

Certificate of Calibration

Calibration Certification Information
Cal. Date: November 20, 2017

Rootsmeter S/N: 438320

Ta: 294

°K
Operator: Jim Tisch

Pa: 756.9

mm Hg
Calibration Model #: TE-5025A

Calibrator S/N: 2456

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4440	3.2	2.00
2	3	4	1	1.0260	6.4	4.00
3	5	6	1	0.9130	7.8	5.00
4	7	8	1	0.8680	8.8	5.50
5	9	10	1	0.7190	12.7	8.00

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
1.0052	0.6961	1.4209	0.9958	0.6896	0.8814
1.0010	0.9756	2.0095	0.9915	0.9664	1.2465
0.9991	1.0943	2.2467	0.9897	1.0840	1.3936
0.9978	1.1495	2.3563	0.9884	1.1387	1.4616
0.9926	1.3805	2.8418	0.9832	1.3675	1.7628
QSTD	m=	2.07133	QA	m=	1.29703
	b=	-0.01892		b=	-0.01173
	r=	0.99995		r=	0.99995

Calculations

$$Vstd = \Delta Vol \left(\frac{Pa - \Delta P}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)$$

$$Va = \Delta Vol \left(\frac{Pa - \Delta P}{Pa} \right)$$

$$Qstd = Vstd / \Delta Time$$

$$Qa = Va / \Delta Time$$

For subsequent flow rate calculations:

$$Qstd = 1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) - b \right)$$

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

Standard Conditions
Tstd: 298.15 °K

Pstd: 760 mm Hg

Key
ΔH: calibrator manometer reading (in H2O)

ΔP: rootsmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30

MATERIALAB CONSULTANTS LIMITED

Room 723 & 725, 7/F, Block B,
Profit Industrial Building,
1-15 Kwai Fung Crescent, Kwai Fong,
Hong Kong.

Tel : (852)-24508238
Fax : (852)-24508032
Email : mcl@fugro.com.hk

MaterialLab**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07

Date of Calibration: 2-Oct-18

Location : KTD1a

Next Calibration Date: 1-Jan-19

Brand: Tisch

Technician: Toby Wan

Model: TE-5170

S/N: 4037

CONDITIONS

Sea Level Pressure (hPa): 1014.9

Corrected Pressure (mm Hg): 761

Temperature (°C): 27

Temperature (K): 300

CALIBRATION ORIFICE

Make: Tisch

Qstd Slope: 2.07013

Model: TE-5025A

Qstd Intercept: -0.01892

Calibration Date: 20-Nov-17

Expiry Date: 20-Nov-18

S/N: 2456

CALIBRATIONS

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	11.50	0.40	11.100	1.614	59.00	58.84	Slope = 31.9470
13	10.30	1.60	8.700	1.430	55.00	54.85	Intercept = 7.5845
10	9.40	2.30	7.100	1.293	48.00	47.87	Corr. coeff.: 0.9939
7	8.30	3.70	4.600	1.042	40.00	39.89	
5	7.30	4.60	2.700	0.801	34.00	33.91	

Calculations: $Qstd = 1/m[\sqrt{(H2O(Pa/Pstd)(Tstd/Ta))}] - b]$ $IC = I[\sqrt{(Pa/Pstd)(Tstd/Ta)}]$

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

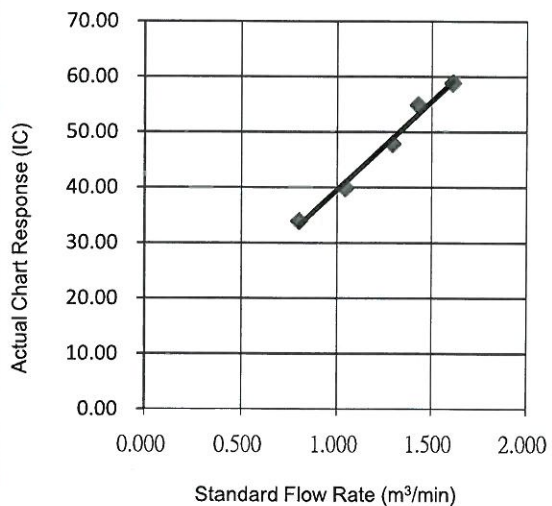
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

FLOW RATE CHART

CHOI KAM HO
Project Consultant

Report Date: 2nd October, 2018

MATERIALAB CONSULTANTS LIMITED

Room 723 & 725, 7/F, Block B,
Profit Industrial Building,
1-15 Kwai Fung Crescent, Kwai Fong,
Hong Kong.

Tel : (852)-24508238
Fax : (852)-24508032
Email : mcl@fugro.com.hk

MaterialLab**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07

Date of Calibration: 2-Oct-18

Location : KER1b

Next Calibration Date: 1-Jan-19

Brand: Tisch

Technician: Toby Wan

Model: TE-5170

S/N: 3482

CONDITIONS

Sea Level Pressure (hPa): 1014.9 Corrected Pressure (mm Hg): 761
Temperature (°C): 27 Temperature (K): 300

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.07013
Model: TE-5025A Qstd Intercept: -0.01892
Calibration Date: 20-Nov-17 Expiry Date: 20-Nov-18
S/N: 2456

CALIBRATIONS

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	12.00	0.00	12.000	1.678	56.00	55.85	Slope = 32.9848
13	10.60	1.30	9.300	1.478	49.00	48.87	Intercept = 0.1261
10	9.40	2.10	7.300	1.311	44.00	43.88	Corr. coeff.: 0.9961
7	8.70	3.50	5.200	1.108	35.00	34.91	
5	7.60	5.20	2.400	0.755	26.00	25.93	

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:

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

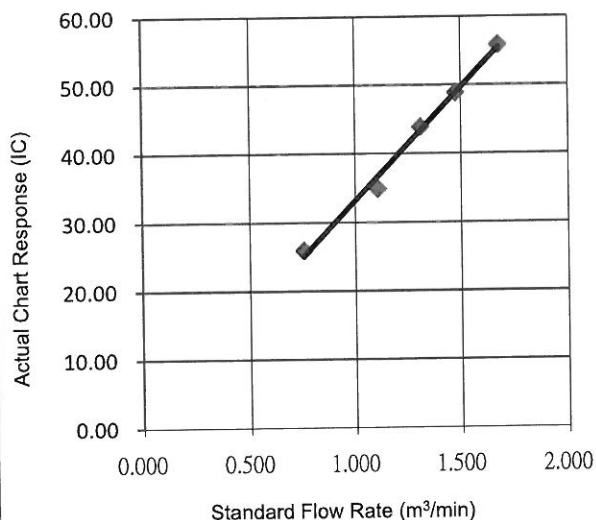
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

FLOW RATE CHART

CHOI KAM HO
Project Consultant

Report Date: 2nd October, 2018

MATERIALAB CONSULTANTS LIMITED

Room 723 & 725, 7/F, Block B,
Profit Industrial Building,
1-15 Kwai Fung Crescent, Kwai Fong,
Hong Kong.

Tel : (852)-24508238
Fax : (852)-24508032
Email : mcl@fugro.com.hk

MaterialLab**TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET**

Project : Environmental Monitoring Works For Contract No. KLN/2015/07

Date of Calibration: 9-Aug-18

Location : KTD2b

Next Calibration Date: 8-Nov-18

Brand: Tisch

Technician: Toby Wan

Model: TE-5170

S/N: 3838

CONDITIONS

Sea Level Pressure (hPa): 1003.3 Corrected Pressure (mm Hg): 753
Temperature (°C): 30 Temperature (K): 303

CALIBRATION ORIFICE

Make: Tisch Qstd Slope: 2.07013
Model: TE-5025A Qstd Intercept: -0.01892
Calibration Date: 20-Nov-17 Expiry Date: 20-Nov-18
S/N: 2456

CALIBRATIONS

Plate No.	H2O (L) (in)	H2O (R) (in)	H2O (in)	Qstd (m ³ /min)	I (chart)	IC (corrected)	LINEAR REGRESSION
18	3.80	-8.50	12.300	1.682	55.00	54.29	Slope = 31.2460 Intercept = 0.7345 Corr. coeff.: 0.9933
13	2.90	-6.50	9.400	1.471	46.00	45.41	
10	1.00	-5.70	6.700	1.243	41.00	40.47	
7	0.20	-4.20	4.400	1.009	31.00	30.60	
5	-0.80	-3.10	2.300	0.732	25.00	24.68	

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

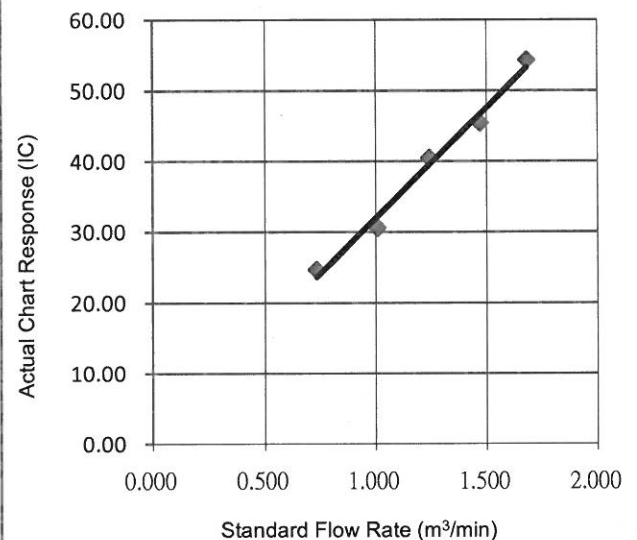
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

FLOW RATE CHART

CHOI KAM HO
Project Consultant

Report Date: 9th August, 2018

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

MaterialLab

Report no.: 172379CA185011A

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CALIBRATION CERTIFICATE OF SOUND LEVEL METER

Client Supplied Information

Client : MaterialLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B, Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

Model No. :

Serial No. :

Next Calibration Date : 12-Apr-2019

Specification Limit : EN 61672: 2003 Type 1

Meter	Microphone	Preamplifier
CEL-63X	CE-251	CEL-495
3148029	01910	003318

Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 13-Apr-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	1.7	2.6 to -0.6
	2000Hz	1.4	2.8 to -0.4
	1000Hz	0.0	1.1 to -1.1
	500Hz	-3.4	-1.8 to -4.6
	250Hz	-8.8	-7.2 to -10.0
	125Hz	-16.2	-14.6 to -17.6
	63Hz	-26.2	-24.7 to -27.7
	31.5Hz	-39.1	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.0	± 0.6
	104dB-114dB	0.0	± 0.6

Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA185011.

Checked by : conf
CA-R-297 (22/07/2009)

Date : 5-7-2018

Certified by : LT Leung

Date : 7-7-2018

Leung Kwok Tai (Assistant Manager)

** End of Report **

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

MaterialLab

Report no.: 172379CA180517A

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CALIBRATION CERTIFICATE OF SOUND LEVEL METER

Client Supplied Information

Client : MaterialLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

Model No.

Serial No.

Next Calibration Date : 11-Mar-2019

Specification Limit : EN 61672: 2003 Type 1

Meter	Microphone	Preamplifier
CEL-63X	CE-251	CEL-495
3756127	00995	003350

Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 12-Mar-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	-0.3	2.6 to -0.6
	2000Hz	0.9	2.8 to -0.4
	1000Hz	0.3	1.1 to -1.1
	500Hz	-2.9	-1.8 to -4.6
	250Hz	-8.2	-7.2 to -10.0
	125Hz	-15.6	-14.6 to -17.6
	63Hz	-25.6	-24.7 to -27.7
	31.5Hz	-38.6	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.0	± 0.6
	104dB-114dB	0.0	± 0.6

Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA180517.

Checked by : any Date : 5-7-2018 Certified by : K.T. Young Date : 7-7-2018

CA-R-297 (22/07/2009)

Leung Kwok Tai (Assistant Manager)

** End of Report **

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

MaterialLab

Report no.: 172379CA185066A

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CALIBRATION CERTIFICATE OF SOUND LEVEL METER**Client Supplied Information**

Client : MaterialLab Consultants Ltd.

Address : Room 723 & 725, 7/F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Level Meter

Manufacturer : Casella

Model No. :
Serial No. :
Next Calibration Date :
Specification Limit :

Meter	Microphone	Preamplifier
CEL-63X	CE-251	CEL-495
0873599	01801	003341

26-Apr-2019

EN 61672: 2003 Type 1

Laboratory Information

Description : B & K Acoustic Multifunction Calibrator 4226 (Traditional free field setting)

Equipment ID. : R-108-1

Date of Calibration : 27-Apr-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct comparison

Calibration Results :

Parameters		Mean Value (dB)	Specification Limit(dB)
A-weighting frequency response	4000Hz	1.9	2.6 to -0.6
	2000Hz	1.3	2.8 to -0.4
	1000Hz	-0.1	1.1 to -1.1
	500Hz	-3.5	-1.8 to -4.6
	250Hz	-8.9	-7.2 to -10.0
	125Hz	-16.4	-14.6 to -17.6
	63Hz	-26.4	-24.7 to -27.7
	31.5Hz	-39.3	-37.4 to -41.4
Differential level linearity	94dB-104dB	0.0	± 0.6
	104dB-114dB	0.0	± 0.6

Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. For calibration: Reference SPL are 94, 104 & 114dB, range setting is 20-140dB & time weighing is fast
4. The equipment does comply with EN 61672: 2003 Type 1 sound level meter for the above measurement.
5. This is to supersede the previous report no. 172379CA185066.

Checked by : [Signature] Date : 5-7-2018 Certified by : [Signature] Date : 7-7-2018
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

**** End of Report ****

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

MaterialLab

Report no.: 172379CA180517(1)

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CALIBRATION CERTIFICATE OF SOUND CALIBRATOR

Client Supplied Information

Client : MaterialLab Consultants Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Sound Calibrator
Manufacturer : Casella (Model no. CEL-120/1)
Serial No. : 5230758
Equipment ID : FY-SLC-01
Next Calibration Date : 11-Mar-2019
Specification Limit : EN 60942: 2003 Type 1

Laboratory Information

Description : Reference Sound level meter
Equipment ID. : R-119-1
Date of Calibration : 12-Mar-2018 Ambient Temperature : 22 °C
Calibration Location : Calibration Laboratory of FTS
Method Used : By direct comparison

Calibration Results :

Parameters (Setting of UUT)	Mean Value (error of measurement)	Specification Limit(dB)
94dB	-0.4 dB	±0.4dB
114dB	-0.3 dB	

Remarks :

1. The equipment used in this calibration is traceable to recognized National Standards.
2. The mean value is the average of four measurements.
3. The equipment does comply with the specification limit.

Checked by : 
CA-R-297 (22/07/2009)

Date : 13.3.2018

Certified by : 

Chan Chun Wai (Manager)

Date : 13.3.2018

**** End of Report ****

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

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Report No. : 183057CA185180(1)

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CALIBRATION CERTIFICATE OF ANEMOMETER

Client Supplied Information

Client : MaterialLab Consultants Ltd.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Anemometer

Manufacturer : Benetech

Model No. : GM816

Serial No. : 13372555

Equipment ID. : N/A

Next Calibration Date : 08-Jun-2019

Laboratory Information

Details of Reference Equipment –

Description : Reference Anemometer

Equipment ID. : R-101-4

Date of Calibration : 09-Jun-2018 Ambient Temperature : 22 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct Comparison

Calibration Results :

Reference Reading (m/s)	UUT Reading (m/s)	Error (m/s)
1.96	2.2	0.2
4.04	4.1	0.1
6.05	6.2	0.2
8.02	7.9	-0.1
10.06	9.7	-0.4

Remark :

1. The equipment being used in this calibration is traceable to recognized National Standards.

Checked by : William Date : 12-6-2018 Certified by : Chan Chun Wai Date : 13-6-2018

CA-R-297 (22/07/2009)

Chan Chun Wai (Manager)

**** End of Report ****

FUGRO TECHNICAL SERVICES LIMITED

Fugro Development Centre,
5 Lok Yi Street, Tai Lam,
Tuen Mun, N.T.,
Hong Kong.

Tel : +852 2450 8233
Fax : +852 2450 6138
E-mail : matlab@fugro.com
Website : www.fugro.com

Materialab

Report No. : 182933CA185214(2)

Page 1 of 1

CALIBRATION CERTIFICATE OF ANEMOMETER

Client Supplied Information

Client : Materialab Consultants Ltd.

Address: Room 723 & 725, 7F., Block B Profit Industrial Building, 1-15 Kwai Fung Crescent, Kwai Chung, N.T.

Project : Calibration Services

Details of Unit Under Test, UUT

Description : Comfort Level Probe

Manufacturer : Testo

Model No. :

Serial No. :

Equipment ID :

Meter	Probe
480	409
61003846	03216409

N/A

Next Calibration Due Date : 22-Aug-2019

Laboratory Information

Details of Reference Equipment –

Description : Reference Anemometer

Equipment ID. : R-101-4

Date of Calibration : 23-Aug-2018

Ambient Temperature : 20± 2 °C

Calibration Location : Calibration Laboratory of FTS

Method Used : By direct Comparison

Calibration Results :

Reference Reading (m/s)	UUT Reading (m/s)	Error (m/s)
1.05	1.06	0.01
3.02	3.06	0.04
5.04	5.07	0.03

Remarks :

1. The equipment being used in this calibration is traceable to recognized National Standards.
2. The reported readings in this calibration are an average from 10 trials.

Checked by : William Date : 31-8-2018 Certified by : K. T. Leung Date : 31-8-2018
CA-R-297 (22/07/2009) Leung Kwok Tai (Assistant Manager)

**** End of Report ****