pa (mm) - 749.3

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3870	3.2	2.00
2	NA	NA	1.00	0.9830	6.4	4.00
3	NA	NA	1.00	0.8760	7.9	5.00
4	NA	NA	1.00	0.8340	8.8	5.50
5	NA	NA	1.00	0.6860	12.7	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9817	0.7078	1.4042	0.9957	0.7179	0.8919
0.9775	0.9944	1.9859	0.9915	1.0086	1.2613
0.9754	1.1135	2.2203	0.9894	1.1294	1.4101
0.9743	1.1683	2.3286	0.9882	1.1849	1.4790
0.9692	1.4128	2.8084	0.9830	1.4330	1.7837
Qstd slope (m) = 1.99175			Qa slope (m) = 1.24720		
intercept (b) = -0.00041			intercept (b) = -0.00026		
coefficient (r) = 0.99991			coefficient (r) = 0.99991		
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)  
 Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]  
 Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{ [SQRT(H2O(Pa/760) (298/Ta))] - b}  
 Qa = 1/m{ [SQRT H2O(Ta/Pa)] - b}



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA1b  
 Equipment no. : EL452  
 Calibration Date : 12-Feb-15  
 Calibration Due Date : 12-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	290	Kelvin	Pressure, P <sub>a</sub>
			1018 mmHg

Orifice Transfer Standard Information			
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175
		Intercept, b <sub>c</sub>	-0.00041
Last Calibration Date	14-Jul-14	$\left( H \times P_a / 1013.3 \times 298 / T_a \right)^{1/2}$ $= m_c \times Q_{std} + b_c$	
Next Calibration Date	14-Jul-15		

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.6	6.6	13.2	1.8536	65	66.0431
2	5.3	5.3	10.6	1.6611	58	58.9308
3	4.0	4.0	8.0	1.4431	50	50.8024
4	2.6	2.6	5.2	1.1635	40	40.6419
5	1.5	1.5	3.0	0.8838	30	30.4814

By Linear Regression of Y on X

Slope, m = 36.6703      Intercept, b = -1.9950  
 Correlation Coefficient\* = 1.0000  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar      Checked by : Derek Lo  
 Date : 12-Feb-15      Date : 12-Feb-15



Lam Geotechnics Limited

### Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA2a  
 Equipment no. : EL449  
 Calibration Date : 12-Feb-15  
 Calibration Due Date : 12-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	291	Kelvin	Pressure, P <sub>a</sub>
			1015 mmHg

Orifice Transfer Standard Information				
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175	Intercept, b <sub>c</sub>
				-0.00041
Last Calibration Date	14-Jul-14	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$		
Next Calibration Date	14-Jul-15			

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.4	6.4	12.8	1.8195	60	60.7683
2	5.0	5.0	10.0	1.6082	55	55.7042
3	3.8	3.8	7.6	1.4020	46	46.5890
4	2.2	2.2	4.4	1.0668	36	36.4610
5	1.4	1.4	2.8	0.8511	30	30.3841

By Linear Regression of Y on X

Slope, m = 32.2546      Intercept, b = 2.4526

Correlation Coefficient\* = 0.9972

Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient < 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar      Checked by : Derek Lo  
 Date : 12-Feb-15      Date : 12-Feb-15



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA3a  
 Equipment no. : EL333

Calibration Date : 12-Feb-15  
 Calibration Due Date : 12-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	290	Kelvin	Pressure, P <sub>a</sub>
			1018 mmHg

Orifice Transfer Standard Information					
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175	Intercept, b <sub>c</sub>	-0.00041
Last Calibration Date	14-Jul-14	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	14-Jul-15				

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.0	6.0	12.0	1.7673	52	52.8345
2	4.7	4.7	9.4	1.5642	47	47.7542
3	3.6	3.6	7.2	1.3690	41	41.6579
4	2.3	2.3	4.6	1.0943	35	35.5617
5	1.4	1.4	2.8	0.8538	28	28.4493

By Linear Regression of Y on X

Slope, m = 26.4964      Intercept, b = 6.0181  
 Correlation Coefficient\* = 0.9989  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar  
 Date : 12-Feb-15

Checked by : Derek Lo  
 Date : 12-Feb-15





Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA4a Calibration Date : 12-Feb-15  
 Equipment no. : EL390 Calibration Due Date : 12-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	290	Kelvin	Pressure, P <sub>a</sub>
			1018 mmHg

Orifice Transfer Standard Information					
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175	Intercept, b <sub>c</sub>	-0.00041
Last Calibration Date	14-Jul-14	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	14-Jul-15				

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	6.5	6.5	13.0	1.8395	58	58.9308
2	5.2	5.2	10.4	1.6453	51	51.8184
3	4.1	4.1	8.2	1.4610	43	43.6900
4	2.7	2.7	5.4	1.1856	30	30.4814
5	1.3	1.3	2.6	0.8228	22	22.3530

By Linear Regression of Y on X

Slope, m = 37.3358 Intercept, b = -10.4734  
 Correlation Coefficient\* = 0.9906  
 Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar Checked by : Derek Lo  
 Date : 12-Feb-15 Date : 12-Feb-15



Lam Geotechnics Limited

**Calibration Data for High Volume Sampler (TSP Sampler)**

Location : CMA5b  
 Equipment no. : EL222

Calibration Date : 04-Feb-15  
 Calibration Due Date : 04-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	289	Kelvin	Pressure, P <sub>a</sub>
			1024 mmHg

Orifice Transfer Standard Information					
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175	Intercept, b <sub>c</sub>	-0.00041
Last Calibration Date	14-Jul-14	$(H \times P_a / 1013.3 \times 298 / T_a)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	14-Jul-15				

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC (W(P <sub>a</sub> /1013.3x298/T <sub>a</sub> ) <sup>1/2</sup> /35.31) Y-axis
	(up)	(down)	(difference)			
1	5.4	5.4	10.8	1.6845	59	60.2271
2	4.4	4.4	8.8	1.5206	54	55.1231
3	3.4	3.4	6.8	1.3367	50	51.0399
4	2.2	2.2	4.4	1.0753	42	42.8736
5	1.4	1.4	2.8	0.8578	37	37.7696

By Linear Regression of Y on X						
Slope, m	=	27.2571	Intercept, b	=	14.1098	
Correlation Coefficient*	=	0.9987				
Calibration Accepted	=	Yes/No**				

\* if Correlation Coefficient &lt; 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar  
 Date : 04-Feb-15

Checked by : Derek Lo  
 Date : 04-Feb-15



Lam Geotechnics Limited

### Calibration Data for High Volume Sampler (TSP Sampler)

Location : CMA6a  
 Equipment no. : EL448  
 Calibration Date : 12-Feb-15  
 Calibration Due Date : 12-Apr-15

**CALIBRATION OF CONTINUOUS FLOW RECORDER**

Ambient Condition			
Temperature, T <sub>a</sub>	290	Kelvin	Pressure, P <sub>a</sub>
			1018 mmHg

Orifice Transfer Standard Information					
Equipment No.	EL086	Slope, m <sub>c</sub>	1.99175	Intercept, b <sub>c</sub>	-0.00041
Last Calibration Date	14-Jul-14	$\left( \frac{H \times P_a}{1013.3 \times 298 / T_a} \right)^{1/2}$ $= m_c \times Q_{std} + b_c$			
Next Calibration Date	14-Jul-15				

Calibration of TSP						
Calibration Point	Manometer Reading			Q <sub>std</sub> (m <sup>3</sup> / min.) X-axis	Continuous Flow Recorder, W (CFM)	IC $(W(P_a/1013.3 \times 298/T_a)^{1/2}/35.31)$ Y-axis
	(up)	(down)	(difference)			
1	6.5	6.5	13.0	1.8395	60	60.9628
2	5.2	5.2	10.4	1.6453	54	54.8666
3	4.0	4.0	8.0	1.4431	48	48.7703
4	2.7	2.7	5.4	1.1856	40	40.6419
5	1.6	1.6	3.2	0.9128	32	32.5135

By Linear Regression of Y on X

Slope, m = 30.7375      Intercept, b = 4.3570

Correlation Coefficient\* = 1.0000

Calibration Accepted = Yes/No\*\*

\* if Correlation Coefficient < 0.990, check and recalibration again.

\*\* Delete as appropriate.

Remarks : \_\_\_\_\_

Calibrated by : LuLu Mar      Checked by : Derek Lo  
 Date : 12-Feb-15      Date : 12-Feb-15