

ภาคผนวก จ



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เอกสารสอบเทียบเครื่องมือวิเคราะห์

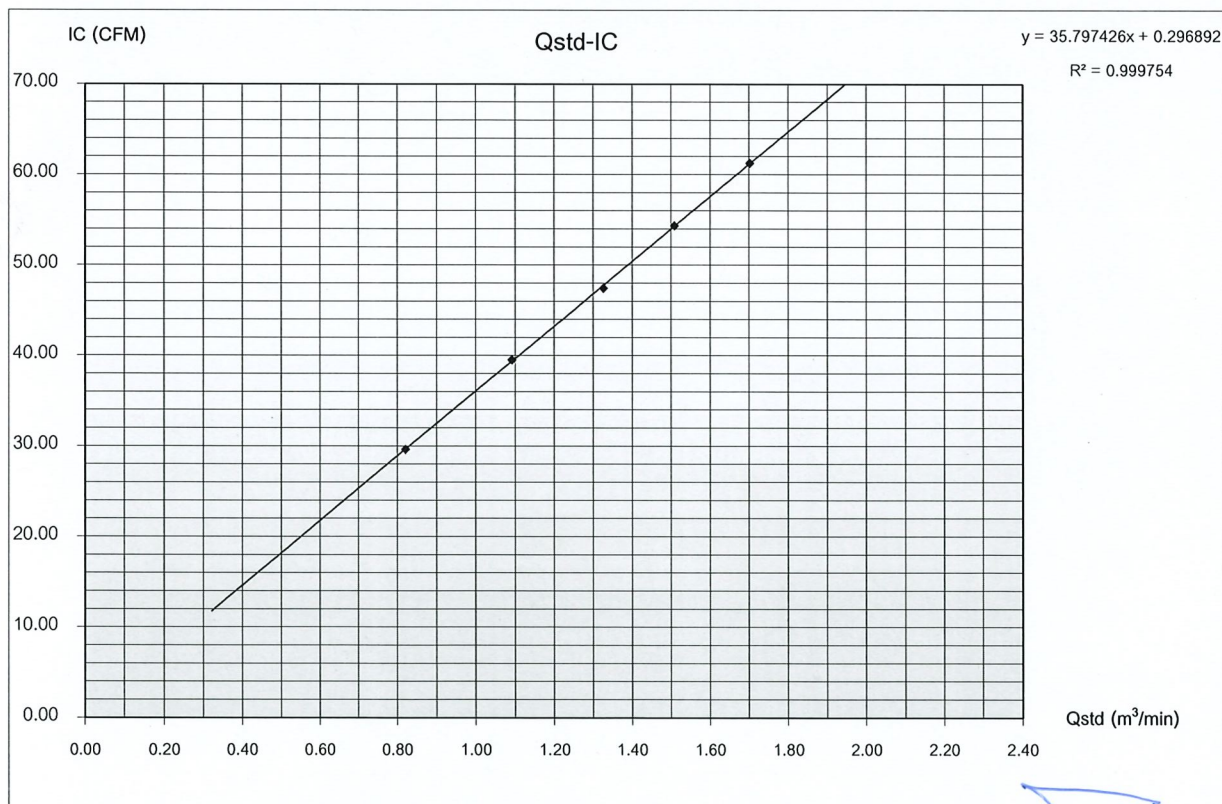
# PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2022
บ้านเลขที่ 60 บ้านคลองตอง หมู่ที่ 12				Start Time	12:42 PM
Sampler Number	PM-10 No.2	Transfer Standard Type	Orifice	Stop Time	12:52 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Nikul Phokamla
Motor Serial Number	610-643	Calibrator Serial Number	3360		
Recorder Serial Number	R0411-001				

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$		Pressure	Meter	Meter	
	Positive	Negative	$\Delta H_2O$		( m <sup>3</sup> /min )	( ft <sup>3</sup> /min )		(°K = °C+273)	( mmHg )			
5	1.3	1.3	2.6	1.59382	0.82035	30.0	29.65	303.0	755.0			
7	2.3	2.3	4.6	2.11998	1.09086	40.0	39.54	303.0	755.0			
10	3.4	3.4	6.8	2.57756	1.32611	48.0	47.45	303.0	755.0			
13	4.4	4.4	8.8	2.93221	1.50845	55.0	54.36	303.0	755.0			
18	5.6	5.6	11.2	3.30798	1.70164	62.0	61.28	303.0	755.0			
Linear Regression Y ON X : Y= mX + b							Average	303.0	755.0			
1	Slope ( m )			1.94506	Linear Equation			r <sup>2</sup>	0.999754	Pstd(mmHg)	760.0	
2	Intercept ( b )			-0.00181	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min)		1.133	r	0.999877	T <sub>NTP</sub>	298.0	
3	Correlation Coefficient ( r )			0.99999	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.977027966		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98844725	

## COMMENT

Andersen Instruments, Inc.



Checked By

( Mr. Prayun Detkla )  
Technician



Approved By

( Mr. Panupon Podang )  
Environmental Scientist

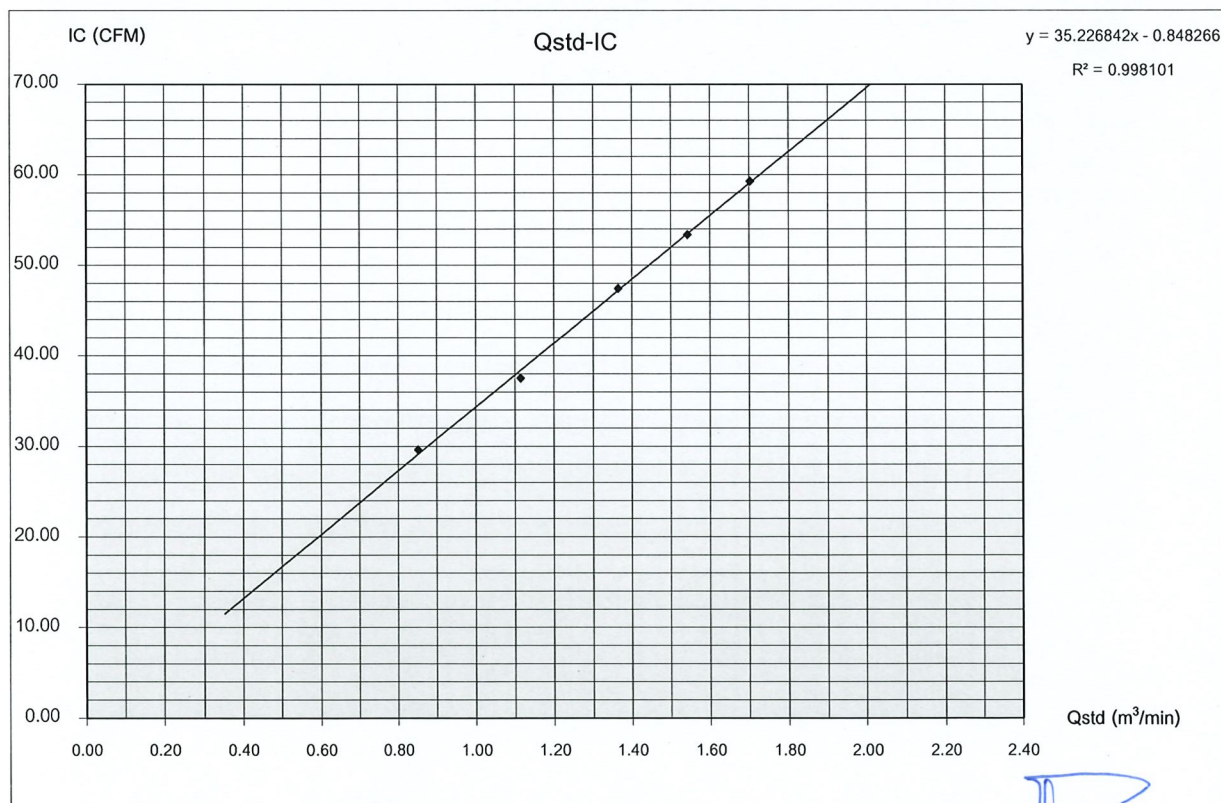
## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2022
โรงพยาบาลส่งเสริมสุขภาพตำบล บ้านคลองหม				Start Time	11:26 AM
Sampler Number	PM-10 No.15	Transfer Standard Type	Onifice	Stop Time	11:36 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Nikul Phokamla
Motor Serial Number	2012-10	Calibrator Serial Number	3360		
Recorder Serial Number	4649				

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	sample Flow Rate Indication	$IC = [(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	( mmHg )			
	Positive	Negative	ΔH <sub>2</sub> O		( m <sup>3</sup> /min )	( ft <sup>3</sup> /min )						
5	1.4	1.4	2.8	1.65399	0.85128	30.0	29.65	303.0	755.0			
7	2.4	2.4	4.8	2.16558	1.11430	38.0	37.56	303.0	755.0			
10	3.6	3.6	7.2	2.65228	1.36453	48.0	47.45	303.0	755.0			
13	4.6	4.6	9.2	2.99811	1.54233	54.0	53.38	303.0	755.0			
18	5.6	5.6	11.2	3.30798	1.70164	60.0	59.31	303.0	755.0			
Linear Regression Y ON X : Y= mX + b							Average	303.0	755.0			
1	Slope ( m )			1.94506	Linear Equation			$r^2$	0.998101	Pstd(mmHg)	760.0	
2	Intercept ( b )			-0.00181	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min)		1.133	r	0.99905	T <sub>MTP</sub>	298.0	
3	Correlation Coefficient ( r )			0.99999	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.977027966		
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98844725	

### COMMENT

Andersen Instruments, Inc.



Checked By

( Mr. Prayun Detkla )  
Technician

envi research  
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By

( Mr. Panupon Podang )  
Environmental Scientist



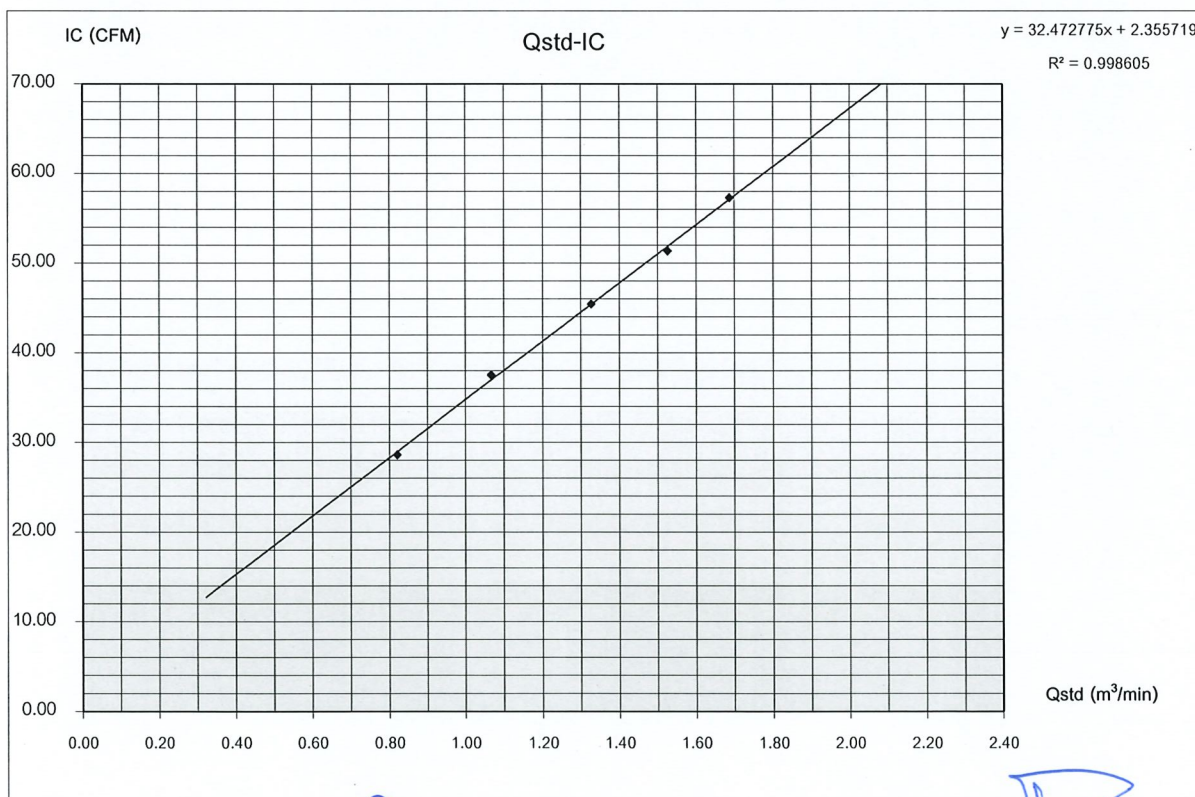
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2022
โรงพยาบาลส่งเสริมสุขภาพตำบล บ้านคลองหม				Start Time	11:26 AM
Sampler Number	TSP No.A2	Transfer Standard Type	Orifice	Stop Time	11:36 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Nikul Phokamla
Motor Serial Number	6215-462	Calibrator Serial Number	3360		
Recorder Serial Number	7156				

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			[ΔH <sub>2</sub> O(Pa/P <sub>std</sub> )(T <sub>std</sub> /Ta)] <sup>1/2</sup>	Qstd = (1/m)/[(A-b)] ( m <sup>3</sup> /min )	ample Flow Rate Indication ( ft <sup>3</sup> /min )	IC = I/[(Pa/P <sub>std</sub> )(T <sub>std</sub> /Ta)] <sup>1/2</sup> (°K = °C+273)		( mmHg )		
	Positive	Negative	ΔH <sub>2</sub> O								
5	1.3	1.3	2.6	1.59382	0.82035	29.0	28.66	303.0	755.0		
7	2.2	2.2	4.4	2.07338	1.06691	38.0	37.56	303.0	755.0		
10	3.4	3.4	6.8	2.57756	1.32611	46.0	45.47	303.0	755.0		
13	4.5	4.5	9.0	2.96534	1.52548	52.0	51.40	303.0	755.0		
18	5.5	5.5	11.0	3.27831	1.68638	58.0	57.33	303.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	755.0		
1	Slope ( m )			1.94506	Linear Equation		r <sup>2</sup>	0.998605	Pstd(mmHg)		760.0
2	Intercept ( b )			-0.00181	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min )		1.133	r	0.9993023	T <sub>NTP</sub>	298.15
3	Correlation Coefficient ( r )			0.99999	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.977027966	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98844725	

## COMMENT

Andersen Instruments, Inc.



Checked By

( Mr. Prayun Detkla )  
Technician

envi research  
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

Approved By

( Mr. Panupon Podang )  
Environmental Scientist

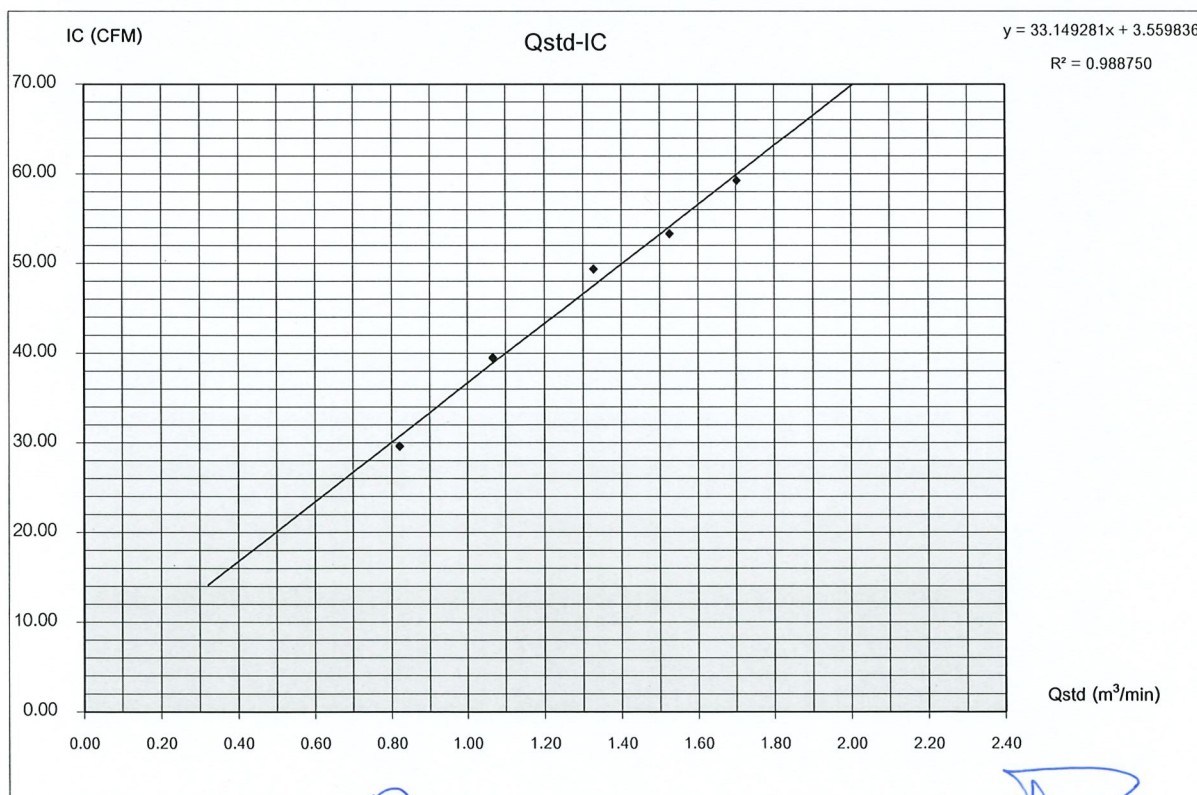
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2022
บ้านเลขที่ 60 บ้านคลองสอง หมู่ที่ 12				Start Time	12:52 PM
Sampler Number	TSP No.A10	Transfer Standard Type	Orifice	Stop Time	1:02 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Nikul Phokamla
Motor Serial Number	2012-04	Calibrator Serial Number	3360		
Recorder Serial Number	1504				

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_{H_2O}(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Qstd = (1/m)[(A-b)] ( m <sup>3</sup> /min )	sample Flow Rate Indication ( ft <sup>3</sup> /min )	IC = $l[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$ (°K = °C+273)	303.0	755.0 ( mmHg )		
	Positive	Negative	ΔH <sub>2</sub> O								
5	1.3	1.3	2.6	1.59382	0.82035	30.0	29.65	303.0	755.0		
7	2.2	2.2	4.4	2.07338	1.06691	40.0	39.54	303.0	755.0		
10	3.4	3.4	6.8	2.57756	1.32611	50.0	49.42	303.0	755.0		
13	4.5	4.5	9.0	2.96534	1.52548	54.0	53.38	303.0	755.0		
18	5.6	5.6	11.2	3.30798	1.70164	60.0	59.31	303.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	303.0	755.0		
1	Slope ( m )			1.94506	Linear Equation			r <sup>2</sup>	0.98875	Pstd(mmHg)	760
2	Intercept ( b )			-0.00181	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min )		1.133	r	0.9943591	T <sub>NTP</sub>	298
3	Correlation Coefficient ( r )			0.99999	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.977027966	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.98844725	

COMMENT

Andersen Instruments, Inc.



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( Mr. Prayun Detkla )  
Technician

envi research

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Approved By

( Mr. Panupon Podang )  
Environmental Scientist

## Certificate of Calibration

Calibration Certification Information			
Cal. Date: February 8, 2022	Rootsmeter S/N: 438320	Ta: 294 °K	
Operator: Jim Tisch		Pa: 750.3 mm Hg	
Calibration Model #: TE-5025A	Calibrator S/N: 3360		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3680	3.2	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8600	8.0	5.00
4	7	8	1	0.8180	8.9	5.50
5	9	10	1	0.6760	12.9	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)
0.9964	0.7284	1.4147	0.9957	0.7279	0.8853
0.9922	1.0281	2.0007	0.9915	1.0274	1.2519
0.9900	1.1512	2.2368	0.9893	1.1504	1.3997
0.9888	1.2088	2.3460	0.9881	1.2080	1.4680
0.9835	1.4549	2.8294	0.9828	1.4539	1.7705
QSTD	m=	1.94506	QA	m=	1.21796
	b=	-0.00181		b=	-0.00113
	r=	0.99999		r=	0.99999

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

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

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



## CERTIFICATE OF CALIBRATION

Customer \_\_\_\_\_ Certificate no. PST-0001-22  
Page no. 1 of 3

Company : ENVIRONMENT RESEARCH & TECHNOLOGY CO.,LTD.  
Address : 25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road, Toongsonghong,  
City / Province : Laksi, Bangkok  
Zip/Postal : 10210

### Device

Equipment : Electronic Balance Capacity : 220 g  
Manufacturer : METTLER TOLEDO Readability : 0.0001 g  
Model : AB204-S ID No. : ERTC-L-In-0048  
Serial No. : 1123103723

### Environment Conditions


Location of Calibration : Calibration Laboratory at Play Solution Technology Co.,Ltd  
Ambient Temperature : 25.9 (°C)  
Relative Humidity : 53.1 (%RH)  
Barometric Pressure : 1011.5 (mba)  
Calibration Procedure : This Calibration was conducted by using In-House calibration procedure number CP-M-001 base on "UKAS LAB 14"  
Comment :

Date of Receipt : January 4, 2022

Date of Calibration : January 4, 2022

Issue Date : January 4, 2022

Calibrated by : Kittichai R.  
( Kittichai Rattanatham )  
Calibrator

Approved by :   
( Kittichai Rattanatham )  
Approved Signature

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

This Certificate is issued in accordance with the conditions of accreditation granted by Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and is traceability to recognize national standards and to the unit of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval prior written approval of the calibration center, Play Solution Technology Co.,Ltd

## CERTIFICATE OF CALIBRATION

Result of Calibration : Without Adjustment Certificate no. PST-0001-22  
Page no. 2 of 3

### 1. Repeatability

Weighing Rang 1 (g)	Normal Value (g)	Standard Deviation (g)
Max.capacity 220	200	0.00005

Weighing Rang 2 (g)	Normal Value (g)	Standard Deviation (g)
Max.capacity		

### 2.Linearity, Departure of Indication from normal value

Weighing Range 1

Normal Value (g)	Standard Value (g)	Indication (g)	Error of Indication (g)	Expanded Uncertainty (g)	Factor k
0.001	0.00100	0.0010	0.0000	0.00011	2.07
0.01	0.01000	0.0100	0.0000	0.00011	2.07
0.1	0.10001	0.1000	0.0000	0.00011	2.07
1	1.00001	1.0000	0.0000	0.00011	2.06
5	5.00002	5.0000	0.0000	0.00011	2.06
10	10.00001	10.0000	0.0000	0.00011	2.05
50	50.00003	50.0000	0.0000	0.00013	2.03
100	100.00004	100.0001	0.0001	0.00018	2.00
150	150.00007	150.0001	0.0000	0.00024	2.00
200	200.00006	200.0002	0.0001	0.00031	2.00

Weighing Range 2

Normal Value (g)	Standard Value (g)	Indication (g)	Error of Indication (g)	Expanded Uncertainty (g)	Factor k

The given extended measurement uncertainty is the standard uncertainty of the measurement multiplied by cover factor k as per listed in table above, which corresponds to a confidence level of about 95%



PLAY SOLUTION TECHNOLOGY COMPANY LIMITED  
179/75 Nawong Pracha Pattana Road, Sikan, Donmuang, Bangkok 10210  
Tel.:+66 2 011 0505, Fax:+66 2 010 7700  
www.playsotec.com



## CERTIFICATE OF CALIBRATION

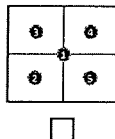
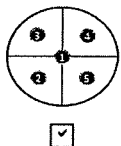
Result of Calibration

Certificate no. PST-0001-22

Page no. 3 of 3

### 3.Eccentricity

Test load at least 1/3 of the maximum capacity, typically placed between 1/2 and 1/3 of the distance from the centre of the load receptor to the edge.



#### Weighing Range 1

Test Load : 100 (g)

Position	Indication (g)
1	100.0001
2	100.0001
3	100.0002
4	100.0001
5	100.0002
Max.Deviation	0.0001

#### Weighing Range 2

Test Load : (g)

Position	Indication (g)
1	
2	
3	
4	
5	
Max.Deviation	

### Standard methode

The calibration was performed by using calibration laboratory's in-house calibration methode : CP-M-001 based on "UKAS LAB 14 : Calibration of weighing machine" : edition 6 | October 2019

### Reference standards instrument

Instrument	OIML Class	S/N	Certificate No.	Due Date
Standard Weight Set	E2	4000021952	MM-0183-20	December 8, 2022
Standard Weight Set	-	-	-	-
Standard Weight Set	-	-	-	-
Standard Weight Set	-	-	-	-

### Measurement Uncertainty

The given measurement uncertainty is the standard of the measurement multiplied by an extension factor k which corresponds to a confidence level of about 95% for a normal distribution. The standard uncertainty was calculated according to M3003

**Traceability :** The measurement is traceable to national standard, which realize the physical unit of measurement (SI)

- National Institute of Metrology (Thailand) through Calibration Laboratory

END OF REPORT



## 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 August, 2022

Certification No. 287/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC80813A59 ID No. : No.12

Customer : Environment Research & Technology Company Limited.  
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1005.6 hPa

### NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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 - 80 m/sec

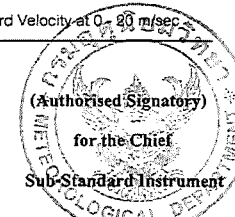
Calibrated by : Watchapol Subwat

Signed :

Mr. Watchapol Subwat

Mr. Pisood Promsut

Mechanical Engineer







# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Certification No. 287/22

10 August, 2022

Page : 2 of 2

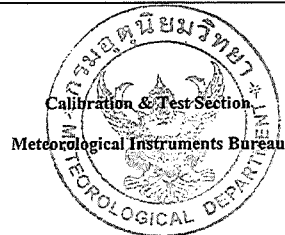
Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.1	0.91
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.1	0.92
20.02	-	-	-	19.3	0.72

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

Calibrated by :

*Handwritten signature*

Mr. Watcharapol Subwat  
Mechanical Engineer



# 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 9 February, 2022

Certification No. 039/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WE91016A20 ID No. : No.10

Customer : Environment Research & Technology Company Limited.  
25/113-114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1013.6 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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

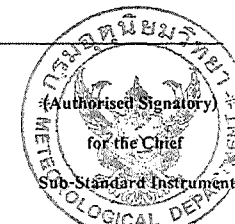
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : *Handwritten signature*  
Mr. Watcharapol Subwat  
Mechanical Engineer

Signed : *Handwritten signature*  
Mr. Pisoon Promsut  
Sub-Standard Instrument





## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

### The Result of Calibration

Certification No. 039/22

9 February, 2022

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.1	0.92
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.1	0.91
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.1	0.92
20.02	-	-	-	19.3	0.72

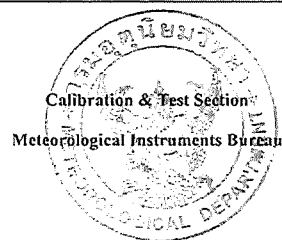
Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer




Support Equipment Type	: Sound Level Calibrator
Manufacture	: Larson Davis
Model	: CAL200
Serial No.	: 3606
Range of Calibrator	
- Sound Pressure Level	: 93.5 dB.
- Frequency	: 1,000 Hz.
Calibrated By	: Mr.Suriya Choothong
Calibration Date	: November 10, 2022
Customer Name	: บริษัท โฟร์เทียร์ คอนซัลแตนต์ จำกัด: นิคมอุตสาหกรรมเอเพ็กซ์กรีน อินดัสเตรียล เอสเตท ของบริษัท เอเพ็กซ์ ปาร์ค จำกัด

[illegible]

Paym.  
-----  
Mr. Prayun Detkla  
Technician

envi research Approved By  
ENVIRONMENT RESEARCH & TECHNOLOGY CO., LTD.

  
.....  
Ms.Sutatip Im-noi  
Environmental Scientist





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0605

MTC No. EEL. BP. 98/0665

### CALIBRATION CERTIFICATE

Submitted by : Environment Research & Technology Co., Ltd.

Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong, Laksi, Bangkok 10210.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

#### Instrument Calibrated :

Description : Precision Acoustic Calibrator

Manufacturer : Larson Davis

Model : CAL200

Serial No. : 3606

#### 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 Bruel&Kjaer 4180 S/N 2633526.

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 : 29 Jun. 2022

Date of Calibration : 5 Jul. 2022

1 / 3

*N. M. K. J.*

The results relate only to the items tested/calibrated or value assigned.

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Request No. 21-65/0605

MTC No. EEL. BP. 98/0665

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&Kjaer4180	93.50	-0.50	$\pm 0.10$	$\pm 0.40 \text{ dB}$

#### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1000.4	0.4	$\pm 1.5$	$\pm 1.0 \%$

#### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer4180	1.83	$\pm 0.50$	$\pm 3.0 \%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at the level of 0.26 dB from manual.

Date of Calibration : 5 Jul. 2022

2 / 3

*N. M. K. J.*

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Request No. 21-65/0605

MTC No. EEL. BP. 98/0665

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	113.53	-0.47	± 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	0.64	± 0.50	± 3.0 %

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

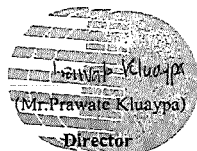
3. The microphone volume correction was included at the level of 0.26 dB from manual.

Calibrated by :

*N. Nuttapong*  
(Mr. Nuttapong Niljrusvanit)

*Tawikiat*  
(Mr. Tawikiat Iamsamran)

Approved by :



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Jul. 2022

Date of Issue : 6 Jul. 2022

Ref : 2011265062902932003

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End of Certificate

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