

ภาคผนวกที่ 5

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด

ภาคผนวกที่ 5-1

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด

ครั้งที่ 3/2568

สถาบันการบินพลเรือน

และโรงเรียนแสงหิรัญ

ตรวจวัดวันที่ 19-24 กุมภาพันธ์ 2569

TSP High Volume Sampler Calibration

Verification Report No.
SO2500251-E001 -TSP 02

PM

Onsite

Site : ร.ร.แสงอาทิตย์

UTM : N 1516341 E 672867

Sampler : ETSP#34

Recorder : ECRDS016339508

Date : 3 Oct 25

Technical :

Approval :

CONDITIONS

Barometric Press. (hPa): 1007.4

Corrected Pressure (mm Hg): 755.6

Temperature (deg C): 32.0

Temperature (deg K): 305.0

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

Model: TE-5025A

Serial#: 2067

Qstd Slope: 2.06933

Dstd Intercept: -0.02815

Date Certified: 4 Mar 25

Due Date : 03-Mar-26

CALIBRATIONS

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	12.20	1.677	56.0	55.19
2	9.60	1.489	52.0	51.25
3	6.40	1.219	44.0	43.37
4	4.30	1.001	34.0	33.51
5	2.20	0.720	24.0	23.65

LINEAR REGRESSION

Slope = 33.7515

Intercept = 0.1752

Corr. coeff = 0.9937

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min: 38

58

Calibrated by :

3 October 2025

Approved by :

3 October 2025

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ประกอบไฟล์ 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500251-E001 -PM 02

PM

Onsite

Site : ร.ร.แสงอาทิตย์

UTM : N 1516341 E 672867

Sampler : EPM10#31

Recorder : ECRDS016449812

Date : 3 Oct 25

Technical :

Approval :

CONDITIONS

Barometric Press. (hPa): 1007.4

Corrected Pressure (mm Hg): 755.6

Temperature (deg C): 32.0

Temperature (deg K): 305.0

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

Model: TE-5025A

Serial#: 2067

Slope: 1.29578

Intercept: -0.01772

Date Certified: 4 Mar 25

Due Date : 3 Mar 26

CALIBRATIONS

Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	12.80	1.768	56.0	35.58
2	10.40	1.595	54.0	34.31
3	7.30	1.338	43.0	27.32
4	4.40	1.042	32.0	20.33
5	2.70	0.819	20.0	12.71

LINEAR REGRESSION

Slope = 24.5513

Intercept = -6.1756

Corr. coeff = 0.9902

SFR = 1.000

SFR = 28.92

of Observations: 5

Range of Chart at SFR +10%: 28

32

Calibrated by :

3 October 2025

Approved by :

3 October 2025

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ประกอบไฟล์ 01/08/2568

ภาควิชาวิทยาศาสตร์สิ่งแวดล้อม คณะสิ่งแวดล้อม มหาวิทยาลัยเกษตรศาสตร์

พ5-4



Verification Test Report

Report No.: SO2500251-E001 / 001
Verification Date : 03 October 2025

Operate Information ☐ PM ☒ Onsite

Site : ร.ร.การบินพลเรือน

GPS coordinates : 47Q N 1516330 E 672887

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 1915

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 103 S/N : 98971

Certificate No. : EEL.BP.65/0168

Date due : 17 January 2026

Traceability : TISTR

Ambient Condition : Temperature 32.60 °C Relative humidity 54.20 %

Atmospheric pressure 1013.3 hpa

Measurement Data

Reference Value (dB)	Correction Value (dB)	Adjustment (dB)	UUR Reading		Error (dB)	Acceptant Criteria (dB)
			Initial	Final		
93.93	-0.3	93.63	93.87	94.03	0.16	±1.0

* UUR = Unit Under Reference flow

Acceptant Criteria : Sound Level Meter Class 1 ±0.5 dB

Sound Level Meter Class 2 ±1.0 dB

Calibrated By:

Date : 03 October 2025

Approve By :

Date : 03 October 2025

The Results shown in this verification report refer only to the instrument used and stated

This Calibration Certificate cannot be reproduced

ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00

Verification Test Report

Report No.: SO2500251-E001 / 001
Verification Date : 03 October 2025

Operate Information ☐ PM ☒ Onsite

Site : ร.ร.แสงศิรัญ

GPS coordinates : 47Q N 1516261 E 667893

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 1974

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 103 S/N : 98971

Certificate No. : EEL.BP.65/0168

Date due : 17 January 2026

Traceability : TISTR

Ambient Condition : Temperature 32.60 °C Relative humidity 54.20 %

Atmospheric pressure 1013.3 hpa

Measurement Data

Reference Value (dB)	Correction Value (dB)	Adjustment (dB)	UUR Reading		Error (dB)	Acceptant Criteria (dB)
			Initial	Final		
93.93	0	93.93	93.27	93.09	-0.18	±1.0

* UUR = Unit Under Reference flow

Acceptant value : Sound Level Meter Class 1 ±0.5 dB

Sound Level Meter Class 2 ±1.0 dB

Calibrated By:

Date : 03 October 2025

Approve By :

Date : 03 October 2025

The Results shown in this verification report refer only to the instrument used and stated

This Calibration Certificate cannot be reproduced

ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00



Calibration Certification Information			
Cal. Date:	March 4, 2025	Rootsmer S/N:	438320
Operator:	Jim Tisch	Ta:	294 °K
Calibration Model #:	TE-5025A	Pa:	746.0 mm Hg
		Calibrator S/N:	2067

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4220	3.2	2.00
2	3	4	1	1.0090	6.4	4.00
3	5	6	1	0.9030	8.0	5.00
4	7	8	1	0.8610	8.8	5.50
5	9	10	1	0.7090	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9907	0.6967	1.4106	0.9957	0.7002	0.6877
0.9864	0.9776	1.9949	0.9914	0.9826	1.2556
0.9843	1.0900	2.2304	0.9893	1.0955	1.4038
0.9832	1.1419	2.3393	0.9882	1.1472	1.4723
0.9779	1.3792	2.8212	0.9828	1.3862	1.7756
QSTD	m=	2.06933	QA	m=	1.29576
	b=	-0.02815		b=	-0.01777
	r=	0.99997		r=	0.99997

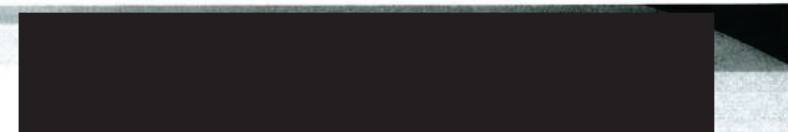
Calculations			
$Vstd = \Delta Vol / ((Pa - \Delta P) / Pstd / (Tstd / Ta))$		$Va = \Delta Vol / ((Pa - \Delta P) / Pa)$	
$Qstd = Vstd / \Delta Time$		$Qa = Va / \Delta Time$	
For subsequent flow rate calculations:			
$Qstd = 1/m \left(\left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \times \frac{Tstd}{Ta}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

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmer 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

www.tisch-env.com
TOLL FREE: (877)263-7611
FAX: (513)467-900



Certificate of Calibration

Certificate No. : 68-200034-1

Page : 1 of 2

Submitted by :

Equipment :

Electronic Balance

Manufacturer : Sartorius

Model :

Serial No. :

ID No. :

Capacity : 220 g

Resolution : 0.0001 g

Environment :

Ambient Temperature : (20.4 to 21.0) °C

Relative Humidity : (41.9 to 42.9) %

Air Pressure : 1014.0 mbar

Date of Received : 28 January 2025

Date of Calibration : 28 January 2025

Date of Issue : 30 January 2025

Calibrated by :

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref: LAB 14

Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.

Cert. No.

Due Date

Traceability

E261-E2624

C02242009

07 Nov 2025

National Institute of Metrology (Thailand), (NIMT)

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior

CAL-P0031-03



Certificate of Calibration

Certificate No. : 68-200034-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty $\pm$ (g)
0.01	0.0000	0.00012
0.1	0.0001	0.00012
1	0.0000	0.00013
2	0.0001	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
20	-0.0001	0.00014
50	-0.0001	0.00015
100	-0.0001	0.00020
200	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%.

Eccentric error

Load test : 50 g

A	B	C	D	E
0.0004	0.0004	0.0005	0.0004	0.0000



Repeatability

Load test	200	g
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Stdev,	±	0.00005	g
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CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer:

AIR LIQUIDE

(PHILIPPINES) LTD.

Part Number: E04NI99E15

Cylinder Number: EB0170003
Laboratory: 124 - Plumsteadville - PA

Laboratory:
PGVP Number:

PGVP Number: A12024
Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-403162930-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2015 PSIG

Valve Outlet:

Certification Date: Oct 23, 2024

Expiration Date: Oct 23, 2027

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. The results relate only to the items listed. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig. i.e. 0.7 megapascals.

NOT USED THIS Equipment unless you go to the calibration page.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.30 PPM	G1	+/- 1.0% NIST Traceable	10/16/2024, 10/23/2024
NITRIC OXIDE	45.00 PPM	45.30 PPM	G1	+/- 0.9% NIST Traceable	10/16/2024, 10/23/2024
SULFUR DIOXIDE	45.00 PPM	45.05 PPM	G1	+/- 0.7% NIST Traceable	10/16/2024, 10/23/2024
CARBON MONOXIDE	45.00 PPM	45.28 PPM	G1	+/- 0.6% NIST Traceable	10/16/2024
NITROGEN	Balance				

CALIBRATION STANDARDS

Sample	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	DC11201202235	CG750377	49.65 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 03, 2026
PRM	12404	APEX 1324257	59.04 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Dec 22, 2023
GMIS	120268699128	CC323207	4.239 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jan 04, 2027
PRM	C2392001,1	D153445	9.87 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Nov 22, 2024
GMIS	717220231	CC494279	49.92 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.7%	Jun 18, 2027
SRM	1863a	FT25467	50.33 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.7%	Jun 27, 2023
CARBON MONOXIDE	08U213	KAL004712	4987 PPM CARBON MONOXIDE/NITROGEN	+/- 0.8%	Feb 20, 2030

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N1M9050	NDIR	Oct 09, 2024
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Oct 17, 2024
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Oct 03, 2024
Nicolet iS50 FTIR AUP2010245 NO2	FTIR	Sen 26, 2024

SO2 Analyzer Verification Test Report

Calibration Report No.: ESA-6810004

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: 2503
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Calibration System

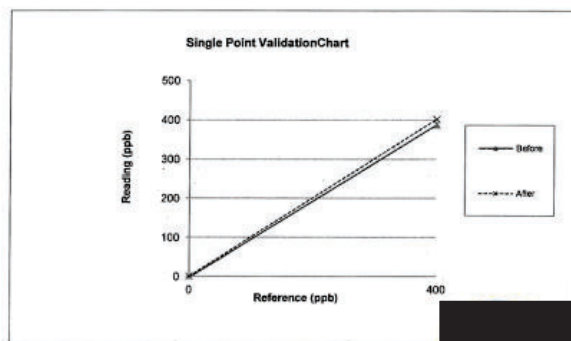
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NOx Conc 45.30 PPM NO Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	SO2 Conc 45.05 PPM CO Conc 4528 PPM
	Expire Date: OCT 23,2027 EB0170003

Environment: Temperature 25.9 °C

Humidity: 60 %RH

Validation Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	-2.6	-2.6	400.0	387.7	-1.6
After	0.0	0.6	0.6	400.0	402.2	0.3



ประกาศใช้ 01/08/2568

FN-SVM-05-09 Rev.00

Calibration Report No.: ESA-6810004

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

Analyzer Signal Values					
Date	1-Oct-25	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	I 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
I 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	16.7	l/h			

Validation By: [Redacted]

Date: 1-Oct-25

Approve By: [Redacted]

Date: 1-Oct-25

ประกาศใช้ 01/08/2568



SO2 Analyzer Verification Test Report

Calibration Report No.: ESA-6810006

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Page:1/2

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA., France S/N: 2505
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Calibration System

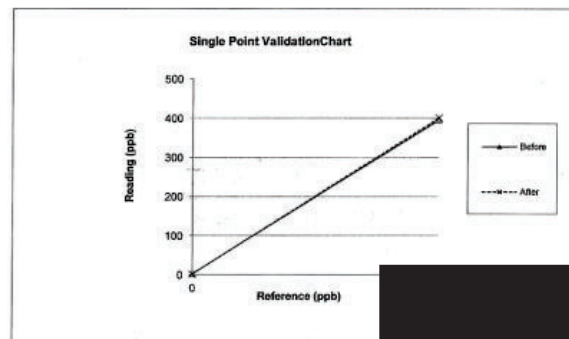
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc: 45.30 PPM NO Conc: 45.30 PPM SO2 Conc: 45.05 PPM CO Conc: 4528 PPM Expire Date: OCT 23,2027 EB0170003

Environment: Temperature 25.9 °C

Humidity: 60 %RH

Validation Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	2.5	2.5	400.0	395.8	-0.5
After	0.0	1.6	1.6	400.0	401.0	0.1



ประกาศใช้ 01/08/2568

FN-SVM-05-09 Rev.00



Calibration Report No.: ESA-6810006

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

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Analyzer Signal Values					
Date	1-Oct-25	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	2826.80	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			

Validation By :

Approve By :

Date: 1-Oct-25

Date: 1-Oct-25

ประกาศใช้ 01/08/2568

CO Analyzer Verification Test Report

Page: 1/2

Validation Report No.: ESA-6810010

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: CO12e	Manufacturer: Environnement SA, France S/N: 355
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Calibration System

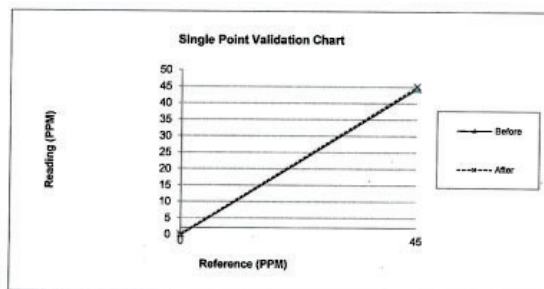
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGA101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.30 PPM NO Conc 45.30 PPM SO2 Conc 45.05 PPM CO Conc 45.28 PPM Expire Date: OCT 23, 2027 EB0170003

Environment: Temperature 25.9 °C

Humidity: 60 %RH

Validation Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	-0.3	-0.3	45.0	44.5	-0.6
After	0.0	0.1	0.1	45.0	45.1	0.1



ประกาศใช้ 01/08/2568

Validation Report No.: ESA-6810010

Page: 2/2

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Detail	Range	Unit	Before	After	Note
Date	1-Oct-25				
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 - 880 cc/min	cc/min	904	896	
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	-0.3	0.1	
Span Gas	45	PPM	44.5	45.1	± 5% of Range

Validation By :

Approve By :

Date: 1-Oct-25

Date: 1-Oct-25

ประกาศใช้ 01/08/2568

CO Analyzer Verification Test Report

Page:1/2

Validation Report No.: ESA-6810007

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: CO12e	Manufacturer: Environnement SA, France S/N: 356
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Calibration System

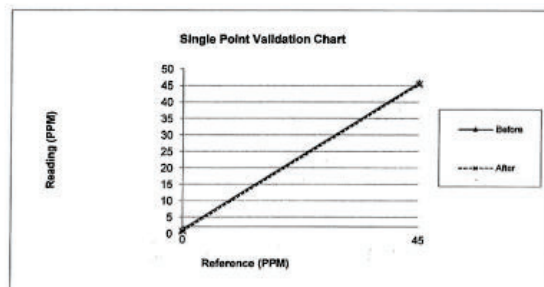
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGA101 S/N: 792	NOx Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 45.30 PPM
	SO2 Conc 45.05 PPM
	CO Conc 45.26 PPM
	Expire Date: OCT 23, 2027 EB0170003

Environment: Temperature: 25.9 °C

Humidity: 60 %RH

Validation Report

Status	Zero			Span		
	Reference (PPM)	Reading (PPM)	Drift (PPM)	Reference (PPM)	Reading (PPM)	Drift%
Before	0.0	1.3	1.3	45.0	45.9	1.0
After	0.0	0.7	0.7	45.0	45.4	0.4



ประกาศใช้ 01/08/2568

FN-SVM-05-10 Rev.00

Validation Report No.: ESA-6810007

Page:2/2

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Detail	Range	Unit	Before	After	Note
Date	1-Oct-25				
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 - 880 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	1.3	0.7	
Span Gas	45	PPM	45.9	45.4	± 5% of Range

Validation By :

Approve By :

Date: 1-Oct-25

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co., Ltd.

ประกาศใช้ 01/08/2568

FN-SVM-05-10 Rev.00

NOx Analyzer Verification Test Report

Page:1/2

Validation Report No.: API-6810004

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: 2572
---	-------------------------------

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc: 45.30 PPM NO Conc: 45.30 PPM SO2 Conc: 45.05 PPM CO Conc: 4528 PPM Expire Date: OCT 23,2027 EB0170003

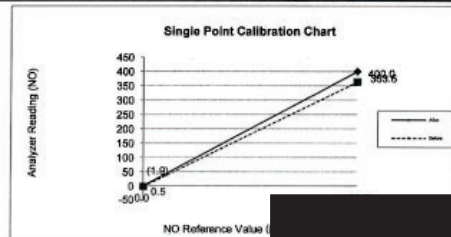
Environment: Temperature: 24.9 °C Humidity: 60 %RH

Validation Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	-1.7	0.0	-1.7	354.4	400.0	-6.0
NO ₂	2	0.0	2.0	9.2	0.0	1.3
NOx	-1.9	0.0	-1.9	363.6	400.0	-4.8

Validation Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.7	0.0	0.7	401	400.0	0.1
NO ₂	0.2	0.0	0.2	1	0.0	-0.1
NOx	0.5	0.0	0.5	400	400.0	0.0



ประกาศใช้ 01/08/2568

FN-SVM-05-08 Rev.00

Validation Report No.: API-6810004

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Analyzer Signal Values					
Date	1-Oct-25	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.	86.71	mV
Sample					
Chamber T	60	deg.C	Internal Temp.	33.33	deg.C
Chamber P	1720.8	hPa	PM T.	1.46	deg.C
Flow	47.21	l/min	Sample Pr.	993.2	hPa

Page:2/2

Validation By: [Redacted]

Date: 1-Oct-25

Approve By: [Redacted]

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co.,Ltd

ประกาศใช้ 01/08/2568

FN-SVM-05-08 Rev.00

NOx Analyzer Verification Test Report

Page:1/2

Validation Report No.: API-6809007

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 200E	Manufacturer: API S/N: 3217
---	--------------------------------

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc: 45.30 PPM NO Conc: 45.30 PPM SO2 Conc: 45.05 PPM CO Conc: 4528 PPM Expire Date: OCT 23, 2027 EB0170003

Environment: Temperature 24.9 °C

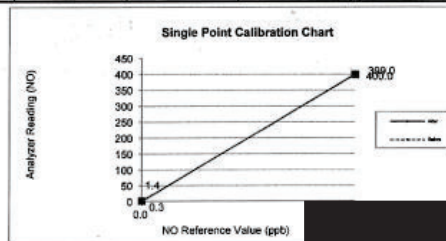
Humidity: 60 %RH

Validation Check (Before 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	395.0	400.0	-0.6
NO ₂	1.4	0.0	1.4	4.0	0.0	0.5
NOx	1.4	0.0	1.4	399.0	400.0	-0.1

Validation 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	401.0	400.0	0.1
NO ₂	0.2	0.0	0.2	1.0	0.0	-0.1
NOx	0.3	0.0	0.3	400.0	400.0	0.0



ประกาศใช้ 01/08/2568

FN-SVM-05-08 Rev.00

Validation Report No.: API-6809007

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Analyzer Signal Values					
Date	1-Oct-25	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 OS	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.	86.71	mV
Sample					
Chamber T	60	deg.C	Internal Temp.	33.33	deg.C
Chamber P	1720.8	hPa	PM T.	1.46	deg.C
Flow	47.21	l/min	Sample Pr.	993.2	hPa

Page:2/2

Validation By: [Signature]

Date: 1-Oct-25

Approve By: [Signature]

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co.,Ltd.

ประกาศใช้ 01/08/2568

FN-SVM-05-08 Rev.00



Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 23 June, 2025 Certification No. 300/25
Page : 1 of 6

Object : เครื่องมือตรวจวัดคุณภาพอากาศ

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2501

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.1 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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

: Ultrasonic Anemometer Model DA-550-3TV (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.9188 : testo, testo 645 Serial No. 02849057

STANDARD BAROMETER : Dig : Type PT8220

Mechanical Engineer



The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 300/25

23 June, 2025

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.3	0.70
3.02	-	-	-	2.4	0.62
5.00	-	-	-	4.8	0.20
7.04	-	-	-	6.9	0.14
9.02	-	-	-	8.8	0.22
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.8	0.21
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.8	0.22
20.02	-	-	-	20.0	0.02

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	92
180	181
270	

Calibra





The Result of Calibration

Sensor model EWSNV110WS2501

Certification No. 300/25

23 June, 2025

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1006.54	1006.70	-0.16
1006.75	1006.83	-0.08
1006.98	1007.12	-0.14
1007.24	1007.35	-0.11
1007.64	1007.72	-0.08
1007.82	1007.91	-0.09
1008.01	1008.11	-0.10
1008.28	1008.30	-0.02
1008.68	1008.74	-0.06
1008.93	1009.00	-0.07
1005.42	1005.51	-0.09
1005.84	1005.94	-0.10
1006.32	1006.41	-0.09
1006.87	1006.91	-0.04
1007.65	1007.73	-0.08
1007.94	1008.02	-0.08
1008.51	1008.64	-0.13
1008.92	1009.05	-0.13
1009.22	1009.32	-0.10
1009.85	1009.91	-0.06

Average

Calibra



The Result of Calibration

Sensor model

EWSNV110WS2501

Certification No. 300/25

23 June, 2025

Page : 4 of 6

Standard Temp.	Temperature Sensor Reading	
	Reading	Correction
°C	°C	°C
45.2	45.6	-0.4
30.4	30.6	-0.2
15.6	15.7	-0.1

Calibra



The Result of Calibration

Sensor model EWSNV110WS2501 Certification No. 300/25
23 June, 2025 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
86.4	93.3	-6.9
65.3	69.4	-4.1
42.2	44.6	-2.4

Calibrated

Date of Issue 23 June, 2025

Certification No. 300/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชีฟต์ Davis Instruments แบบ TIPPING BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue 23 June, 2025 Certification No. 301/25
Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามอากาศ

Manufacturer : NovaLynx

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

Serial No. : EWSNV110WS2503

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.6 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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.9188 : testo, testo 645 Serial No. 02948057

STANDARD BAROMETER : Dig : Type PT



The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 301/25

23 June, 2025

Page : 2 of 6

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	hPa	hPa	m/sec	m/sec	m/sec
1.00	-	-	-	0.3	0.70
3.02	-	-	-	2.4	0.62
5.00	-	-	-	4.3	0.70
7.04	-	-	-	6.8	0.24
9.02	-	-	-	8.8	0.22
11.01	-	-	-	11.1	-0.09
13.01	-	-	-	12.8	0.21
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	16.8	0.22
20.02	-	-	-	20.1	-0.08

Vane Angel Bench Stand Model 18112	
Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	92
180	181
270	



The Result of Calibration

Sensor model EWSNV110WS2503

Certification No. 301/25

23 June, 2025

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1006.54	1006.94	-0.40
1006.75	1007.21	-0.46
1006.98	1007.57	-0.59
1007.24	1007.65	-0.41
1007.64	1008.13	-0.49
1007.82	1008.51	-0.69
1008.01	1008.51	-0.50
1008.28	1008.83	-0.55
1008.68	1008.02	-0.34
1008.93	1009.38	-0.45
1006.42	1005.87	-0.45
1005.84	1006.32	-0.48
1006.32	1006.74	-0.42
1008.87	1007.24	-0.37
1007.65	1008.03	-0.38
1007.94	1008.36	-0.42
1008.51	1008.96	-0.45
1008.92	1009.35	-0.43
1009.22	1009.64	-0.42
1009.85	1010.21	-0.36

Average

The Result of Calibration

Sensor model

EWSNV110WS2503

Certification No. 301/25

23 June, 2025

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.5	-0.3
30.4	30.6	-0.2
15.6	15.5	0.1



The Result of Calibration

Sensor model EWSNV110WS2503 Certification No. 301/25
23 June, 2025 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
86.4	95.2	-8.8
65.3	71.2	-5.9
42.2	45.5	-3.3



Date of Issue 23 June, 2025

Certification No. 301/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING
BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัดฝน
แบบแก้วตวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No.
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0152 **MTC No. EEL. BP.** 65/0168

CALIBRATION CERTIFICATE

Submitted by
Address
Calibrated at

Instrument Calibrated :

Description : Acoustic Calibrator	Ambient Environment
Manufacturer : Pulsar	Temperature : (23 ± 3) °C
Model : 103	Relative Humidity : (50 ± 15) %
Serial No. : 98971	Ambient Pressure : (101.325 ± 1.500) kPa

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was 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 Jan. 2025

Date of Calibration : 17 Jan. 2025

1/3

The results relate only to the items tested/calibrated or value assigned.
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. 21-68/0152 **MTC No. EEL. BP.** 65/0168

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	93.93	-0.07	± 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	1000.4	0.4	± 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	1.40	± 0.50	±3.0%

Note :

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

Date of Calibration : 17 Jan. 2025

2/3

The results relate only to the items tested/calibrated or value assigned.
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. 21-68/0152**MTC No.** EEL. BP. 65/0168

Nominal Output of Unit Under Test = 114 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	114.01	0.01	± 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	1000.3	0.3	± 1.5	±3.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.05	± 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 :

Date of Calibration : 17 Jan. 2025

Date of Issue : 20 Jan. 2025

Ref : 2011268011000116001

End of Certificate

3 / 3

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

FMJL/MTC.002 Rev.5

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
สถาบันการบินพลเรือน
และโรงเรียนแสงหิรัญ
ครั้งที่ 4/2568
ตรวจวัดวันที่ 2-7 เมษายน 2569

TSP High Volume Sampler Calibration

Verification Report No.
SO2500305-E001-TSP 01

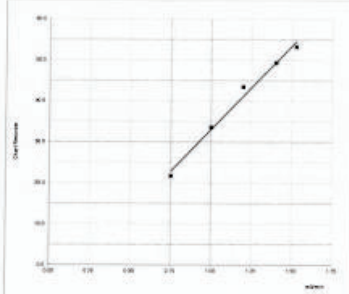
☐ PM ☒ Onsite
 Site: 11 การไฟฟ้าฟาร์ม
 UTM: N 1526240 E 667896
 Sampler: ETSP#34
 Recorder: ECRD5016339508
 Date: 3 Dec 25
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS
 Barometric Press. (hPa): 1007.5 Corrected Pressure (mm Hg): 755.7
 Temperature (deg C): 32.0 Temperature (deg K): 305.0
 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: 2.06933
 Model: TE-5025A Qstd Intercept: -0.02815
 Serial#: 2067 Date Certified: 4 Mar 25
 Due Date: 03-Mar-26

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	10.10	1.527	54.0	53.23
2	8.50	1.402	50.0	49.28
3	6.20	1.200	44.0	43.37
4	4.30	1.001	34.0	33.51
5	2.40	0.752	22.0	21.66

LINEAR REGRESSION
 Slope = 40.7713
 Intercept = -7.7493
 Corr. coeff = 0.9937
 # of Observations: 5
 Range of Chart at 1.1 - 1.7 m3/min: 38 / 62



Calibrated by: XXXXXXXXXX
 3 December 2025
 Approved by: XXXXXXXXXX
 3 December 2025

This report shall not be reproduced except in full, without the written approval of Enviro-Go, Ltd.

ปีงบประมาณ ๒๕๖๘/๒๕๖๘

TSP High Volume Sampler Calibration

Verification Report No.
SO2500305-E001-TSP 02

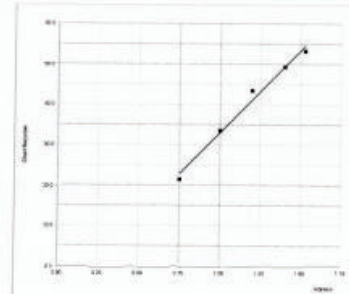
☐ PM ☒ Onsite
 Site: 11 การไฟฟ้าฟาร์ม
 UTM: N 1515345 E 672853
 Sampler: ETSP#33
 Recorder: ECRD5016339509
 Date: 3 Dec 25
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS
 Barometric Press. (hPa): 1007.4 Corrected Pressure (mm Hg): 755.6
 Temperature (deg C): 32.0 Temperature (deg K): 305.0
 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: 2.06933
 Model: TE-5025A Qstd Intercept: -0.02815
 Serial#: 2067 Date Certified: 4 Mar 25
 Due Date: 03-Mar-26

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)
1	12.20	1.677	56.0	55.19
2	9.60	1.459	52.0	51.25
3	6.40	1.219	44.0	43.37
4	4.30	1.001	34.0	33.51
5	2.20	0.720	24.0	23.65

LINEAR REGRESSION
 Slope = 33.7515
 Intercept = 0.1752
 Corr. coeff = 0.9937
 # of Observations: 5
 Range of Chart at 1.1 - 1.7 m3/min: 38 / 58



Calibrated by: XXXXXXXXXX
 3 December 2025
 Approved by: XXXXXXXXXX
 3 December 2025

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ปีงบประมาณ ๒๕๖๘/๒๕๖๘

PM10 High Volume Sampler Calibration

Verification Report No.
SQ2500305-E001-PM 01

L PM ☒ Onsite
 Site: ร.ร.การนิเวศน์
 UTM: N 1526240 E 667886
 Sampler: EPM10#16
 Recorder: NCRDS014261033
 Date: 3 Dec 25
 Technical: 
 Approval: 

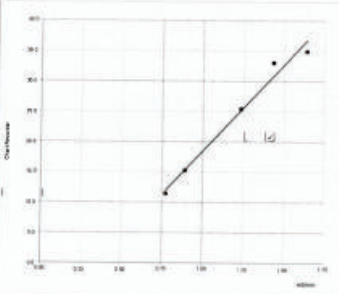
CONDITIONS

Barometric Press. (hPa): 1007.5 Corrected Pressure (mm Hg): 755.7
 Temperature (deg C): 32.0 Temperature (deg K): 305.0
 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: 1.29578
 Model: TE-5025A Intercept: -0.01772
 Serial#: 2067 Date Certified: 4 Mar 25
 Due Date: 3 Mar 26

CALIBRATIONS					LINEAR REGRESSION
Plate or Test #	H2O (in)	Qs (m3/min)	I (chart)	IC (corrected)	
1	11.00	1.640	55.0	34.94	Slope = 28.5429 Intercept = -10.0820 Corr. coeff = 0.9905 SFR = 1.000 SSP = 29.06 # of Observations: 5 Range of Chart at SFR ±10%: 25/33
2	8.40	1.435	52.0	33.04	
3	6.20	1.234	40.0	25.41	
4	3.20	0.891	24.0	15.25	
5	2.40	0.773	18.0	11.44	



Calibrated by: 

Approved by: 

วันที่ 31/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SQ2500305-E001-PM 02

L PM ☒ Onsite
 Site: ร.ร.การนิเวศน์
 UTM: N 1516345 E 672853
 Sampler: EPM10#15
 Recorder: NCRP1500900752
 Date: 3 Dec 25
 Technical: 
 Approval: 

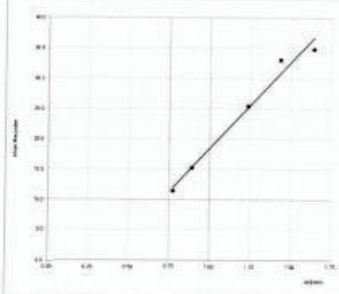
CONDITIONS

Barometric Press. (hPa): 1007.4 Corrected Pressure (mm Hg): 755.6
 Temperature (deg C): 32.0 Temperature (deg K): 305.0
 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: 1.29578
 Model: TE-5025A Intercept: -0.01772
 Serial#: 2067 Date Certified: 4 Mar 25
 Due Date: 3 Mar 26

CALIBRATIONS					LINEAR REGRESSION
Plate or Test #	H2O (in)	Qs (m3/min)	I (chart)	IC (corrected)	
1	12.80	1.768	56.0	35.58	Slope = 24.5513 Intercept = -6.1756 Corr. coeff = 0.9902 SFR = 1.000 SSP = 28.92 # of Observations: 5 Range of Chart at SFR ±10%: 26/32
2	10.40	1.595	54.0	34.31	
3	7.30	1.338	43.0	27.32	
4	4.40	1.042	32.0	20.33	
5	2.70	0.819	20.0	12.71	



Calibrated by: 

Approved by: 

วันที่ 31/08/2568

31/08/68



Verification Test Report

Report No.: SO2500304-E001 / 001

Verification Date : 03 December 2025

Operate Information ☐ PM ☒ Onsite

Site : 1.1.การเดินรถ

GPS coordinates : 47P N 1526240 E 667886

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 1860

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 103 S/N : 98971

Certificate No. : EEL BP 65/0168

Date due : 17 January 2026

Traceability : TISTR

Ambient Condition : Temperature 32.60 °C Relative humidity 54.20 %
Atmospheric pressure 1013.3 hpa

Measurement Data

Reference Value (dB)	Correction Value (dB)	Adjustment (dB)	UUR Reading		Error (dB)	Acceptant Criteria (dB)
			Initial	Final		
93.93	-0.3	93.63	93.87	94.03	0.16	±1.0

* UUR = Unit Under Reference flow

Acceptant Criteria : Sound Level Meter Class 1 ±0.5 dB

Sound Level Meter Class 2 ±1.0 dB

Calibrated By: [Redacted]

Approve By: [Redacted]

Date : 03 December 2025

Date : 03 December 2025

The Results shown in this verification report refer only to the equipment

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ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00



Verification Test Report

Report No.: SO2500304-E001 / 001

Verification Date : 03 December 2025

Operate Information ☐ PM ☒ Onsite

Site : 1.1.แผนผัง

GPS coordinates : 47P N 1516340 E 672853

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 2124

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 103 S/N : 98971

Certificate No. : EEL BP 65/0168

Date due : 17 January 2026

Traceability : TISTR

Ambient Condition : Temperature 32.60 °C Relative humidity 54.20 %
Atmospheric pressure 1013.3 hpa

Measurement Data

Reference Value (dB)	Correction Value (dB)	Adjustment (dB)	UUR Reading		Error (dB)	Acceptant Criteria (dB)
			Initial	Final		
93.93	0	93.93	93.27	93.09	-0.18	±1.0

* UUR = Unit Under Reference flow

Acceptant value : Sound Level Meter Class 1 ±0.5 dB

Sound Level Meter Class 2 ±1.0 dB

Calibrated By: [Redacted]

Approve By: [Redacted]

Date : 03 December 2025

Date : 03 December 2025

The Results shown in this verification report refer only to the equipment

This Calibration Certificate cannot be reproduced, except in full

ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00

Certificate of Calibration

Calibration Certification Information			
Cal. Date: March 4, 2025	Rootsmer S/N: 438320	Ta: 294	*K
Operator: Jim Tisch		Pa: 746.0	mm Hg
Calibration Model #: TE-5025A	Calibrator S/N: 2067		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.4220	3.2	2.00
2	3	4	1	1.0090	6.4	4.00
3	5	6	1	0.9030	8.0	5.00
4	7	8	1	0.8610	8.8	5.50
5	9	10	1	0.7090	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9907	0.6967	1.4106	0.9957	0.7002	0.8878
0.9864	0.9776	1.9949	0.9914	0.9826	1.2556
0.9843	1.0900	2.2304	0.9893	1.0955	1.4038
0.9832	1.1419	2.3393	0.9882	1.1477	1.4723
0.9779	1.3792	2.8212	0.9828	1.3862	1.7756
QSTD		m= 2.06933	QA		m= 1.29578
		b= -0.02815			b= -0.01772
		r= 0.99997			r= 0.99997

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:	rootsmer 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

www.tisch-env.com
TOLL FREE: (877)263-71
FAX: (513)467-9

Certificate of Calibration

Certificate No. : 68-200034-1

Page : 1 of 2

Submitted by :

Equipment :

Electronic Balance

Manufacturer : Sartorius

Model : SECURA224-1S

Serial No. : 0034803270

ID No. : ELABBALANCEN04

Capacity : 220 g

Resolution : 0.0001 g

Environment :

Relative Humidity : (41.9 to 42.9) %

Air Pressure : 1014.0 mbar

Date of Received : 28 January 2025

Date of Calibration : 28 January 2025

Date of Issue : 30 January 2025

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14

Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02242009	07 Nov 2025	National Institute of Metrology (Thailand), (NIMT)

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written

CAL-F0031-03

Certificate of Calibration

Certificate No. : 68-200034-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.01	0.0000	0.00012
0.1	0.0001	0.00012
1	0.0000	0.00013
2	0.0001	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
20	-0.0001	0.00014
50	-0.0001	0.00015
100	-0.0001	0.00020
200	-0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E

0.0004 0.0004 0.0005 0.0004 0.0000 g

Repeatability

Load test : 200 g

Sidev. : 0.00005 g

-0.00-

Airgas

an Air Liquide company

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD

Part Number: ED4NI99E15AD0V3

Cylinder Number: EB0170003

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12024

Gas Code: CO,NO,NOX,SO2,BALN

Reference Number: 160-403162930-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2015 PSIG

Valve Outlet: 660

Certification Date: Oct 23, 2024

Expiration Date: Oct 23, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12(03), using the assay procedure 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. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.30 PPM	G1	±1.5% NIST Traceable	10/16/2024, 10/23/2024
NITRIC OXIDE	45.00 PPM	45.30 PPM	G1	±1.5% NIST Traceable	10/16/2024, 10/23/2024
SULFUR DIOXIDE	45.00 PPM	45.05 PPM	G1	±1.5% NIST Traceable	10/16/2024, 10/23/2024
CARBON MONOXIDE	4500 PPM	4520 PPM	G1	±1.5% NIST Traceable	10/16/2024
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	DC1201202235	CC790377	48.05 PPM NITRIC OXIDE/NITROGEN	±1.5%	May 03, 2026
PRM	12404	AFEX 1324257	50.04 PPM NITRIC OXIDE/NITROGEN	±1.5%	Dec 22, 2025
GMIS	124206889128	CC323207	4.238 PPM NITROGEN DIOXIDE/NITROGEN	±1.5%	Jan 04, 2027
PRM	C2380001.1	D153445	9.87 PPM NITROGEN DIOXIDE/NITROGEN	±1.5%	Nov 22, 2024
GMIS	0712202310	CC404279	48.92 PPM SULFUR DIOXIDE/NITROGEN	±1.5%	Jun 18, 2027
SRM	1893a	FF25487	50.33 PPM SULFUR DIOXIDE/NITROGEN	±1.5%	Jun 27, 2025
CARBON MONOXIDE	080123	KAL004712	4857 PPM CARBON MONOXIDE/NITROGEN	±1.5%	Feb 20, 2030

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

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT 6 N190050	NDIR	Oct 09, 2024
Nicolet iS50 FTIR AUP2010245 ND	FTIR	Oct 17, 2024
Nicolet iS50 FTIR AUP2010245 ND2	FTIR	Oct 03, 2024
Nicolet iS50 FTIR AUP2010245 SO2	FTIR	Sep 26, 2024

Page 1 of 1

Airgas Specialty Gases
Airgas USA LLC
6141 Sartan Road
Plymouth, PA 15069
Airgas.com

Verification/Calibration Test Report

Report No.: API-6812007

Verification Date: 01 December 2025

Page: 1/2

Operate Information ☒ PM ☐ Onsite

Site: [REDACTED]

GPS coordinates: 47P N 1514454 E 654233

Instrument Information

Equipment: SO2 Analyzer

Manufacturer: ESA

Model: AF22e

Serial No: 2506

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No:	EB0170003	ZERO AIR Generator	Model: ZAG7001
Certificate No:	2015 FO,G		S/N: 644
Date Due:	OCT 23,2027	Dilutor	Model: ESA MGC101
Traceability:	Air Liquide		S/N: 792

Ambient Condition: Temperature 25.00 °C Relative humidity 58.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

Calibration Gas Level	Zero Conc. (Indicate Unit) ☐ ppb ☐ ppm	Level 1 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 2 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 3 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 4 Conc. (Indicate Unit) ☒ ppb ☐ ppm
Calibrator Value (X)	0.00	50.00	100.00	150.00	400.00
Instrument Value (Y)	-0.15	49.15	97.13	147.67	398.40
	-1.13	47.98	98.19	148.32	399.50
	-1.13	49.98	99.19	149.32	397.10
	-1.13	47.98	98.19	148.32	397.10
	-0.47	48.92	99.12	149.11	397.10
Ins. Value Average	-0.80	48.80	98.36	148.55	397.84
Best Fit Concentration (Y=Mx+b)		48.82	98.67	148.52	397.77
Point Difference(Best Fit - Average)		0.02	0.31	-0.03	-0.07
Percent difference (Best fit vs Ins.(Y) Value)		-0.04%	-0.31%	0.02%	0.02%
Result Status (Pass/Fail)		Pass	Pass	Pass	Pass

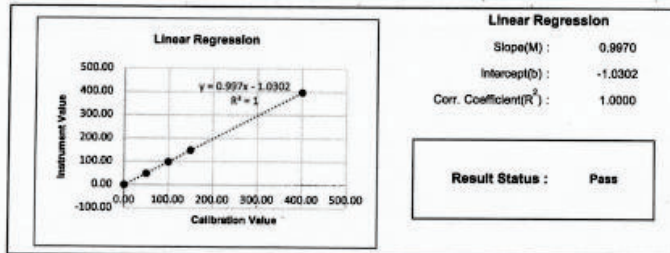
Note:

1. Calibrator Value(X) is concentration points were evenly spaced across that range generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from instrument. The worksheet shows

ประกาศใช้ 01/06/2568



Page : 2/2



Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line. Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within 1±0.05. See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program



Calibrated By:

Date :

neediss Supply Instrument Co., Ltd.

Approve By:

Date : 01 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated
This Calibration Certificate cannot be reproduced, except in full, without permission of company.

**** End Verification/Calibration Test Report ****

ประกาศใช้ 01/08/2568

Verification/Calibration Test Report

Report No.: API-6812006

Verification Date : 01 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : SO2 Analyzer

Manufacturer : ESA

Model : AF22e

Serial No : 2505

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 FO.G		S/N : 644
Date Due :	OCT 23,2027	Dilutor	Model : ESA MGC101
Traceability :	Air Liquide		S/N : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

Calibration Gas Level	Zero Conc. (Indicate Unit) ☐ ppb ☐ ppm	Level 1 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 2 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 3 Conc. (Indicate Unit) ☒ ppb ☐ ppm	Level 4 Conc. (Indicate Unit) ☒ ppb ☐ ppm
Calibrator Value (X)	0.00	50.00	100.00	150.00	400.00
Instrument Value (Y)	-0.15	49.15	97.13	147.67	401.10
	-1.13	47.98	96.19	148.32	401.10
	-1.13	49.98	99.19	149.32	402.50
	-1.13	47.98	96.19	148.32	402.50
Ins.Value Average	-0.47	48.92	99.12	149.11	401.20
	-0.80	48.60	98.36	148.55	401.68
Best Fit Concentration (Y=Mx+b)		48.66	99.03	149.39	401.22
Point Difference(Best Fit - Average)		-0.14	0.66	0.84	-0.46
Percent difference (Best fit vs Ins.(Y) Value)		0.29%	-0.67%	-0.56%	0.12%
Result Status (Pass/Fail)		Pass	Pass	Pass	Pass

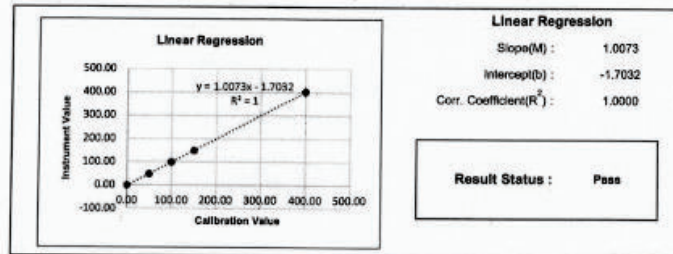
Note :

1. Calibrator Value(X) is concentration points were evenly spaced across that range, with the highest test concentration generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from instrument. The worksheet

ประกาศใช้ 01/08/2568



Page : 2/2



Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line. Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within ± 0.05 . See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program



Calibrated By:  neediss Supply Instrument Co., Ltd.
Approve By: 
Date : 01 December 2025 Date : 01 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated.
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**** End Verification/Calibration Test Report ****

ประกาศใช้ 01/08/2568



Verification/Calibration Test Report

Report No.: API-6812008
Verification Date : 06 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site : 

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : CO Analyzer

Manufacturer : ESA

Model : CO12e

Serial No : 355

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 FO.G		S/N : 644
Date Due :	OCT 23,2027	Dilutor	Model : ESA MGC101
Traceability :	Air Liquide		S/N : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

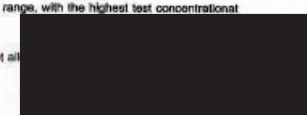
Measurement Data

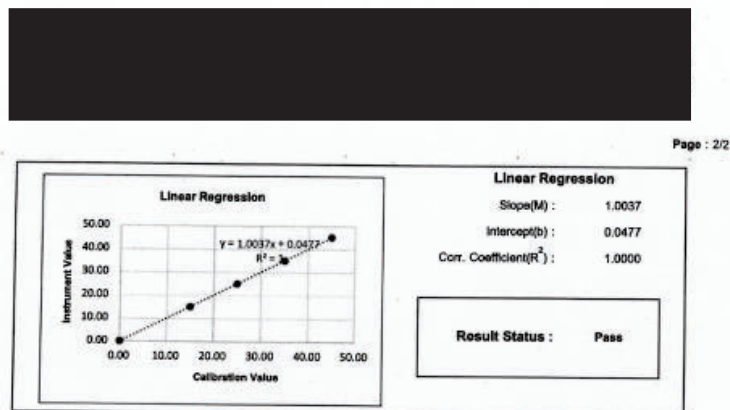
Calibration Gas Level	Zero Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 1 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 2 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 3 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 4 Conc. (Indicate Unit) ☐ ppb ☒ ppm
Calibrator Value (X)	0.00	15.00	25.00	35.00	45.00
Instrument Value (Y)	0.15	15.11	25.14	35.12	45.55
	0.14	14.97	25.14	35.09	45.55
	0.13	14.97	25.14	34.99	45.55
	0.13	14.97	25.10	35.12	44.99
	0.15	14.99	25.14	35.12	44.99
Ins. Value Average	0.14	15.00	25.13	35.09	45.33
Best Fit Concentration (Y=Mx+b)		15.10	25.14	35.18	45.22
Point Difference(Best Fit - Average)		0.10	0.01	0.09	-0.11
Percent difference (Best fit vs Ins.(Y) Value		-0.67%	-0.04%	-0.26%	0.24%
Result Status (Pass/Fail)		Pass	Pass	Pass	Pass

Note :

1. Calibrator Value(X) is concentration points were evenly spaced across that range, with the highest test concentration generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from Instrument. The worksheet all

ประกาศใช้ 01/08/2568





Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within 1±.05. See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program



Calibrated By: [Signature] neediss Supply Instrument Co., Ltd.
Date : 06 December 2025

Approve By: [Signature]
Date : 06 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated.
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== End Verification/Calibration Test Report ==

รทกคป 01/08/2568

Verification/Calibration Test Report

Report No.: API-6812009

Verification Date : 06 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site [Redacted]

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : CO Analyzer

Manufacturer : ESA

Model : CO12e

Serial No : 356

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 FO,G		S/N : 644
Date Due :	OCT 23,2027	Dilutor	Model : ESA MGC101
Traceability :	Air Liquide		S/N : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 58.30 %

Atmospheric pressure 1011.0 hpa

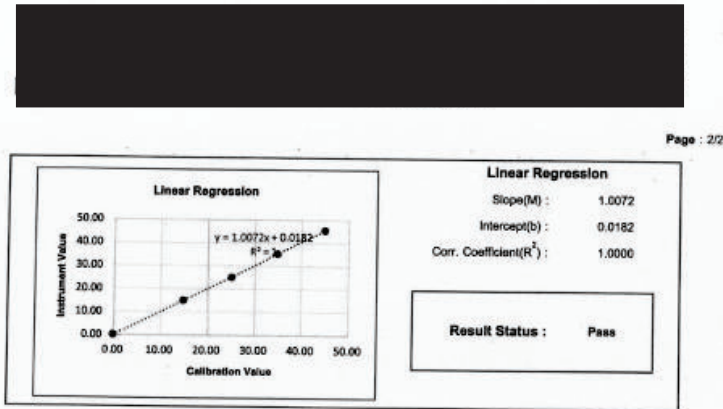
Measurement Data

Calibration Gas Level	Zero Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 1 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 2 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 3 Conc. (Indicate Unit) ☐ ppb ☒ ppm	Level 4 Conc. (Indicate Unit) ☐ ppb ☒ ppm
Calibrator Value (X)	0.00	15.00	25.00	35.00	45.00
Instrument Value (Y)	0.15	15.11	25.14	35.42	45.55
	0.14	14.97	25.14	35.42	45.55
	0.13	14.97	25.14	34.94	45.54
	0.13	14.97	25.10	35.12	45.55
	0.11	14.96	25.14	35.42	44.94
Ins.Value Average	0.13	15.00	25.13	35.26	45.43
Best Fit Concentration (Y=Mx+b)		15.13	25.20	35.27	45.34
Point Difference(Best Fit - Average)		0.12	0.07	0.01	-0.08
Percent difference (Best fit vs Ins.(Y) Value		-0.82%	-0.26%	-0.02%	0.18%
Result Status (Pass/Fail)		Pass	Pass	Pass	Pass

Note :

1. Calibrator Value(X) is concentration points were evenly spaced across that range, with the highest test concentration generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from instrument. The worksheet all

รทกคป 01/08/2568



Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line. Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within 1±0.05. See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program

Calibrated By: **neediss**
Neediss Supply Instrument Co., Ltd.
Date : 06 December 2025
Approved By: **neediss**
Date : 06 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated.
This Calibration Certificate cannot be reproduced, except in full, without permission of company.

**** End Verification/Calibration Test Report ****

ประกาศใช้ 01/08/2568

Verification/Calibration Test Report

Report No.: ESA-8612002

Verification Date : 01 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site : Envileb Co., Ltd.

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : NO2 Analyzer

Manufacturer : ESA

Model : AC32e

Serial No : 2399

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 FO.G		S/N : 644
Date Due :	OCT 23,2027	Dilutor	Model : ESA MGC101
Traceability :	Air Liquide		S/N : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

Calibration Gas Level	Zero Conc. (Indicate Unit)		Level 1 Conc. (Indicate Unit)		Level 2 Conc. (Indicate Unit)		Level 3 Conc. (Indicate Unit)		Level 4 Conc. (Indicate Unit)	
	□ ppb □ ppm		□ ppb □ ppm		□ ppb □ ppm		□ ppb □ ppm		□ ppb □ ppm	
	Nox	NO	Nox	NO	Nox	NO	Nox	NO	Nox	NO
Calibrator Value (X)	0.00	0.00	50.00	50.00	100.00	100.00	150.00	150.00	400.00	400.00
Instrument Value (Y)	0.11	-0.15	49.64	49.30	100.19	98.28	148.89	149.16	402.73	402.40
	0.12	-1.13	49.72	49.03	100.47	99.37	148.25	150.56	405.20	405.20
	0.13	-1.13	49.51	49.28	99.82	98.66	147.43	149.42	403.1	403.1
	0.13	-1.13	49.11	48.57	100.39	98.08	147.61	152.44	402.50	402.40
	0.14	-0.47	50.45	50.32	98.42	99.19	151.27	147.07	403.10	405.20
Ins.Value Average	0.13	-0.80	49.69	49.30	99.66	98.72	148.69	149.73	403.38	403.80
Best Fit Concentration (Y=Mx+b)	49.48	49.02	99.94	99.65	150.40	150.27	402.70	403.40		
Point Difference(Best Fit - Average)	-0.20	-0.28	0.28	0.93	1.71	0.54	-0.69	-0.40		
Percent difference (Best fit vs Ins.(Y) Value)	0.41%	0.56%	-0.28%	-0.93%	-1.14%	-0.36%	0.17%	0.10%		
Result Status (Pass/Fail)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass		

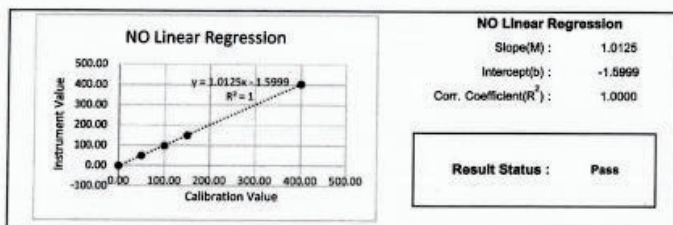
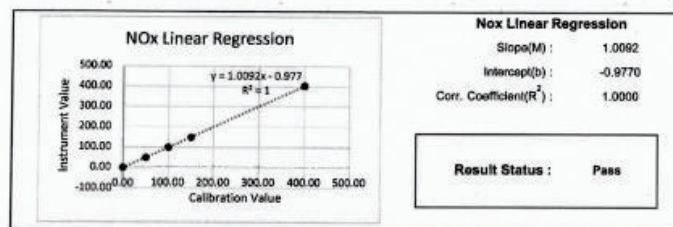
Note :

1. Calibrator Value(X) is concentration points were evenly spaced across that generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from instrument. The worksheet

ประกาศใช้ 01/08/2568



Page : 2/2



Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line. Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within 1±.05. See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program

Calibrated By: [Redacted]

Date : 01 December 2025

Date : 01 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated.
This Calibration Certificate cannot be reproduced, except in full, without permission of company.

**** End Verification/Calibration Test Report**

ประกาศใช้ 01/08/2568



Verification/Calibration Test Report

Report No.: ESA-6812003

Verification Date : 01 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site : [Redacted]

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : NO2 Analyzer

Manufacturer : ESA

Model : AC32e

Serial No : 2400

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 FO,G		S/N : 844
Date Due :	OCT 23,2027	Dilutor	Model : ESA MGC101
Traceability :	Air Liquide		S/N : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

Calibration Gas Level	Zero Conc. (Indicate Unit)		Level 1 Conc. (Indicate Unit)		Level 2 Conc. (Indicate Unit)		Level 3 Conc. (Indicate Unit)		Level 4 Conc. (Indicate Unit)	
	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm
Calibrator Value (X)	0.00	0.00	50.00	50.00	100.00	100.00	150.00	150.00	400.00	400.00
Instrument Value (Y)	0.11	-0.15	49.84	49.30	100.19	98.29	148.89	149.16	402.73	397.31
	0.12	-1.13	49.72	49.03	100.47	99.37	148.26	150.56	399.76	397.31
	0.13	-1.13	49.51	49.28	99.82	98.66	147.43	149.42	398.27	398.05
	0.14	-0.47	50.45	50.32	98.42	99.19	151.27	147.07	400.45	399.79
Ins.Value Average	0.13	-0.80	49.89	49.30	99.66	98.72	148.69	149.73	400.20	398.45
Best Fit Concentration (Y=Mx+b)	49.81	49.25	99.65	99.15	149.88	149.08	399.84	398.60		
Point Difference(Best Fit - Average)	-0.07	-0.05	-0.01	0.44	0.99	-0.67	-0.36	0.15		
Percent difference (Best fit vs Ins.(Y) Value	0.15%	0.11%	0.01%	-0.44%	-0.66%	0.45%	0.08%	-0.04%		
Result Status (Pass/Fail)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass		

Note :

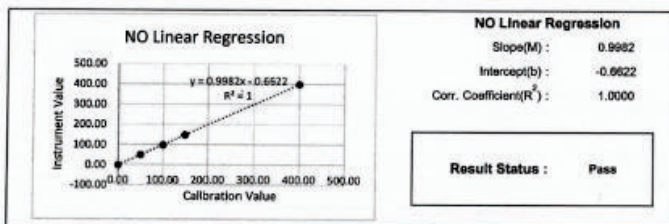
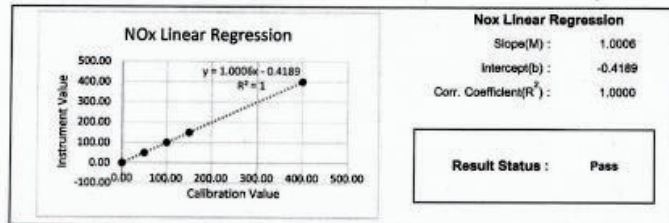
1. Calibrator Value(X) is concentration points were evenly spaced across that range, generated approximately 80% full scale.

2. Instrument Value(Y) is Concentration values from instrument. The worksheet allow

ประกาศใช้ 01/08/2568



Page : 2/2



Acceptance Criteria

For the gaseous pollutants, the calibration (including the multi-point verification) is considered acceptable if all test concentrations fall within 2%, or an absolute difference of 1.5 ppb for O₃, SO₂ and NO₂ and 0.03 ppm for CO, of the calibration scale, best-fit straight line. Which acceptance criteria (percent or absolute difference) is used depends on the concentration of the calibration points. It is also recommended that the slope is within ± 0.05 . See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program

Calibrated By:

Date : 01 December 2025

Date : 01 December 2025

The Results shown in this verification report refer only to the equipment verification unless otherwise stated

This Calibration Certificate cannot be reproduced, except in full, without

**** End Verification/Calibration Test Report ****

ประกาศใช้ 01/08/2568

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0152 MTC No. EEL. BP. 65/0168

CALIBRATION CERTIFICATE

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

Instrument Calibrated :
Description : Acoustic Calibrator
Manufacturer : Pulsar
Model : 103
Serial No. : 98971

Ambient Environment
Temperature : (23 $\pm$ 3) °C
Relative Humidity : (50 $\pm$ 15) %
Ambient Pressure : (101.325 $\pm$ 1.500) kPa

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was 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 Jan. 2025
Date of Calibration : 17 Jan. 2025

The results relate only to the items tested/calibrated or value assigned.
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. 21-68/0152 **MTC No.** EEL. BP. 65/0168

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 1
1/2 inch Bruel&Kjaer 4180	93.93	-0.07	± 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	1000.4	0.4	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.40	± 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.

Date of Calibration : 17 Jan. 2025

2 / 3

The results relate only to the items tested/calibrated or value assigned.
 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. 21-68/0152 **MTC No.** EEL. BP. 65/0168

Nominal Output of Unit Under Test = 114 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 1
1/2 inch Bruel&Kjaer 4180	114.01	0.01	± 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	1000.3	0.3	± 1.5	$\pm 3.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.05	± 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 :

Date of Calibration : 17 Jan. 2025
Date of Issue : 20 Jan. 2025

End of Certificate 3 / 3

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



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 8 July, 2025

Certification No. 332/25

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามอากาศ

Manufacturer : Novall Lynx

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

Serial No. : EWSNV110WS2506

Customer :



Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.6 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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 Friedrichs : Dry No.8390/94 Wet No. 8389/94

: Thermoschneider No.9188 : testo, testo 645 Serial No. 02849057



The Result of Calibration

Sensor model EWSNV110WS2506

Certification No. 332/25

8 July, 2025

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.8	0.20
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	10.1	0.91
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Vane Angel Bench Stand Model 18112 Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180



The Result of Calibration

Sensor model EWSNV110WS2506

Certification No. 332/25

8 July, 2025

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1011.60	1012.52	-0.92
1011.24	1012.05	-0.81
1010.86	1011.64	-0.78
1010.21	1011.03	-0.82
1009.82	1010.64	-0.82
1009.45	1010.25	-0.80
1009.06	1010.02	-0.96
1008.83	1009.61	-0.78
1008.43	1009.12	-0.69
1008.22	1009.14	-0.92
1007.75	1008.61	-0.86
1007.37	1008.15	-0.77
1007.17	1008.15	-0.98
1006.84	1007.79	-0.95
1010.63	1011.61	-0.98
1010.06	1010.86	-0.78
1009.77	1010.63	-0.86
1008.97	1009.86	-0.91
1008.24	1008.13	-0.89
1007.23	1008.06	-0.83

Average

The Result of Calibration

Sensor model EWSNV110WS2506

Certification No. 332/25

8 July, 2025

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	46.0	-0.3
30.4	30.5	-0.1
15.6	15.7	-0.1



The Result of Calibration

Sensor model EWSNV110WS2506 Certification No. 332/25
8 July, 2025 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
87.5	83	4.5
63.2	61	2.2
45.1	44	1.1



Date of Issue 8 July, 2025

Certification No. 332/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



ลงชื่อ.. [REDACTED]

วิศวกรชำนาญการ



Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 8 July, 2025

Certification No. 333/25

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุณหภูมิตามอากาศ

Manufacturer : NovusLynx

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

Serial No. : [Redacted]

Customer : [Redacted]

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.2 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrich FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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.9188 : testo, testo 645 Serial No. 02848057

la Type PTB220 N



The Result of Calibration

Sensor model EWSNV110WS2507

Certification No. 333/25

8 July, 2025

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	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
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	-	-	-	17.0	0.02
20.02	-	-	-	20.2	-0.18

Vane Angel Bench Stand Model 18112 Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	



The Result of Calibration

Sensor model EWSNV110WS2507

Certification No. 333/25

8 July, 2025

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1011.60	1011.28	0.32
1011.24	1010.86	0.38
1010.86	1010.52	0.34
1010.21	1009.85	0.36
1009.82	1009.45	0.37
1009.45	1009.12	0.33
1009.06	1008.71	0.35
1008.83	1008.48	0.35
1008.43	1008.03	0.40
1008.22	1007.86	0.36
1007.75	1007.42	0.33
1007.37	1006.98	0.39
1007.17	1006.73	0.44
1006.84	1006.51	0.33
1010.63	1010.32	0.31
1010.06	1009.62	0.46
1009.77	1009.43	0.34
1008.97	1008.56	0.41
1008.24	1007.97	0.27
1007.23	1006.86	0.37

Average



The Result of Calibration

Sensor model EWSNV110WS2507

Certification No. 333/25

8 July, 2025

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	45.9	-0.2
30.4	30.5	-0.1
15.6	15.8	-0.2

Mechanical Engineer



The Result of Calibration

Sensor model EWSNV110WS2507 Certification No. 333/25

8 July, 2025

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
87.5	92	-4.5
63.2	67	-3.6
45.1	47	-1.9



Date of Issue 8 July, 2025

Certification No. 333/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชีท้อ Davis Instruments แบบ TIPPING
BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัดฝน
แบบแก้ววง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No.
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



วิศวกรชำนาญการ