

ภาคผนวกที่ 5-3
เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
ครั้งที่ 1/2565
สถานีเรียนกรุงเทพคริสเตียนวิทยาลัย
สถานีโรงพยาบาลเซนต์หลุยส์
วันที่ตรวจวัดวันที่ 4-9 สิงหาคม 2565

TSP High Volume Sampler Calibration

Verification Report No.
SO2200116-E001 -TSP 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: 47° N 1517399 E 664630
 Sampler: ETSP#44
 Recorder: ECRANG15315224

Date: 4 Aug 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.5
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION OFFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.33957
Model: TE-5028A	Qstd Intercept: -0.01202
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.98	2.082	54.0	53.06
2	8.99	1.804	52.0	51.09
3	7.43	1.641	48.0	47.16
4	5.12	1.363	44.0	43.23
5	2.65	0.983	38.0	37.34

LINEAR REGRESSION

Slope = 14.8621
Intercept = 22.9762
Corr. coeff = 0.9920

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	41
	49

Calibrated by: XXXXXXXXXX

Approved by: XXXXXXXXXX

4 August 2022

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200116-E001 -PM 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: 47° N 1517399 E 664630
 Sampler: EFM10#35
 Recorder: ECRDS01618124

Date: 4 Aug 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.5
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION OFFICE

Brand: Tisch Environmental, Inc	Slope: 1.02667
Model: TE-5028A	Intercept: -0.00753
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.21	2.176	50.0	31.86
2	8.75	1.843	46.0	29.31
3	7.16	1.668	44.0	28.04
4	4.74	1.359	40.0	25.49
5	2.82	1.050	36.0	22.94

LINEAR REGRESSION

Slope = 7.9229
Intercept = 14.7010
Corr. coeff = 0.9997
SFR = 1.151
SSP = 37.38

of Observations: 5

Range of Chart at SFR ±10%	37
	38

Calibrated by: XXXXXXXXXX

Approved by: XXXXXXXXXX

4 August 2022

รายงานการติดตามตรวจสอบคุณภาพสิ่งแวดล้อมประจำปี 2565
โครงการระบบขนส่งมวลชนกรุงเทพมหานคร (ครั้งที่ 1)

บริษัท ระบบขนส่งมวลชนกรุงเทพ จำกัด (มหาชน)

TSP High Volume Sampler Calibration

Verification Report No.
SO2200116-E001 -TSP_02

☐ PM ☒ Onsite

Site: โรงพยาบาลเชลล์ทูลุส

UTM : 47P N 1517266 E 664912

Sampler: ETSP#41

Recorder: ECRANG15315224

Date: 4 Aug 22

Technical: [Redacted]

Approval: [Redacted]

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.6
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.63957
Model: TE-5028A	Qstd Intercept: -0.01202
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.11	2.005	52.0	51.09
2	9.66	1.670	50.0	49.13
3	6.21	1.501	44.0	43.23
4	3.91	1.192	42.0	41.27
5	2.54	0.962	38.0	37.34

LINEAR REGRESSION

Slope = 12.7550

Intercept = 25.2027

Corr. coeff. = 0.9918

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	40
	47

Calibrated by : [Redacted]

Approved by : [Redacted]

4 August 2022

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200116-E001 -PM_02

☐ PM ☒ Onsite

Site: โรงพยาบาลเชลล์ทูลุส

UTM : 47P N 1517266 E 664912

Sampler: EPM10#14

Recorder: ECRDS01618124

Date: 4 Aug 22

Technical: [Redacted]

Approval: [Redacted]

CONDITIONS

Barometric Press. (hPa): 1006.3	Corrected Pressure (mm Hg): 754.8
Temperature (deg C): 33.3	Temperature (deg K): 306.3
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.02667
Model: TE-5028A	Intercept: -0.00753
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.89	2.235	54.0	34.40
2	8.62	1.629	50.0	31.85
3	6.45	1.563	46.0	29.30
4	3.21	1.119	40.0	25.48
5	2.87	1.059	38.0	24.21

LINEAR REGRESSION

Slope = 8.5929

Intercept = 15.6011

Corr. coeff. = 0.9947

SFR = 1.150

SSP = 40.00

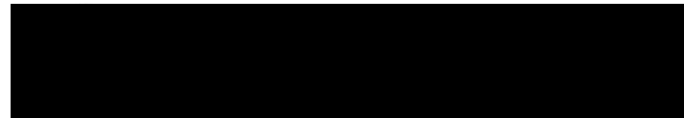
of Observations: 5

Range of Chart at SFR ±10%	39
	41

Calibrated by : [Redacted]

Approved by : [Redacted]

4 August 2022



Verification Test Report

Report No.:

SO22000116-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1517400 E 664651

Calibrated Date: 4 August 2022

Site : โรงเรียนเทพศิรินทร์

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1973

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March 21, 2022

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.70	0.04	93.66

Calibrated By:

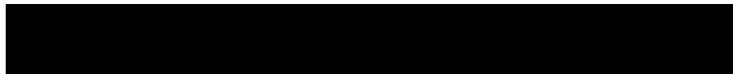
Date:

Approve By:

Date:

4 August 2022

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Verification Test Report

Report No.:

SO22000116-E001 -SLM 02

☐ PM ☒ Onsite UTM : 47P N 1517246 E 664916

Calibrated Date: 4 August 2022

Site : โรงพยาบาลเซนต์หลุยส์

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1968

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March 21, 2022

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.60	-0.06	93.66

Calibrated By:

Date:

Approve By:

Date:

4 August 2022

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Verification Test Report

Report No.:

SO22000116-E001 -SLM 02

☐ PM ☒ Onsite UTM : 47P N 1517246 E 664916

Calibrated Date: 4 August 2022

Site : โรงพยาบาลเซนต์หลุยส์

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1968

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March 21, 2022

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.60	-0.06	93.66

Calibrated By:

Date:

Approve By:

Date:

4 August 2022

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Verification Test Report

Report No.:

SO22000116-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1517400 E 664651

Calibrated Date: 4 August 2022

Site : โรงเรียนกรุงเทพคริสเตียน

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1973

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March 21, 2022

Result of Test

Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.70	0.04	93.66

Calibrated By:

Date:

Approve By:

Date:

4 August 2022

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รายงานการติดตามตรวจสอบคุณภาพสิ่งแวดล้อมประจำปี 2565

โครงการระบบขนส่งมวลชนกรุงเทพมหานคร (ครั้งที่ 1)

บริษัท ระบบขนส่งมวลชนกรุงเทพ จำกัด (มหาชน)

RECALIBRATION
DUE DATE:
January 19, 2023

Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 19, 2022	Rootsometer S/N: 438320	Ta: 294 °K	
Operator: [REDACTED]	Pa: 749.05 mm Hg		
Calibration Model #: TE-5028A	Calibrator S/N: 1328		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3190	3.7	1.50
2	3	4	1	1.0220	6.2	2.50
3	5	6	1	0.9290	7.5	3.00
4	7	8	1	0.8590	8.7	3.50
5	9	10	1	0.6530	14.8	6.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9941	0.7536	1.2241	0.9951	0.7544	0.7673
0.9907	0.9694	1.5803	0.9917	0.9704	0.9906
0.9890	1.0646	1.7312	0.9900	1.0656	1.0851
0.9874	1.1495	1.8699	0.9884	1.1506	1.1721
0.9793	1.4996	2.4483	0.9802	1.5011	1.5346
QSTD	m= 1.63957		QA	m= 1.02667	
	b= -0.01202			b= -0.00753	
	r= 0.99999			r= 0.99999	

Calculations			
Vstd= ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)	Va= ΔVol((Pa-ΔP)/Pa)		
Qstd= Vstd/ΔTime	Qa= Va/ΔTime		
For subsequent flow rate calculations:			
Qstd= $1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa= $1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$		

Standard Conditions	
Tstd: 298.15 °K	
Pstd: 760 mm Hg	
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

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.

Calibration Certificate ID
TH2088-888-030222-ACC-TH

Accuracy Calibration Certificate

Customer

Company: [REDACTED]

Address: [REDACTED]

City: Bang Khae Contact: [REDACTED]

Zip / Postal: 10160

State / Province: Bangkok

Order Number: [REDACTED]

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument

Model: XSR2050U Asset Number: N/A

Serial No.: B911363567 Terminal Model: SRAT

Building: N/A Terminal Serial No.: B911363567

Floor: 3 Terminal Asset No.: N/A

Room: B304

Range	Max. Capacity	Readability (g)
1	51 g	0.0001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CPW002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.2 °C	End: 22.6 °C	Start: 58.3 %	End: 59.7 %

As Found Calibration Date: 02-Mar-2022 Calibration: [REDACTED]

As Left Calibration Date: N/A

Issue Date: 03-Mar-2022

Approved Signatory: [REDACTED]

Software Version: 1.23.0.260
Report Version: 2.16.12
Form Number: F103C

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Calibration Certificate ID
TH2068-088-030222-ACC-TH

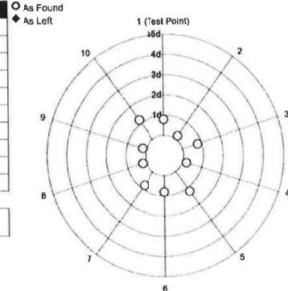
Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00001 g	N/A
2	70.00002 g	N/A
3	70.00001 g	N/A
4	70.00002 g	N/A
5	70.00003 g	N/A
6	70.00001 g	N/A
7	70.00001 g	N/A
8	70.00002 g	N/A
9	70.00002 g	N/A
10	70.00003 g	N/A

Standard Deviation	0.00008 g	N/A
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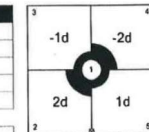
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0002 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

Software Version: 1.23.0.360
Report Version: 2.16.12
Form Number: F103C

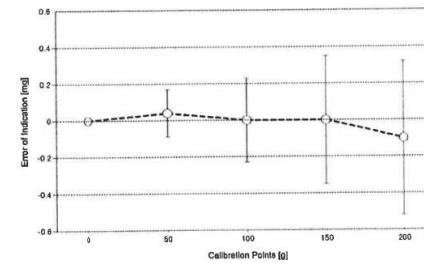
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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.10000 g	0.10000 g	0.00000 g	0.028 mg	2
3	0.50000 g	0.50001 g	0.00001 g	0.032 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.040 mg	2
5	1.99999 g	2.00000 g	0.00001 g	0.046 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.062 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.13 mg	2
8	49.99998 g	50.00002 g	0.00004 g	0.23 mg	2
9	100.0000 g	100.0000 g	0.00000 g	0.35 mg	2
10	150.0000 g	150.0000 g	0.00000 g	0.42 mg	2
11	199.9999 g	199.9998 g	-0.0001 g		



As Found

As Left

For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-16. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Software Version: 1.23.0.360
Report Version: 2.16.12
Form Number: F103C

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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS22 Date of Issue: 09-Jan-2022
Certificate Number: 177036 Calibration Due Date: 03-Jul-2023

Weight Set 2: OIML E2

Weight Set No.: WS76 Date of Issue: 31-Jan-2022
Certificate Number: C205470237 Calibration Due Date: 12-Jul-2023

Thermo Hygrometer

Equipment No.: IN193 Date of Issue: 14-Jun-2021
Certificate Number: Z1H1221 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Software Version: 1.23.0.260
Report Version: 2.18.12
Form Number: F103C

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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

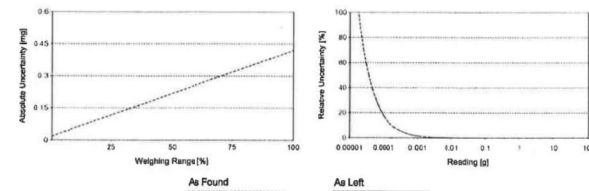
Uncertainty of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	61 g	$U_1 = 0.016 \text{ mg} + 0.00497 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00492 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.00220 g	0.018 mg	0.82%
0.02200 g	0.018 mg	0.082%
0.22000 g	0.019 mg	0.0087%
2.20000 g	0.029 mg	0.0013%
220.0000 g	1.1 mg	0.00052%



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

Software Version: 1.23.0.260
Report Version: 2.18.12
Form Number: F103C

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Certificate of Calibration

Reference No. : 4182/2202-017

Customer : [REDACTED]

Equipment : Digital Thermo-Hygrometer

Manufacturer : Testo

Model : 608-H1

Serial No. : 83353607

ID No. : -

Received Date : 7 March 2022

Calibrated Date : 9 March 2022

Issued Date : 15 March 2022

Certificate No. : L2203-290

Page 1 of 2

Environment	Start Calibration	Stop Calibration
Ambient Temperature (°C)	24.7	25.5
Relative Humidity (% RH)	51	52

Calibrated by : Mr. Nattawut Reangdech

Calibration Method

In-house method : by comparison with standard hygrometer for humidity measurement function and comparison with standard thermometer for temperature measurement function into humidity/temperature chamber

Condition of this result of calibration

- Reference standard instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygrometer	HL-NT2-D	61468576	QR21-0851	13 May 22
2) Digital Thermometer With Probe	GT11	08000089	PSL-T 0072/65	14 November 2022
- This result of calibration was found accurate as shown on date and place of calibration only
- This certificate can be traceable to International System of Unit :
 - Through Thailand Institute of Scientific And Technological Research (TISTR)
 - Through Quality Reborn Co.Ltd.

Approved by : [REDACTED]

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence level of approximately 95 %

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Certificate No. : L2203-290

Page 2 of 2

Result of Calibration

Function : Humidity Measurement Reference Temperature at 25 °C

STD Reading (% RH)	UUC Reading (% RH)	UUC Error (% RH)	Measurement Uncertainty (±% RH)
50.00	49.0	-1.00	2.3

Function : Temperature Measurement


STD Reading (°C)	UUC Reading (°C)	UUC Error (°C)	Measurement Uncertainty (±°C)
25.012	25.0	-0.012	0.35

Resolution : 0.1 (°C) , 0.1 % RH

STD= Standard

UUC= Unit Under Calibration


** End of Calibration Report **

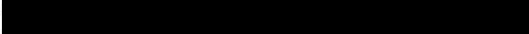


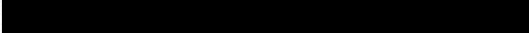
THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0383 **MTC No.** EEL. BP. 59/0365

CALIBRATION CERTIFICATE

Submitted by : 

Address : 

Calibrated at : 

Instrument Calibrated :	Ambient Environment
Description : Acoustic Calibrator	Temperature : (23 ± 3) °C
Manufacturer : Bruel&Kjaer	Relative Humidity : (50 ± 15) %
Model : 4220	Ambient Pressure : (101.325 ± 1.500) kPa
Serial No. : 1351075	

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202A S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N 4:06495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

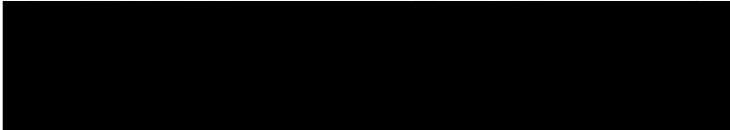
The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

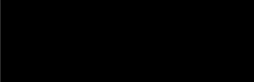
Date of Receipt : 10 Mar. 2022

Date of Calibration : 21 Mar. 2022

1 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0383 **MTC No.** EEL. BP. 59/0365

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.66	-0.34	± 0.10	± 0.40 dB

2. Frequency


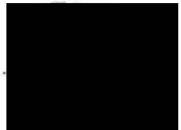
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	997.8	-2.2	± 1.5	± 1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	4.55	± 0.50	± 3.0%

Note :

1. No adjustment.
2. The calibrator pressure correction was not included.
3. The microphone volume correction was not included.

Calibrated by :  **Approved by :** 

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

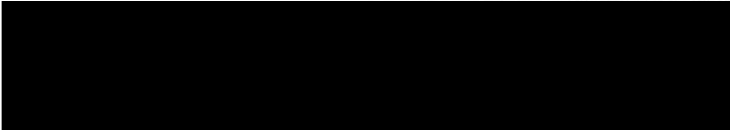
Date of Calibration : 21 Mar. 2022

Date of Issue : 22 Mar. 2022

Ref: 2011265031501147002

End of Certificate 2 / 2

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A00V3 Reference Number: 160-402021734-1
Cylinder Number: EB0140762 Cylinder Volume: 144.4 Cubic Feet
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A12021 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Feb 19, 2021

Expiration Date: Feb 19, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
NOX	45.00 PPM	44.88 PPM	G1	+/- 1.4% NIST Traceable
NITRIC OXIDE	45.00 PPM	44.82 PPM	G1	+/- 1.4% NIST Traceable
SULFUR DIOXIDE	45.00 PPM	45.34 PPM	G1	+/- 1.1% NIST Traceable
CARBON MONOXIDE	4500 PPM	4500 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			02/15/2021

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	200811-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%
GMIS	124206889	CC323707	4.925 PPM NITROGEN DIOXIDE/NITROGEN	2.1%
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
SIEMENS ULTRAMAT 8N1K0579	NDIR	Jan 27, 2021
Nicolet IS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021
Nicolet IS50 FTIR AUP2010245 NO2	FTIR	Jan 21, 2021
Nicolet IS50 FTIR AUP2010245 SO2	FTIR	Jan 21, 2021

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.4 Kg
Net Weight: 4.5 Kg
PO# 5221000405

NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508007

Page:1/1

Calibrated Date: 2-Aug-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer
Model: T200

Manufacturer API
S/N: ENOAIT20002469

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature: 26.8 °C

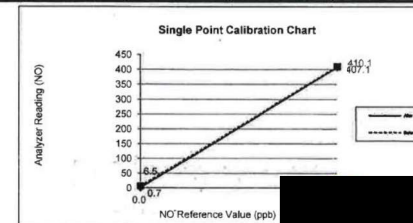
Humidity: 53 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	4.0	0.0	4.0	408.3	400.0	1.0
NO ₂	2.5	0.0	2.5	1.8	0.0	0.2
NOx	6.5	0.0	6.5	410.1	400.0	1.2

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	404.3	400.0	0.5
NO ₂	0.5	0.0	0.5	2.8	0.0	0.3
NOx	0.7	0.0	0.7	407.1	400.0	0.9



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508007
Calibrated Date: 2-Aug-22

Page: 1/1

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	13:30:00 AM				
Range	0.00 - 500.00 PPM	PPM	500	500	
Stability (Zero Gas)	< 0.2	PPM	0.5	0.2	
Sample Flow	500 +/- 50	cc/min	505	480	
Ozone Flow	80-90	cc/min	79	72	
PMT Detector	0-5000	mV	26.2	29.3	
AZERO	-20-150	mV	56.0	55.0	
HVPS	400-900 constant	V	755	755	
DCPS	2500 +/- 200	mV	-	-	
RECELL TEMP	50 +/- 1	Degree C	50	50	
BOX TEMP	20-35	Degree C	30.2	32.0	
PMT TEMP	7 +/- 1	Degree C	7.2	7.2	
IZS TEMP	50 +/- 4	Degree C	-	-	
MOLY Temp	315 +/- 5	Degree C	315.0	315.0	
REEL PRES	4-10 constant	IN-Hg-A	4	5	
SAMP PRES	20-30 constant	IN-Hg-A	29	29	
NO Slope	1 +/- 0.3		0.890	1.118	
Nox Slope	1 +/- 0.3		0.911	1.046	
NO Offset	-10 to + 150	mV	12.9	2.2	
NOx Offset	-10 to + 150	mV	-2.4	9.1	
Span and Cal Values					
Zero Value	NO	0	ppb	4.0	0.2
	NOx	0	ppb	6.5	0.7
Span Value	NO	400	ppb	408.3	404.3
	NOx	400	ppb	410.1	407.1

NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508009
Calibrated Date: 2-Aug-22

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer
Model: 200A

Manufacturer: API
S/N: ENOAI200E03408

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792	NO Conc: 4468 PPM SO2 Conc: 45.34 PPM CO Conc: 4500 PPM
ZERO AIR Generator: ZAG7001 S/N: 644	Expire Date: Feb 19, 2024 ND24137

Environment: Temperature: 26.9 °C

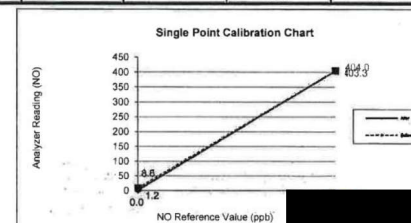
Humidity: 54 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.6	0.0	5.6	382.0	400.0	-2.3
NO ₂	3.0	0.0	3.0	22.0	0.0	2.8
NOx	6.6	0.0	8.6	404.0	400.0	0.5

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.4	0.0	0.4	399.9	400.0	0.0
NO ₂	0.8	0.0	0.8	3.4	0.0	0.4
NOx	1.2	0.0	1.2	403.3	400.0	0.4



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508009
Calibrated Date: 2-Aug-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	15:30				
Range	0.00 - 500.00 PPB	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.8	0.2	
Sample Flow	500 +/- 50	cc/min	470.0	476.0	
Ozone Flow	60-90	cc/min	90.0	76.0	
PMT Detector	0-5000	mV	24.8	19.6	
AZERO	20-150	mV	11.7	7.3	
HVPS	400-900 constant	V	768.0	714.0	
DCPS	2500 +/- 200	mV	-	-	
CELL TEMP	50 +/- 1	Degree C	50.3	50.3	
BOX TEMP	20-35	Degree C	28.0	27.5	
PMT TEMP	7 +/- 1	Degree C	7.7	7.8	
IS TEMP	50 +/- 4	Degree C	-	-	
MOLY Temp	315 +/- 5	Degree C	313.1	315.0	
REL PRES	4-10 constant	IN-Hg-A	7.30	7.30	
SAMP PRES	20-30 constant	IN-Hg-A	31.4	31.3	
NO Slope	1 +/- 0.3		0.647	0.963	
Nox Slope	1 +/- 0.3		0.652	0.940	
NO Offset	-10 to + 150	mV	17.40	6.60	
NOx Offset	-10 to + 150	mV	24.10	12.70	
Span and Cal Values					
Zero Value	NO	0	ppb	5.6	0.4
	NOx	0	ppb	8.6	1.2
Span Value	NO	400	ppb	382.0	399.9
	NOx	400	ppb	404.0	403.3

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508002
Calibrated Date: 2-Aug-22

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Instruments Information

Analyzer Type: SO2 Analyzer Model: T100	Manufacturer API S/N: ESOAIT10002034
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Calibration System

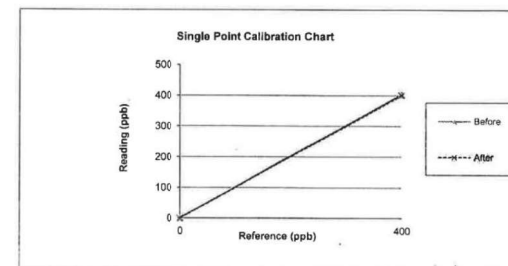
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.3 °C

Humidity: 50 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.4	0.4	400.0	403.0	0.4
After	0.0	0.1	0.1	400.0	400.2	0.0



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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508002

Calibrated Date: 2-Aug-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	11:50				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	650 (+/- 50)	cc/min	650	619	
PMT Detector	0 - 5000	mV	34.7	26.4	
Norm PMT Detector	0 - 5000	mV	44.0	25.9	
HVPS	400-900 constant	V	723	723	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreagee C	50	50	
BOX TEMP	20-40	Dreagee C	35.5	33.9	
PMT TEMP	7 (+/- 1)	Dreagee C	8.0	8.0	
UV lamp	1000-4900	mV	2132.0	2132.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR Light (Zero Gas)	<100	PPB	19	19	
Dark PMT	(-50) - (+200)	mV	64.5	64.5	
Dark lamp	(-50) - (+200)	mV	-15.1	-15.1	
SAMP PRES	20-30 constant	IN-Hg-A	27.4	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2012	2008	
SO2 Conc	1000 (+/- 250)	PPB	1006	1004	
SO2 Slope	1 (+/- 0.3)	-	0.959	0.959	
SO2 Offset	< 250	mV	30.3	1	
Stability at Zero	< 0.2	PPB	0.1	17.7	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.5	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	0.4	0.1	
Span Gas (400 PPB)	400	ppb	403.0	400.2	± 5% of Range

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508001

Calibrated Date: 2-Aug-22

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Instruments Information

Analyzer Type: SO2 Analyzer Model: T100	Manufacturer API S/N: ESOAIT10002035
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Calibration System

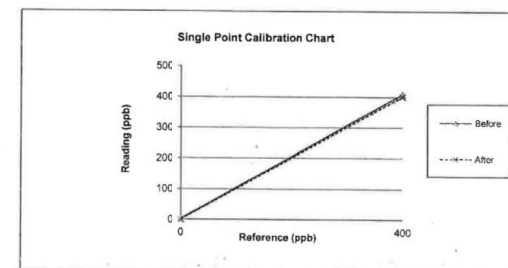
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.3 °C

Humidity: 61 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	2.1	2.1	400.0	408.0	1.0
After	0.0	0.5	0.5	400.0	401.0	0.1



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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508001

Calibrated Date: 2-Aug-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	16:40				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.3	
Sample Flow	850 (+/- 50)	cc/min	666	650	
PMT Detector	0 - 5000	mV	27.4	32.5	
Norm PMT Detector	0 - 5000	mV	30.4	41.7	
rVPS	400-900 constant	V	674	679	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreagee C	50	50	
BOX TEMP	20-40	Dreagee C	33.6	32.8	
PMT TEMP	7 (+/-1)	Dreagee C	7.9	7.9	
UV lamp	1000-4900	mV	3020	3022	
Lamp Ratio	30-120	%	96.5	96.5	
STR Light (Zero Gas)	<100	PPB	20.2	20.0	
Dark PMT	(-50) - (+200)	mV	164.5	164.5	
Dark lamp	(-50) - (+200)	mV	3.4	3.4	
SAMP PRES	20-30 constant	IN-Hg-A	28.0	27.4	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2014.0	2024.0	
SO2 Conc	1000 (+/- 250)	PPB	1007.0	1012.0	
SO2 Slope	1 (+/- 0.3)	-	1.000	1.011	
SO2 Offset	< 250	mV	44.3	38.5	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.3	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	2.1	0.5	
Span Gas (400 PPB)	400	ppb	408.0	401.0	± 5% of Range

CO Analyzer Verification Test Report

Calibration Report No.: ES-C6508004

Calibrated Date: 2-Aug-22

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Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA, France S/N: ECOESACO12E205
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Calibration System

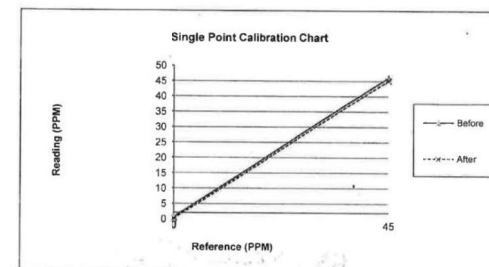
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 4468 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.6 °C

Humidity: 55 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.630	0.6	45.0	45.97	1.1
After	0.0	0.067	0.1	45.0	45.05	0.1



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6508004
Calibrated Date: 2-Aug-22

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Analyzer Signal Values					
Date	2-Aug-22	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	508.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

CO Analyzer Verification Test Report

Calibration Report No.: AP-C6508003
Calibrated Date: 2-Aug-22

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Instruments Information

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Analyzer Type: CO Analyzer Model: 300	Manufacturer API S/N: ECOAI300E01510
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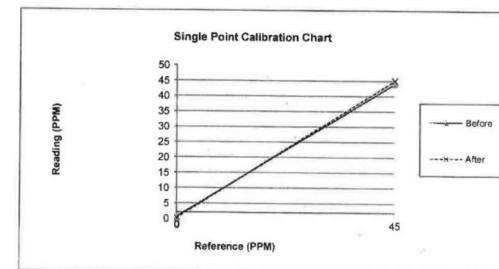
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.6 °C Humidity 55 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.6	0.6	45.0	44.0	-1.1
After	0.0	0.2	0.2	45.0	45.0	0.0



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CO Analyzer Verification Test Report

Calibration Report No.: AP-C6508003

Calibrated Date: 2-Aug-22

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Detail	Range	Unit	Before	After	Note
Date	2-Aug-22				
Time	16:13				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.1	0.4	
CO Measure	2500 - 4800 MV.	mV	3035.9	3055.2	
CO Reference	2500 - 4800 MV.	mV	2957.4	2975.3	
MR Ratio	1.2 +/- 0.5		1.03	1.03	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	29.8	29.9	
Sample Flow	720 - 880 cc/min	cc/min	785	793	
Sample Temp	44 - 52 deg.C	deg.C	38.9	38.3	
Bench Temp	47 - 49 deg.C	deg.C	51	50.5	
Wheel Temp	66 - 70 deg.C	deg.C	67.9	68	
Box Temp	27 - 50 deg.C	deg.C	33	34	
PHT drive	250 - 4750 mv.	mV	3680	3685	
Slope	0.800 - 1.200		0.957	0.957	
Offset	0.05 +/- 0.2		-0.094	-0.095	
Gas Test Response					
Zero Gas	0	PPM	-2.4	0.0	
Span Gas	45	PPM	45.0	45.1	± 5% of Range

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 August, 2021

Certification No. 376/21

Page : 1 of 6

Object : เครื่องมือตรวจวัดคุณภาพอากาศ

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2511

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala 2015 (PTB220 No. 18720015)



The Result of Calibration

Sensor model EWSNV110WS2511 Certification No. 376/21

10 August, 2021

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.1	-0.06
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.8	0.21
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.9	0.12
20.02	-	-	-	20.2	-0.18

Wind Aloft Plotting Board.

US DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	



The Result of Calibration

Sensor model EWSNV110WS2511

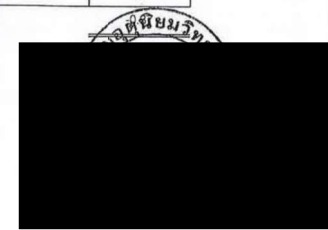
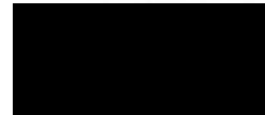
Certification No. 376/21

10 August, 2021

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.87	1010.07	-0.20
1009.53	1009.81	-0.28
1007.23	1007.68	-0.45
1007.00	1007.41	-0.41
1006.68	1007.15	-0.47
1006.46	1006.88	-0.42
1006.27	1006.61	-0.34
1006.44	1006.88	-0.44
1006.78	1007.15	-0.37
1007.64	1008.21	-0.57
1008.23	1008.74	-0.51
1007.79	1008.21	-0.42
1008.96	1009.27	-0.31
1007.85	1008.21	-0.36
1008.02	1008.41	-0.39
1008.30	1008.74	-0.44
1008.77	1009.01	-0.24
1009.28	1009.54	-0.26
1009.65	1009.81	-0.16
1009.75	1010.07	-0.32

Average



The Result of Calibration

Sensor model: EWSNV110WS2511 Certification No. 376/21
10 August, 2021 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.4	-0.2
31.3	31.4	-0.1
15.8	15.6	0.2

The Result of Calibration

Sensor model: EWSNV110WS2511 Certification No. 376/21
10 August, 2021 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	79.1	6.1
61.4	57.2	4.2
41.5	39.8	1.7

Date of Issue 10 August, 2021

Certification No. 376/21

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis แบบ TIPPING BUCKET
Model 7342.026 ID No.EWSNV110WS2511 ทำการสอบเทียบกับแก้วฝนแบบแก้ว
ดวง GAUGE DIAMETER 8.0 INCHES , NECRETTI & ZAMBRA LONDON No
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องวัดฝน (0.2 มม.) (IP)

วิศวกรชำนาญการ

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 August, 2021

Certification No. 377/21

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger 110-WS-25DL-D

Serial No. : EWSNV110WS2509

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.3 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.9184

STANDARD BAROMETER : Digital Barometer Vaisala TFS320 No.1220015



The Result of Calibration

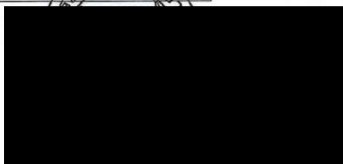
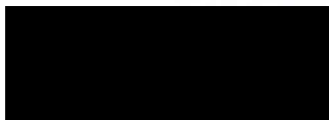
Sensor model EWSNV110WS2509 Certification No. 377/21

10 August, 2021

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	3.1	-0.08
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.7	0.32
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.7	0.31
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.3	-0.28

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	



The Result of Calibration

Sensor model EWSNV110WS2509

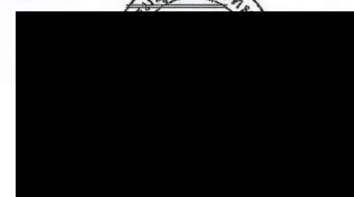
Certification No. 377/21

10 August, 2021

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.87	1009.99	-0.12
1009.53	1009.72	-0.19
1007.23	1007.59	-0.36
1007.00	1007.33	-0.33
1006.68	1007.06	-0.38
1006.46	1006.79	-0.33
1006.27	1006.53	-0.26
1005.44	1006.79	-0.35
1006.78	1006.79	-0.01
1007.64	1007.86	-0.22
1008.23	1008.39	-0.16
1007.79	1008.13	-0.34
1008.96	1009.19	-0.23
1007.85	1008.13	-0.28
1008.02	1008.39	-0.37
1008.30	1008.66	-0.36
1008.77	1008.92	-0.15
1009.28	1009.46	-0.18
1009.65	1009.72	-0.07
1009.75	1009.99	-0.24

Average



The Result of Calibration

Sensor model EWSNV110WS2509 Certification No. 377/21
10 August, 2021 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.0	0.2
31.3	31.0	0.3
15.8	15.7	0.1

The Result of Calibration

Sensor model EWSNV110WS2509 Certification No. 377/21
10 August, 2021 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	78.0	7.2
61.4	56.4	5.0
41.5	38.8	2.7

Date of Issue 10 August, 2021

Certification No. 377/21

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝุ่น ชื่อ Davis แบบ TIPPING BUCKET
Model 7342.026 ID No.EWSNV110WS2509 ทำการสอบเทียบกับแก้วฝนแบบแก้ว
ทอง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องวัด (0.2 mm (8 in))

วิศวกรชำนาญการ

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด

สถานีโรงพยาบาลเซนต์หลุยส์

สถานีโรงเรียนกรุงเทพคริสเตียนวิทยาลัย

ครั้งที่ 2/2565

วันที่ตรวจวัดวันที่ 18-23 ตุลาคม 2565

TSP High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -TSP 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: 47P N 1517399 E 664630
 Sampler: ETSP#35
 Recorder: ECRANG15315224

Date: 18 Oct 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.6
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.63957
Model: TE-5028A	Qstd Intercept: -0.01202
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qstd (m3/min)	I (char)	IC (corrected)
1	11.98	2.082	54.0	53.06
2	8.99	1.804	52.0	51.09
3	7.43	1.641	48.0	47.16
4	5.12	1.363	44.0	43.23
5	2.65	0.983	38.0	37.34

LINEAR REGRESSION

Slope = 14.8621
Intercept = 22.9762
Corr. coeff = 0.9920

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min.

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

18 October 2022

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -PM 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: 47P N 1517399 E 664630
 Sampler: EPM10#35
 Recorder: ECRDS01618124

Date: 18 Oct 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.6
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.02667
Model: TE-5028A	Intercept: -0.00753
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qa (m3/min)	I (char)	IC (corrected)
1	12.21	2.176	50.0	31.86
2	8.75	1.843	46.0	29.31
3	7.16	1.668	44.0	26.04
4	4.74	1.359	40.0	25.49
5	2.82	1.050	36.0	22.94

LINEAR REGRESSION

Slope = 7.9229
Intercept = 14.7010
Corr. coeff = 0.9997
SFR = 1.151
SSP = 37.38

of Observations: 5

Range of Chart at SFR ±10%

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

18 October 2022

TSP High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -TSP 02

☐ PM ☒ Onsite

Site: โรงพยาบาลเวชศาสตร์
UTM : 47P N 1517266 E 664912
Sampler: ETSP#30
Recorder: ECRANG15315224

Date: 18 Oct 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.5	Corrected Pressure (mm Hg): 754.9
Temperature (deg C): 33.6	Temperature (deg K): 306.6
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Qstd Slope: 1.63957
Model: TE-5028A	Qstd Intercept: -0.01202
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.11	2.005	52.0	51.09
2	9.66	1.870	50.0	49.13
3	6.21	1.501	44.0	43.23
4	3.91	1.192	42.0	41.27
5	2.54	0.962	38.0	37.34

LINEAR REGRESSION

Slope = 12.7550
Intercept = 25.2027
Corr. coeff = 0.9918

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	40 47
------------------------------------	----------

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -PM 02

☐ PM ☒ Onsite

Site: โรงพยาบาลเวชศาสตร์
UTM : 47P N 1517266 E 664912
Sampler: EPM10#30
Recorder: ECRDS01618124

Date: 18 Oct 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.3	Corrected Pressure (mm Hg): 754.8
Temperature (deg C): 33.3	Temperature (deg K): 306.3
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.02667
Model: TE-5028A	Intercept: -0.00753
Serial#: 1328	Date Certified: 19 Jan 22

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.89	2.235	54.0	34.40
2	8.82	1.829	50.0	31.85
3	6.45	1.583	46.0	29.30
4	3.21	1.119	40.0	25.48
5	2.87	1.059	38.0	24.21

LINEAR REGRESSION

Slope = 8.5929
Intercept = 15.6011
Corr. coeff = 0.9947
SFR = 1.150
SSP = 40.00

# of Observations: 5	39
Range of Chart at SFR ±10%	41

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

Verification Test Report

Report No.:

SO22000172-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1517399 E 664630

Calibrated Date: 18 October 2022

Site : โรงเรียนกรุงเทพคริสเตียน

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1968

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March.21, 2022

Result of Test			
Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.70	0.04	93.66

Calibrated By:

Date:

Approve By:

Date:

18 October 2022

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Verification Test Report

Report No.:

SO22000172-E001 -SLM 02

☒ PM ☒ Onsite UTM : 47P N 1517266 E 664912

Calibrated Date: 18 October 2022

Site : โรงพยาบาลเซนต์หลุยส์

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1915

Environment: Temperature 32.3 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230, Bruel&Kjaer

Serial No.1351075

Date of Calibration : March.21, 2022

Result of Test			
Reference Standard (dB)	Instrument reading (dB)	Error (dB)	Adjust (dB)
93.66	93.60	-0.06	93.66

Calibrated By:

Date:

Approve By:

Date:

18 October 2022

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**RECALIBRATION
DUE DATE:**
January 19, 2023

Certificate of Calibration

Calibration Certification Information					
Cal. Date: January 19, 2022	Rootmeter S/N: 438320	Ta: 294	"K		
Operator: [REDACTED]		Pa: 749.05	mm Hg		
Calibration Model #: TE-5028A	Calibrator S/N: 1328				

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (In H2O)
1	1	2	1	1.3190	3.7	1.50
2	3	4	1	1.0220	6.2	2.50
3	5	6	1	0.9290	7.5	3.00
4	7	8	1	0.8590	8.7	3.50
5	9	10	1	0.6530	14.8	6.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9941	0.7536	1.2241	0.9951	0.7544	0.7673
0.9907	0.9694	1.5803	0.9917	0.9704	0.9906
0.9890	1.0646	1.7312	0.9900	1.0656	1.0851
0.9874	1.1495	1.8699	0.9884	1.1506	1.1721
0.9793	1.4996	2.4483	0.9802	1.5011	1.5346
QSTD	m= 1.63957		QA	m= 1.02667	
	b= -0.01202			b= -0.00753	
	r= 0.99999			r= 0.99999	

Calculations	
$Vstd = \Delta Vol(Pa - \Delta P) / Pstd(Tstd / Ta)$	$Va = \Delta Vol((Pa - \Delta P) / Pa)$
$Qstd = Vstd / \Delta Time$	$Qa = Va / \Delta Time$

For subsequent flow rate calculations:

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

Standard Conditions

Tstd: 298.15 °K

Pstd: 760 mm Hg

Key

ΔH: calibrator manometer reading (in H2O)

ΔP: rootsmeter manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

RECALIBRATION

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

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

Accuracy Calibration Certificate

Customer

Company: [REDACTED]
Address: [REDACTED]
City: Bang Khas
Zip / Postal: 10160
State / Province: Bangkok
Order Number: [REDACTED]

Customer Contact: [REDACTED]

Weighing Device

Manufacturer: Mettler Toledo	Instrument Type: Weighing Instrument
Model: XSR205DU	Asset Number: N/A
Serial No.: B911383567	Terminal Model: SRAT
Building: N/A	Terminal Serial No.: B911383567
Floor: 3	Terminal Asset No.: N/A
Room: B304	

Range	Max. Capacity	Readability (g)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cp-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW00208

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cp-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 22.2 °C	End: 22.8 °C	Start: 58.3 %	End: 58.7 %

As Found Calibration Date: 02-Mar-2022
As Left Calibration Date: N/A
Issue Date: 03-Mar-2022

Calibrator: [REDACTED]
Approved Signatory: [REDACTED]

Software Version: 1.39.0.260
Report Version: 2.16.12
Form Number: 1103C

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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Measurement Results

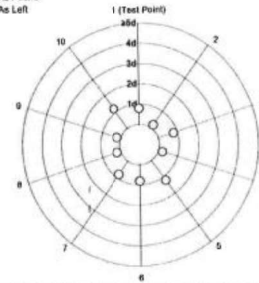
Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00001 g	N/A
2	70.00002 g	N/A
3	70.00001 g	N/A
4	70.00002 g	N/A
5	70.00003 g	N/A
6	70.00001 g	N/A
7	70.00001 g	N/A
8	70.00002 g	N/A
9	70.00002 g	N/A
10	70.00003 g	N/A

Standard Deviation	0.000008 g	N/A
--------------------	------------	-----

○ As Found
◆ As Left



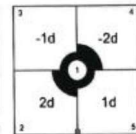
The "1" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0002 g	N/A
3	99.9999 g	N/A
4	99.9998 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
-------------------	----------	-----



○ As Found

The "1" in the graph represents the readability of the range/interval in which the test was performed.

Software Version: 1.20.0.260
Report Version: 2.15.12
Form Number: F103C

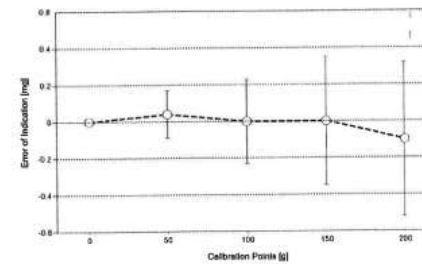
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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
3	0.50000 g	0.50001 g	0.00001 g	0.028 mg	2
4	0.99999 g	0.99999 g	0.00000 g	0.032 mg	2
5	1.99999 g	2.00000 g	0.00001 g	0.040 mg	2
6	5.00001 g	5.00001 g	0.00000 g	0.048 mg	2
7	10.00001 g	10.00002 g	0.00001 g	0.062 mg	2
8	49.99998 g	50.00002 g	0.00004 g	0.13 mg	2
9	100.0000 g	100.0000 g	0.00000 g	0.23 mg	2
10	150.0000 g	150.0000 g	0.00000 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.42 mg	2



○ As Found

◆ As Left

For improved legibility of the graphics
only increasing measurement points
are shown and measurement points
close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-16. The value of the measured lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Software Version: 1.20.0.260
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Page 3 of 5

Calibration Certificate ID
TH2068-088-030222-ACC-TH

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.: WS22 Date of issue: 06-Jan-2022
Certificate Number: 177036 Calibration Due Date: 03-Jul-2023

Weight Set 2: OIML E2

Weight Set No.: WS76 Date of issue: 31-Jan-2022
Certificate Number: C205470237 Calibration Due Date: 12-Jul-2023

Thermo Hygrometer

Equipment No.: IN193 Date of issue: 14-Jun-2021
Certificate Number: 21H1221 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Software Version: 1.20.0.260
Report Version: 2.05.12
Form Number: F103C

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Calibration Certificate ID
TH2068-088-030222-ACC-TH

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with $k=2$ in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-4}$ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

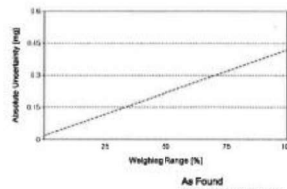
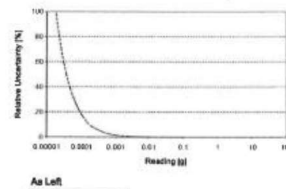
Linearization of Uncertainty Equation

	Range	Max	As Found	As Left
1	0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00497 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00492 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Found	As Left	As Left
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0087%	N/A	N/A
2.20000 g	0.029 mg	0.0013%	N/A	N/A
220.0000 g	1.1 mg	0.00052%	N/A	N/A

The weighing range shown in the absolute uncertainty graph refers to the first interval range of the device.

Software Version: 1.20.0.260
Report Version: 2.05.12
Form Number: F103C

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Certificate of Calibration

Reference No. : 4162/2202-017 Certificate No. : L2203-290
 Customer : [REDACTED] Page 1 of 2

Equipment : Digital Thermo-Hygrometer
 Manufacturer : Testo
 Model : 608-H1
 Serial No. : 83353607
 ID No. : -
 Received Date : 7 March 2022
 Calibrated Date : 9 March 2022
 Issued Date : 15 March 2022

Environment	Start Calibration	Stop Calibration
Ambient Temperature (°C)	24.7	25.5
Relative Humidity (% RH)	51	52

Calibrated by : Mr. Nattawut Reangdech

Calibration Method.
 In-house method : by comparison with standard hygrometer for humidity measurement function and comparison with standard thermometer for temperature measurement function into humidity/temperature chamber

Condition of this result of calibration

1. Reference standard instrument

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygrometer	HL-NT2-D	61468576	QR21-0851	13 May 22
2) Digital Thermometer With Probe	GT11	06000089	PSL-T 0072/85	14 November 2022

2. This result of calibration was found accurate as shown on date and place of calibration only

3. This certificate can be traceable to International System of Unit :
 - Through Thailand Institute of Scientific And Technological Research (TISTR)
 - Through Quality Reborn Co.,Ltd.

Approved by : [REDACTED]

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence level of approximately 95 %

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Certificate No. : L2203-290 Page 2 of 2

Result of Calibration

Function : Humidity Measurement Reference Temperature at 25 °C

STD Reading (% RH)	UUC Reading (% RH)	UUC Error (% RH)	Measurement Uncertainty (±% RH)
50.00	49.0	-1.00	2.3

Function : Temperature Measurement

STD Reading (°C)	UUC Reading (°C)	UUC Error (°C)	Measurement Uncertainty (±°C)
25.012	25.0	-0.012	0.35

Resolution : 0.1 (°C) , 0.1 % RH
 STD= Standard
 UUC= Unit Under Calibration

** End of Calibration Report **

Grade of Product: EPA Protocol

Part Number:	E04N199E15A00V3	Reference Number:	160-402021734-1
Cylinder Number:	EB0140762	Cylinder Volume:	144.4 Cubic Feet
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Feb 19, 2021

Expiration Date: Feb 19, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	44.88 PPM	G1	+/- 1.4% NIST Traceable	02/12/2021, 02/19/2021
NITRIC OXIDE	45.00 PPM	44.82 PPM	G1	+/- 1.4% NIST Traceable	02/12/2021, 02/19/2021
SULFUR DIOXIDE	45.00 PPM	45.34 PPM	G1	+/- 1.1% NIST Traceable	02/12/2021, 02/19/2021
CARBON MONOXIDE	45.00 PPM	4500 PPM	G1	+/- 1.0% NIST Traceable	02/15/2021
NITROGEN	Relative				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200611-04	CC707068	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%	Feb 02, 2025
PRM	12386	D865025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
CRM	02608066	CS23370	4.026 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	K94303109	49.87 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 29, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Jun 07, 2024

The SRM, PRM or CRM listed above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration	
SIEMENS ULTRAMAT 6 NTK0576	NDIR	Jan 27, 2021	
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Feb 11, 2021	
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Jan 21, 2021	
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Jan 21, 2021	

Triad Data Available Upon Request

NOTES:

Gross Weight: 28,4 Kg

Net Weight: 4.5 Kg

PC# 5221000405

CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510001

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA., France S/N: NCOESAC012E355
--	--

Calibration System

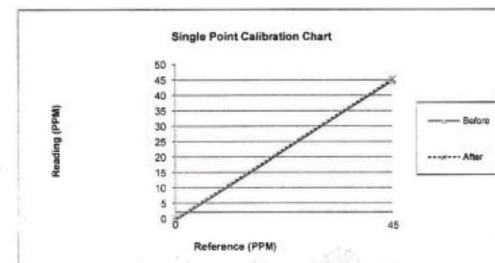
Calibrator Unit	Standard Gas	
Dilutor Model ESA MGC101	NO Conc	44.68 PPM
S/N: 792	SO2 Conc	45.34 PPM
ZERO AIR Generator ZAG7001	CO Conc	4500 PPM
S/N: 644	Expire Date:	Feb 19 2024 EB140762

Environment: Temperature 24.7 °C

Humidity: 69 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	-0.578	-0.6	45.0	44.65	-0.4
After	0.0	0.005	0.0	45.0	45.21	0.2





CO Analyzer Verification Test Report

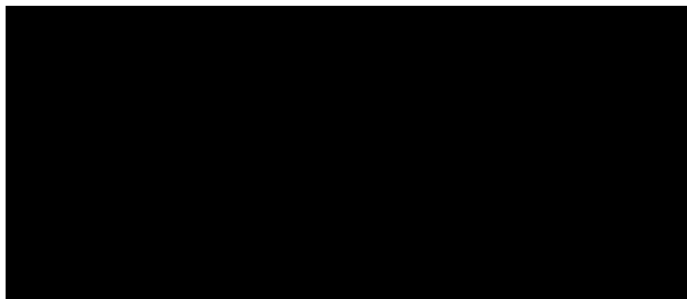
Calibration Report No.: ES-C6510001

Calibrated Date: 1-Oct-22

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Analyzer Signal Values					
Date	1-Oct-22	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	508.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h



CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510002

Calibrated Date: 1-Oct-22

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Page: 1/2

Instruments Information

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA, France S/N: NCOESACO12E356
--	---

Calibration System

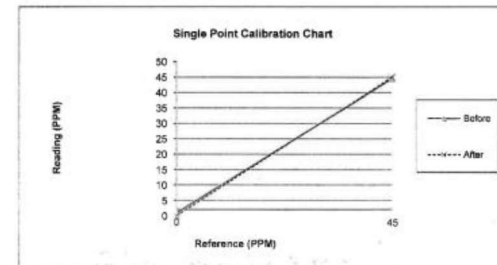
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGC101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NO Conc: 44.68 PPM SO2 Conc: 45.34 PPM CO Conc: 4500 PPM Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature: 24.5 °C

Humidity: 66 %RH

Calibration Report

Status	Reference (PPM)	Zero Reading (PPM)	Drift (PPM)	Reference (PPM)	Span Reading (PPM)	Drift%
Before	0.0	0.901	0.9	45.0	44.54	-0.5
After	0.0	0.023	0.0	45.0	45.01	0.0



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510002

Calibrated Date: 1-Oct-22

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Analyzer Signal Values					
Date	1-Oct-22	Time	10:09:00		
Power Supplies					
Option	0.0	mV	+5 V Sensor	5	V
+3.3 V	3.3	V	+24 V	24.2	V
+12 V	11.8	V	+5 V	5.1	V
+24 V	1.1	mV			
Optical Bench					
IR current ratio	884.7	mA	Pbse current	618.2	mV
Optical T.	46.0	deg.C	Pbse T.	-24.2	deg.C
Measure sig.	506.4	mV	Refer Sig.	456.4	mV
Min sig.	945.0	mV	Max Sig.	2840	mV
Sample					
Inst. Ratio	1.109		Ratio	1.105	
Ref. ratio	1.109		Internal Temp.	28.9	deg.C
Source Temp.	46.0	deg.C	Gas Pressure	997	hPa
Up Pressure	947.0	hPa	Flow	59	l/h

SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6510003

Calibrated Date: 1-Oct-22

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Page: 1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: NSOESAAF32E453
---	---

Calibration System

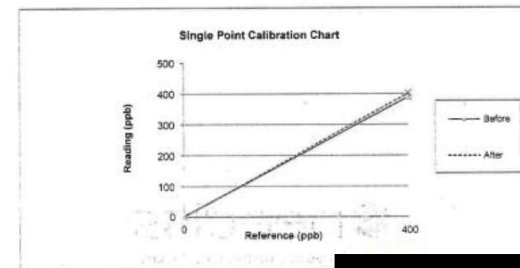
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc: 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc: 45.34 PPM
	CO Conc: 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.5 °C

Humidity: 69 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	2.3	2.3	400.0	390.3	-1.2
After	0.0	0.9	0.9	400.0	402.0	0.2



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SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6510003

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Page: 2/2

Analyzer Signal Values					
Date	1-Oct-22	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4068	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	UV lamp	44.3	mA
+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref ratio	0		Meas ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	inst.meas.	22.8	ppb
UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6510004

Calibrated Date: 1-Oct-22

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Instruments Information

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: NSOESAAF32E454
---	---

Calibration System

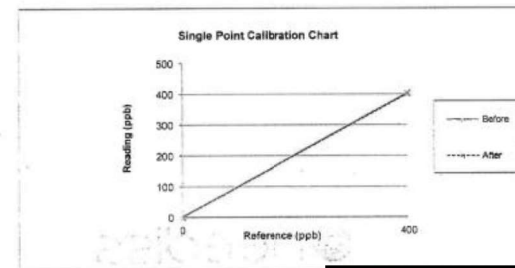
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.5 °C

Humidity 67 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	0.9	0.9	400.0	404.1	0.5
After	0.0	0.2	0.2	400.0	401.6	0.2



SO2 Analyzer Verification Test Report

Calibration Report No.: ES-S6510004

Calibrated Date: 1-Oct-22

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Page: 2/2

Analyzer Signal Values					
Date	1-Oct-22	Time	13:11:00		
Power Supplies					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4068	mV	+3.3 V	3.3	V
+24 V	24.1	V	+12 V	11.9	V
+5 V	5	V	UV lamp	44.3	mA
+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref ratio	0		Meas ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	inst.meas.	22.8	ppb
UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/min			

NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6510001

Page: 1/1

Calibrated Date: 1-Oct-22

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Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: ENOAIT20003573
---	---

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MOC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.5 °C

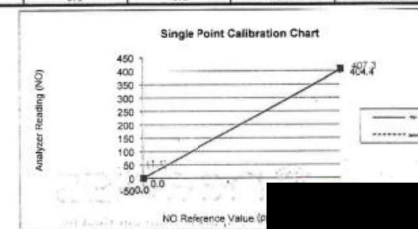
Humidity 80 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	-1.1	0.0	-1.1	394.2	400.0	-0.7
NO2	0.0	0.0	0.0	13.1	0.0	1.6
NOx	-1.1	0.0	-1.1	407.3	400.0	0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	402.4	400.0	0.3
NO2	0.0	0.0	0.0	2.0	0.0	0.2
NOx	0.0	0.0	0.0	404.4	400.0	0.5



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6510001

Page:1/1

Calibrated Date: 1-Oct-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Oct-22				
Time	9:25				
Range	0.00 - 500.00 PPB	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500±1.50	cc/min	481	485	
Ozone Flow	50-90	cc/min	80	80	
PMT Detector	0-5000	mV	85.0	25.0	
AZERO	<20-150	mV	84.1	14.5	
HVPS	400-900 constant	V	734	734	
DCPS	2500 ±1.200	mV	-	-	
CELL TEMP	50±1.1	Degrees C	50	50	
BOX TEMP	20-35	Degrees C	34.7	33.6	
PMT TEMP	7 ±1.1	Degrees C	7.0	7.0	
ZS TEMP	50±1.4	Degrees C	-	-	
MOLY Temp	315 ±1.5	Degrees C	314.0	314.0	
REFL PRES	4-10 constant	IN-Hg-A	5.0	5.0	
SAMP PRES	20-30 constant	IN-Hg-A	28.8	27.9	
NO Slope	1 ±1.0.3		1.135	1.197	
NOx Slope	1 ±1.0.3		1.260	1.114	
NO Offset	-10 to +150	mV	0.8	-3.9	
NOx Offset	-10 to +150	mV	-2.8	6.1	
Span and Cal Values					
Zero Value	NO	0	ppb	-1.1	0.0
	NOx	0	ppb	-1.1	0.0
Span Value	NO	400	ppb	394.2	402.4
	NOx	400	ppb	407.3	404.4

NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6510002

Page:1/1

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: AC32e	Manufacturer: Environnement SA, France S/N: NNOESAAC32E278
--	---

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MG3101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.68 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140782

Environment: Temperature 24.5 °C

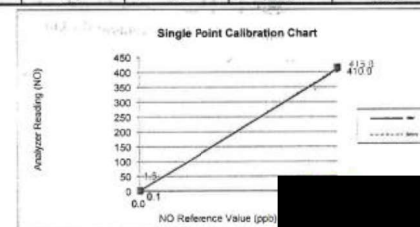
Humidity: 66 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.642	0.0	0.5	386.0	400.0	-1.8
NO ₂	0.814	0.0	0.8	29.0	0.0	3.6
NOx	1.456	0.0	1.5	415.0	400.0	1.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.129	0.0	0.1	408.0	400.0	1.0
NO ₂	0.018	0.0	0.0	2.0	0.0	0.2
NOx	0.147	0.0	0.1	410.0	400.0	1.2





NOx Analyzer Verification Test Report

Calibration Report No.: ES-N6510002

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Calibrated Date: 1-Oct-22

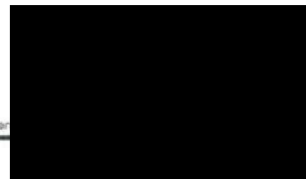
☒ PM ☐ Onsite

Page:2/2

Analyzer Signal Values					
Date	1-Oct-22	Time	14:14		
Power Supplies					
Option	-13.52	mV	+5 V Sensor	4.99	V
+3.3 V	3.3	V	+24 V	23.96	V
+12 V	11.88	V	+5 V	4.99	V
+4 V	3974.3	mV	I+ 24V	2.4	A
I O3	82.74	mA			
Optical Bench					
Dark PM sig.	0.0	mV	PM NO sig.	84.28	mV
PM Nox sig.	107.0	mV	PM Ny sig.	88.71	mV
Sample					
Chamber T	60	deg.C	Internal Temp.	33.33	deg.C
Chamber P	1720.6	hPa	PM T.	1.46	deg.C
Flow	47.21	l/min	Sample Pr.	993.2	hPa



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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No.: 21-65/0383 MTC No. EEL. BP. 59/0365

CALIBRATION CERTIFICATE

Submitted by: [Redacted]
Address: [Redacted]
Calibrated at: [Redacted]

Instrument Calibrated: [Redacted] Ambient Environment

Description: Acoustic Calibrator Temperature: $(23 \pm 3) ^\circ\text{C}$
Manufacturer: Bruel&Kjaer Relative Humidity: $(50 \pm 15) \%$
Model: 4230 Ambient Pressure: $(101.325 \pm 1.500) \text{ kPa}$
Serial No.: 1351075

Standards used:

- Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
- Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
- Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Pressure Transmitter Vaisala PTB202AD S/N T0650001.
- Audio Analyzer Keithley 2015-P S/N 4106495.
- Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

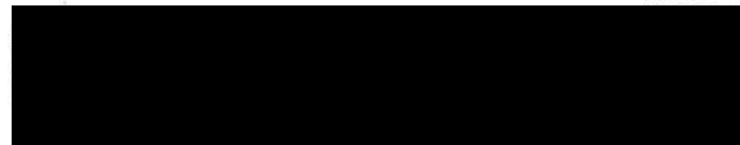
This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt: 10 Mar. 2022
Date of Calibration: 21 Mar. 2022

1 / 2

The results relate only to the items tested/calibrated or value assigned.
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0383 **MTC No.** EEL, BP. 59/0365

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class I
1/2 inch Briel&Kjaer 4180	93.66	-0.34	± 0.10	± 0.40 dB



2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class I
1/2 inch Briel&Kjaer 4180	997.8	-2.2	± 1.5	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class I
1/2 inch Briel&Kjaer 4180	1.55	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.
2. The calibrator pressure correction was not included.
3. The microphone volume correction was not included.

Calibrated by :  **Approved by :** 

**Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre**

Date of Calibration : 21 Mar. 2022
Date of Issue : 22 Mar. 2022
Ref : 2011265031501147002

End of Certificate 2 / 2

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Issued by : Calibration & Test Section : Meteorological Instruments Bureau


Date of Issue : 11 February, 2022 **Certification No.** 049/22
Page : 1 of 6

Object : เครื่องมือวัดทางอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130149 **ID No. :** NWSDCMS1200149

Customer : 

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.1 hPa

NATIONAL STANDARD WIND TUNNEL : Micromanometer Theodor Friedrichs FC014 Serial 9310119
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board
: N.I.S.T. Test Reference Number 731/241460
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrichs : Dry No.8390/94 Wet No. 8389/94
: Thermoschneider No.910802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB270 No. 70220015

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 049/22

11 February, 2022 Serial No. 1223 Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer					
m/sec	inches H ₂ O	inches H ₂ O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

The Result of Calibration

Sensor Pressure Model TP11-1 D

Serial No. 6381

Certification No. 049/22

11 February, 2022

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1007.91	1006.10	-0.19
1008.08	1006.40	-0.32
1008.36	1006.70	-0.34
1008.72	1009.00	-0.28
1009.35	1009.70	-0.35
1010.01	1010.30	-0.29
1010.23	1010.50	-0.27
1009.30	1009.50	-0.20
1009.68	1009.90	-0.22
1009.84	1010.10	-0.26
1010.54	1010.80	-0.26
1010.71	1010.90	-0.19
1010.93	1011.10	-0.17
1009.58	1009.80	-0.22
1010.70	1011.00	-0.30
1011.09	1011.30	-0.21
1010.08	1010.40	-0.32
1008.86	1009.10	-0.24
1008.97	1009.20	-0.23
1009.08	1009.30	-0.22
Average		-0.23

The Result of Calibration

Sensor Temperature Model TPH-1 D Certification No. 049/22
11 February, 2022 Serial No. 6381 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45.2	-0.1
31.2	31.4	-0.2
16.4	16.5	-0.1

The Result of Calibration

Sensor Humidity Model TPH-1 D Certification No. 049/22
11 February, 2022 Serial No. 6381 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.6	80.3	5.3
51.4	57.4	4.0
40.6	37.8	2.8

Date of Issue 11 February, 2022

Certification No. 049/22

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis แบบ TIPPING BUCKET Model 7342.026 ID No. NWSDCMS1200149 ทำการสอบเทียบกับแก้วฝนแบบแก้ว ตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTE & ZAMBRA LONDON No 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 มม./TIP)

วิศวกรชำนาญการ

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 30 June, 2022

Certification No. 255/22

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

Type : Data Logger NDWD100

Serial No. : EWSNV110WS2505

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1003.8 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SIN 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94

: Thermoschneider No. 918902

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

The Result of Calibration

Sensor model EWSNV110WS2505 Certification No. 255/22

30 June, 2022

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.4	0.62
5.00	-	-	-	4.7	0.30
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.9	0.11
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.1	-0.08
20.02	-	-	-	20.3	-0.28

Wind Aloft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	

The Result of Calibration

Sensor model EWSNV110WS2505

Certification No. 255/22

30 June, 2022

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1001.48	1002.42	-0.94
1001.87	1002.92	-1.05
1002.41	1003.79	-1.38
1003.52	1004.67	-1.15
1004.06	1004.96	-0.90
1003.67	1004.36	-0.81
1003.92	1005.54	-1.62
1003.80	1005.22	-1.42
1003.76	1004.96	-1.20
1003.18	1004.67	-1.49
1003.38	1004.96	-1.58
1003.83	1005.54	-1.71
1004.26	1005.83	-1.57
1001.77	1002.92	-1.15
1001.35	1002.92	-1.57
1002.29	1003.50	-1.21
1002.77	1003.92	-1.15
1003.49	1004.50	-1.01
1004.14	1005.25	-1.11
1004.00	1004.79	-0.79

Average -1.24

The Result of Calibration

Sensor model EWSNV110WS2505 Certification No. 255/22
30 June, 2022 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	45.8	-0.1
30.4	30.6	-0.2
15.6	15.7	-0.1

The Result of Calibration

Sensor model EWSNV110WS2505 Certification No. 255/22
30 June, 2022 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.20	79	6.2
64.10	60	4.1
45.20	42	3.2

Date of Issue 30 June, 2022

Certification No. 255/22

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชีตส์ Davis แบบ TIPPING BUCKET
Model 7342.026 ID No.EWSNV110WS2505 ทำการสอบเทียบกับแก้วฝนแบบแก้ว
ตวง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/
TIP)

วิศวกรชำนาญการ