

ภาคผนวกที่ 5-3

เอกสารผลการสอบเทียบเครื่องมือตรวจวัด

ครั้งที่ 3/2568

สถานีโรงเรียนกรุงเทพคริสเตียนวิทยาลัย

สถานีโรงพยาบาลเซนต์หลุยส์

ตรวจวัดวันที่ 19-24 กุมภาพันธ์ 2569

TSP High Volume Sampler Calibration

Verification Report No.
SO2500249-E001 -TSP 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517392 E 664627
 Sampler: ETSP#31
 Recorder: ECRDS016339506

Date: 3 Oct 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 6025A	Qstd Intercept: 0.02816
Serial#: 2067	Date Certified: 4 Mar 25
	Due Date: 03-Mar-26

Plate or Test #	H ₂ O (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	21.68

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 October 2025

Approved by: XXXXXXXXXX

3 October 2025

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ประกาศใช้ 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500249-E001 -PM 01

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517392 E 664627
 Sampler: EPM10#39
 Recorder: ECRDS019075261

Date: 3 Oct 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	Slope: 1.29578
Model: TE-5025A	Intercept: -0.01772
Serial#: 2067	Date Certified: 4 Mar 25
	Due Date: 3 Mar 26

Plate or Test #	H ₂ O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.00	1.940	55.0	34.94
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

LINEAR REGRESSION

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

Calibrated by: XXXXXXXXXX

3 October 2025

Approved by: XXXXXXXXXX

3 October 2025

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TSP High Volume Sampler Calibration

Verification Report No.
SO2500249-E001 -TSP 02

☐ PM ☒ Onsite

Site: ร.พ.เชลียง

UTM : N 1517268 E 664919

Sampler: ETSP#37

Recorder: ECRAN000031070

Date: 3 Oct 25

Technical: [Redacted]

Approval: [Redacted]

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: -0.02615
Serial#: 2067	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

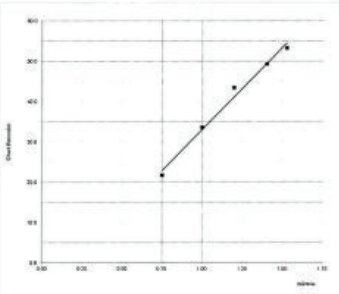
Corr. coeff = 0.9937

of Observations: 5

Range of Chart at 1.1 - 1.7 m3/min

38

58



Calibrated by: [Redacted]

Approved by: [Redacted]

3 October 2025

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ประกอบวันที่ 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500249-E001 -PM 02

☐ PM ☒ Onsite

Site: ร.พ.เชลียง

UTM : N 1517268 E 664919

Sampler: EPM10#11

Recorder: NCRT1500904955

Date: 3 Oct 25

Technical: [Redacted]

Approval: [Redacted]

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

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

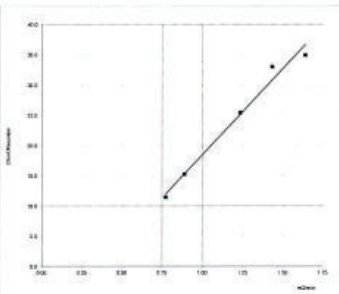
SSP = 28.92

of Observations: 5

Range of Chart at SFR ±10%

26

32



Calibrated by: [Redacted]

Approved by: [Redacted]

3 October 2025

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ประกอบวันที่ 01/08/2568



Verification Test Report

Report No.: SO2500249-E003 / 001

Verification Date : 03 October 2025

Operate Information ☐ PM ☒ Onsite

Site : ร.ร.กรุงเทพคริสเตียน

GPS coordinates : 47Q N 1517396 E 664651

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 2197

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

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

Certificate No. : EELBP.65/0168

Date due : 17 January 2026

Traceability : TISTR

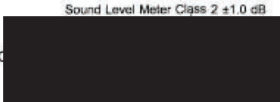
Ambient Condition : Temperature 32.60 °C Relative humidity 54.20 %

Atmospheric pressure 1013.3 hpa

Measurement Data

Refferance 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



Date : 03 October 2025



Date : 03 October 2025

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06 Rev.00



Verification Test Report

Report No.: SO2500249-E003 / 001

Verification Date : 03 October 2025

Operate Information ☐ PM ☒ Onsite

Site : โรงพยาบาลเซนต์หลุยส์

GPS coordinates : 47Q N 1517248 E 664910

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 1914

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

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

Certificate No. : EELBP.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

Refferance 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



Date : 03 October 2025



Date : 03 October 2025

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FM-SVM-05-06 Rev.00

Certificate of Calibration

Calibration Certification Information

Cal. Date:	March 4, 2025	Rootmeter 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	2.0
2	3	4	1	1.0090	6.4	4.0
3	5	6	1	0.9030	8.0	5.0
4	7	8	1	0.8610	8.8	5.5
5	9	10	1	0.7090	12.8	8.0

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \cdot \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9507	0.6967	1.4106	0.9957	0.7002	0.8878
0.9864	0.9776	1.9949	0.9514	0.9826	1.2556
0.9843	1.0900	2.2304	0.9893	1.0955	1.4036
0.9832	1.1419	2.3393	0.9882	1.1473	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=	0.99597		r=	0.99597

Calculations

$V_{std} = \Delta Vol((P_a - \Delta P)/P_{std})(T_{std}/T_a)$	$V_a = \Delta Vol((P_a - \Delta P)/P_a)$
$Q_{std} = V_{std}/\Delta Time$	$Q_a = V_a/\Delta Time$

For subsequent flow rate calculations:

$$Q_{std} = 1/m \left(\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)} \right) - b$$

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

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

877/263-7614

513)467-900

513/467-330

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

Std. dev. : 0.00005 g

- 0.00 -

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD

Part Number: E04N199E15A00V3

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 820R-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. 6.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.30 PPM	G1	±1.0% NIST Traceable	10/18/2024, 10/23/2024
NITRIC OXIDE	45.00 PPM	45.30 PPM	G1	±1.0% NIST Traceable	10/18/2024, 10/23/2024
SULFUR DIOXIDE	45.00 PPM	45.05 PPM	G1	±1.0% NIST Traceable	10/18/2024, 10/23/2024
CARBON MONOXIDE	4500 PPM	4525 PPM	G1	±1.0% NIST Traceable	10/15/2024
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	DC1201202235	CC750377	48.05 PPM NITRIC OXIDE/NITROGEN	±1.0%	May 03, 2026
PRM	12404	APEX 1324257	50.04 PPM NITRIC OXIDE/NITROGEN	±1.0%	Dec 22, 2023
GMIS	124206899128	CC323207	4.239 PPM NITROGEN DIOXIDE/NITROGEN	±1.0%	Jan 04, 2027
PRM	C2392001.1	D153445	9.87 PPM NITROGEN DIOXIDE/NITROGEN	±1.0%	Nov 22, 2024
GMIS	0712202310	CC494279	49.32 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 16, 2027
SRM	15939	FF25467	50.33 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 27, 2023
CARBON MONOXIDE	080123	KAL004712	4857 PPM CARBON MONOXIDE/NITROGEN	±1.0%	Feb 20, 2030

The SRM, NTRA, 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 8 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 SO2	FTIR	Sep 28, 2024

SO2 Analyzer Verification Test Report

Page:1/2

Calibration Report No.: API-6810003

Calibrated Date: 1-Oct-68

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: SO2 Analyzer Model: T100	Manufacturer API S/N: 2034
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Calibration System

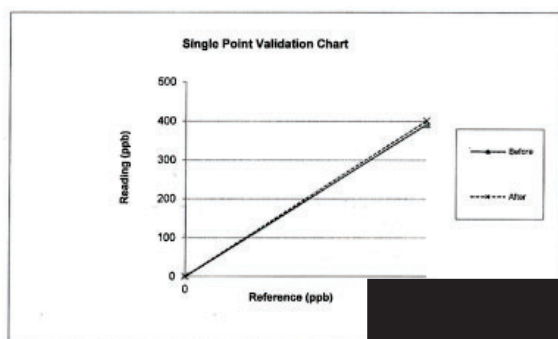
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NOx Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 45.30 PPM
	SO2 Conc 45.05 PPM
	CO Conc 4528 PPM
	Expire Date: OCT 23,2027 EB0170003

Environment: Temperature 25.1 °C

Humidity: 59 %RH

Validation Report

Status	Zero			Span		
	Reference (ppb)	Reading (ppb)	Drift (ppb)	Reference (ppb)	Reading (ppb)	Drift%
Before	0.0	-0.6	-0.6	400.0	392.3	-1.0
After	0.0	0.4	0.4	400.0	401.4	0.2



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FN-SVM-05-09 Rev.00

Calibration Report No.: API-6810003

Calibrated Date: 1-Oct-68

☒ PM ☐ Onsite

Test Function Value	Nominal range	Unit	Before	After	Note
Date	1-Oct-68				
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	-	-	
CELL TEMP	50 (+/- 1)	Degree C	50	50	
BOX TEMP	20-40	Degree C	32.6	35.1	
PMT TEMP	7 (+/-1)	Degree C	8.3	8.3	
UV lamp	1000-4900	mV	3251	3251	
Lamp Ratio	30-120	%	67.4	67.4	
STR. Light (Zero Gas)	<100	PPB	38.5	38.5	
Dark PMT	(-50) - (+200)	mV	27.8	27.8	
Dark lamp	(-50) - (+200)	mV	3.6	3.6	
SAMP PRES	20-30 constant	IN-Hg-A	28.9	27.3	
Electric Test/Optic Test					
PMT Volta	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 PPH)	0	ppb	-0.6	0.4	
Span Gas (400 PPH)	400	ppb	392.3	401.4	± 5% of Range

Calibrate By: [Signature]

Date: 1-Oct-68

Approve By: [Signature]

Date: 1-Oct-68

neediss
Neediss Supply Instrument Co.,Ltd

ประกาศใช้ 01/08/2568

FN-SVM-05-09 Rev.00



SO2 Analyzer Verification Test Report

Calibration Report No.: ESA-6810007

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Page: 1/2

Analyzer Type: SO2 Analyzer Model: AF22e	Manufacturer: Environnement SA, France S/N: 2482
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Calibration System

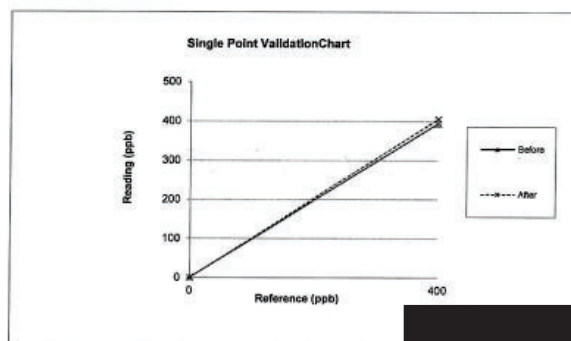
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NOx Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 45.30 PPM
	SO2 Conc 45.05 PPM
	CO Conc 4528 PPM
	Expire Date: OCT 23, 2027 EB0170003

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	1.0	1.0	400.0	395.0	-0.6
After	0.0	0.4	0.4	400.0	406.0	0.7



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FN-SVM-05-09 Rev.00



Page: 2/2

Calibration Report No.: ESA-6810007

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	UV lamp	44.3	mA
+24 V	1.2	A			
Optical Bench					
Dark UV sig.	0	mV	Dark PM sig.	88	mV
UV ref.	0	mV	PM ref.	0	mV
UV sig.	24.1	mV	PM sig.	138.6	mV
Ref. ratio	0		Meas. ratio	0.34	
Mean sig.	0.7		Raw trend	11	
Raw sig.	24.4	ppb	Inst. meas.	22.8	ppb
UV Lamp	44.7	mA	HV PM	2626.80	mV
Sample					
Internal Temp.	31.9	deg.C	Chamber T.	50	deg.C
Gas Pr.	970	hPa	Pump Pr.	355.5	hPa
Flow	18.7	l/h			

Validation By: [Redacted]

Date: 1-Oct-25

Approve By: [Redacted]

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co., Ltd

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NOx Analyzer Verification Test Report

Page:1/2

Validation Report No.: API-6810001

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: 108
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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 24.9 °C

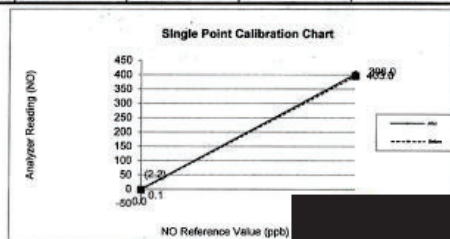
Humidity: 60 %RH

Validation Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	-1.2	0.0	-1.2	395.0	400.0	-0.6
NO ₂	-1	0.0	-1.0	1.0	0.0	0.1
NOx	-2.2	0.0	-2.2	396.0	400.0	-0.5

Validation Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.2	0.0	0.2	402.0	400.0	0.2
NO ₂	0.1	0.0	0.1	1.0	0.0	0.1
NOx	0.1	0.0	0.1	403.0	400.0	0.4



ประกาศใช้ 01/08/2568

FN-SVM-05-08 Rev.00

Page:2/2

Validation Report No.: API-6810001

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	+24V	2.4	A
OS	82.74	mA			
Optical Bench					
Dark PM sig.	0.0	mV	PM NO sig.	84.26	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

Validation By: Supachai Anankijyingyong

Approve By: [Signature]

Date: 1-Oct-25

Date: 1-Oct-25

neediss
Needle Supply Instrument Co.,Ltd

ประกาศใช้ 01/08/2568

NOx Analyzer Verification Test Report

Page:1/2

Validation Report No.: API-6810002

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: T200	Manufacturer API S/N: 2468
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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 24.9 °C

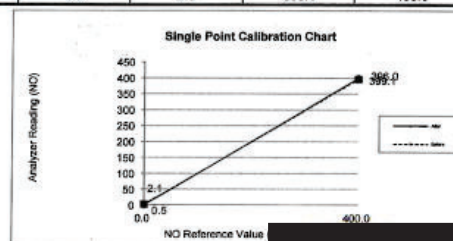
Humidity: 60 %RH

Validation Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	2.7	0.0	2.7	395.0	400.0	-0.6
NO ₂	-0.6	0.0	-0.6	1.0	0.0	0.1
NOx	2.1	0.0	2.1	398.0	400.0	-0.5

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	395.5	400.0	-0.6
NO ₂	0.2	0.0	0.2	3.6	0.0	0.5
NOx	0.5	0.0	0.5	399.1	400.0	-0.1



ประกาศใช้ 01/08/2568

Page:2/2

Validation Report No.: API-6810002

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	Nl/h	Sample Pr.	993.2	hPa

Validation By: [Signature]

Date: 1-Oct-25

Approve By: [Signature]

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co.,Ltd

ประกาศใช้ 01/08/2568

CO Analyzer Verification Test Report

Page:1/2

Validation Report No.: ESA-6810005

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: CO12e	Manufacturer: Environnement SA., France S/N: 1202
--	--

Calibration System

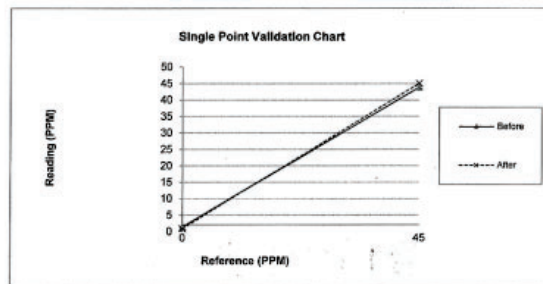
Calibrator Unit	Standard Gas
Dilutor Model: ESA MGA101 S/N: 792 ZERO AIR Generator: ZAG7001 S/N: 644	NOx Conc: 45.30 PPM NO Conc: 45.30 PPM SO2 Conc: 45.05 PPM CO Conc: 45.28 PPM Expire Date: OCT 23, 2027 EB0170003

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	1.4	1.4	45.0	43.9	-1.2
After	0.0	0.9	0.9	45.0	45.1	0.1



ประกาศใช้ 01/08/2568

FN-SVM-05-10 Rev.00

Validation Report No.: ESA-6810005

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	1.4	0.9	
Span Gas	45	PPM	43.9	45.1	± 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

CO Analyzer Verification Test Report

Page:1/2

Validation Report No.: ESA-6810009

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

Analyzer Type: CO Analyzer Model: CO12e	Manufacturer: Environnement SA, France S/N: 1203
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Calibration System

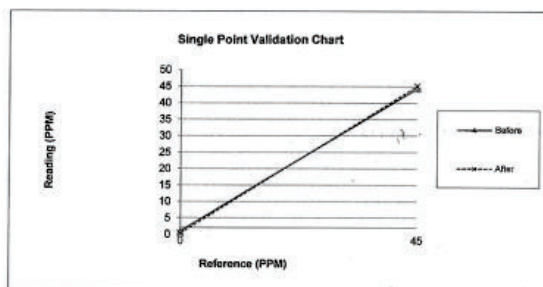
Calibrator Unit	Standard Gas
Dilutor Model ESA MGA101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 644	NOx Conc 45.30 PPM NO Conc 45.30 PPM SO2 Conc 45.05 PPM CO Conc 45.28 PPM Expire Date: OCT 23,2027 EB0170003

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	1.0	1.0	45.0	44.4	-0.7
After	0.0	0.3	0.3	45.0	45.1	0.1



ประกาศใช้ 01/08/2568

FN-SVM-05-10 Rev.00

Validation Report No.: ESA-6810009

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	3788.5	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	1.0	0.3	
Span Gas	45	PPM	44.4	45.1	± 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

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 23 May, 2025

Certification No. 261/25

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130149 ID No. : EWSDCMS1200149

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 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

: Thermochimides No.9188 : Testa : Testa 645 Serial No. 02849057

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 G

Certification No. 261/25

23 May, 2025

Serial No. 1340

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	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibration

The Result of Calibration

Sensor Pressure Model TPH-1 D

Serial No. 6473

Certification No. 261/25

23 May, 2025

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1006.72	1006.6	0.12
1007.36	1007.2	0.16
1007.32	1007.2	0.12
1007.17	1007.0	0.17
1005.40	1005.3	0.10
1006.09	1006.0	0.09
1006.51	1006.4	0.11
1003.03	1002.9	0.13
1003.56	1003.5	0.06
1004.09	1004.0	0.09
1004.61	1004.5	0.11
1005.22	1005.1	0.12
1005.33	1005.2	0.13
1005.79	1005.7	0.09
1005.55	1005.5	0.05
1004.53	1004.4	0.13
1005.32	1005.2	0.12
1004.09	1004.0	0.09
1004.51	1004.4	0.11
1005.06	1005.0	0.08

Ave

The Result of Calibration

Sensor Temperature Model TPH-1 D

Certification No. 261/25

23 May, 2025

Serial No. 6473

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	45.6	0.1
30.3	30.3	0.0
15.6	15.6	0.0





The Result of Calibration

Sensor Humidity Model TPH-1 D Certification No. 261/25
23 May, 2025 Serial No. 6473 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
86.3	87.5	-1.2
65.1	65.9	-0.8
42.3	42.8	-0.5

Calibrate



Date of Issue 23 May, 2025

Certification No. 261/25

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.....

(นายวัชรพล ทรัพย์วิวัฒน์)

วิศวกรชำนาญการ



THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469
Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 10 September, 2025

Certification No. 423/25

Page : 1 of 6

Object : เครื่องมือตรวจวัดอุตุนิยมวิทยา

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130151 ID No. : EWSDCMS1200151

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.2 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

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 423/25

10 September, 2025

Serial No. 1225

Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.02	-	-	3.0	0.02
5.00	-	-	5.0	0.00
7.04	-	-	6.9	0.14
9.02	-	-	9.0	0.02
11.01	-	-	10.9	0.11
13.01	-	-	13.0	0.01
15.01	-	-	14.9	0.11
17.02	-	-	17.0	0.02
20.02	-	-	19.9	0.12

Vane Angel Bench Stand Model 18112

Young Meteorological Instruments

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



The Result of Calibration

Sensor Pressure Model TPH-1 C

Serial No. 6276

Certification No. 423/25

10 September, 2025

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1007.78	1007.0	0.78
1007.45	1006.6	0.85
1007.19	1006.2	0.99
1005.08	1004.1	0.98
1004.94	1004.1	0.84
1003.90	1003.1	0.80
1004.00	1003.3	0.70
1004.35	1003.5	0.85
1004.85	1004.0	0.85
1005.10	1004.3	0.80
1005.41	1004.5	0.91
1005.60	1004.8	0.80
1004.82	1004.1	0.82
1005.23	1004.4	0.83
1005.48	1004.6	0.88
1005.69	1004.8	0.89
1006.20	1005.4	0.80
1005.92	1005.1	0.82
1003.55	1002.8	0.75
1004.73	1003.9	0.83

Average



The Result of Calibration

Sensor Temperature Model TPH-1 C

Certification No. 423/25

10 September, 2025

Serial No. 6276

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45.4	-0.2
30.4	30.5	-0.1
15.6	15.6	0.0



The Result of Calibration

Sensor Humidity Model TPH-1 C Certification No. 423/25
10 September, 2025 Serial No. 6276 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
92.6	95.5	-2.9
65.2	66.5	-1.3
42.2	42.5	-0.3



Date of Issue 10 September, 2025

Certification No. 423/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING
BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วทรง 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
Manufacturer : Pulsar
Model : 103
Serial No. : 98971

Ambient Environment
Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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.
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FM.BL.MTC.002 Rev.5

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 $^\circ$ 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	$\pm 0.40 \text{ dB}$

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.
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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.



เอกสารผลการสอบเทียบเครื่องมือตรวจวัด ครั้งที่ 4/2568

สถานีโรงเรียนกรุงเทพคริสเตียนวิทยาลัย
และสถานีโรงพยาบาลเซนต์หลุยส์
ตรวจวัดวันที่ 2-7 เมษายน 2569

TSP High Volume Sampler Calibration

Verification Report No.
SO2500303-E001 -TSP 01

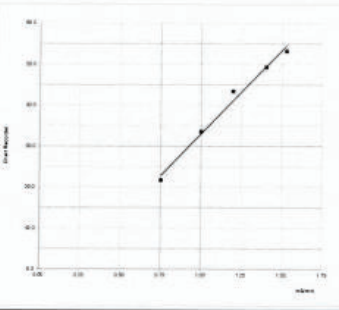
☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517392 E 664627
 Sampler: ETSW35
 Recorder: ECRAN00031070
 Date: 3 Dec 25
 Technical Approval:

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. Qstd Slope: 2.08933
 Model: TE-5025A Qstd Intercept: -0.02615
 Serial#: 2067 Date Certified: 4 Mar 25
 Due Date: 03-Mar-26

CALIBRATIONS				
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	49.26
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	21.68

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: _____
 Approved by: _____

ปี 2568 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500303-E001 -PM 01

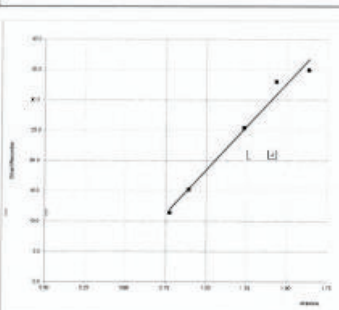
☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517392 E 664627
 Sampler: EPM10W35
 Recorder: ECRDS019075261
 Date: 3 Dec 25
 Technical Approval:

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				
Plate or Test #	H2O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.00	1.840	55.0	34.94
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

LINEAR REGRESSION
 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



Calibrated by: _____
 Approved by: _____

ปี 2568 01/08/2568

TSP High Volume Sampler Calibration

Verification Report No.
SO2500303-E010/R01 - TSP 01

☐ PM ☒ Onsite

Site: กรุงเทพมหานคร

UTM: N 1517286 E 664906

Sampler: ETS930

Recorder: ECRD5016339505

Date: 7 Jan 26

Technical: Paritop P.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1016.6	Corrected Pressure (mm Hg): 762.5
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 #	H ₂ O (in)	Q _{std} (m ³ /min)	I (chart)	IC (corrected)
1	13.10	1.745	52.0	51.48
2	10.00	1.527	48.0	47.52
3	7.60	1.333	42.0	41.58
4	4.50	1.029	34.0	33.66
5	2.80	0.785	30.0	29.70

LINEAR REGRESSION

Slope = 23.7301

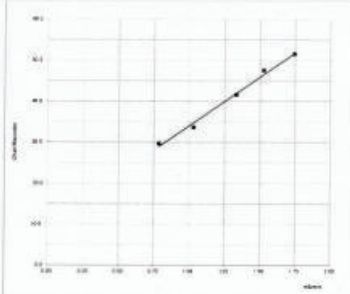
Intercept = 10.3306

Corr. coeff. = 0.9957

of Observations: 5

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

51



Calibrated by:

Approved by:

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วันที่พิมพ์: 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500303-E010/R01 - PM 01

☐ PM ☒ Onsite

Site: กรุงเทพมหานคร

UTM: N 1517286 E 664906

Sampler: EPM10430

Recorder: C

Date: 7 Jan 26

Technical: Paritop P.

Approval: Wisan R.

CONDITIONS

Barometric Press. (hPa): 1016.6	Corrected Pressure (mm Hg): 762.5
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: 1.29516
Model: TE-5025A	Intercept: -0.01772
Serial#: 2067	Date Certified: 4 Mar 25
	Due Date: 03-Mar-26

Plate or Test #	H ₂ O (in)	Q _{std} (m ³ /min)	I (chart)	IC (corrected)
1	13.30	1.794	52.0	52.89
2	8.60	1.445	46.0	39.06
3	6.30	1.239	38.0	24.03
4	3.90	0.978	32.0	20.24
5	2.20	0.738	24.0	15.18

LINEAR REGRESSION

Slope = 96.9676

Intercept = 3.2340

Corr. coeff. = 0.9925

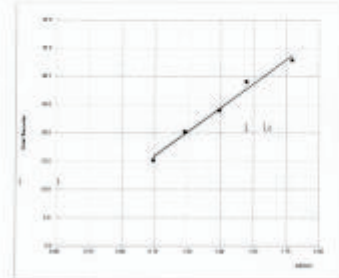
SFR = 1.000

SSR = 31.99

of Observations: 5

Range of Chart at SFR ±15%: 30

34



Calibrated by:

Approved by:

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วันที่พิมพ์: 01/08/2568

Verification Test Report

Report No.: SQ2500303-E003 / 001

Verification Date : 03 December 2025

Operate Information ☐ PM ☒ Onsite

Site : บ.ท.กรุงเทพเฟิร์สลิ้น

GPS coordinates : 47Q N 1517396 E 664851

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 1862

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

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

Certificate No. : EEL BP 650168

Date due : 17 January 2026

Traceability : T15TR

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 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.

ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00

Verification Test Report

Report No.: SQ2500303-E0012-R01 / 001

Verification Date : 07 January 2025

Operate Information ☐ PM ☒ Onsite

Site : โครงการบางเขนสีหลอกสี

GPS coordinates : 47P N 1517256 E 664913

Instrument Information

Equipment : Sound Level Meter

Manufacturer : Pulsar

Model : 44

Serial No : 2200

Scale Rang : 20dB-140dB

Class : 2

Reference Standard

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

Certificate No. : EEL BP 650168

Date due : 17 January 2026

Traceability : T15TR

Ambient Condition : Temperature 32.50 °C

Relative humidity 56.20 %

Atmospheric pressure 1016.8 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 : 07 January 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.

ประกาศใช้ 01/08/2568

FM-SVM-05-06 Rev.00

Certificate of Calibration

Certificate No. : **68-200034-1** Page : 1 of 2

Submitted by : [REDACTED]

Equipment : Electronic Balance
 Manufacturer : Sartorius Model : SECURA224-1S
 Serial No. : 0034803270 ID No. : ELABBALANCE04
 Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Balance Room, Envilab Co., Ltd.
 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 : Akarapoth Thippibhai

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	CG2240039	01 Nov 2025	National Institute of Metrology (Thailand) (NIMT)

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 permission of the issuing authority.

CAL-0001-03

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	0.0001	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	A	B	C	D	E
50 g	0.0004	0.0004	0.0005	0.0004	0.0000

Repeatability

Load test	Std. dev.
200 g	0.00005 g

-o0o-

Certificate of Calibration

Calibration Certification Information			
Cal. Date:	March 4, 2025	Rootmeter S/N:	438320
Operator:	Jim Tisch	Tas:	294
Calibration Model #:	TE-5025A	Pat:	746.0
		Calibrator S/N:	2067
			"K mm Hg

Run	Vol. Inlet (ml)	Vol. Final (ml)	Δ Vol. (ml)	Δ Time (min)	ΔP (mm Hg)	ΔH (ln H ₂ O)
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	17.8	8.00

Data Tabulation							
Vold (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pa_{std}} \right) \left(\frac{V_{std}}{V} \right) \left(\frac{T_{std}}{T_a} \right)}$ (y-axis)	Vu	Qu (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)		
0.9907	0.6967	1.4105	0.9957	0.7002	0.8878	QSTD mm mm mm mm mm	QA mm mm mm mm mm
0.9864	0.9776	1.9949	0.9914	0.9826	1.2556		
0.9843	1.0900	2.2304	0.9895	1.0935	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		
	mm=	2.06933			1.29578		
	mm=	-0.02815			-0.02772		
	mm=	0.99997			0.99997		

Calculations			
Vel=	$\Delta Vol / (Pa \cdot \Delta P / Pstd) / (Tstd / Ta)$	Var=	$\Delta Vsc / (Pa \cdot \Delta P / Pa)$
Qstd=	Vel / $\Delta Time$	Qv=	Var / $\Delta Time$
For subsequent flow rate calculations:			
Qstd=	$1/h \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} \right) \cdot \Phi$	Qv=	$1/h \left(\sqrt{\Delta H \left(Ta / Pa \right)} \right) \cdot \Phi$

Standard Conditions	
Wtd:	298.15 °g
Pstd:	760 mm Hg
Key	
GR:	calibrator manometer reading (in H ₂ O)
MP:	rootsmeter manometer reading (mm Hg)
TA:	actual absolute temperature (°K)
PA:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

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

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

www.fisch-ny.com
 TOLL FREE: (877)263-71
 FAX: (513)457-9

Grade of Product: EPA PROTOCOL STANDARD

Customer:	AIR LIQUIDE	
	(THAILAND) LTD	
Part Number:	EDANRRE15AD0V3	Reference Number: 165-403162930-1
Cylinder Number:	EB4170003	Cylinder Volume: 144.0 CF
Laboratory:	120 - Plumsteadville - PA	Cylinder Pressure: 2015 PSIG
POVP Number:	A12034	Valve Outlet: 693
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date: Oct 23, 2024

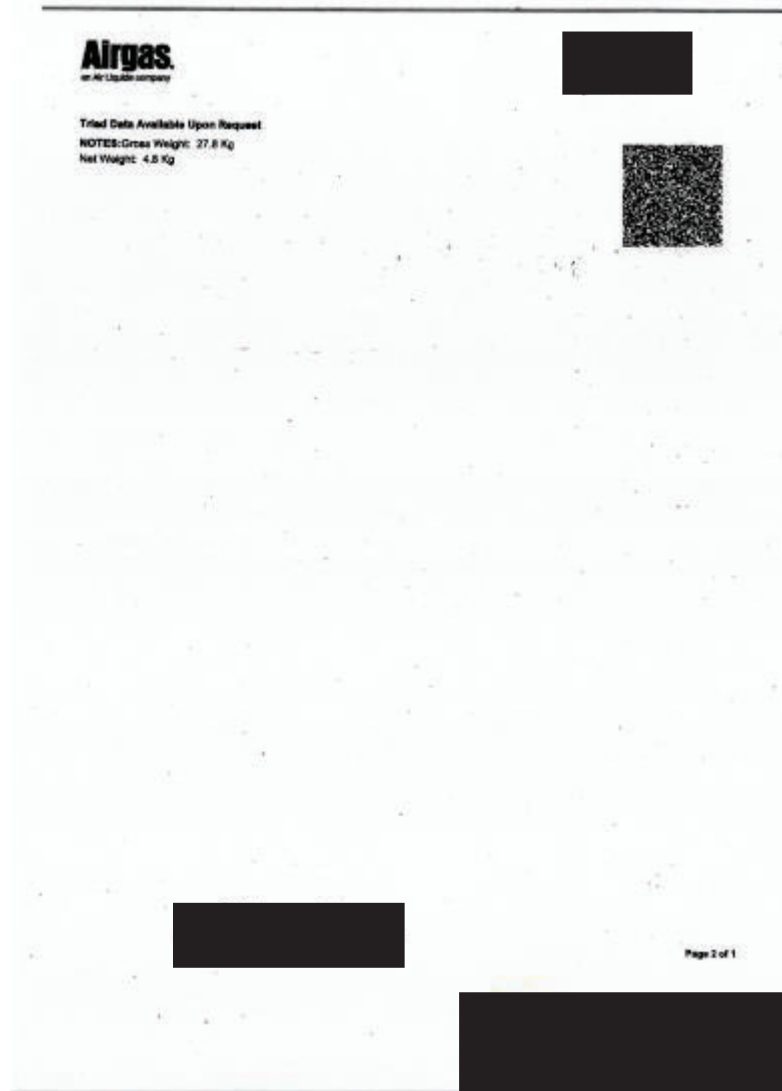
Expiration Date: Oct 21, 2027

Calibration performed in accordance with EPA Traceability Protocol for Assay and Certification of Reference Collection Standards (May 2014) document EPA-823-R-12-013, 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 medium. All concentrations are on a substrate basis unless otherwise noted. The results apply only to the listed target. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder before 100 days, i.e. 2.7 years maximum.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NO ₂	45.00 PPM	45.30 PPM	Q1	+/- 1.0% NIST Traceable	10/19/2024, 10/23/2024
NITRIC OXIDE	45.00 PPM	45.30 PPM	Q1	+/- 0.5% NIST Traceable	10/19/2024, 10/23/2024
SULFUR DIOXIDE	45.00 PPM	45.55 PPM	Q1	+/- 0.7% NIST Traceable	10/19/2024, 10/23/2024
CARBON MONOXIDE	4500 PPM	4525 PPM	Q1	+/- 0.5% NIST Traceable	10/19/2024
NO ₂ /NO _x	See				

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
AMES	0226002222-10	453 PMM	45.3 PMM NITROGEN DIOXIDE/NITROGEN	+0.2%
PMMA	12304	50.04 PMM	50.04 PMM NITROGEN DIOXIDE/NITROGEN	+0.2%
AMES	022600186/126	4236 PMM	4.236 PMM NITROGEN DIOXIDE/NITROGEN	+0.2%
PMMA	022600301.1	9754448	9.87 PMM NITROGEN DIOXIDE/NITROGEN	+0.2%
PMMA	022600222-10	45.95 PMM	45.95 PMM SULFUR DIOXIDE/NITROGEN	+0.2%
SRM	1918a	FT25467	50.33 PMM SULFUR DIOXIDE/NITROGEN	+0.2%
CARBON MONOXIDE	880123	KALN01712	4687 PMM CARBON MONOXIDE/NITROGEN	+0.8%

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS ULTRAMAT FIM18050	NDH	Oct 09, 2004
Molecular 6000 FTR AUP2910245 NO	FTIR	Oct 17, 2004
Molecular 6000 FTR AUP2910245 NC2	FTIR	Oct 03, 2004
Molecular 6000 FTR AUP2910245 GC2	FTIR	Nov 26, 2004



Verification/Calibration Test Report

Report No.: ESA-6612001
Verification Date: 01 December 2025

Page: 1/2

Operate Information ☒ PM ☐ Onsite
Site: Enslab Co., Ltd.
GPS coordinates: 47P N 1014454 E 654233

Instrument Information
Equipment: NO2 Analyzer
Model: AC30a
Manufacturer: ESA
Serial No: 2398

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No:	ES0170303	ZERO AIR Calibrator	Model: ZAG7001
Certificate No:	2015 F0, G		S/N: 944
Date Due:	OCT 23, 2027	Detector	Model: ESA MGC161
Traceability:	Air Liquide		S/N: 792

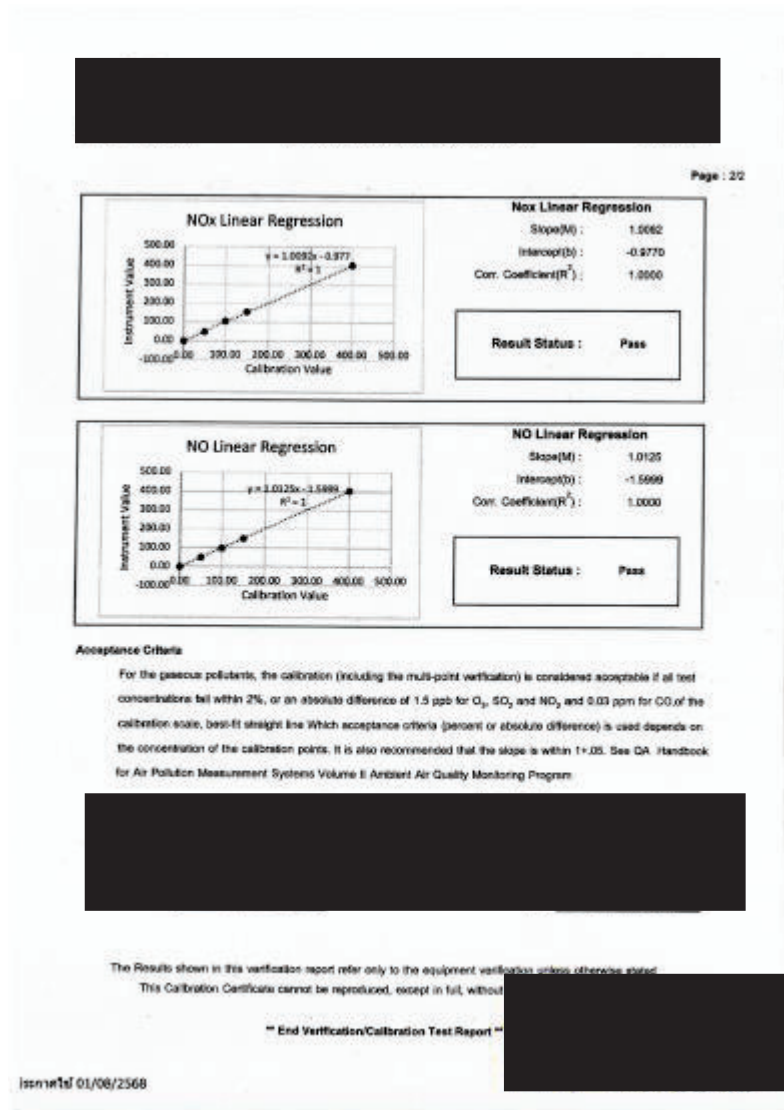
Ambient Condition: Temperature 25.00 °C Relative humidity 55.30 %
Atmospheric pressure 1011.0 hpa

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	49.35	100.19	99.29	149.69	149.16	402.73	402.40
	0.12	-1.13	49.72	49.03	100.47	99.37	149.25	149.58	405.20	405.20
	0.13	-1.13	49.61	49.23	99.82	99.86	147.43	149.42	403.1	403.1
	0.13	-1.13	49.11	48.57	100.39	99.06	147.81	152.44	402.50	402.40
	0.14	-0.47	50.45	50.32	99.42	99.19	151.27	147.07	403.10	405.20
Ins. Value Average	0.13	-0.80	49.69	49.30	99.69	99.72	149.69	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	-0.26	0.28	0.80	1.71	0.54	-0.68	-0.40
Percent difference (Best Fit vs Ins.(Y) Value)			0.41%	0.56%	-0.25%	-0.83%	-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 range generated approximately 80% full scale.
2. Instrument Value(Y) is Concentration values from instrument. The worksheet will

หมายเลข 01/06/2568



Verification/Calibration Test Report

Report No. : AP16812034
Verification Date : 01 December 2025

Operate Information ☒ PM ☐ Orsive

Site : [Redacted]

GPS coordinates : 47P N 1514454 E 654233

Instrument Information
Equipment : SO₂ Analyzer
Model : AF22a
Manufacturer : ESA
Serial No : 2462

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 F0,G		SN : 644
Date Due :	OCT 23,2027	Dilutor	Model : ESA M3C101
Traceability :	Air Liquide		SN : 792

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %
Atmospheric pressure 1011.0 hpa

Measurement Data

Calibration Gas Level	Zero Conc.	Level 1 Conc.	Level 2 Conc.	Level 3 Conc.	Level 4 Conc.
	(Indicate Unit) ☐ ppb ☐ ppm	(Indicate Unit) ☒ ppb ☐ ppm	(Indicate Unit) ☒ ppb ☐ ppm	(Indicate Unit) ☒ ppb ☐ ppm	(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	399.40
	-1.13	47.86	96.19	146.32	398.50
	-1.13	49.86	99.19	149.32	397.10
	-1.13	47.86	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=Ma+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

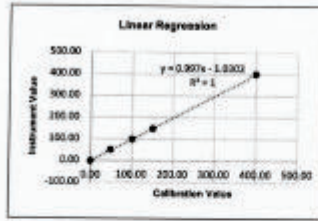
Note :

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

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

Issued on 01/08/2568

Page : 2/2



Linear Regression
 Slope(M) : 0.9970
 Intercept(b) : -1.9303
 Corr. Coefficient(R²) : 1.0000

Result Status : Pass

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+/-0.5. See QA Handbook for Air Pollution Measurement Systems Volume 6 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 permission of company.

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

วันที่ 01/08/2568

Verification/Calibration Test Report

Report No.: ESA-8812004
 Verification Date : 01 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Orsibe
 Site : Envalab Co.,Ltd.
 GPS coordinates : 47P N 1514454 E 654233

Instrument Information
 Equipment : CO Analyzer Manufacturer : ESA
 Model : CO12e Serial No : 1202

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170033	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 PD/G		S/N : 944
Date Due :	OCT 23,2027	Dilutor	Model : ESA MDC101
Traceability :	Air Liquide		S/N : 792

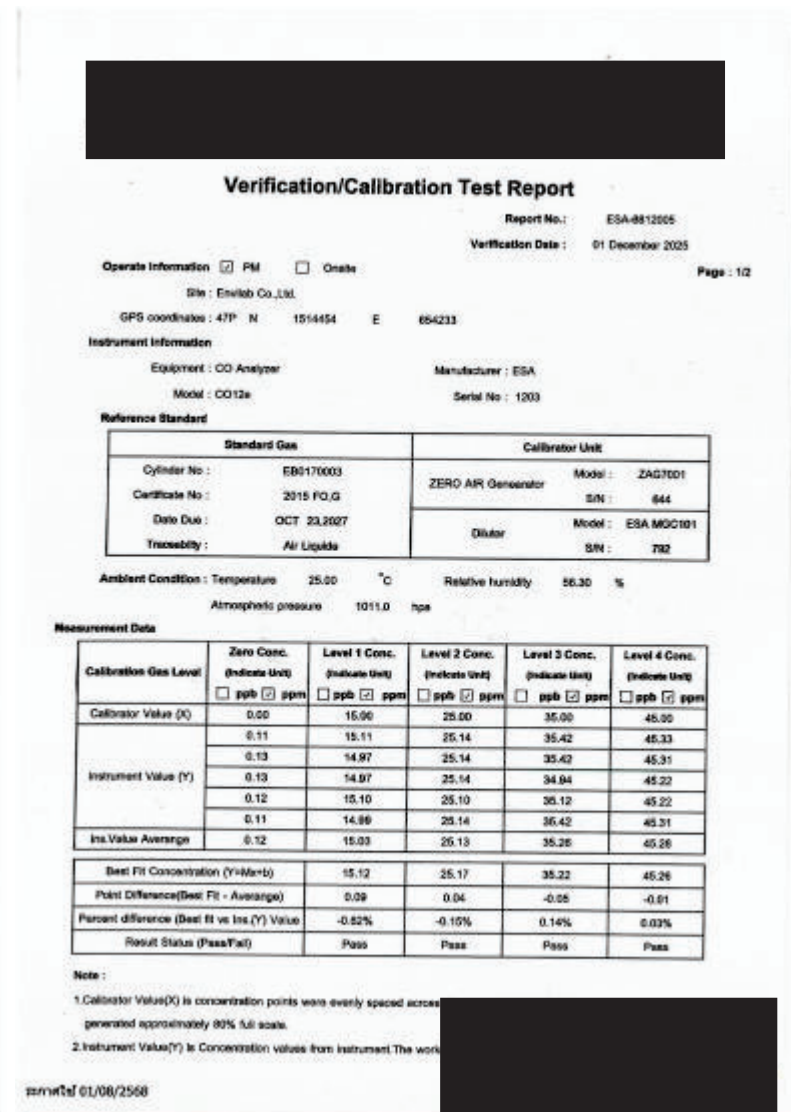
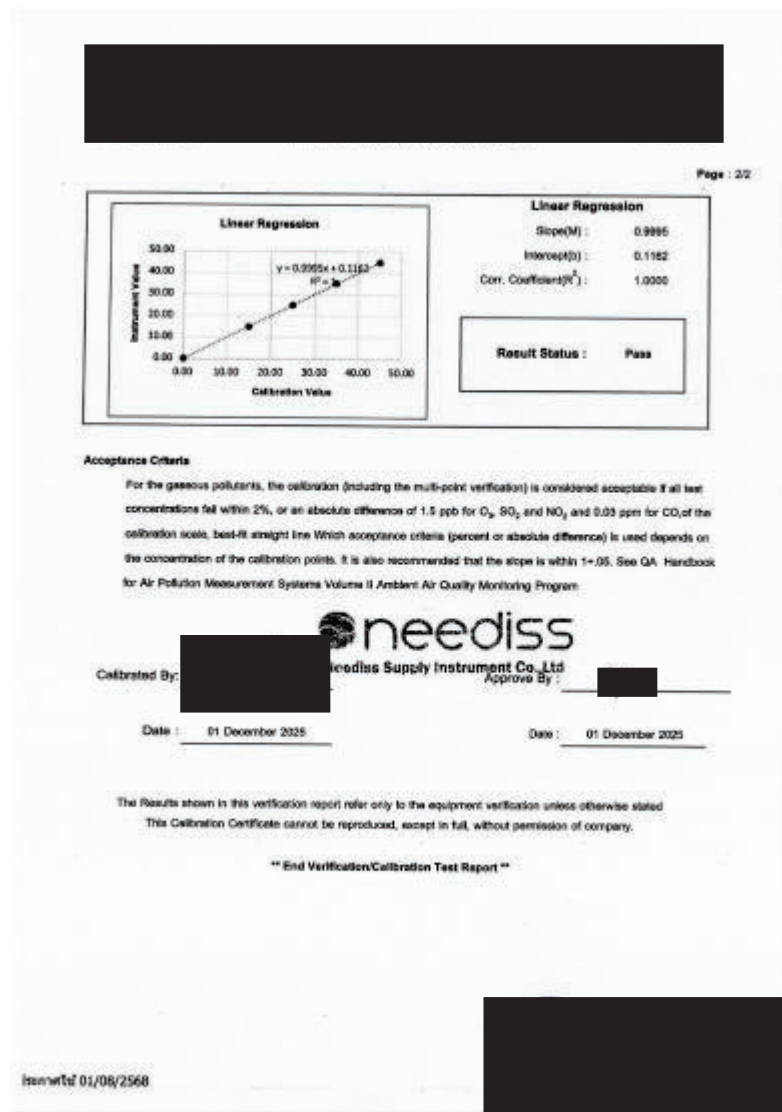
Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %
 Atmospheric pressure 1011.0 hpa

Measurement Data

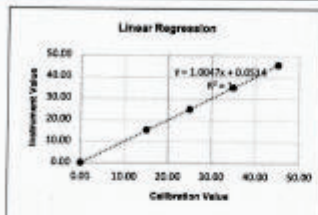
Calibration Gas Level	Zero Conc.	Level 1 Conc.	Level 2 Conc.	Level 3 Conc.	Level 4 Conc.
	(Indicate Unit) ☐ ppb ☒ ppm	(Indicate Unit) ☐ ppb ☒ ppm	(Indicate Unit) ☐ ppb ☒ ppm	(Indicate Unit) ☐ ppb ☒ ppm	(Indicate Unit) ☐ ppb ☒ ppm
Calibrator Value (X)	0.00	15.00	25.00	35.00	45.00
Instrument Value (Y)	0.11	15.11	25.14	35.42	44.93
	0.13	14.97	25.14	35.42	44.99
	0.13	14.97	25.14	34.94	44.99
	0.12	15.10	25.10	35.12	44.95
	0.11	14.99	25.14	35.42	45.01
Ins. Value Average	0.12	15.03	25.13	35.29	44.97
Best Fit Concentration (Y=Meib)		15.11	25.10	35.10	45.09
Point Difference(Best Fit - Average)		0.08	-0.03	-0.17	0.12
Percent difference (Best Fit vs Ins.(Y) Value		-0.53%	0.12%	0.47%	-0.28%
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

วันที่ 01/08/2568



Page : 2/2



Linear Regression
 $Y = 1.0047x + 0.0514$
 $R^2 = 0.9999$

Linear Regression
 Slope(M) : 1.0047
 Intercept(b) : 0.0514
 Cor. Coefficient(R²) : 0.9999

Result Status : Pass

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: [Signature]

Date: 01 December 2025


 Ins Supply Instrument Co., Ltd.
 Approve By: [Signature]

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 **

โทรศัพท์ 01/08/2568

Verification/Calibration Test Report

Report No.: ESA-8812011

Page : 1/2

Verification Date : 01 December 2025

Operate Information ☒ PM ☐ Onsite

Site : Enrich Co., Ltd.

GPS coordinates : 47P N 1514454 E 654233

Instrument Information

Equipment : NO2 Analyzer Manufacturer : API

Model : T200 Serial No : 106

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No. : EB0170003		ZERO AIR Generator Model : ZAG7001	
Certificate No. : 2015 FO,G		SIN : 644	
Date Due : OCT 23,2027		Dilutor Model : ESA NGC101	
Traceability : Air Liquide		S/N : 792	

Ambient Condition : Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

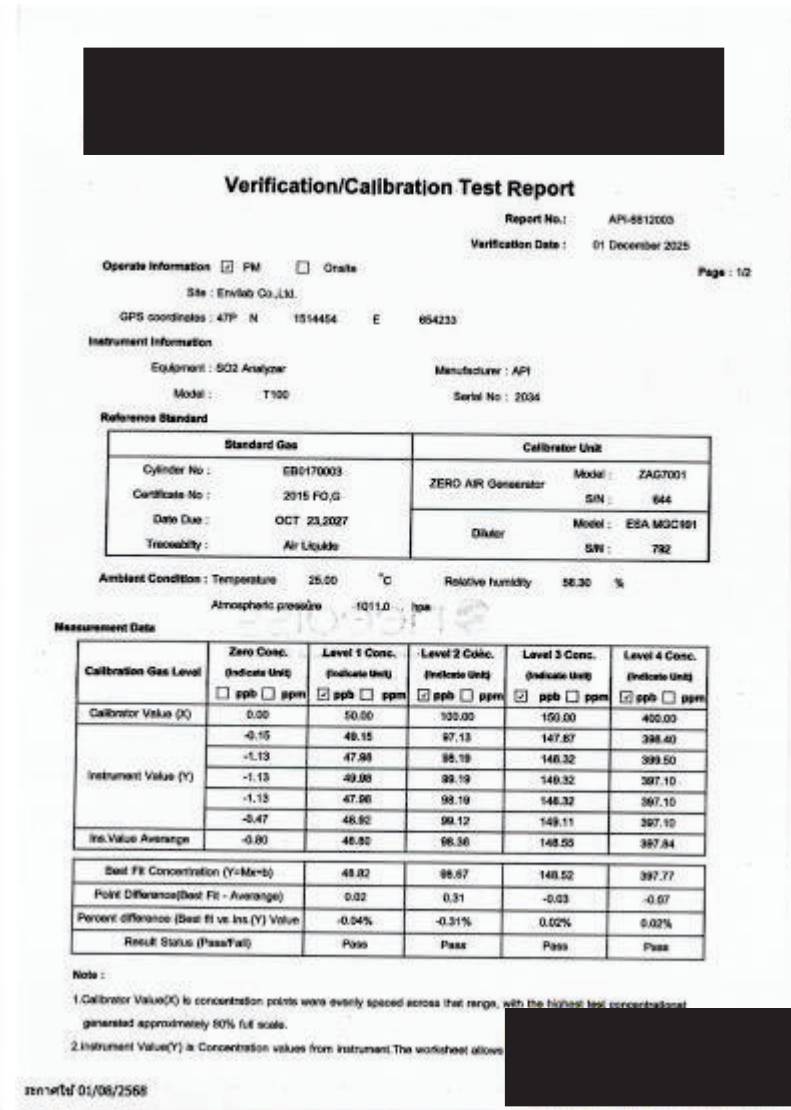
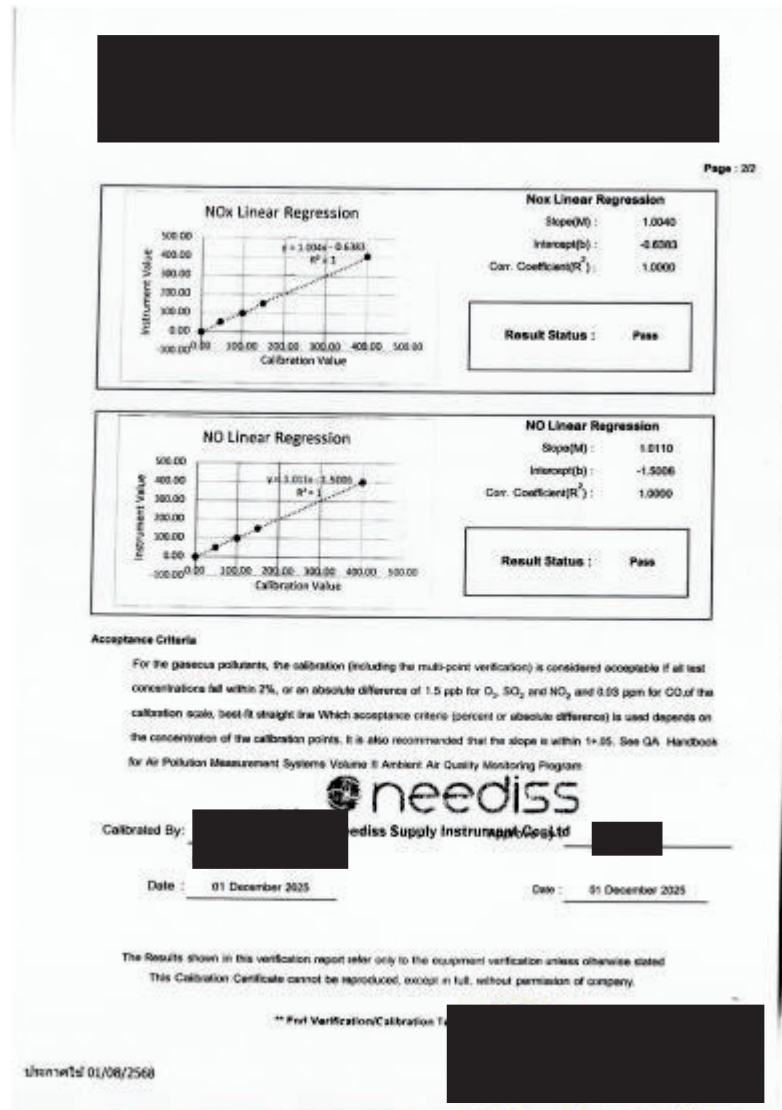
Calibration Gas Level	Zero Conc. (Indicate Unit)		Level 1 Conc. (Indicate Unit)		Level 2 Conc. (Indicate Unit)		Level 3 Conc. (Indicate Unit)		Level 4 Conc. (Indicate Unit)	
	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm
Calibrator Value (X)	0.00	0.00	50.00	50.00	100.00	100.00	150.00	150.00	400.00	400.00
Instrument Value (Y)	0.11	-0.15	49.64	49.30	100.19	98.29	149.99	149.16	401.50	403.10
	0.12	-1.13	49.72	49.03	100.47	99.37	149.25	150.56	401.90	403.30
	0.13	-1.13	49.51	49.29	99.82	99.69	147.43	149.42	401.50	403.99
	0.13	-1.13	49.11	48.57	100.39	98.08	147.61	152.44	401.90	403.30
	0.14	-0.47	50.45	50.32	99.42	99.19	151.27	147.07	403.45	403.90
Ins Value Average	0.13	-0.80	49.69	48.30	99.65	98.72	148.89	149.73	401.45	403.23
Best Fit Concentration (Y=Ma+b)			49.56	49.05	99.70	99.99	149.96	150.15	400.96	402.89
Point Difference(Best Fit - Average)			-0.12	-0.25	0.10	0.66	1.27	0.42	-0.49	-0.34
Percent difference (Best Fit vs Ins(Y) Value)			0.25%	0.51%	-0.10%	-0.80%	-0.85%	-0.26%	0.12%	0.09%
Result Status (Pass/Fail)			Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

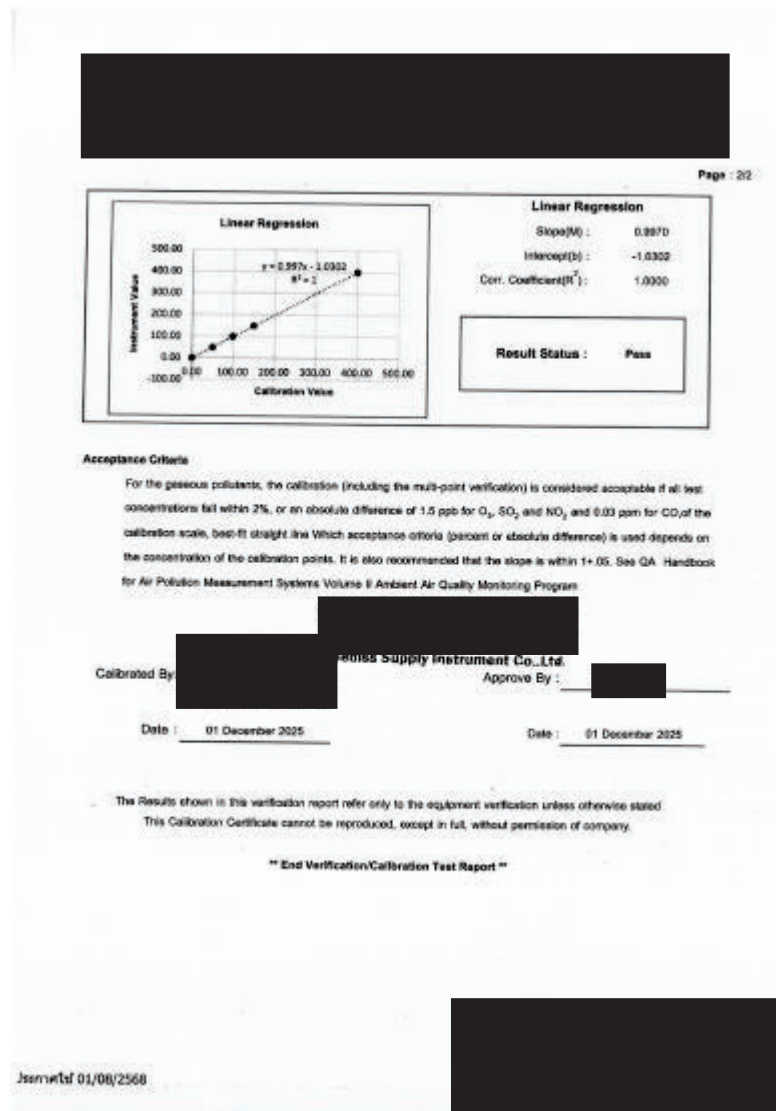
Note:

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

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

โทรศัพท์ 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 : Pulzar Model : 103 Serial No. : 98971	Ambient Environment Temperature : (23 ± 3) °C Relative Humidity : (50 ± 15) % Ambient Pressure : (101.325 ± 1.500) kPa
--	---

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.
3. Programmable Attenuator Tamaawa 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-T722A 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 1
1/2 inch Brüel&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 Brüel&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 1
1/2 inch Brüel&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 Brüel&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 Brüel&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 Brüel&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 : [Redacted]

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 : 23 May, 2025 Certification No. 260/25
Page : 1 of 6

Object : เครื่องวัดความเร็วลม
Manufacturer : DYADON
Type : Data Logger MS-100
Serial No. : 130148 ID No. : EWSDCMS1200148
Customer :
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa
NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112
: Micromanometer Theodor Friedrich FC014 Serial No. 8610119 : 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 TIR-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

The Result of Calibration
Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 260/25
23 May, 2025 Serial No. 1222 Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure Inches Hg	Vacuum Inches Hg	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.1	-0.09
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.06

Vane Angel Bench Stand Model 18112
Young Meteorological Instruments

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

Sensor: Pressure Model TPH-1 C

Serial No. 6273

Certification No. 260/25

23 May, 2025

Page : 3 of 6

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1006.72	1006.1	0.62
1007.36	1006.0	0.86
1007.32	1006.0	0.52
1007.17	1006.6	0.57
1005.40	1004.9	0.50
1006.09	1005.4	0.69
1006.51	1006.0	0.51
1005.03	1002.6	0.43
1005.99	1003.1	0.46
1004.09	1003.5	0.59
1004.61	1004.1	0.51
1005.22	1004.6	0.42
1005.33	1004.9	0.43
1005.79	1005.2	0.59
1005.55	1005.0	0.55
1004.53	1003.9	0.63
1005.32	1004.9	0.42
1004.09	1003.5	0.49
1004.51	1003.9	0.61
1005.28	1004.6	0.48

Average



Sensor Temperature Model TPH-1 C

Certification No. 260/25

23 May, 2025

Serial No. 6273

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	45.8	-0.1
30.3	30.4	-0.1
15.6	15.6	0.0



The Result of Calibration

Sensor Humidity Model TP10-1 C Certification No. 260/25
 23 May, 2025 Serial No. 6273 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
86.3	86.3	-2.0
66.1	66.3	-1.2
42.9	42.6	-0.3





Date of Issue 23 May, 2025 Certification No. 260/25
 Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING BUCKET Product [REDACTED] ทำการสอบเทียบกับแก้ววัดฝนแบบแก้วควง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71682 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 23 May, 2025 Certification No. 261/25

Page : 1 of 6

Object : เครื่องวัดความเร็วลม

Manufacturer : DYACON

Type : Data Logger MS-100

Serial No. : 130149 ID No. : EWSOCMS1200149

Customer :

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112

: Micromanometer Theodor Friedrich P0014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241480 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-600-3TV (sensor TR-90A16)

Serial Number 110730029 (sensor 120629086)

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

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

The Result of Calibration

Sensor Wind Speed & Wind Direction Model WSD-1.0 Certification No. 261/25

23 May, 2025 Serial No. 1340 Page : 2 of 6

Standard Ultrasonic Anemometer m/sec	BOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure inches Hg	Vacuum inches Hg	Velocity m/sec	Correction m/sec
1.00	-	-	1.0	0.00
3.00	-	-	3.0	0.00
5.00	-	-	5.0	0.00
7.04	-	-	7.0	0.04
9.02	-	-	9.0	0.02
11.01	-	-	11.0	0.01
13.01	-	-	13.0	0.01
15.01	-	-	15.0	0.01
17.02	-	-	17.0	0.02
20.02	-	-	20.0	0.02

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

The Result of Calibration

Sensor: Pressure Model TP91-1 D

Serial No. 6473 Certification No. 261/25

23 May, 2025 Page : 3 of 6

Standard Parameter Pressure	Tested Parameter Pressure	Correction
1006.72	1006.6	0.12
1007.36	1007.2	0.16
1007.32	1007.2	0.12
1007.17	1007.0	0.17
1005.40	1005.3	0.10
1006.09	1006.0	0.09
1008.51	1008.4	0.11
1003.03	1002.9	0.13
1003.96	1003.5	0.46
1004.09	1004.0	0.09
1004.61	1004.5	0.11
1005.22	1005.1	0.12
1006.33	1006.2	0.13
1005.79	1005.7	0.09
1005.55	1005.5	0.05
1004.63	1004.4	0.13
1005.32	1005.2	0.12
1004.09	1004.0	0.09
1004.51	1004.4	0.11
1006.08	1006.0	0.08
Average		



The Result of Calibration

Sensor: Temperature Model TP91-1 D

Serial No. 6473 Certification No. 261/25

23 May, 2025 Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.7	45.6	0.1
30.3	30.3	0.0
15.0	15.0	0.0



The Result of Calibration

Sensor Humidity Model TH10-1 D Certification No. 261/25

23 May, 2025 Serial No. 6473 Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
66.3	67.5	-1.2
65.1	65.9	-0.8
42.3	42.6	-0.3



Date of Issue 23 May, 2025 Certification No. 261/25

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ Davis Instruments แบบ TIPPING BUCKET Product No. #7852 Mfg. Code. [REDACTED] ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วคว่ำ GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 710R2 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)



[REDACTED]

วิศวกรชำนาญการ