

ภาคผนวกที่ 5-3
เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
ครั้งที่ 1/2568
สถานีโรงเรียนกรุงเทพคริสเตียนวิทยาลัย
สถานีโรงพยาบาลเซนต์หลุยส์
วันที่ตรวจวัดวันที่ 3-8 ตุลาคม 2568

TSP High Volume Sampler Calibration

Verification Report No.
 SO2500249-E001 -TSP 01

☐ PM ☒ Onsite
 Site: ร.ร.เทพศิรินทร์
 UTM : N 1517392 E 664627
 Sampler: ETS#31
 Recorder: ECRDS016339506

Date: 3 Oct 25
 Technical: [REDACTED]
 Approval: [REDACTED]

CONDITIONS

Barometric Press. (hPa): 1007.5
 Temperature (deg C): 32.0
 Average Press. (hPa): 1013.0
 Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 755.7
 Temperature (deg K): 305.0
 Corrected Avg. Press. (mm Hg): 759.8
 Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

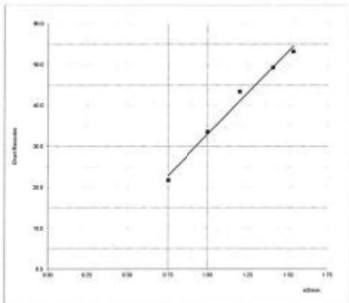
Brand: Tisch Environmental, Inc
 Model: TE 6025A
 Serial#: 2067

Qstd Slope: 2.06933
 Qstd Intercept: 0.02816
 Date Certified: 4 Mar 25
 Due Date: 03-Mar-26

CALIBRATIONS

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	46.28
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: [REDACTED]
 3 October 2025
 Approved by: [REDACTED]
 3 October 2025

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ประกอบไฟล์ 01/08/2568

PM10 High Volume Sampler Calibration

Verification Report No.
 SO2500249-E001 -PM 01

☒ PM ☐ Onsite
 Site: ร.ร.เทพศิรินทร์
 UTM : N 1517392 E 664627
 Sampler: EPM10#39
 Recorder: ECRDS016075261

Date: 3 Oct 25
 Technical: [REDACTED]
 Approval: [REDACTED]

CONDITIONS

Barometric Press. (hPa): 1007.5
 Temperature (deg C): 32.0
 Average Press. (hPa): 1013.0
 Average Temp. (deg C): 30.0

Corrected Pressure (mm Hg): 755.7
 Temperature (deg K): 305.0
 Corrected Avg. Press. (mm Hg): 759.8
 Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

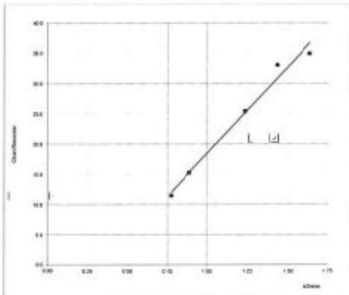
Brand: Tisch Environmental, Inc
 Model: TE-5025A
 Serial#: 2067

Slope: 1.29578
 Intercept: -0.01777
 Date Certified: 4 Mar 25
 Due Date: 3 Mar 26

CALIBRATIONS

Plate or Test #	H ₂ O (in)	Qa (m3/min)	I (chart)	IC (corrected)
1	11.00	1.840	55.0	34.94
2	8.40	1.435	52.0	31.04
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: [REDACTED]
 3 October 2025
 Approved by: [REDACTED]
 3 October 2025

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ประกอบไฟล์ 01/08/2568

TSP High Volume Sampler Calibration

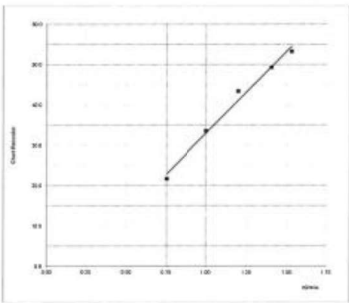
Verification Report No.
 SO2500249-E001 -TSP 02

☐ PM ☒ Onsite
 Site: ร.พ.เชลยวงศ์
 UTM : N 1517268 E 664919
 Sampler: ETSP#37
 Recorder: ECRAN00031070
 Date: 3 Oct 25
 Technical: XXXXXXXXXX
 Approver: 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.
 Model: TE-5025A
 Serial#: 2067
 Qstd Slope: 2.06933
 Qstd Intercept: -0.02815
 Date Certified: 4 Mar 25
 Due Date: 03-Mar-26

CALIBRATIONS					LINEAR REGRESSION
Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart)	IC (corrected)	
1	12.20	1.677	56.0	55.19	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
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	



Calibrated by: XXXXXXXXXX
 3 October 2025
 Approved by: XXXXXXXXXX
 3 October 2025

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ประกอบไฟล์ 01.08/2568

PM10 High Volume Sampler Calibration

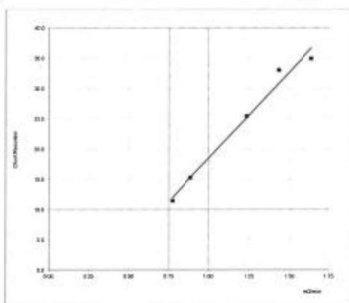
Verification Report No.
 SO2500249-E001 -PM 02

☐ PM ☒ Onsite
 Site: ร.พ.เชลยวงศ์
 UTM : N 1517268 E 664919
 Sampler: EPM10#11
 Recorder: NCRT1500904855
 Date: 3 Oct 25
 Technical: XXXXXXXXXX
 Approver: 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

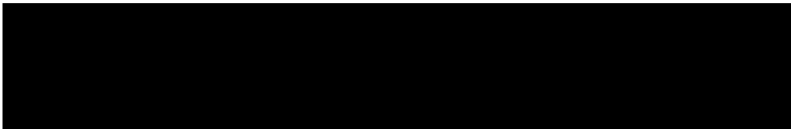
CALIBRATION ORIFICE
 Brand: Tisch Environmental, Inc.
 Model: TE-5025A
 Serial#: 2067
 Slope: 1.29578
 Intercept: -0.01772
 Date Certified: 4 Mar 25
 Due Date: 3 Mar 26

CALIBRATIONS					LINEAR REGRESSION
Plate or Test #	H2O (in)	Qa (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: XXXXXXXXXX
 3 October 2025
 Approved by: XXXXXXXXXX
 3 October 2025

ประกอบไฟล์ 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. : 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:

Approve By:

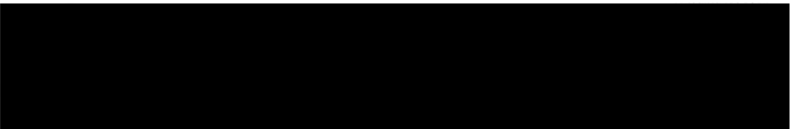
Date : 03 October 2025

Date : 03 October 2025

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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. : 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:

Approve By:

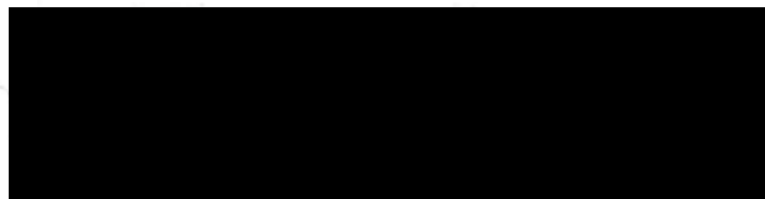
Date : 03 October 2025

Date : 03 October 2025

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M-SVM-05-06 Rev.00



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	0.9826	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=	$\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$	Va=	$\Delta Vol((Pa-\Delta P)/Pa)$
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
71263-7611
131467-900



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 :

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 :

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

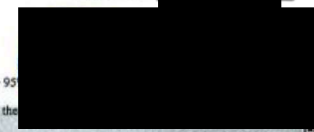
Edition 7 - November 2022

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%

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CAL-P0031-03

Certificate of Calibration

Certificate No. : 68-20034-1 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

- o o o -

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	10/16/2024, 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	4500 PPM	4528 PPM	G1	+/- 0.6% NIST Traceable	10/15/2024
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	DC120120235	CC750377	49.05 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 03, 2026
PRM	12404	APEX 1324257	50.04 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Dec 22, 2023
GMIS	124206899128	CC323207	4.238 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jan 04, 2027
PRM	C2392001.1	D153446	9.87 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Nov 22, 2024
GMIS	0712202310	CC494279	49.92 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.7%	Jun 16, 2027
SRM	1693a	FF25467	50.33 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.7%	Jun 27, 2023
CARBON MONOXIDE	080123	KAL004712	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	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 N1M9050	NDIR	Oct 08, 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 26, 2024

Page 1 of 1



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

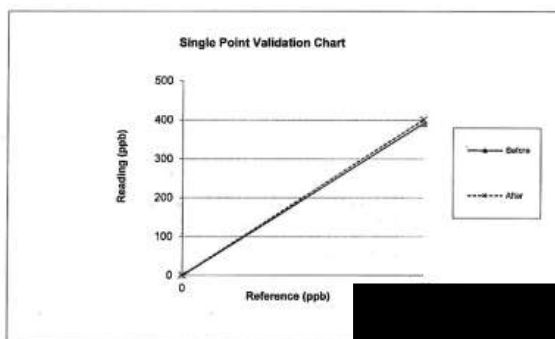
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 782	NOx Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 45.30 PPM
	SO2 Conc 45.05 PPM
	CO Conc 4528 PPM
	Expire Date: OCT 23,2027 EB0170003

Environment: Temperature 25.1 °C

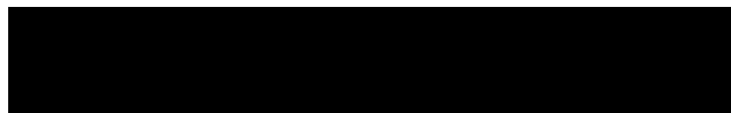
Humidity: 59 %RH

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



ประกาศใช้ 01/08/2568



Page:2/2

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	850 (+/- 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	-	-	
ROCELL 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	%	87.4	87.4	
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	26.9	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 PPB)	0	ppb	-0.6	0.4	
Span Gas (400 PPB)	400	ppb	392.3	401.4	± 5% of Range

Calibrate By :

Date: 1-Oct-68

Approve By :

Date: 1-Oct-68

neediss
Neediss Supply Instrument Co., Ltd

ประกาศใช้ 01/08/2568



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

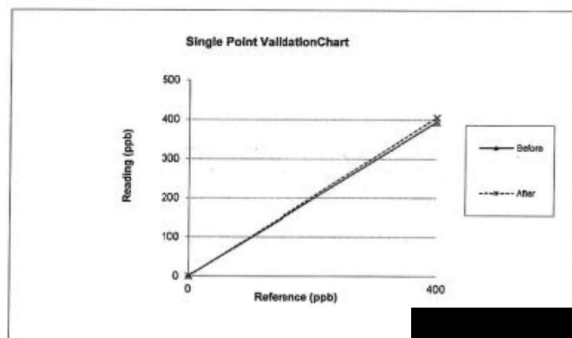
Calibrator Unit	Standard Gas
Dilutor Model ESA MGC101 S/N: 792	NOx Conc 45.30 PPM
ZERO AIR Generator ZAG7001 S/N: 644	NO Conc 45.30 PPM
	SO2 Conc 45.05 PPM
	CO Conc 4528 PPM
	Expire Date: OCT 23, 2027 EB0170003

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



ประกาศใช้ 01/08/2568

FN-SVM-05-09 Rev.00



Calibration Report No.: ESA-6810007

Calibrated Date: 1-Oct-25

☒ PM ☐ Onsite

Page: 2/2

Analyzer Signal Values					
Date	1-Oct-25	Time	13:11:00		
Power Supply					
Option	0.00	mV	+5 V Sensor	5	V
+4 V	4088	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	2526.80	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:

Supachai Anankijyingyong

Approve By:

Date: 1-Oct-25

Date: 1-Oct-25

neediss
Neediss Supply Instrument Co., Ltd

ประกาศใช้ 01/08/2568



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
---	------------------------------

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model ESA M8C101 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

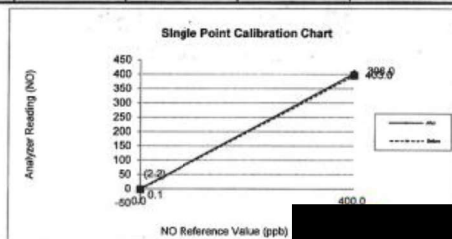
Environment: Temperature 24.9 °C Humidity: 60 %RH

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.	84.28	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

Validation By: Supachai Anankijyingyong
Date: 1-Oct-25

Approve By: [Redacted]
Date: 1-Oct-25

neediss
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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/NO ₂ /NO _x 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	NO _x Conc 45.30 PPM NO Conc 45.30 PPM SO ₂ Conc 45.05 PPM CO Conc 4528 PPM Expire Date: OCT 23,2027 EB0170003

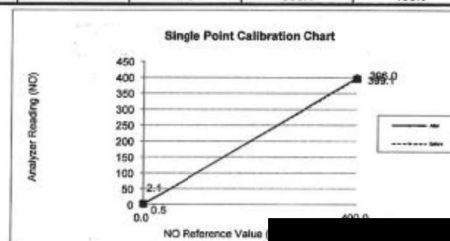
Environment: Temperature 24.9 °C Humidity 60 %RH

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
NO _x	2.1	0.0	2.1	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	0.7	0.0	0.7	395.5	400.0	-0.6
NO ₂	0.2	0.0	0.2	3.6	0.0	0.5
NO _x	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	l/min	Sample Pr.	993.2	hPa

Validation By: [Redacted]

Date: 1-Oct-25

Approve By: [Redacted]

Date: 1-Oct-25

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Neediss Supply Instrument Co.,Ltd

ประกาศใช้ 01/08/2568



CO Analyzer Verification Test Report

Page:1/2

Validation Report No.: ESA-8810005

Validation Date: 1-Oct-25

☒ PM ☐ Onsite

Instruments Information

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

Calibration System

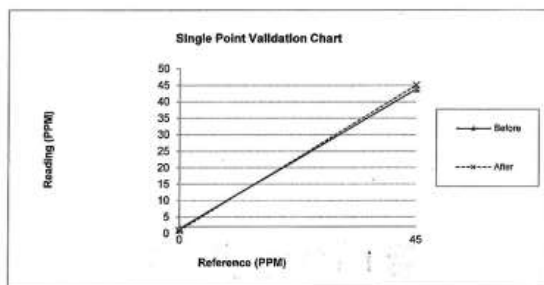
Calibrator Unit	Standard Gas
Dilutor Model ESA MGA101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 544	NOx Conc 45.30 PPM NO Conc 45.30 PPM SO2 Conc 45.05 PPM CO Conc 45.28 PPM Expire Date: OCT 23, 2027 EB0170003

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-8810005

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 : [Redacted]

Supachai Anankijyinyong

Date: 1-Oct-25

Approve By : [Redacted]

Date: 1-Oct-25

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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

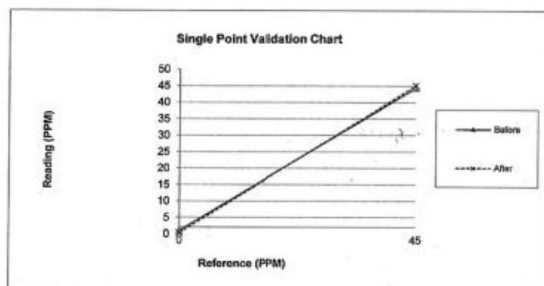
Calibrator Unit	Standard Gas
Dilutor Model ESA MGA101 S/N: 792 ZERO AIR Generator ZAG7001 S/N: 544	NOx Conc 45.30 PPM NO Conc 45.30 PPM SO2 Conc 45.05 PPM CO Conc 45.28 PPM Expire Date: OCT 23,2027 EB0170003

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

PM-01/08/2568



Page:2/2

Validation Report No.: ESA-6810009

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	1.0	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

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

pe PTB220 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	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	m/sec	m/sec	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
270	

Calibr



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	Tested Barometer	Correction
Pressure	Pressure	
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

Average

Calibrated by

Mechanical Engineer

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

Calibrated by


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

Calibrated by

Mechanical Engineer



Date of Issue 23 May, 2025 Certification No. 261/25
Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. ทำการสอบเทียบกับแก้ววัดฝน แบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของคู่มือ (0.2 mm (0.01 INCH) TYP)

ลงชื่อ

วิศวกรชำนาญการ



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

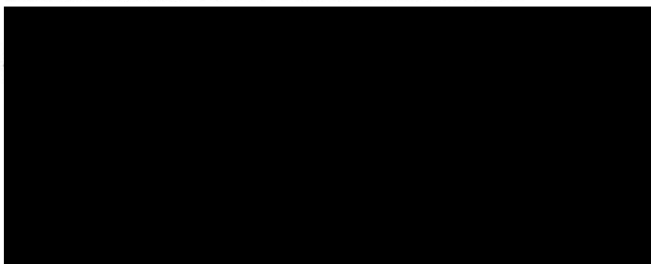
: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

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	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
1004.92	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 อีพือ Davis Instruments แบบ TIPPING
BUCKET Product No. [REDACTED] ทำการสอบเทียบกับแก้ววัด
ฝนแบบแก้วดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No.
71082 และสามารถนำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm/TIP)

วิศวกรชำนาญการ

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 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Standards used :

- Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
- Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
- Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Pressure Transmitter Vaisala PTB202AD S/N T0650001.
- Audio Analyzer Panasonic VP-7722A S/N 041477D122.
- 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 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	±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	±3.0%

Note :

- No adjustment.
- The calibrator pressure correction was not included.
- 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] App: [Redacted]

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.
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Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1673-80 ext. 115, 116
(66) 08 3219 9400
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

FM.BLMTC.002 Rev.5

**เอกสารผลการสอบเทียบเครื่องมือตรวจวัด
ครั้งที่ 2/2568**

สถานีโรงเรียนกรุงเทพคริสเตียนวิทยาลัย

ตรวจวัดวันที่ 3-8 ธันวาคม 2568

สถานีโรงพยาบาลเซนต์หลุยส์

ตรวจวัดวันที่ 7-12 มกราคม 2569

TSP High Volume Sampler Calibration

Verification Report No.
SO2500303-E001-TSP 01

☐ PM ☒ Onsite
Site: 1.1 กรุงเทพมหานคร
UTM: N 1517392 E 664627
Sampler: ETS/PM35
Recorder: ECRAN003031070
Date: 3 Dec 25
Technical: [Redacted]
Approval: [Redacted]

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

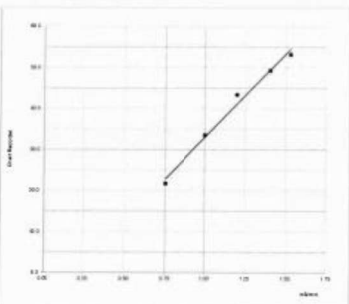
CALIBRATION ORIFICE

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	49.28
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: [Redacted]
3 December 2025

Approved by: [Redacted]
3 December 2025

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ประกอบโดย: อ.อ.อ.อ.อ.อ.

PM10 High Volume Sampler Calibration

Verification Report No.
SO2500303-E001-PM 01

☐ PM ☒ Onsite
Site: 1.1 กรุงเทพมหานคร
UTM: N 1517392 E 664627
Sampler: EPM10W39
Recorder: ECRDS019075261
Date: 3 Dec 25
Technical: [Redacted]
Approval: [Redacted]

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

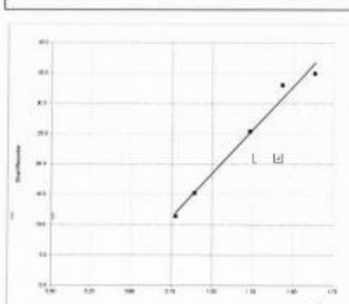
CALIBRATION ORIFICE

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: [Redacted]
3 December 2025

Approved by: [Redacted]
3 December 2025

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ประกอบโดย: อ.อ.อ.อ.อ.

TSP High Volume Sampler Calibration

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

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517285 E 664906
 Sampler: ETSP#30
 Recorder: ECRD5016339505

Date: 7 Jan 26
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

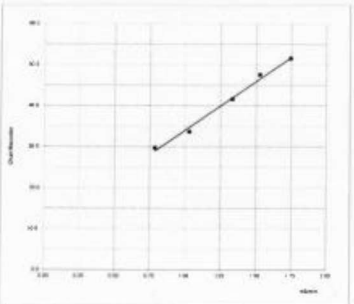
Barometric Press. (hPa): 1016.6	Corrected Pressure (mm Hg): 762.5
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Orifice Slope: 2.06933
Model: TE-5025A	Orifice 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	33.86
5	2.80	0.785	30.0	29.70

LINEAR REGRESSION
 Slope = 23.7301
 Intercept = 10.3306
 Corr. coeff = 0.9997
 # of Observations: 5
 Range of Chart at 1.1 - 1.7 m³/min: 51



Calibrated by: XXXXXXXXXX

7 January 2026

Approved by: XXXXXXXXXX

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ประกอบใช้ 030307568

PM10 High Volume Sampler Calibration

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

☐ PM ☒ Onsite
 Site: กรุงเทพมหานคร
 UTM: N 1517285 E 664906
 Sampler: EP6110#30
 Recorder: 0

Date: 7 Jan 26
 Technical: XXXXXXXXXX
 Approval: XXXXXXXXXX

CONDITIONS

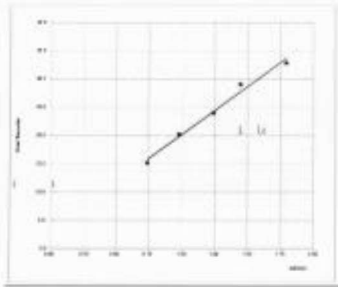
Barometric Press. (hPa): 1016.6	Corrected Pressure (mm Hg): 762.5
Temperature (deg C): 32.0	Temperature (deg K): 305.0
Average Press. (hPa): 1013.0	Corrected Avg Press. (mm Hg): 759.8
Average Temp. (deg C): 30.0	Average Temp. (deg K): 303.0

CALIBRATION ORIFICE

Brand: Tisch Environmental, Inc	Slope: 1.26576
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)	Q _{std} (m ³ /min)	I (chart)	IC (corrected)
1	13.30	1.794	52.0	52.89
2	9.80	1.445	46.0	46.09
3	6.30	1.239	38.0	38.03
4	3.90	0.978	32.0	32.24
5	2.20	0.738	24.0	24.18

LINEAR REGRESSION
 Slope = 16.6676
 Intercept = 3.2340
 Corr. coeff = 0.9925
 SFR = 1.000
 SSP = 31.99
 # of Observations: 5
 Range of Chart at SFR ±10%: 34



Calibrated by: XXXXXXXXXX

7 January 2026

Approved by: XXXXXXXXXX

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ประกอบใช้ 030307568

Verification Test Report

Report No.: SQ2500303-E003 / 001
Verification Date : 03 December 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 : 1862
Scale Rang : 20dB-140dB
Class : 2

Reference Standard
Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 105 S/N : 98971
Certificate No. : EEL BP 05/0168
Date due : 17 January 2026
Traceability : T1STR

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	93.67	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]

Date : 03 December 2025 Date : 03 December 2025

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

GPS coordinates : 47P N 1517256 E 664913

Instrument Information
Equipment : Sound Level Meter
Manufacturer : Pulsar
Model : 44
Serial No : 2205
Scale Rang : 20dB-140dB
Class : 2

Reference Standard
Standard : Acoustic Calibrator Manufacturer : Pulsar Model : 105 S/N : 98971
Certificate No. : EEL BP 05/0168
Date due : 17 January 2026
Traceability : T1STR

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	93.67	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]

Date : 07 January 2025 Date : 07 January 2025


The Results shown in this verification report refer only to the equipment verification unless otherwise stated
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ประกาศใช้ 01/08/2568 FM-SVM-05-06 Rev.00

Certificate of Calibration


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

Submitted by : Envilab Co., Ltd.

Equipment : 

Manufacturer : Sartorius Model : SECURA224-1S
Serial No. : 0034805270 ID No. : ELABBALANC04
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 : 

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.	Exp. Date	Traceability
E261-E2624	CE02420099	07 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-0001-01

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 $k = 2.05$,
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

g

Repeatability

Load test	Std. Dev.
200 g	0.00005

g

- 0.000 -

0.000148 g

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. Inlet (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	5.30
5	9	10	1	0.7090	12.8	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Vstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9907	0.6967	1.4306	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	1.4018
0.9832	1.1459	2.3393	0.9882	1.1477	1.4723
0.9779	1.3792	2.8212	0.9828	1.3862	1.7756
QSTD = 1/m = 2.06933			QA = 1/m = 1.29578		
b = -0.02815			b = -0.01772		
r = 0.99997			r = 0.99997		

Calculations	
Vstd = (ΔVol)(Pa-ΔP)/(Pstd)(Ta)	Va = (ΔVol)(Pa-ΔP)/Pa
Qstd = Vstd/ΔTime	Qa = Va/ΔTime

For subsequent flow rate calculations:

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

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg

Key

- ΔP: calibrator manometer reading (in H2O)
- ΔP: rootmeter manometer reading (mm Hg)
- Ta: actual absolute temperature (°K)
- Pa: actual barometric pressure (mm Hg)
- b: Intercept
- r: 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.tisch-env.com
TOLL FREE: (877)263-71
(614)513/467-9

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND) LTD
Part Number: E54N89615A00V3
Cylinder Number: E80170003
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12024
Gas Code: CO,NO,NOX,S02,BALN

Reference Number: 160-403162930-1
Cylinder Volume: 144.8 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Oct 23, 2024
Expiration Date: Oct 23, 2027

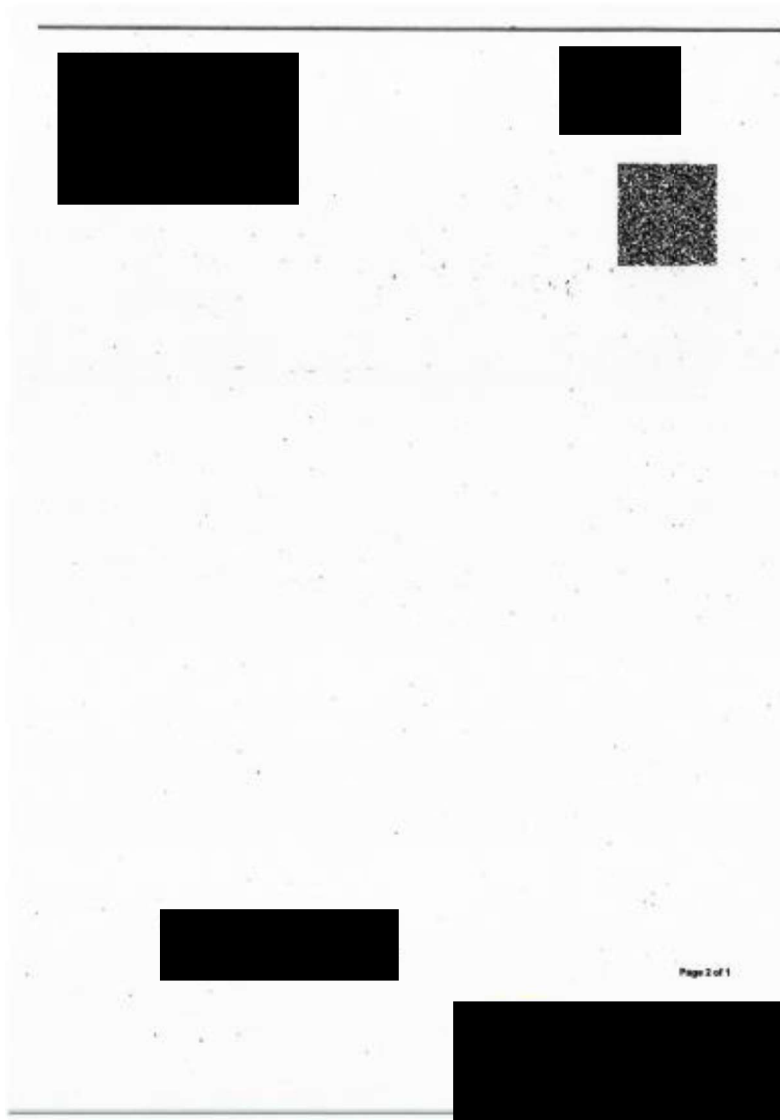
Certificates performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 820R-12021, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total 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 nomenclatures are on a multiple basis unless otherwise noted. The results inside only to the limits listed. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder before 100 days, i.e. 8.7 months.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.50 PPM	45.30 PPM	01	±1.0% NIST Traceable	10/18/2024, 10/22/2024
NITRIC OXIDE	45.50 PPM	45.30 PPM	01	±1.0% NIST Traceable	10/18/2024, 10/22/2024
SULFUR DIOXIDE	45.50 PPM	45.35 PPM	01	±1.0% NIST Traceable	10/18/2024, 10/22/2024
CARBON MONOXIDE	45.50 PPM	45.30 PPM	01	±1.0% NIST Traceable	10/18/2024, 10/22/2024
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
DM5	00K120102228	0078207	49.50 PPM NITRIC OXIDE/NITROGEN	±1.0%	May 03, 2026
PM10	13404	APEX 1340357	30.04 PPM NITRIC OXIDE/NITROGEN	±1.0%	Dec 22, 2023
DM5	13400866128	00323257	4.256 PPM NITROGEN DIOXIDE/NITROGEN	±1.0%	Jan 04, 2027
PM10	023680911	0160446	9.87 PPM NITROGEN DIOXIDE/NITROGEN	±1.0%	Nov 22, 2024
DM5	0710232219	0046429	49.00 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 19, 2027
SRM	1992e	FF25467	50.30 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 27, 2025
CARBON MONOXIDE	080123	KAL064712	4957 PPM CARBON MONOXIDE/NITROGEN	±1.0%	Feb 20, 2030

The SRM, NIST, PM10, or SRM listed above is only in reference to the DM5 used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
SIEMENS ULTRAMAT F1N48020	NDIR	Oct 30, 2024
Moxel 886 FTR AUP2010345 NO	FTIR	Oct 11, 2024
Moxel 886 FTR AUP2010345 NO2	FTIR	Oct 31, 2024
Moxel 886 FTR AUP2010345 SO2	FTIR	Sep 25, 2024



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 1514454 E 054235

Instrument Information

Equipment: NO2 Analyzer

Manufacturer: ESA

Model: AC32a

Serial No: 2398

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No:	EB0170305	ZERO Air Generator	Model: ZA07001
Certificate No:	2015 FO,G		S/N: 644
Date Due:	OCT 23,2027	Dilutor	Model: ESA MGC191
Traceability:	Air Liquide		S/N: 792

Ambient Condition: Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

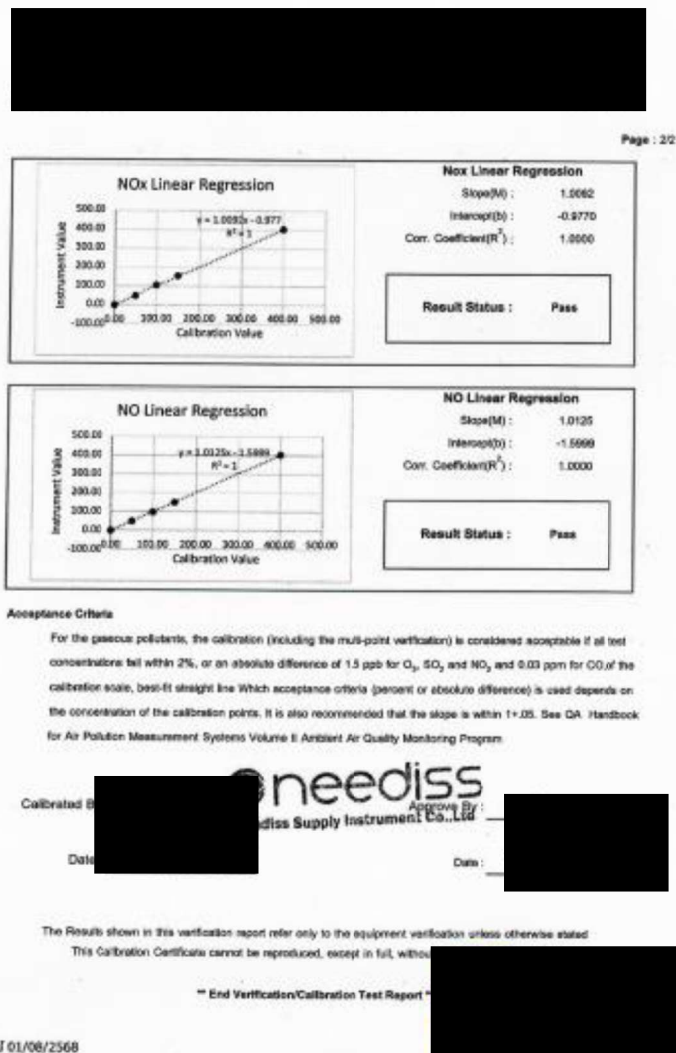
Calibration Gas Level	Zero Conc. (Indicate Unit)		Level 1 Conc. (Indicate Unit)		Level 2 Conc. (Indicate Unit)		Level 3 Conc. (Indicate Unit)		Level 4 Conc. (Indicate Unit)	
	<input type="checkbox"/> ppb <input type="checkbox"/> ppm		<input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm		<input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm		<input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm		<input checked="" type="checkbox"/> ppb <input type="checkbox"/> 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	149.89	149.19	402.73	402.40
	0.12	-1.13	49.72	49.03	100.47	99.37	149.25	150.59	405.20	405.20
	0.13	-1.13	49.51	49.23	99.82	99.66	147.43	149.42	403.1	403.1
	0.13	-1.13	49.11	48.57	100.39	99.98	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	99.60	99.72	149.09	149.73	403.39	403.80
Best Fit Concentration (Y-Metric)	49.48		49.62	99.94	99.65	150.40	150.27	402.70	403.40	
Point Difference (Best Fit - Average)	-0.20		-0.28	0.28	0.83	1.71	0.54	-0.68	-0.40	
Percent difference (Best Fit vs Ins.(Y) Value	0.41%		0.56%	-0.28%	-0.80%	-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

หมายเลข 01/05R/2568



Verification/Calibration Test Report

Report No.: AP1-6812004

Verification Date: 01 December 2025

Page: 1/2

Operate Information: ☒ PM ☐ Onsite

Site: Enviteb Co., Ltd.

GPS coordinates: 47P N 1514454 E 604233

Instrument Information

Equipment: SO₂ Analyzer

Manufacturer: ESA

Model: AF22a

Serial No: 2482

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No:	EB0170033	Model:	ZAG7001
Certificate No:	2015 F0/G	SN:	644
Date Due:	OCT 23, 2027	Model:	ESA MGC101
Traceability:	Air Liquide	SN:	792

Ambient Condition: Temperature 25.00 °C Relative humidity 56.30 %

Atmospheric pressure 1011.0 hpa

Measurement Data

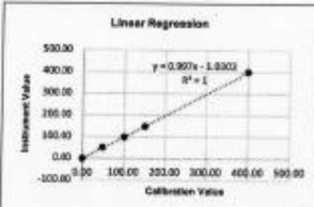
Calibration Gas Level	Zero Conc. (Indicate Unit) <input type="checkbox"/> ppb <input type="checkbox"/> ppm	Level 1 Conc. (Indicate Unit) <input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm	Level 2 Conc. (Indicate Unit) <input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm	Level 3 Conc. (Indicate Unit) <input checked="" type="checkbox"/> ppb <input type="checkbox"/> ppm	Level 4 Conc. (Indicate Unit) <input checked="" type="checkbox"/> ppb <input type="checkbox"/> 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	95.19	145.32	398.50
	-1.13	48.86	95.19	145.32	397.10
	-1.13	47.86	95.19	145.32	397.10
Ins. Value Average	-0.90	48.90	95.30	145.55	397.84
Best Fit Concentration (Y=Ma+b)		48.82	96.67	146.52	397.77
Point Difference(Best Fit - Average)		0.02	0.31	-0.05	-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 allow

Issued 01/08/2568

Page : 2/2



Linear Regression

Slope(M) : 0.9970
Intercept(b) : -1.2302
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±0.05. See QA Handbook for Air Pollution Measurement Systems Volume 6 Ambient Air Quality Monitoring Program.

neediss
Supply Instrument Co., Ltd.

Calibrated By: [Redacted] Approve 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 **

วันที่ 01/08/2568

Verification/Calibration Test Report

Report No.: EISA-0812004
Verification Date : 01 December 2025

Page : 1/2

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

Instrument Information
Equipment : CO Analyzer Manufacturer : ESA
Model : CO12e Serial No : 1222

Reference Standard

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

Ambient Condition : Temperature 25.00 °C Relative humidity 56.32 %
Atmospheric pressure 1011.0 hpa

Measurement Data

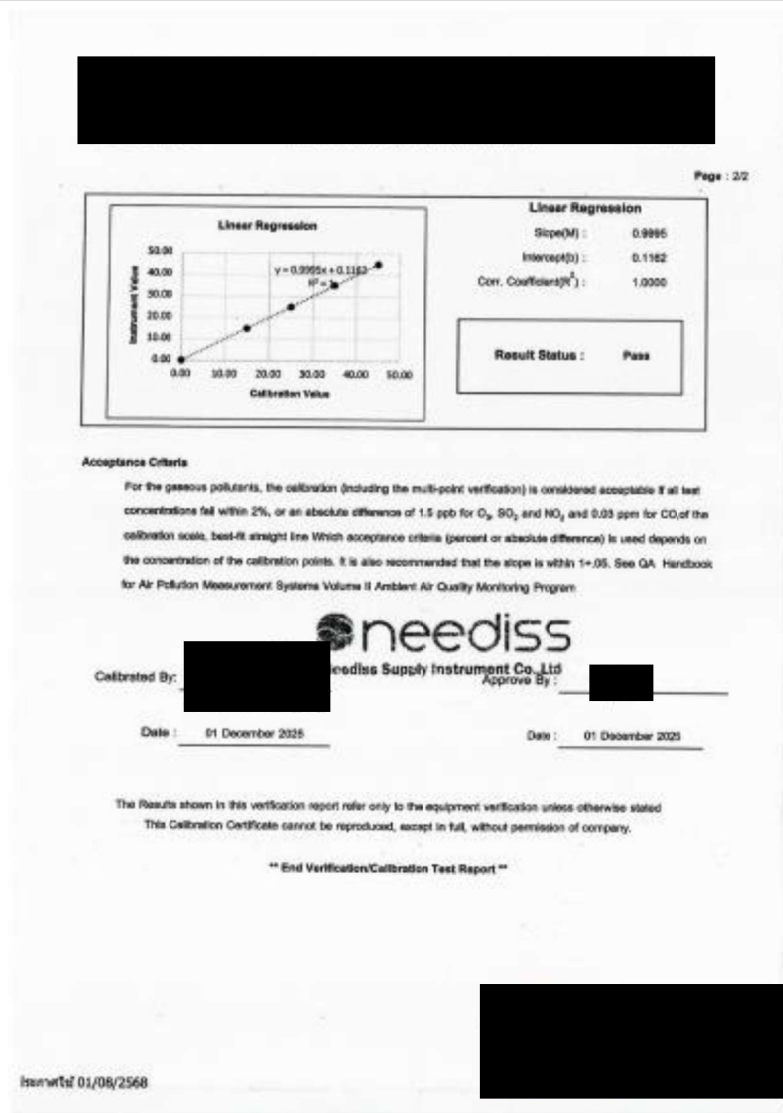
Calibration Gas Level	Zero Conc. (Indicate Unit)	Level 1 Conc. (Indicate Unit)	Level 2 Conc. (Indicate Unit)	Level 3 Conc. (Indicate Unit)	Level 4 Conc. (Indicate Unit)
	<input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	<input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	<input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	<input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	<input type="checkbox"/> ppb <input checked="" type="checkbox"/> 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	44.89
	0.13	14.97	25.14	35.42	44.89
	0.13	14.97	25.14	34.94	44.89
	0.12	15.10	25.10	35.12	44.86
	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=Me+b)		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 provided approximately 80% full scale.

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

วันที่ 01/08/2568



Verification/Calibration Test Report

Report No.: ESA-8812005
Verification Date : 01 December 2025

Page : 1/2

Operate Information ☒ PM ☐ Onsite

Site [Redacted]

GPS coordinates : 47° N 1514454 E 654233

Instrument Information

Equipment : CO Analyzer Manufacturer : ESA
Model : CO12e Serial No : 1203

Reference Standard

Standard Gas		Calibrator Unit	
Cylinder No :	EB0170003	ZERO AIR Generator	Model : ZAG7001
Certificate No :	2015 PQ.G		S/N : 644
Date Due :	OCT 23,2027	Diluter	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.	Level 1 Conc.	Level 2 Conc.	Level 3 Conc.	Level 4 Conc.
	(Indicate Unit) <input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	(Indicate Unit) <input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	(Indicate Unit) <input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	(Indicate Unit) <input type="checkbox"/> ppb <input checked="" type="checkbox"/> ppm	(Indicate Unit) <input type="checkbox"/> ppb <input checked="" type="checkbox"/> 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	45.33
	0.13	14.97	25.14	35.42	45.31
	0.13	14.97	25.14	34.94	45.22
	0.12	15.10	25.10	35.12	45.22
	0.11	14.99	25.14	35.42	45.31
Ins. Value Average	0.12	15.03	25.13	35.26	45.26
Best Fit Concentration (Y=Me+bi)		15.12	25.17	35.22	45.26
Point Difference(Best Fit - Average)		0.09	0.04	-0.06	-0.01
Percent difference (Best Fit vs Ins.(Y) Value)		-0.62%	-0.16%	0.14%	0.03%
Result Status (Pass/Fail)		Pass	Pass	Pass	Pass

Note :

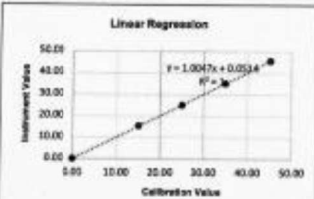
1. Calibrator Value(X) is concentration points were evenly spaced across that generated approximately 80% full scale.

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

[Redacted]

หมายเลข 01/08/2568

Page : 20



Linear Regression

Slope(M) : 1.0047
Intercept(b) : 0.0514
Corr. Coefficient(R²) : 0.9990

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±.05. See QA Handbook for Air Pollution Measurement Systems Volume II Ambient Air Quality Monitoring Program

neediss

Calibrated By: [Signature]

Date: 01 December 2025

neediss Supply Instrument Co., Ltd.

Approved By: [Signature]

Date: 01 December 2025

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** End Verification/Calibration Test Report **

ประกาศใช้ 01/08/2568

Verification/Calibration Test Report

Report No.: ESA-4812011
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	Model :	ZAG7001
Certificate No. :	2015 FO,G	SN :	844
Date Due :	OCT 23,2027	Model :	ESA MGC101
Traceability :	Air Liquide	SN :	792

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

Measurement Data

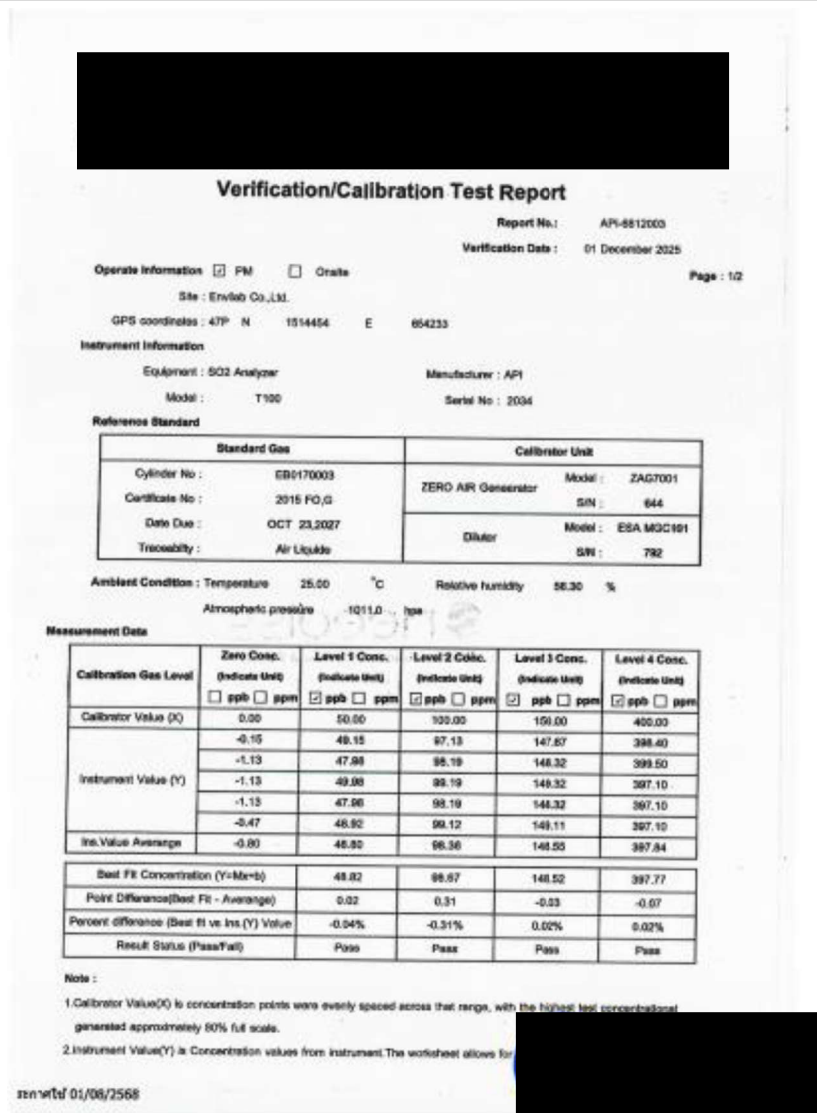
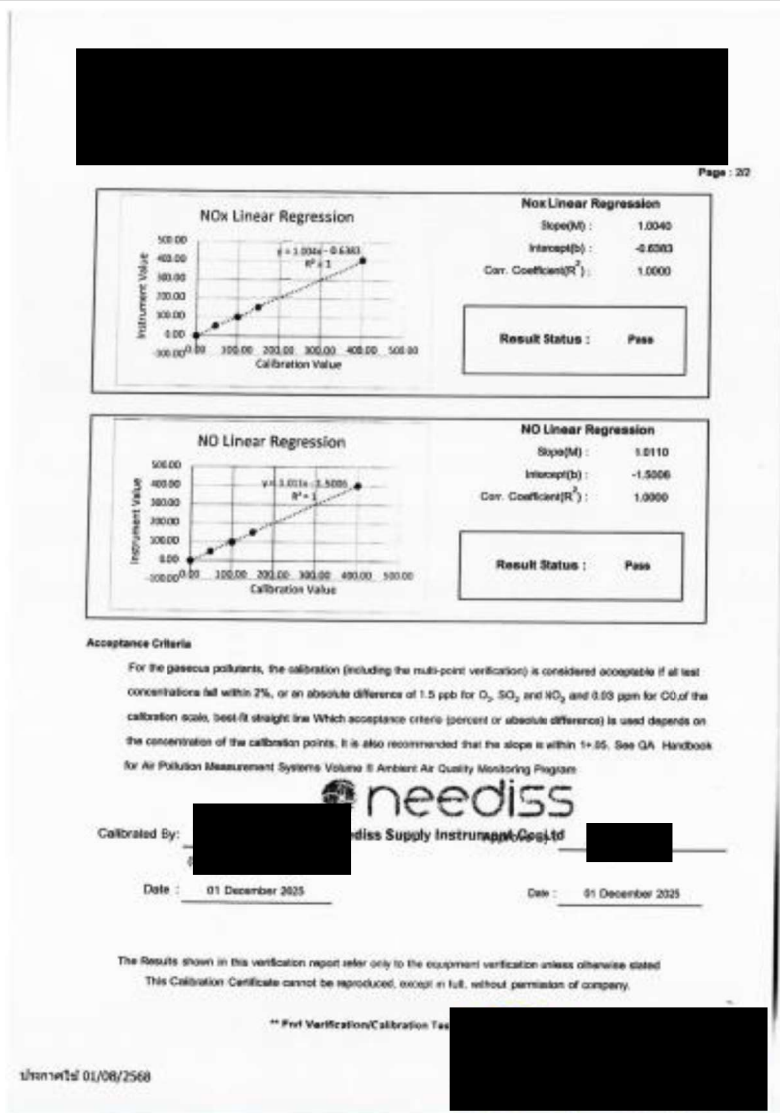
Calibration Gas Level	Zero Conc. (Indicate Unit)		Level 1 Conc. (Indicate Unit)		Level 2 Conc. (Indicate Unit)		Level 3 Conc. (Indicate Unit)		Level 4 Conc. (Indicate Unit)	
	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppm
Calibrator Value (X)	0.00	0.00	50.00	50.00	100.00	100.00	150.00	150.00	400.00	400.00
Instrument Value (Y)	0.11	-0.15	49.84	49.30	100.19	98.29	149.89	149.16	401.59	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	98.69	147.43	149.43	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	403.99
Ins. Value Average	0.13	-0.89	49.69	48.30	99.65	98.72	148.89	149.75	401.45	403.23
Best Fit Concentration (Y=Ma+b)	49.56	49.05	99.70	99.60	149.96	150.15	400.98	402.89		
Point Difference(Best Fit - Average)	-0.12	-0.25	0.10	0.86	1.27	0.42	-0.49	-0.34		
Percent difference (Best Fit vs Ins.(Y) Value	0.25%	0.51%	-0.10%	-0.86%	-0.82%	-0.28%	0.12%	0.09%		
Result Status (Pass/Fail)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass		

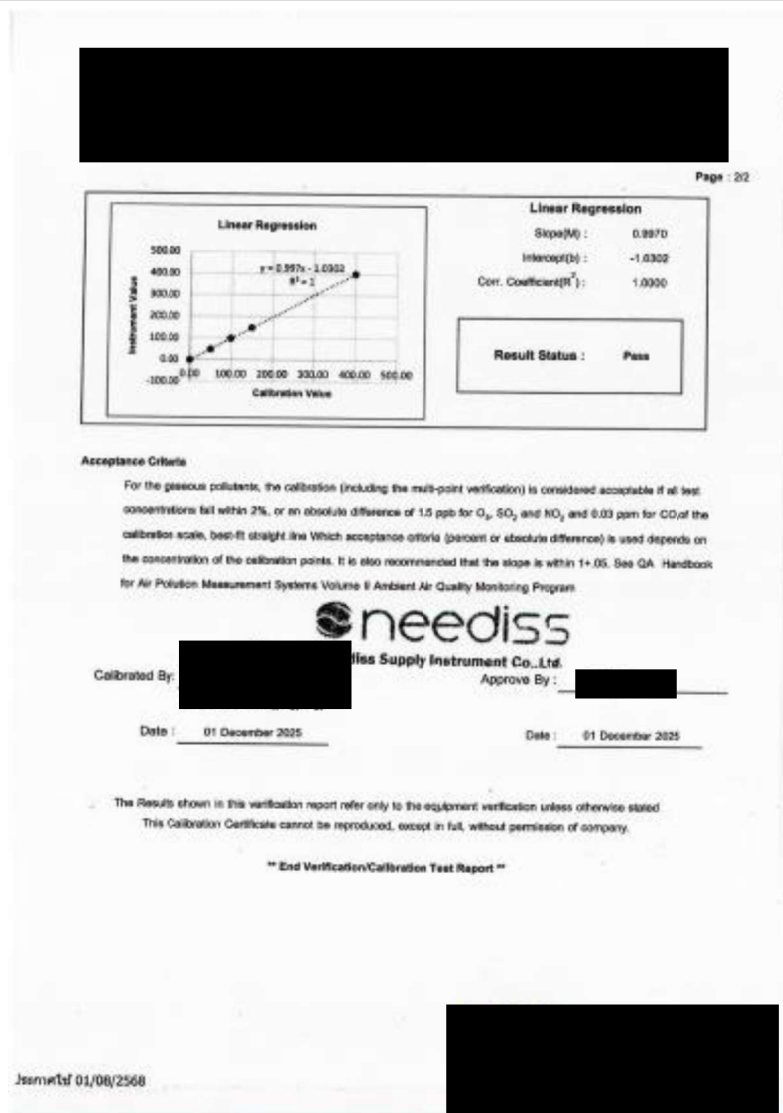
Note :



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

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

ประกาศใช้ 01/08/2568



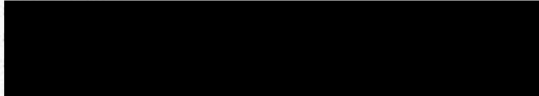







THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)
ELECTRONIC EQUIPMENT LABORATORY (EEL)

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

CALIBRATION CERTIFICATE

Submitted by: 

Address: 

Calibrated at: 

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

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 Tarnagawa 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 4189 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, without 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.
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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 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 : App

Date of Calibration : 17 Jan. 2025
Date of Issue : 20 Jan. 2025 Ref : 2011268011000116001 3/3

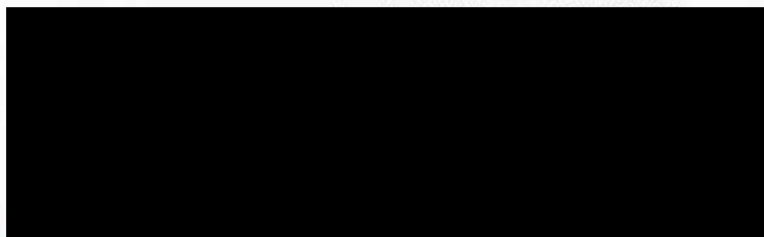
End of Certificate

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. 269/25
Page : 1 of 6

Object : เครื่องวัดความเร็วลมแบบถ้วย
Manufacturer : DYACON
Type : Data Logger MS-100
Serial No. : 130148 ID No. : EWSDCMS1200148
Customer : EnviLab Co.,Ltd.(Head Office)
840.540/1 Soi Bangkhao 7, Bangkhao, Bangkok
Bangkok 10160,Thailand.
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. 9910119 : 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.8395/94 Wet No. 8389/94



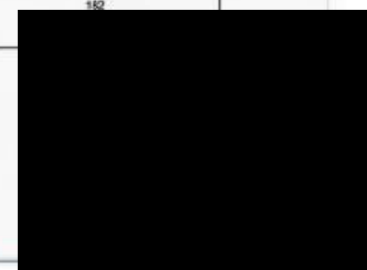
The Result of Calibration


Sensor Wind Speed & Wind Direction Model WSD-1 F Certification No. 269/25

23 May, 2025 Serial No. 1222 Page : 2 of 6


Standard Ultrasonic Anemometer	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	-	-	-	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	-0.08

Vane Angel Bench Stand Model 18112 Young Meteorological Instruments	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	182
270	







The Result of Calibration
 Sensor Pressure Model TPH-1 C
 Serial No. 6273 Certification No. 269/25
 23 May, 2025 Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1006.72	1006.1	0.62
1007.36	1006.8	0.56
1007.32	1006.8	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
1006.03	1002.8	0.43
1006.98	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	1003.6	0.49
1004.51	1003.9	0.61
1005.06	1004.5	0.48





Average






The Result of Calibration
 Sensor Temperature Model TPIB-1 C Certification No. 269/25
 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. 26025		
23 May, 2025 Serial No. 6273 Page : 5 of 6		
Standard Humidity	Relative Humidity Sensor Reading	
% R.H.	Reading % R.H.	Correction % R.H.
66.3	66.3	-2.0
66.1	66.3	-1.2
42.3	42.6	-0.3

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ชื่อ 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)

กรมอุตุนิยมวิทยา
METEOROLOGICAL DEPARTMENT

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 : Enviaab Co.,Ltd.(Head Office)
540,540/1 Soi Bangkhee 7, Bangkhee, Bangkok
Bangkok 10160,Thailand.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Vane Angel Bench Stand Model 18112
: Micromanometer Theodor Friedrich FCO14 Serial No. 9310119 : HOCK GAGE NO 1425
N.I.S.T. Test Reference Number 731/241468 : Standard Velocity at 20 - 30 m/sec
: Ultrasonic Anemometer Model DA-600-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629686)
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94
: Thermocouple No.8188 : type type 645 Type AAA (2545007)


The Result of Calibration

Sonic Wind Speed & Wind Direction Model WSD-10 Certification No. 261/25
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Standard Ultrasonic Anemometer m/sec	BOOK 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
270	

Calibrated





The Result of Calibration
 Sensor Pressure Model TP51-1 D
 Serial No. 6473 Certification No. 261/25
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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
1008.51	1008.4	0.11
1003.03	1002.9	0.13
1003.96	1003.5	0.06
1004.09	1004.0	0.09
1004.61	1004.5	0.11
1005.22	1005.1	0.12
1006.33	1006.2	0.13
1006.79	1006.7	0.09
1006.95	1006.5	0.05
1004.53	1004.4	0.13
1005.32	1005.2	0.12
1004.06	1004.0	0.09
1004.51	1004.4	0.11
1006.08	1006.0	0.08

Average





The Result of Calibration
 Sensor Temperature Model TP51-1 D Certification No. 261/25
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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 T7H-1 D Certification No. 261/25		
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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	42.6	-0.3

ใบรับรอง

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

กรมอุตุนิยมวิทยา
METEOROLOGICAL DEPARTMENT