

ภาคผนวกที่ 5-2

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
สถานีรถไฟฟ้าชองนนทบุรี (อาคารโดมอันทาวเวอร์)
และสถานีรถไฟฟ้าศาลาแดง (สถานีอาคารหอแว่น)
ครั้งที่ 1/2565
วันที่ตรวจวัด วันที่ 4-9 สิงหาคม 2565

TSP High Volume Sampler Calibration

Verification Report No.
SQ2200117-E001 -TSP 01

PM ☐ Onsite ☒

Site: BTS ศาลาแดง
UTM : 47P N 1517733 E 665364
Sampler: ETSP#33
Recorder: ECRANG15315224

Date: 4 Aug 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 33.5	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: 1.63957
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	11.31	2.023	54.0	53.06
2	8.98	1.803	52.0	51.10
3	7.34	1.631	48.0	47.16
4	5.21	1.375	42.0	41.27
5	3.81	1.177	38.0	37.34

LINEAR REGRESSION

Slope = 19.5023
Intercept = 14.7453
Corr. coeff. = 0.9906

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	37
	48

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

PM10 High Volume Sampler Calibration

Verification Report No.
SQ2200117-E001 -PM 01

PM ☐ Onsite ☒

Site: BTS ศาลาแดง
UTM : 47P N 1517733 E 665364
Sampler: EPM10#39
Recorder: ECRDS01618124

Date: 4 Aug 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 33.5	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: 1.02697
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	12.23	2.178	50.0	31.86
2	8.67	1.835	46.0	29.31
3	7.32	1.687	44.0	28.04
4	4.06	1.258	40.0	25.49
5	2.56	1.000	36.0	22.94

LINEAR REGRESSION

Slope = 7.3508
Intercept = 15.8301
Corr. coeff. = 0.9972
SFR = 1.151
SSP = 38.11

of Observations: 5

Range of Chart at SFR ±10%	37
	39

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

TSP High Volume Sampler Calibration

Verification Report No.
SO2200117-E001 -TSP_02

☐ PM ☒ Onsite
 Site: BTS รางจันทน์
 UTM : 47P N 1518188 E 665834
 Sampler: ETSP#23
 Recorder: ECRANG15315224

Date: 4 Aug 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 33.5	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 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	11.12	2.005	54.0	53.06
2	9.87	1.850	50.0	49.13
3	6.55	1.542	45.0	45.20
4	3.21	1.081	40.0	39.30
5	2.72	0.996	38.0	37.34

LINEAR REGRESSION

Slope = 14.2323
Intercept = 23.4153
Corr. coeff = 0.9914

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	40 48
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Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200117-E001 -PM_02

☒ PM ☐ Onsite
 Site: BTS รางจันทน์
 UTM : 47P N 1518188 E 665834
 Sampler: EPM10#23
 Recorder: ECRDS01618124

Date: 4 Aug 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.0	Corrected Pressure (mm Hg): 754.6
Temperature (deg C): 33.8	Temperature (deg K): 306.8
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	12.03	2.162	54.0	34.43
2	8.56	1.824	50.0	31.88
3	6.66	1.610	45.0	29.33
4	4.23	1.285	42.0	26.78
5	2.36	0.961	38.0	24.23

LINEAR REGRESSION

Slope = 8.6391
Intercept = 15.7816
Corr. coeff = 0.9979

SFR = 1.152
SSP = 40.36

of Observations: 5

Range of Chart at SFR ±10%	40 41
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Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

Verification Test Report

Report No.:

SO22000117-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1518198 E 665859

Calibrated Date: 4 August 2022

Site : BTS ศาลาแดง

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1914

Environment: Temperature 33.8 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,BrueI&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	93.50	-0.16	93.66

Calibrated By:

Date:

Approve By:

Date:

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Verification Test Report

Report No.:

SO22000117-E001 -SLM 02

☐ PM ☒ Onsite UTM : 47P N 1517752 E 665368

Calibrated Date: 4 August 2022

Site : BTS ช่องนนทรี

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1915

Environment: Temperature 33.8 °C Humidity 60 %RH

Reference Standard: Acoustic Calibrator Class 1 Model 4230,BrueI&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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[REDACTED]	RECALIBRATION
	DUE DATE:
	January 19, 2023

Certificate of Calibration

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

Run	Vol. Init (m3)	Vol. Final (m3)	Δ Vol. (m3)	Δ Time (min)	Δ P (mm Hg)	Δ H (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)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \left(\frac{Tstd}{Ta} \right) \right)}$ (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	0.9684	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	
$V_{std} = \Delta Vol[(Pa - \Delta P) / P_{std}] (T_{std} / T_a)$	$V_a = \Delta Vol[(Pa - \Delta P) / P_a]$
$Q_{std} = V_{std} / \Delta T_{ime}$	$Q_a = V_a / \Delta T_{ime}$
For subsequent flow rate calculations:	
$Q_{std} = 1/m \left(\sqrt{\frac{\Delta H}{P_{std}}} \times \frac{T_{std}}{T_a} \right) \cdot b$	$Q_a = 1/m \left(\sqrt{\frac{\Delta H}{T_a/P_a}} \right) \cdot b$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H ₂ O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	Intercept
m:	slope

RECALIBRATION
<p>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.</p>

Accuracy Calibration Certificate

Customer

Company: [REDACTED]

Address: [REDACTED]

City: [REDACTED] Contact: [REDACTED]

Zip / Postal: [REDACTED]

State / Province: [REDACTED]

Order Number: [REDACTED]

Weighing Device			
Manufacturer:	Mettler Toledo	Instrument Type:	Weighing Instrument
Model:	XBR205DU	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 (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guidelines:		EURAMET cg-18 v.4.0 (11/2015)	
METTLER TOLEDO Work Instruction:		CPW00220	
<p>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.</p> <p>The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.</p> <p>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.</p>			
Temperature		Humidity	
As Found	Start: 22.2 °C End: 22.6 °C	Start: 59.3 % End: 59.7 %	

As Found Calibration Date: 02-Mar-2022 Calibrator: _____
As Left Calibration Date: N/A _____
Issue Date: 03-Mar-2022 _____
Approved Signatory: _____

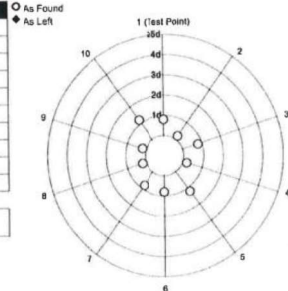
Measurement Results

Repeatability

Test Load: 76 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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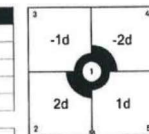
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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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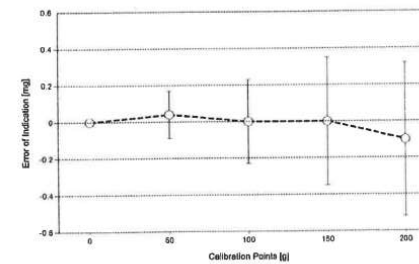


The "d" in the graph represents the readability of the range/interval in which the test was performed.

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	100.00000 g	100.00000 g	0.00000 g	0.23 mg	2
10	150.00000 g	150.00000 g	0.00000 g	0.35 mg	2
11	199.99999 g	199.99998 g	-0.00001 g	0.42 mg	2



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-18. 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.

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.

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

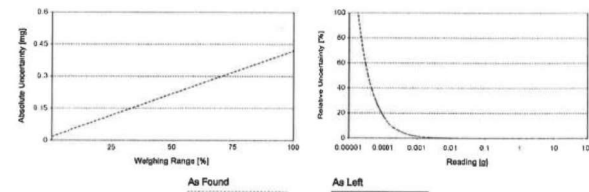
Uncertainty of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00021 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 (Example)

Net Indication	As Found		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	0.0081%	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.

Certificate of Calibration

Reference No. : 4182/2202-017

Customer : [REDACTED]

Equipment : Digital Thermo-Hygrometer

Manufacturer : Testo

Model : 808-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 : [REDACTED]

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]

☐ [REDACTED]

The reported uncertainty is based on a standard uncertainty multiplied a level of confidence level of approximately 95 %

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Certificate No. : L2203-290

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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 **

[REDACTED]

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:	Ambient Environment
Description : Acoustic Calibrator	Temperature : (23 ± 3) °C
Manufacturer : Bruel&Kjaer	Relative Humidity : (50 ± 15) %
Model : 4230	Ambient Pressure : (101.325 ± 1.500) 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

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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. BF. 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	1.55	± 0.50	± 3.0%

Note :

- No adjustment.
- The calibrator pressure correction was not included.
- The microphone volume correction was not included.

Calibrated by : [REDACTED] Approved by : [REDACTED]

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

The results relate only to the items tested/calibrated or value assigned.
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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-12/031, 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 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	Assay Dates
NOX	45.00 PPM	44.86 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	4500 PPM	4500 PPM	G1	+/- 1.0% NIST Traceable	02/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty Expiration Date
NTRM	200611-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0% Feb 02, 2025
PRM	12386	D685025	3.91 PPM AIR/NITROGEN DIOXIDE	2.9% Feb 20, 2020
GMS	124206889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1% Aug 15, 2021
NTRM	0141709	KAL003190	49.67 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0% Jun 20, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6% Jun 07, 2024

The SRM, PRM or RGM noted 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 Multi-point Calibration
SIEMENS ULTRAMAT 6N1KD579	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-N6508004

Page:1/1

Calibrated Date: 2-Aug-22

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200A	Manufacturer API S/N: ENOAI200E03217
---	---

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.58 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

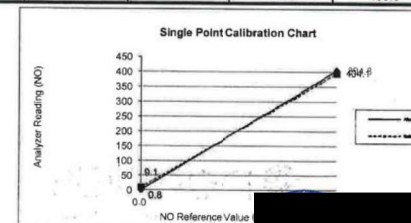
Humidity: 54 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.3	0.0	2.3	383.6	400.0	-2.1
NO ₂	8.8	0.0	8.8	11.2	0.0	1.4
NOx	9.1	0.0	9.1	394.8	400.0	-0.7

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.5	0.0	0.5	402.0	400.0	0.2
NO ₂	0.3	0.0	0.3	2.1	0.0	0.3
NOx	0.8	0.0	0.8	404.1	400.0	0.5



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508004

Page:1/1

Calibrated Date: 2-Aug-22

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Page:2/2

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	19.8	
AZERO	-20-150	mV	11.7	7.3	
HVPS	400-900 constant	V	768.0	714.0	
DCPS	2500 +/- 200	mV	-	-	
RECELL TEMP	50 +/- 1	Degrees C	50.3	50.3	
BOX TEMP	20-35	Degrees C	28.0	27.5	
PMT TEMP	17 +/- 1	Degrees C	7.7	7.8	
IZS TEMP	50 +/- 4	Degrees C	-	-	
MCLY Temp	315 +/- 5	Degrees C	313.1	315.0	
RCELL 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		0.847	0.963	
NOx Slope	1 +/- 0.3		0.852	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	2.3	0.5
	NOx	0	ppb	9.1	0.8
Span Value	NO	400	ppb	383.6	402.0
	NOx	400	ppb	394.8	404.1

NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508005

Page:1/1

Calibrated Date: 2-Aug-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 MGC101 S/N: 792	NO Conc: 44.88 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc: 45.34 PPM CO Conc: 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

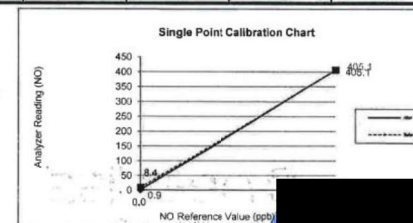
Environment: Temperature: 26.8 °C Humidity: 54 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.2	0.0	3.2	391.8	400.0	-1.0
NO ₂	5.2	0.0	5.2	13.3	0.0	1.7
NOx	8.4	0.0	8.4	405.1	400.0	0.6

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.6	0.0	0.6	402.3	400.0	0.3
NO ₂	0.3	0.0	0.3	2.8	0.0	0.3
NOx	0.9	0.0	0.9	405.1	400.0	0.6



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6508005

Page: 1/1

Calibrated Date: 2-Aug-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	9:25				
Range	0.00 - 500.00 PPS	PPS	500	500	
Stability (Zero Gas)	< 0.2	PPS	0.5	0.2	
Sample Flow	500 +/- 50	cc/min	491	485	
Ozone Flow	60-90	cc/min	80	80	
PMT Detector	0-5000	mV	85.0	25.0	
AZERO	-20-150	mV	94.1	14.5	
HVPS	400-900 constant	V	734	734	
DCPS	2500 +/- 200	mV	-	-	
RCCELL TEMP	50 +/- 1	Dewegge C	50	50	
BOX TEMP	20-35	Dewegge C	34.7	33.6	
PMT TEMP	7 +/- 1	Dewegge C	7.0	7.0	
IZS TEMP	50 +/- 4	Dewegge C	-	-	
MOLY Temp	315 +/- 5	Dewegge C	314.0	314.0	
RCEL PRES	4-10 contant	IN-Hg-A	5.0	5.0	
SAMP PRES	20-30 contant	IN-Hg-A	28.6	27.9	
NO Slope	1 +/- 0.3		1.135	1.197	
Nox Slope	1 +/- 0.3		1.260	1.114	
NO Offset	-10 to + 150	mV	0.8	-3.6	
NOx Offset	-10 to + 150	mV	-2.6	6.1	
Span and Cal Values					
Zero Value	NO	0	ppb	3.2	0.8
	NOx	0	ppb	8.4	0.9
Span Value	NO	400	ppb	391.8	402.3
	NOx	400	ppb	405.1	405.1

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508006

Calibrated Date: 2-Aug-22

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Page: 1/2

Instruments Information

Analyzer Type: SO2 Analyzer
Model: 100A

Manufacturer API
S/N: NSOAI100A00632

Calibration System

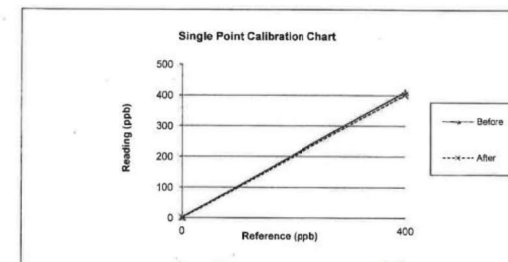
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 26.8 °C

Humidity 54 %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	410.1	1.2
After	0.0	0.8	0.8	400.0	401.5	0.2





SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508006
Calibrated Date: 2-Aug-22

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Page: 2/2

Test Function Value	Nominal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	13:45				
Range	50 - 20000	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.2	0.1	
Sample Flow	850 (+/- 50)	cc/min	592.0	591.0	
PMT Detector	0 - 5000	mV	255.8	61.0	
Norm PMT Detector	0 - 5000	mV	59.7	65.2	
WVPS	400-900 constant	V	607.0	607.0	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreagee C	50.0	50.0	
BOX TEMP	20-40	Dreagee C	34.0	34.1	
PMT TEMP	7 (+/- 1)	Dreagee C	8.0	8.0	
UV lamp	1000-4900	mV	1981.0	1981.0	
Lamp Ratio	30-120	%	82.6	82.6	
STR Light (Zero Gas)	<100	PPB	61.5	61.7	
Dark PMT	(-50) - (+200)	mV	3.8	3.8	
Dark lamp	(-50) - (+200)	mV	56.5	57.0	
SAMP PRES	20-30 constant	IN-Hg-A	29.3	29.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	1682.0	2044.0	
SO2 Conc	1000 (+/- 250)	PPB	841.0	1022.0	
SO2 Slope	1 (+/- 0.3)	-	1.224	1.104	
SO2 Offset	< 250	mV	24.8	8.0	
Stability at Zero	< 0.2	PPB	0.2	0.2	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.2	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	2.1	0.8	
Span Gas (400 PPB)	400	ppb	410.1	401.5	± 5% of Range

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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508005
Calibrated Date: 2-Aug-22

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Page: 1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100E	Manufacturer API S/N: ESOAI100E01218
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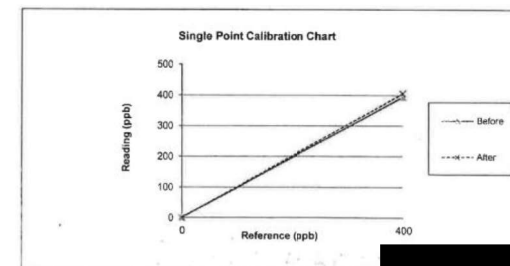
Calibration System

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 E80140762

Environment: Temperature 26.8 °C Humidity: 54 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	1.3	1.3	400.0	394.1	-0.7
After	0.0	0.6	0.6	400.0	405.0	0.6



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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6508005

Calibrated Date: 2-Aug-22

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Test Function Value	Normal range	Unit	Before	After	Note
Date	2-Aug-22				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.6	0.2	
Sample Flow	659 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Dreagee C	50	50	
BOX TEMP	20-40	Dreagee C	34.1	32.7	
PMT TEMP	7 (+/-1)	Dreagee C	8.0	8.0	
UV lamp	1000-4900	mV	4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR_Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 constant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.866	
SO2 Offset	< 250	mV	65	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	1.3	0.6	
Span Gas (400 PPB)	400	ppb	394.1	405.0	± 5% of Range

CO Analyzer Verification Test Report

Calibration Report No.: TD-C6508006

Calibrated Date: 2-Aug-22

☒ PM ☐ Onsite

Page:1/2

Instruments Information

Analyzer Type: CO Analyzer
Model: T300

Manufacturer API

S/N: ECOAIT30000099

Calibration System

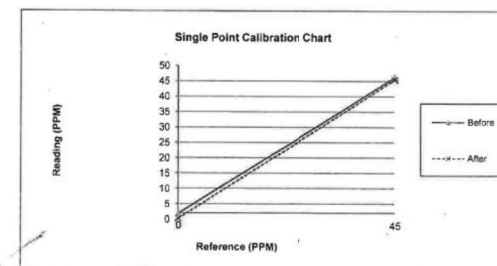
Calibrator Unit	Standard Gas
Dilutor Model ESA MGCT01	NO Conc 44.68 PPM
S/N: 792	SO2 Conc 45.34 PPM
ZERO AIR Generator ZAG7001	CO Conc 4500 PPM
S/N: 644	Expire Date: Feb 19 2024 EB0140762

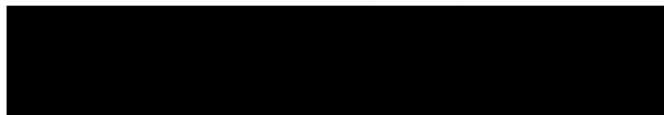
Environment: Temperature 26.6 °C

Humidity 54 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.8	1.8	45.0	46.1	1.2
After	0.0	0.2	0.2	45.0	45.4	0.4





CO Analyzer Verification Test Report

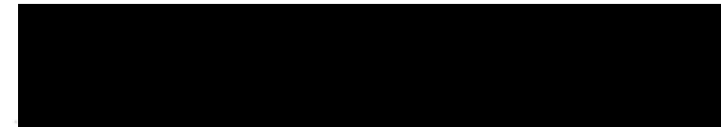
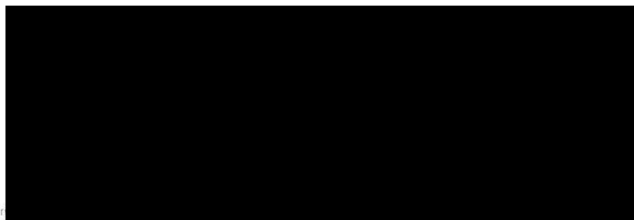
Calibration Report No.: TD-C6508006

Calibrated Date: 2-Aug-22

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Page: 2/2

Detail	Range	Unit	Before	After	Note
Date	2-Aug-22				
Time	14:57				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.22	0	
CO Measure	2500 - 4800 MV.	mV	3793.2	3836.5	
CO Reference	2500 - 4800 MV.	mV	3143.6	3179.5	
MR Ratio	1.2 +/- 0.5		1.215	1.215	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.6	28.6	
Sample Flow	720 - 380 cc/min	cc/min	859	859	
Sample Temp	44 - 52 deg.C	deg.C	47.8	46.7	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	32	34.9	
PHT drive	250 - 4750 mv.	mV	3015	3018.6	
Slope	0.803 - 1.200		0.867	0.875	
Offset	0.05 +/- 0.2		0.006	0.005	
Gas Test Response					
Zero Gas	0	PPM	0.4	0.0	
Span Gas	45	PPM	45.6	45.0	± 5% of Range



CO Analyzer Verification Test Report

Calibration Report No.: TD-C6508006

Calibrated Date: 2-Aug-22

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Page: 1/2

Instruments Information

Analyzer Type: CO Analyzer Model: T300	Manufacturer API S/N: ECOAIT30000098
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Calibration System

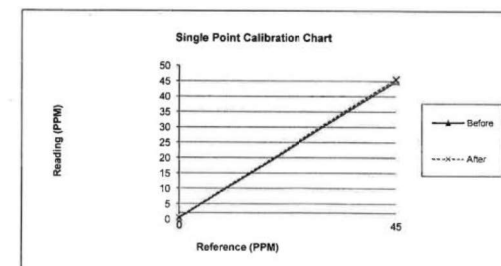
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature: 26.6 °C

Humidity: 54 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	0.3	0.3	45.0	44.9	-0.1
After	0.0	0.5	0.5	45.0	45.6	0.7



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CO Analyzer Verification Test Report

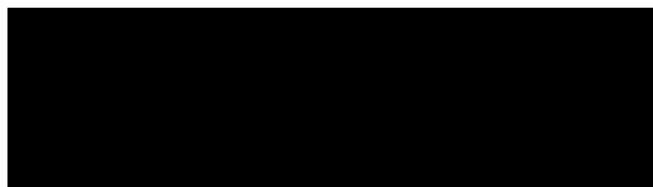
Calibration Report No.: TD-C6508005

Calibrated Date: 2-Aug-22

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Page: 2/2

Detail	Range	Unit	Before	After	Note
Date	8-Jun-22				
Time	10:51				
Range	0.1-1000 PPM	PPM	50	50	
Stability	(0.1-2PPB)	ppb	0.04	0.2	
CO Measure	2500 - 4800 MV.	mV	4465.6	4431.3	
CO Reference	2500 - 4800 MV.	mV	3768.5	3730.2	
MR Ratio	1.2 +/- 0.5		1.19	1.20	
Sample Pressure	26 - 30 in-Hg-A	in-Hg-A	28.7	28.6	
Sample Flow	720 - 980 cc/min	cc/min	904	898	
Sample Temp	44 - 52 deg.C	deg.C	48.5	43.3	
Bench Temp	47 - 49 deg.C	deg.C	48	48	
Wheel Temp	66 - 70 deg.C	deg.C	68	68	
Box Temp	27 - 50 deg.C	deg.C	33.3	34.8	
PHT drive	250 - 4750 mv.	mV	2912.3	2913.5	
Slope	0.800 - 1.200		1.197	1.138	
Offset	0.05 +/- 0.2		-0.015	-0.016	
Gas Test Response					
Zero Gas	0	PPM	0.4	0.0	
Span Gas	45	PPM	44.8	45.0	± 5% of Range



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Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 10 August, 2021

Certification No. 379/21

Page : 1 of 6

Object : เครื่องมือตรวจวัดจุดศูนย์รวมวิทยา

Manufacturer : DYACON

Type : Data Logger CM-1

Serial No. : 130129 ID No. : NWSDCMS1200129

Customer :



Calibration Condition : Temperature 25.1 °C Barometric Pressure 1004.9 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-850-3TV (sensor TR-90AH)

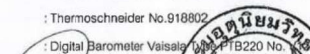
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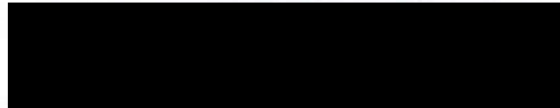
JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/84 Wet No. 8389/84

: Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Waa PTB220 No. 14800415



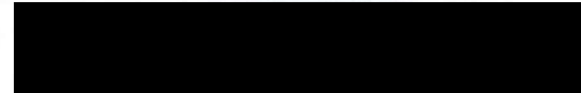
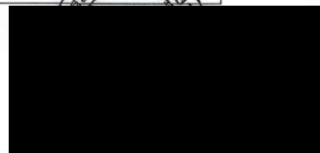


The Result of Calibration

Sensor model NWSDCMS1201129 Certification No. 379/21
10 August, 2021 Serial No. 1198 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	-	-	-	0.8	0.20
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.1	-0.10
7.04	-	-	-	7.2	-0.16
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	-	-	-	16.7	0.32
20.02	-	-	-	19.6	0.42

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	92
180	181
270	



The Result of Calibration

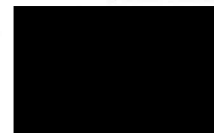
Sensor Pressure Model TPH-1 C

Serial No. 6235 Certification No. 379/21

10 August, 2021 Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.87	1008.80	1.07
1009.53	1008.40	1.13
1007.23	1006.10	1.13
1007.00	1005.90	1.10
1006.68	1005.50	1.18
1006.46	1005.30	1.16
1006.27	1005.10	1.17
1006.44	1005.20	1.24
1006.78	1005.40	1.38
1007.64	1006.50	1.14
1008.23	1006.90	1.33
1007.79	1006.50	1.29
1008.96	1007.60	1.36
1007.85	1006.50	1.35
1008.02	1006.70	1.32
1008.30	1006.90	1.40
1008.77	1007.40	1.37
1009.28	1007.90	1.38
1009.65	1008.30	1.35
1009.75	1008.40	1.35

Average



[Redacted]		
The Result of Calibration		
Sensor Temperature Model TPH-1 C Certification No. 379/21		
10 August, 2021	Serial No. 6235	Page : 4 of 6
Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.1	0.1
31.3	31.1	0.2
15.8	15.6	0.2
[Redacted]		
[Redacted]		
[Redacted]		

[Redacted]		
The Result of Calibration		
Sensor Humidity Model TPH-1 C Certification No. 379/21		
10 August, 2021	Serial No. 6235	Page : 5 of 6
Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.2	87.6	-2.4
61.4	63.2	-1.8
41.5	42.1	-0.6
[Redacted]		
[Redacted]		
[Redacted]		

Date of Issue 10 August, 2021

Certification No. 379/21

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝนยี่ห้อ Davis แบบ TIPPING BUCKET Model 7342.026 ID No. NWSDCMS1200129 ทำการสอบเทียบกับแก้วฝนแบบแก้ว ตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.0 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 S/N 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

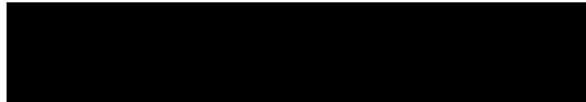
STANDARD THERMOMETER

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

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015



The Result of Calibration

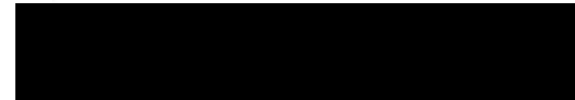
Sensor model EWSNV110WS2505 Certification No. 255/22

30 June, 2022

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H ₂ O	inches H ₂ O	m/sec	m/sec	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	Tested Barometer	Correction
Pressure	Pressure	
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
1003.57	1004.38	-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 อีห้อ Davis แบบ TIPPING BUCKET
Model 7342.026 ID No.EWSNV110WS2505 ทำการสอบเทียบกับแก้วฝนแบบแก้ว
ดวง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/
TIP)

วิศวกรชำนาญการ

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
สถานีรถไฟฟ้าชองนนทบุรี (อาคารโดมอันทาวเวอร์)
สถานีรถไฟฟ้าศาลาแดง (สถานีอาคารหอแว่น)
ครั้งที่ 2/2565
วันที่ตรวจวัด วันที่ 18-23 ตุลาคม 2565

TSP High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -TSP 01

☐ PM ☒ Onsite
Site: BTS ศาลาแดง
UTM : 47P N 1517733 E 665354
Sampler: ETSP#23
Recorder: ECRANG15315224

Date: 18 Oct 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 32.5	Temperature (deg K): 305.5
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 ORIFICE

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

CALIBRATIONS				
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	11.31	2.026	54.0	53.15
2	8.98	1.806	52.0	51.18
3	7.34	1.634	48.0	47.24
4	5.21	1.378	42.0	41.34
5	3.81	1.179	38.0	37.40

LINEAR REGRESSION

Slope = 19.5023
Intercept = 14.7896
Corr. coeff = 0.9906

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min	37
	48

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -PM 01

☐ PM ☒ Onsite
Site: BTS ศาลาแดง
UTM : 47P N 1517733 E 665354
Sampler: EPM10#34
Recorder: ECRD501618124

Date: 18 Oct 22
Technical: XXXXXXXXXX
Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 32.5	Temperature (deg K): 305.5
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 ORIFICE

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

CALIBRATIONS				
Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.23	2.175	50.0	31.81
2	8.87	1.832	46.0	29.27
3	7.32	1.684	44.0	27.99
4	4.06	1.256	40.0	25.45
5	2.56	0.999	36.0	22.90

LINEAR REGRESSION

Slope = 7.3508
Intercept = 15.8041
Corr. coeff = 0.9972
SFR = 1.147
SSP = 38.09

of Observations: 5

Range of Chart at SFR ±10%	37
	39

Calibrated by : XXXXXXXXXX

Approved by : XXXXXXXXXX

TSP High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -TSP 02

☐ PM ☒ Onsite
 Site: BTS ปิ่นเกล้า
 UTM : 47P N 1518188 E 665834
 Sampler: ETSP#23
 Recorder: ECRANG15315224

Date: 18 Oct 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.2	Corrected Pressure (mm Hg): 754.7
Temperature (deg C): 32.5	Temperature (deg K): 305.5
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 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	11.12	2.009	54.0	53.15
2	9.87	1.893	50.0	49.21
3	6.56	1.545	46.0	45.27
4	3.21	1.083	40.0	39.37
5	2.72	0.997	38.0	37.40

LINEAR REGRESSION

Slope = 14.2323
Intercept = 23.4538
Corr. coeff = 0.9914

of Observations: 5

Range of Chart	40
at 1.1 - 1.7 m3/min	48

Calibrated by: XXXXXXXXXX

Approved by: XXXXXXXXXX

PM10 High Volume Sampler Calibration

Verification Report No.
SO2200173-E001 -PM 02

☐ PM ☒ Onsite
 Site: BTS ปิ่นเกล้า
 UTM : 47P N 1518188 E 665834
 Sampler: EPM10#23
 Recorder: ECRD501616124

Date: 18 Oct 22
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

Barometric Press. (hPa): 1006.0	Corrected Pressure (mm Hg): 754.6
Temperature (deg C): 32.8	Temperature (deg K): 305.8
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	12.03	2.158	54.0	34.38
2	8.56	1.822	50.0	31.83
3	6.56	1.608	46.0	29.28
4	4.23	1.283	42.0	26.74
5	2.36	0.960	38.0	24.19

LINEAR REGRESSION

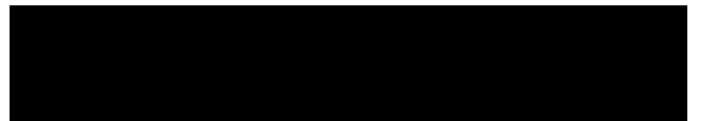
Slope = 8.6391
Intercept = 15.7557
Corr. coeff = 0.9979
SFR = 1.148
SSP = 40.33

of Observations: 5

Range of Chart	39
at SFR ±10%	41

Calibrated by: XXXXXXXXXX

Approved by: XXXXXXXXXX



Verification Test Report

Report No.:

SO22000173-E001 -SLM 01

☐ PM ☒ Onsite UTM : 47P N 1517733 E 665364

Calibrated Date: 18 October 2022

Site : BTS ศาลาแดง

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1860

Environment: Temperature 33.8 °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	93.50	-0.16	93.66

Calibrated By:

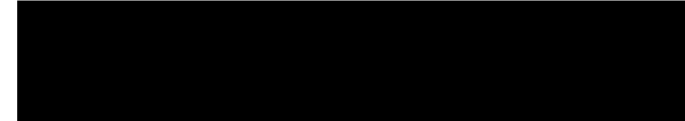
Date:

Approve By:

Date:

18 October 2022

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Verification Test Report

Report No.:

SO22000173-E001 -SLM 02

☐ PM ☒ Onsite UTM : 47P N 1518188 E 665834

Calibrated Date: 18 October 2022

Site : BTS ปลงนนท์

Equipment: Sound Level Meter

Manufacturer: PULSAR

Model: 44

Serial : 1864

Environment: Temperature 33.8 °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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**RECALIBRATION
DUE DATE:**

January 19, 2023

Certificate of Calibration

Calibration Certification Information			
Cal. Date: January 19, 2022	Roots-meter 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:	roots-meter 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]	Contact: [REDACTED]
Address: [REDACTED]	
City: Bang Khae	
Zip / Postal: 10160	
State / Province: Bangkok	
Order Number: [REDACTED]	

Weighing Device	
Manufacturer: Mettler Toledo	Instrument Type: Weighing Instrument
Model: XSR205DU	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 (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure			
Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)			
METTLER TOLEDO Work Instruction: CP/W002/20			
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	Calibrator: [REDACTED]
As Left Calibration Date: N/A	
Issue Date: 03-Mar-2022	Approved Signatory: [REDACTED]

Software Version: 1.28.0280

Report Version: 2.16.12

Form Number: F103C

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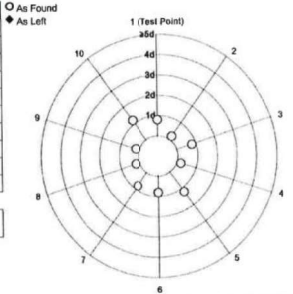
Calibration Certificate ID
TH2068-088-030222-ACC-TH

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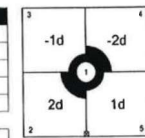
The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

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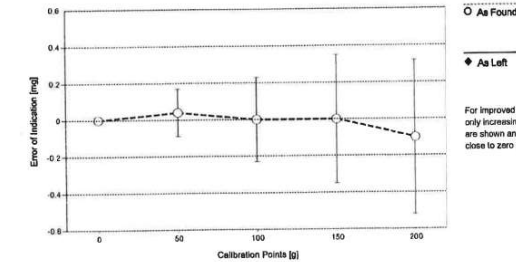
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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	0.0000 g	0.23 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.35 mg	2
11	199.9999 g	199.9998 g	-0.0001 g	0.42 mg	2



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.

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: 177016 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: 1.23.0.260
Report Version: 2.16.12
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

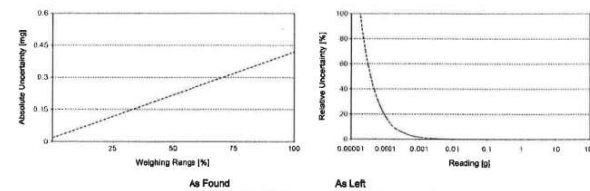
Linearization of Uncertainty Equation

	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: 1.23.0.260
Report Version: 2.16.12
Form Number: F103C

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Page 5 of 5

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 : [REDACTED]

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-N12-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 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 **

CERTIFICATE OF ANALYSIS

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 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	Assay Dates
NOX	45.00 PPM	44.68 PPM	G1	+/- 1.4% NIST Traceable	02/12/2021, 02/19/2021
NITRIC OXIDE	45.00 PPM	44.62 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	4500 PPM	4500 PPM	G1	+/- 1.0% NIST Traceable	02/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	200611-04	CC707968	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM AIR/NITROGEN DIOXIDE	2.0%	Feb 20, 2020
GMS	124208889	CC323707	4.028 PPM NITROGEN DIOXIDE/NITROGEN	2.1%	Aug 15, 2021
NTRM	0141709	KAL003190	49.57 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jun 20, 2022
NTRM	08012341	KAL004716	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Jun 07, 2024

The SRM, PRM or GMS noted 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 NIKD579	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

CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510003

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Instruments Information

Page: 1/2

Analyzer Type: CO Analyzer Model: CO12E	Manufacturer: Environnement SA, France S/N: ECOESACO12E204
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Calibration System

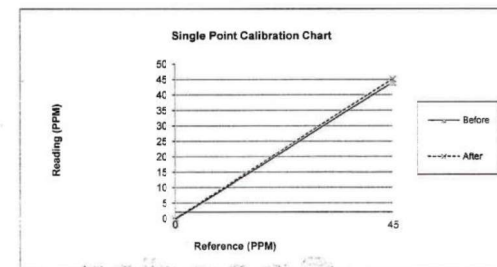
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.5 °C

Humidity: 70 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	-0.315	-0.3	45.0	44.00	-1.1
After	0.0	0.007	0.0	45.0	45.09	0.1



CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510003

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Page: 2/2

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

CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510004

Calibrated Date: 1-Oct-22

☒ PM ☐ Onsite

Page: 1/2

Instruments Information

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

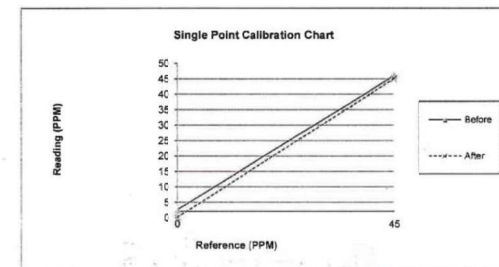
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NO Conc 44.68 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.34 PPM
	CO Conc 4500 PPM
	Expire Date: Feb 19, 2024 EB0140762

Environment: Temperature 24.6 °C

Humidity: 76 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	2.567	2.6	45.0	46.01	1.1
After	0.0	0.086	0.1	45.0	45.05	0.1



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CO Analyzer Verification Test Report

Calibration Report No.: ES-C6510004

Calibrated Date: 1-Oct-22

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Page: 2/2

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.: AP-S6510001

Calibrated Date: 1-Oct-22

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Instruments Information

Page: 1/2

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: ESOAIT10003032
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC131 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 44.88 PPM SO2 Conc 45.34 PPM CO Conc 4500 PPM Expire Date: Feb 19, 2024 EB0140762

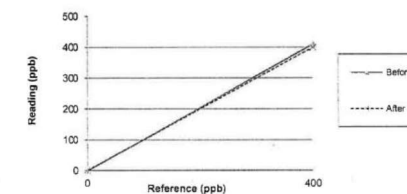
Environment: Temperature: 23.5 °C

Humidity: 50 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	-1.4	-1.4	400.0	409.4	1.2
After	0.0	0.5	0.6	400.0	399.2	-0.1

Single Point Calibration Chart



SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6510001
Calibrated Date: 1-Oct-22
☒ PM ☐ Onsite

Page: 2/2

Test Function Value	Normal range	Unit	Before	After	Note
Date	1-Oct-22				
Time	8:30				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.4	0.2	
Sample Flow	650 (+/- 50)	cc/min	666	662	
PMT Detector	0 - 5000	mV	24.3	28.2	
Norm PMT Detector	0 - 5000	mV	31.4	34.3	
HVPS	400-900 constant	V	725	725	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Degree C	50	50	
BOX TEMP	20-40	Degree C	32.5	35.1	
PMT TEMP	7 (+/-1)	Degree C	8.3	8.3	
UV lamp	1000-4900	mV	3251	3251	
Lamp Ratio	30-120	%	87.4	87.4	
STR. Light (Zero Gas)	<100	PPB	38.5	36.5	
Dark PMT	(-50) - (+200)	mV	27.6	27.6	
Dark lamp	(-50) - (+200)	mV	3.6	3.6	
SAMP PRES	20-30 constant	IN-Hg-A	26.9	27.3	
Electric Test/Optic Test					
PMT Volts	2000 (+/- 500)	mV	2010	2006	
SO2 Conc	1000 (+/- 250)	PPB	1005	1003	
SO2 Slope	1 (+/- 0.3)	-	1.054	1.053	
SO2 Offset	< 250	mV	94.7	90.4	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.4	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	-1.4	0.6	
Span Gas (400 PPB)	400	ppb	409.4	399.2	± 5% of Range

SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6510005
Calibrated Date: 1-Oct-22
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Page: 1/2

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: NSOA100A00632
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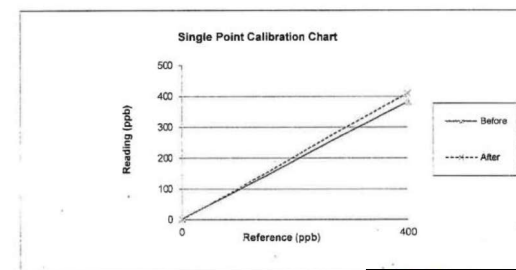
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC131 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: 65 %RH

Calibration Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	3.7	3.7	400.0	382.6	-2.2
After	0.0	1.2	1.2	400.0	410.6	1.3



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SO2 Analyzer Verification Test Report

Calibration Report No.: AP-S6510005

Calibrated Date: 1-Oct-22

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Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Oct-22				
Time	13:10				
Range	50 - 20000	PPB	500	500	
Stability (Zero Gas)	< 0.2	PPB	0.8	0.2	
Sample Flow	850 (+/- 50)	cc/min	663	659	
PMT Detector	0 - 5000	mV	36.5	34.5	
Norm PMT Detector	0 - 5000	mV	34.1	32.8	
HVPS	400-900 constant	V	719	648	
DCPS	2500 (+/- 200)	mV	-	-	
RCCELL TEMP	50 (+/- 1)	Draeger C	50	50	
BOX TEMP	20-40	Draeger C	34.1	32.7	
PMT TEMP	7 (+/-1)	Draeger C	8.0	8.0	
UV lamp	1000-4900		4034.0	4034.0	
Lamp Ratio	30-120	%	114.0	114.0	
STR. Light (Zero Gas)	<100	PPB	29	29	
Dark PMT	(-50) - (+200)	mV	44.7	44.7	
Dark lamp	(-50) - (+200)	mV	5.1	5.1	
SAMP PRES	20-30 constant	IN-Hg-A	28.1	27.8	
Electric Test/Optic Test					
PMT Volta	2000 (+/- 500)	mV	2004	2020	
SO2 Conc	1000 (+/- 250)	PPB	1002	1010	
SO2 Slope	1 (+/- 0.3)	-	0.920	0.886	
SO2 Offset	< 250	mV	85	130.1	
Stability at Zero	< 0.2	PPB	0.1	0.1	
Stability at Span	< 2 ppb @ 400 ppb	PPB	0.6	0.2	
Gas Test Response					
Zero Gas (0.00 PPB)	0	ppb	3.7	1.2	
Span Gas (400 PPB)	400	ppb	382.6	410.6	± 5% of Range

NOx Analyzer Verification Test Report

Calibration Report No.: SV-W6510004

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: NNOESAAC32E277

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

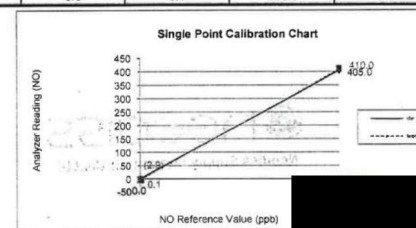
Humidity 66 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	-2.500	0.0	-2.5	380.4	400.0	-2.5
NO ₂	-0.390	0.0	-0.4	29.6	0.0	3.7
NOx	-2.890	0.0	-2.9	410.0	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	0.067	0.0	0.1	403.0	400.0	0.4
NO ₂	0.028	0.0	0.0	2.0	0.0	0.2
NOx	0.095	0.0	0.1	405.0	400.0	0.6



NOx Analyzer Verification Test Report

Calibration Report No.: SV-W6510004 Page: 1/1
 Calibrated Date: 1-Oct-22

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Page: 2/2

Analyzer Signal Values					
Date	1-Oct-22	Time	13:00		
Voltage					
+24 V (23-25)	24.0	V	+ 24V (1.5-3)	2.4	A
+12 V	12.0	V	I Peltier (0.5-1.2)	1.2	A
+5 V	5.0	V	I O3 (40-100)	90.7	mA
+4 V	4.0	V			
+3.3 V	3.3	V	PMT V (450-750)	633.0	V
Sensor					
Chamber T (39-61)	80.0	deg.C	Cham P (140-230)	199.0	hPa
Converter T (338-342)	340.0	deg.C	Sam P (850-1150)	992	hPa
Internal T (10-50)	30.5	deg.C	Flow (39-46)	40.00	Nl/h
PM T (-0.5-+0.5)	0.0	deg.C			
Calculation					
Dark PM sig(20-150)	79.66	mV			

NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6510003 Page: 1/1
 Calibrated Date: 1-Oct-22

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Instruments Information

Analyzer Type: NO/NO2/NCx Analyzer Model: 200E	Manufacturer API S/N: ENOA1200E00305
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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

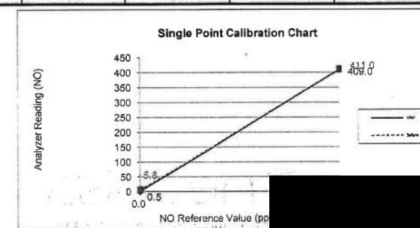
Environment: Temperature 24.5 °C Humidity 66 %RH

Calibration Check (Before adjust)

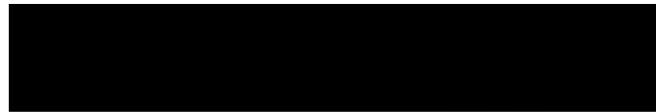
GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	3.2	0.0	3.2	410.1	400.0	1.2
NO ₂	2.6	0.0	2.6	0.9	0.0	0.1
NOx	5.8	0.0	5.8	411.0	400.0	1.4

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.3	0.0	0.3	406.0	400.0	0.7
NO ₂	0.2	0.0	0.2	3.0	0.0	0.4
NOx	0.5	0.0	0.5	409.0	400.0	1.1



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NOx Analyzer Verification Test Report

Calibration Report No.: AP-N6510003

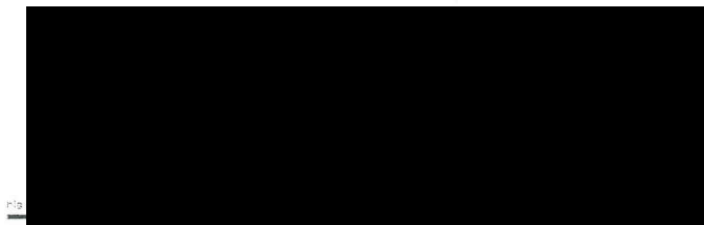
Page:1/1

Calibrated Date: 1-Oct-22

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Page:2/2

Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Oct-22				
Time	13:25				
Range	0.00 - 500.00 PPB	PPB	500.0	500.0	
Stability (Zero Gas)	< 0.2	PPB	0.5	0.2	
Sample Flow	500 +/- 50	cc/min	474.0	441.0	
Ozone Flow	60-90	cc/min	76.0	76.0	
PMT Detector	0-5000	mV	24.5	62.2	
AZERO	20-150	mV	8.6	67.5	
PMPS	400-900 constant	V	839.0	836.0	
DCPS	2500 +/- 200	mV	-	-	
CELL TEMP	50 +/- 1	Degree C	50.0	50.0	
BOX TEMP	20-35	Degree C	34.5	30.5	
PMT TEMP	7 +/- 1	Degree C	7.0	7.1	
IS TEMP	50 +/- 4	Degree C	-	-	
MOLY Temp	316 +/- 5	Degree C	315.0	314.4	
REL PRES	4-10 constant	IN-Hg-A	4.20	7.90	
SAMP PRES	20-30 constant	IN-Hg-A	29.9	28.6	
NO Slope	1 +/- 0.3		1.256	1.032	
NOx Slope	1 +/- 0.3		1.232	1.048	
NO Offset	-10 to + 150	mV	4.50	6.90	
NOx Offset	-10 to + 150	mV	-5.00	-1.50	
Span and Cal Values					
Zero Value	NO	0	ppb	3.2	0.3
	NOx	0	ppb	5.8	0.5
Span Value	NO	400	ppb	410.1	406.0
	NOx	400	ppb	411.0	409.0



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 : 4230

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 PTB202AD S/N T0650001.
 6. Audio Analyzer Keithley 2015-P S/N 4106495.
 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

The results relate only to the items tested/calibrated or those supplied.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.



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 I
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 I
1/2 inch Bruel&Kjaer 4180	997.8	-2.2	± 1.5	±1.0%

3. Total Distortion

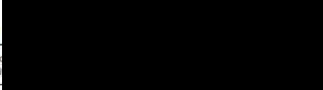
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class I
1/2 inch Bruel&Kjaer 4180	1.55	± 0.50	±3.0%

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

End of Certificate 

The results relate only to the items tested/
Advertising the Report/Certificate and publicity of the results except in full are prohibited

FM/BL/MTC/002 Rev.4

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 2 September, 2022 **Certification No.** 316/22

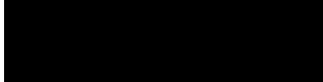
Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger CM-1

Serial No. : 130129 **ID No. :** NWSDCMS1200129

Customer : 

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.3 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 : 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.918302

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. 1920015

The Result of Calibration

Sensor model NWDCMS120129 Certification No. 316/22

2 September, 2022 Serial No. 1198 Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	inches H2O	inches H2O	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	-	-	-	6.9	0.14
9.02	-	-	-	8.9	0.12
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.

US.DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91
180	180
270	

The Result of Calibration

Sensor Pressure Model TPH-1 C

Serial No. 6235

Certification No. 316/22

2 September, 2022

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1010.31	1010.10	0.21
1010.60	1010.20	0.40
1010.38	1010.00	0.38
1010.23	1009.70	0.53
1009.93	1009.50	0.43
1009.66	1009.20	0.46
1009.41	1009.00	0.41
1009.13	1008.80	0.33
1008.96	1008.60	0.36
1008.58	1008.20	0.38
1008.25	1007.90	0.35
1007.57	1007.30	0.27
1007.27	1007.00	0.27
1007.04	1006.70	0.34
1006.63	1006.30	0.33
1010.02	1009.80	0.22
1008.77	1008.50	0.27
1008.67	1008.40	0.27
1007.63	1007.40	0.23
1007.40	1007.10	0.30

Average

0.25

The Result of Calibration

Sensor Temperature Model TPH-1 C Certification No. 316/22
2 September, 2022 Serial No. 6235 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.5	0.0
30.5	30.4	0.1
15.2	15.2	0.0

The Result of Calibration

Sensor Humidity Model TPH-1 C Certification No. 316/22
2 September, 2022 Serial No. 6235 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.6	87.4	-1.8
60.4	61.2	-0.8
42.3	42.7	-0.4

Date of Issue 2 September, 2022

Certification No. 316/22

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ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชีต้อ Davis แบบ TIPPING BUCKET Model 7342.026 ID No.NWSDCMS1200129 ทำการสอบเทียบกับแก้วฝนแบบแก้ว ตวง GAUGE DIAMETER 8.0 INCHES , NEGRETTI & ZAMBRA LONDON No 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/TIP)

วิศวกรชำนาญการ

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 1 September, 2022

Certification No. 311/22

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2508

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.1 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 : 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.9188902

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. 1220015

The Result of Calibration

Sensor model EWSNV110WS2508 Certification No. 311/22

1 September, 2022

Page : 2 of 6

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
	m/sec	inches	inches hPa	m/sec	m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	3.1	-0.08
5.00	-	-	-	5.2	-0.20
7.04	-	-	-	7.4	-0.36
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.1	-0.09
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.2	-0.19
17.02	-	-	-	17.2	-0.18
20.02	-	-	-	20.5	-0.48

Wind Aloft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	87
180	179
270	

The Result of Calibration

Sensor model EWSNV110WS2508

Certification No. 311/22

1 September, 2022

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1010.31	1009.62	0.69
1010.60	1010.15	0.45
1010.38	1009.89	0.49
1010.23	1009.62	0.61
1009.93	1009.35	0.58
1009.66	1009.03	0.63
1009.41	1009.09	0.32
1009.13	1008.82	0.31
1008.96	1008.56	0.40
1008.58	1008.29	0.29
1008.25	1008.02	0.23
1007.57	1007.23	0.34
1007.27	1006.96	0.31
1007.04	1006.69	0.35
1006.63	1006.43	0.20
1010.02	1009.62	0.40
1008.77	1008.29	0.48
1008.67	1008.02	0.65
1007.63	1007.23	0.40
1007.40	1006.96	0.44

Average



The Result of Calibration

Sensor model EWSNV110WS2508 Certification No. 311/22
1 September, 2022 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.4	0.1
30.5	30.5	0.0
15.2	15.4	-0.2

The Result of Calibration

Sensor model EWSNV110WS2508 Certification No. 311/22
1 September, 2022 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
85.6	81.2	4.4
60.4	56.8	3.6
42.3	39.7	2.6

Date of Issue 1 September, 2022

Certification No. 311/22

Page : 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝุ่น ชื่อ Davis แบบ TIPPING BUCKET
Model 7342.026 ID No.EWSNV110WS2508 ทำการสอบเทียบกับแก้วฝุ่นแบบแก้ว
ตวง GAUGE DIAMETER 8.0 INCHES , NEGRETTE & ZAMBRA LONDON No
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องวัด (NIST, FIP)

วิศวกรชำนาญการ