

ภาคผนวก 3ข

---

เอกสารสอบเทียบเครื่องมือตรวจวัด ของบริษัท  
เอ็นไวรอนเมนต์ รีเสิร์ช แอนด์ เทคโนโลยี จำกัด

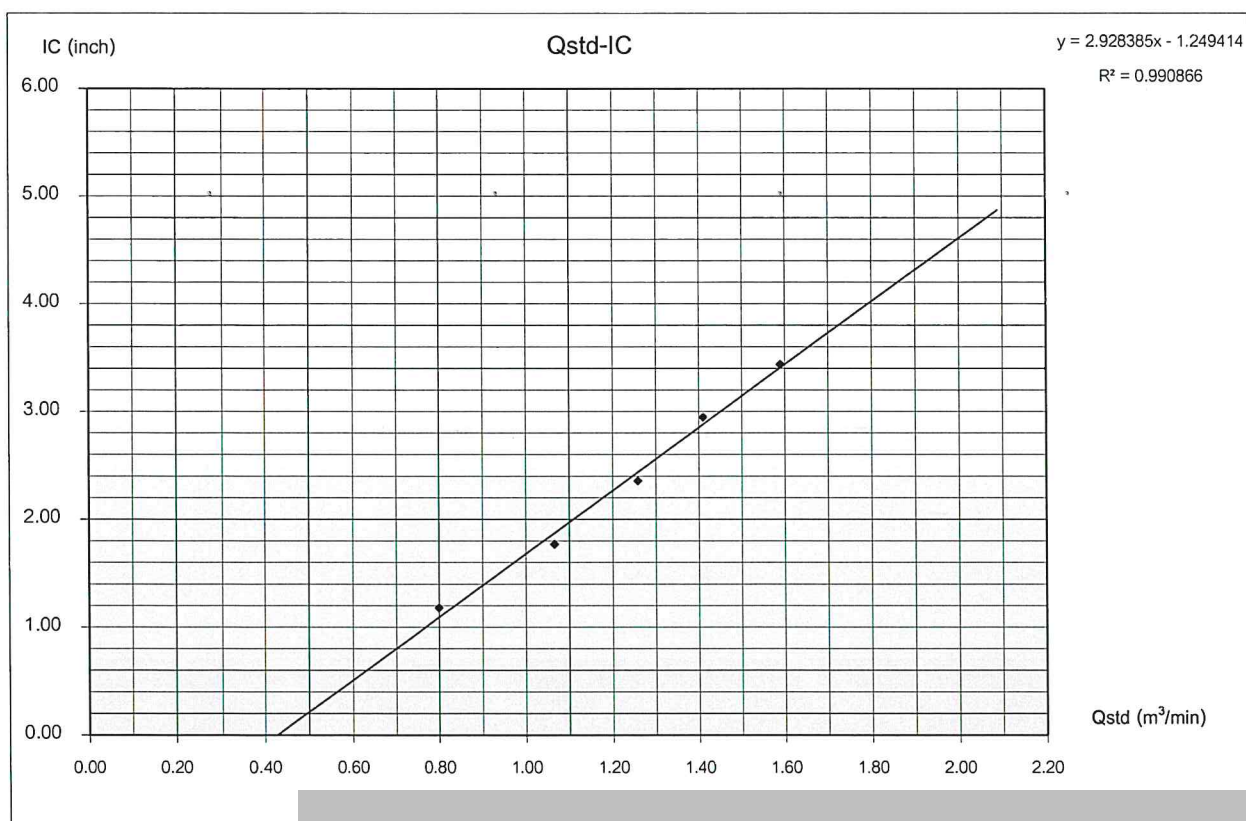
# TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	สำนักงานภายในโครงการ			Start Time	11:14 AM
Sampler Number	TSP No.A8	Transfer Standard Type	Orifice	Stop Time	11:24 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Watcharapon On-nom
Motor Serial Number	3680	Calibrator Serial Number	2914		
Recorder Serial Number	3767				

Plate	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric	Start	Stop
No.	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 Indicato ( inch )	IC = I[(Pa/P <sub>std</sub> )(T <sub>std</sub> /Ta)] <sup>1/2</sup>	(*K = °C+273)	Pressure ( mmHg )	Meter	Meter
	Positive	Negative	ΔH <sub>2</sub> O								
5	1.4	1.4	2.8	1.64318	0.79943	1.2	1.18	307.0	755.0		
7	2.5	2.5	5.0	2.19579	1.06528	1.8	1.77	307.0	755.0		
10	3.5	3.5	7.0	2.59809	1.25881	2.4	2.36	307.0	755.0		
13	4.4	4.4	8.8	2.91304	1.41032	3.0	2.95	307.0	755.0		
18	5.6	5.6	11.2	3.28636	1.58991	3.5	3.44	307.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	307.0	755.0		
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.990866	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9954225	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.96429796	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.981986741	

COMMENT

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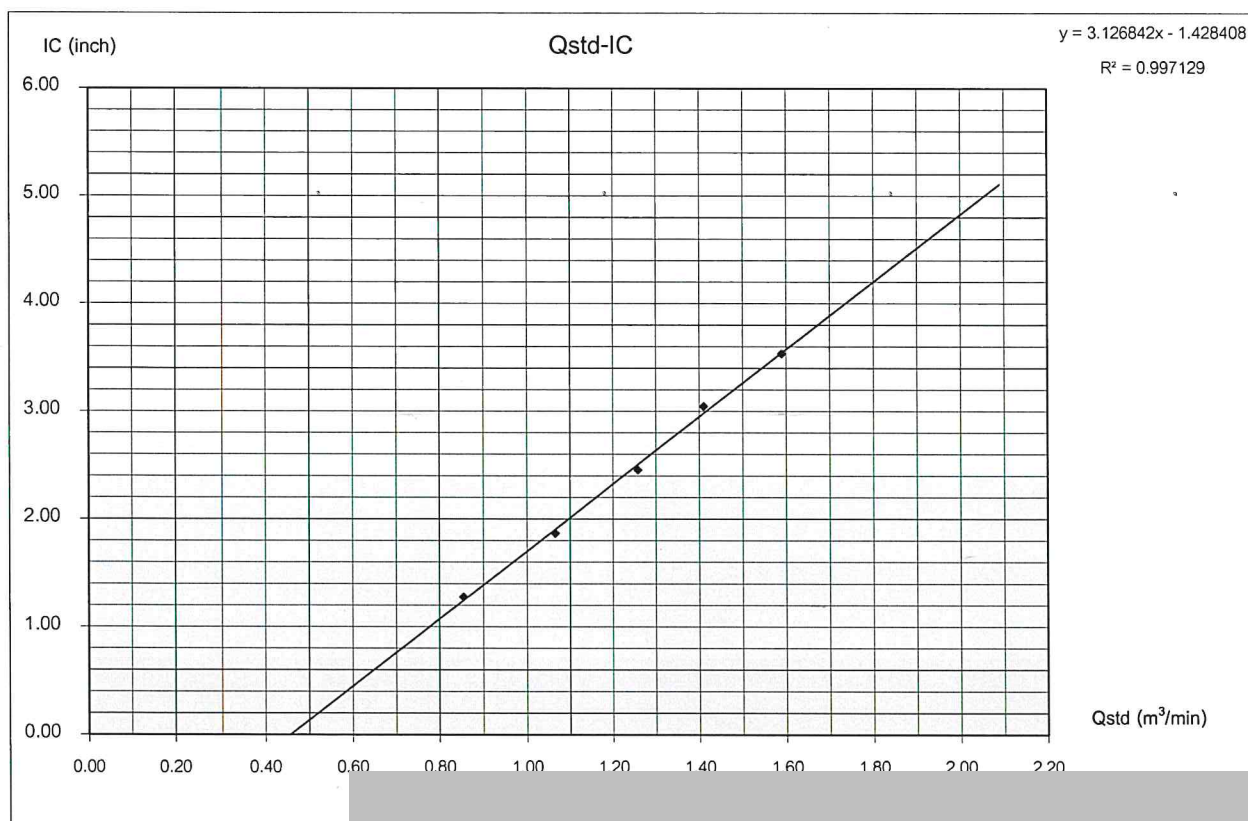
## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	พื้นที่ทำเทียบเรือลำนานา			Start Time	11:58 AM
Sampler Number	TSP No.A12	Transfer Standard Type	Orifice	Stop Time	12:08 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Sittipom Wongksam
Motor Serial Number	610-650	Calibrator Serial Number	2914		
Recorder Serial Number	102930701				

Plate	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric	Start	Stop
No.	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	Qstd = (1/m)[(A-b)] ( m <sup>3</sup> /min )	Sample Flow Rate Indication ( inch )	$IC = I/[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	("K = °C+273)	Pressure ( mmHg )	Meter	Meter
	Positive	Negative	ΔH <sub>2</sub> O								
5	1.6	1.6	3.2	1.75663	0.85401	1.3	1.28	307.0	755.0		
7	2.5	2.5	5.0	2.19579	1.06528	1.9	1.87	307.0	755.0		
10	3.5	3.5	7.0	2.59809	1.25881	2.5	2.45	307.0	755.0		
13	4.4	4.4	8.8	2.91304	1.41032	3.1	3.04	307.0	755.0		
18	5.6	5.6	11.2	3.28636	1.58991	3.6	3.54	307.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	307.0	755.0		
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.997129	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9985635	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.96429796	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.981986741	

COMMENT

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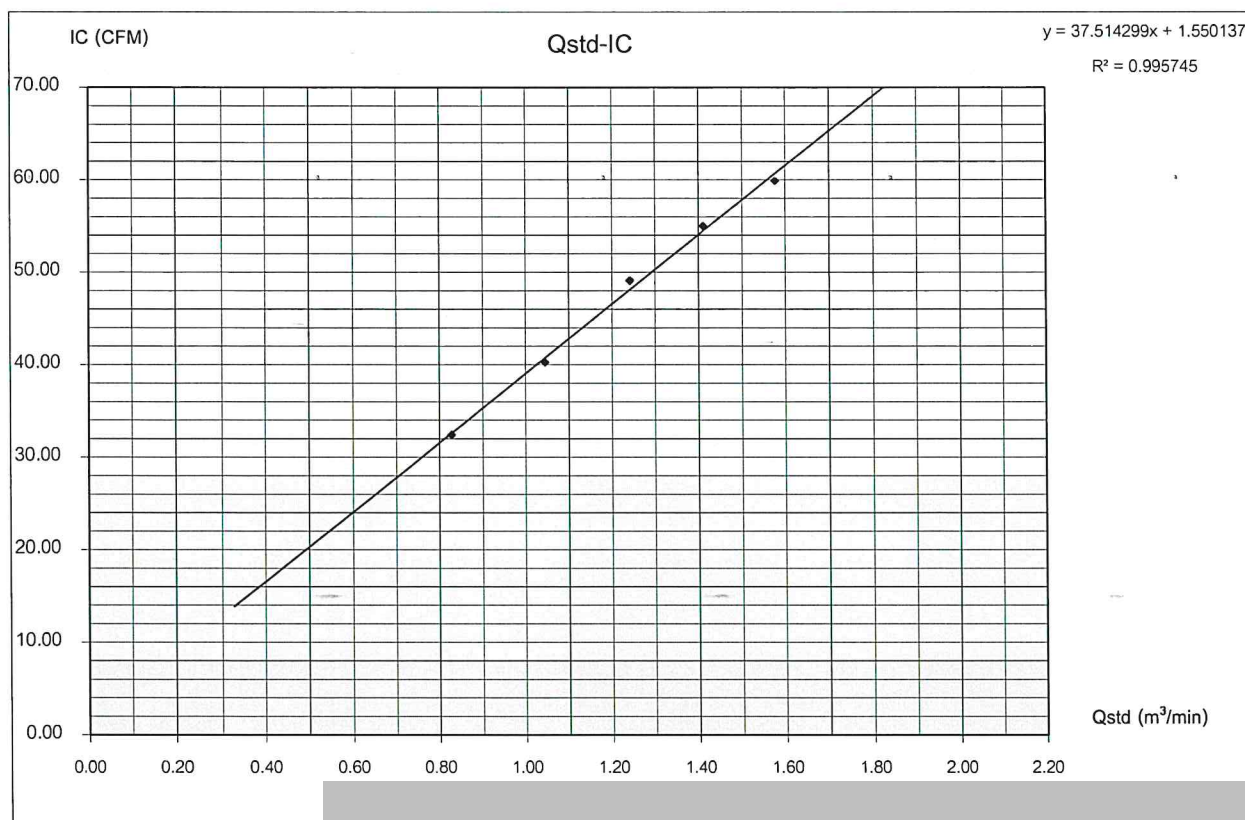
## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	บ้านพักอาศัยย่านตึกหนึ่ง			Start Time	12:36 PM
Sampler Number	TSP No.A28	Transfer Standard Type	Orifice	Stop Time	12:46 PM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Watcharapon On-nom
Motor Serial Number	2217	Calibrator Serial Number	2914		
Recorder Serial Number	2134				

Plate	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric	Start	Stop	
No.	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 )	Sample 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)	Pressure ( mmHg )	Meter	Meter	
	Positive	Negative	ΔH <sub>2</sub> O									
5	1.5	1.5	3.0	1.70085	0.82796	33.0	32.41	307.0	755.0			
7	2.4	2.4	4.8	2.15143	1.04471	41.0	40.26	307.0	755.0			
10	3.4	3.4	6.8	2.56071	1.24161	50.0	49.10	307.0	755.0			
13	4.4	4.4	8.8	2.91304	1.41110	56.0	54.99	307.0	755.0			
18	5.5	5.5	11.0	3.25688	1.57651	61.0	59.90	307.0	755.0			
Linear Regression Y ON X : Y= mX + b							Average	307.0	755.0			
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.995745	Pstd(mmHg)	760.0	
2	Intercept ( b )			-0.02023	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min)			1.133	r	0.9978702	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )			0	(Pa/Pstd)*(Tstd/Ta)		0.96429796	
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.981986741	

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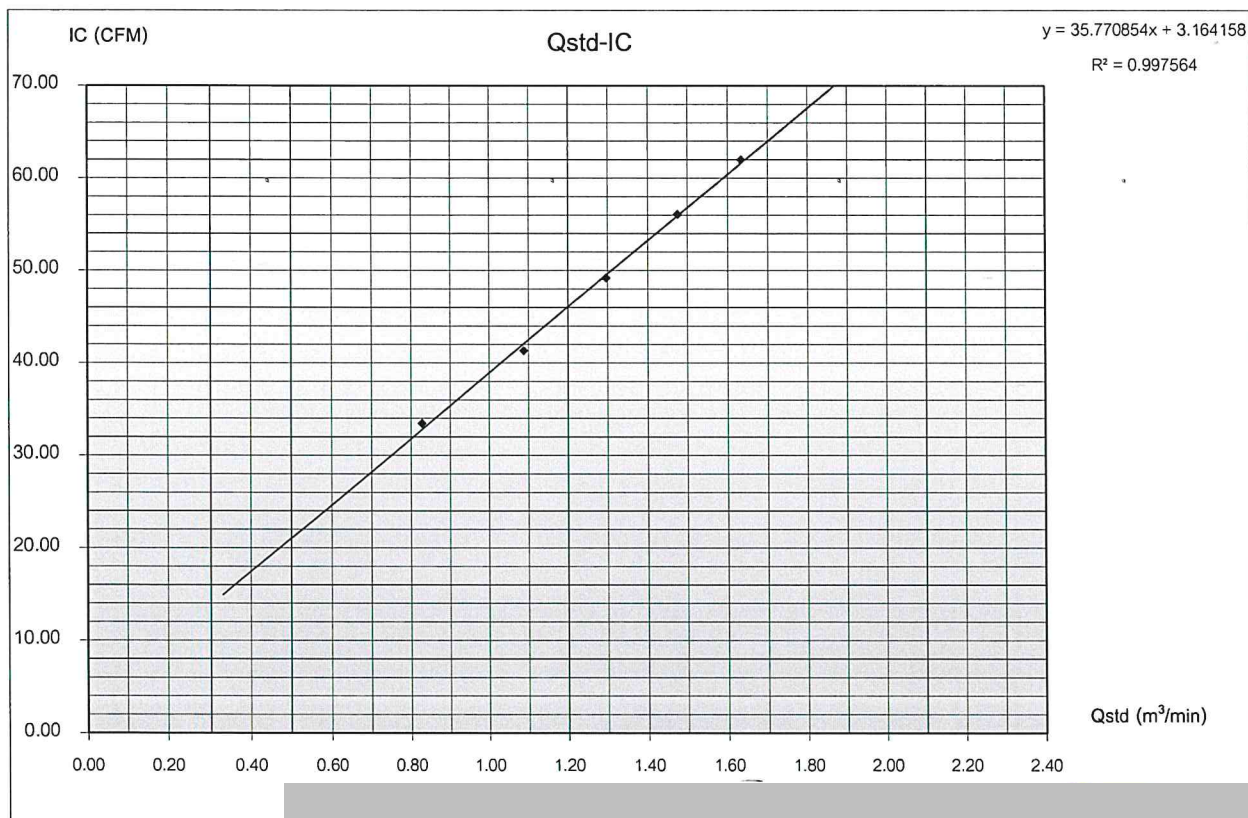
## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273	Date	June 6, 2024
Sampler Location	A4 กรุงเทพมหานคร	Start Time	12:05 PM
Sampler Number	TSP No. A30	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A
Motor Serial Number	2213	Calibrator Serial Number	2914
Recorder Serial Number	2136	Calibrated By	Mr. Anan Kongguenok

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	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	( mmHg )		
	Positive	Negative	ΔH <sub>2</sub> O		( m <sup>3</sup> /min )	( ft <sup>3</sup> /min )					
5	1.5	1.5	3.0	1.70363	0.82851	34.0	33.44	306.0	755.0		
7	2.6	2.6	5.2	2.24293	1.08795	42.0	41.31	306.0	755.0		
10	3.7	3.7	7.4	2.67565	1.29612	50.0	49.18	306.0	755.0		
13	4.8	4.8	9.6	3.04754	1.47503	57.0	56.06	306.0	755.0		
18	5.9	5.9	11.8	3.37874	1.63436	63.0	61.97	306.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	306.0	755.0		
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.997564	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min)		1.133	r	0.9987813	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)			0.96744926
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.983589986

COMMENT

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## TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	A5 อมต.ปทุมโพธิ์			Start Time	10:45 AM
Sampler Number	TSP No.A10	Transfer Standard Type	Orifice	Stop Time	10:55 AM
Instrument Model	HIVOL-BBCBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Anan Kongnguenok
Motor Serial Number	2012-04	Calibrator Serial Number	2914		
Recorder Serial Number	1504				

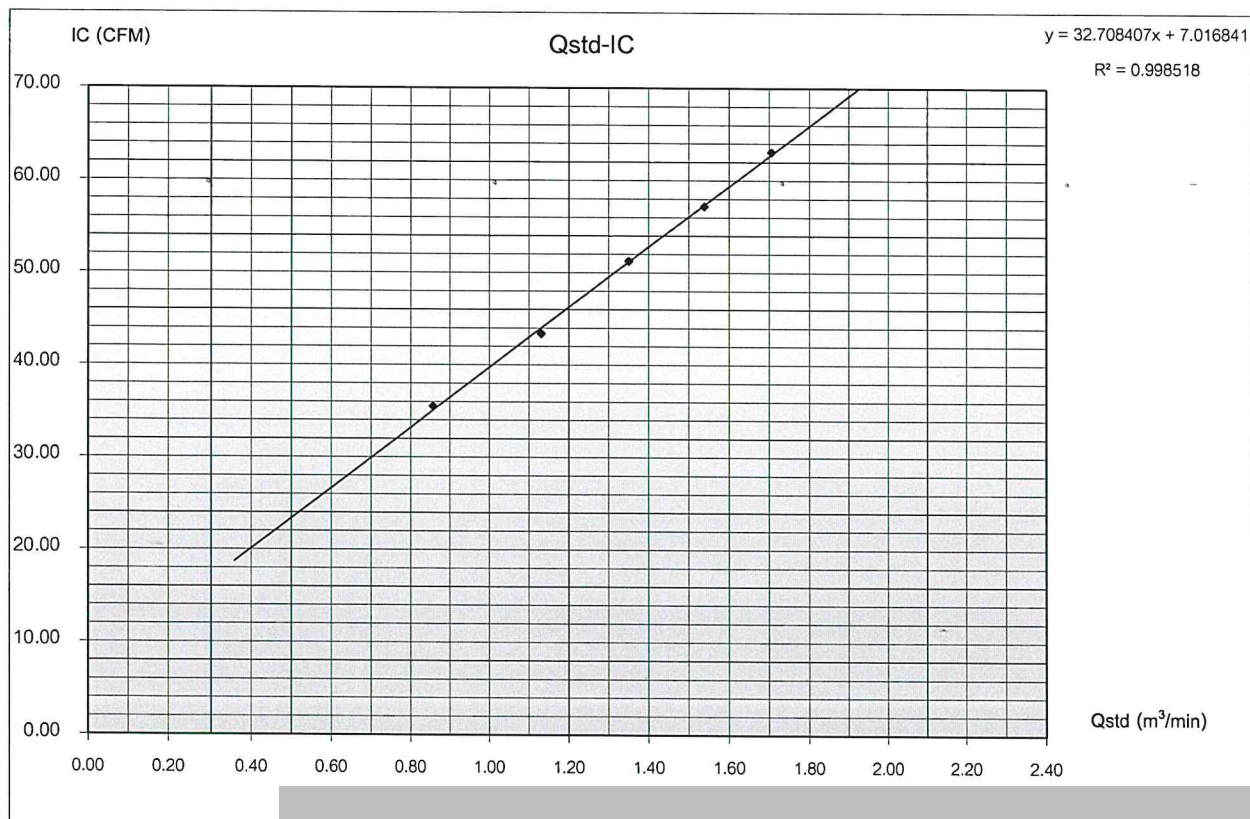
Plate No.	(Delta H) Pressure Drop Across Orifice (inH <sub>2</sub> O)			(A) $[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(X) Qstd = (1/m)[(A-b)] (m <sup>3</sup> /min)	(I) ample Flow Rate Indication (ft <sup>3</sup> /min)	(Y) $IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	Temperature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	$\Delta H_2O$								
5	1.6	1.6	3.2	1.76355	0.85734	36.0	35.49	305.0	756.0		
7	2.8	2.8	5.6	2.33295	1.13126	44.0	43.38	305.0	756.0		
10	4.0	4.0	8.0	2.78841	1.35037	52.0	51.26	305.0	756.0		
13	5.2	5.2	10.4	3.17928	1.53840	58.0	57.18	305.0	756.0		
18	6.4	6.4	12.8	3.52710	1.70572	64.0	63.09	305.0	756.0		

Linear Regression Y ON X : Y= mX + b

1	Slope ( m )	2.07871	Linear Equation		Average	305.0	756.0		
2	Intercept ( b )	-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)	1.133	r <sup>2</sup>	0.998518	Pstd(mmHg)	760.0	
3	Correlation Coefficient ( r )	0.99984	Final Set Flow Rate = ( I )	0	r	0.9992587	T <sub>NTP</sub>	298.0	
					(Pa/Pstd)*(Tstd/Ta)			0.971906816	
Result					C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.985853344	

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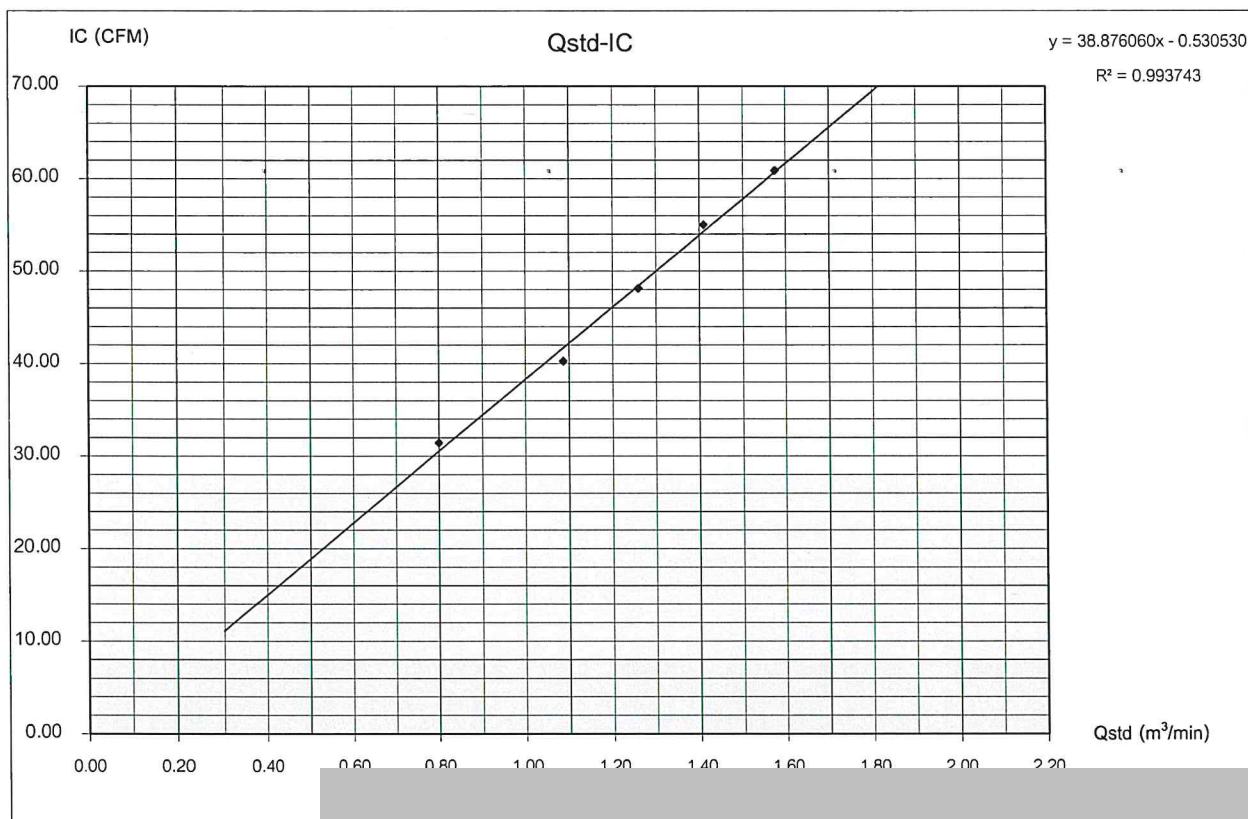
## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	สำนักงานภายในโครงการ			Start Time	11:04 AM
Sampler Number	PM-10 No.24	Transfer Standard Type	Orifice	Stop Time	11:14 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Watcharapon On-nom
Motor Serial Number	2151	Calibrator Serial Number	2914		
Recorder Serial Number	2407				

Plate	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric	Start	Stop	
No.	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 )	Sample 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)	Pressure ( mmHg )	Meter	Meter	
	Positive	Negative	ΔH <sub>2</sub> O									
5	1.4	1.4	2.8	1.64318	0.79943	32.0	31.42	307.0	755.0			
7	2.6	2.6	5.2	2.23927	1.08619	41.0	40.26	307.0	755.0			
10	3.5	3.5	7.0	2.59809	1.25881	49.0	48.12	307.0	755.0			
13	4.4	4.4	8.8	2.91304	1.41032	56.0	54.99	307.0	755.0			
18	5.5	5.5	11.0	3.25688	1.57573	62.0	60.88	307.0	755.0			
Linear Regression Y ON X : Y= mX + b							Average	307.0	755.0			
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.993743	Pstd(mmHg)	760.0	
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9968666	T <sub>NTP</sub>	298.0	
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)			0.96429796	
Result									C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.981986741

### COMMENT

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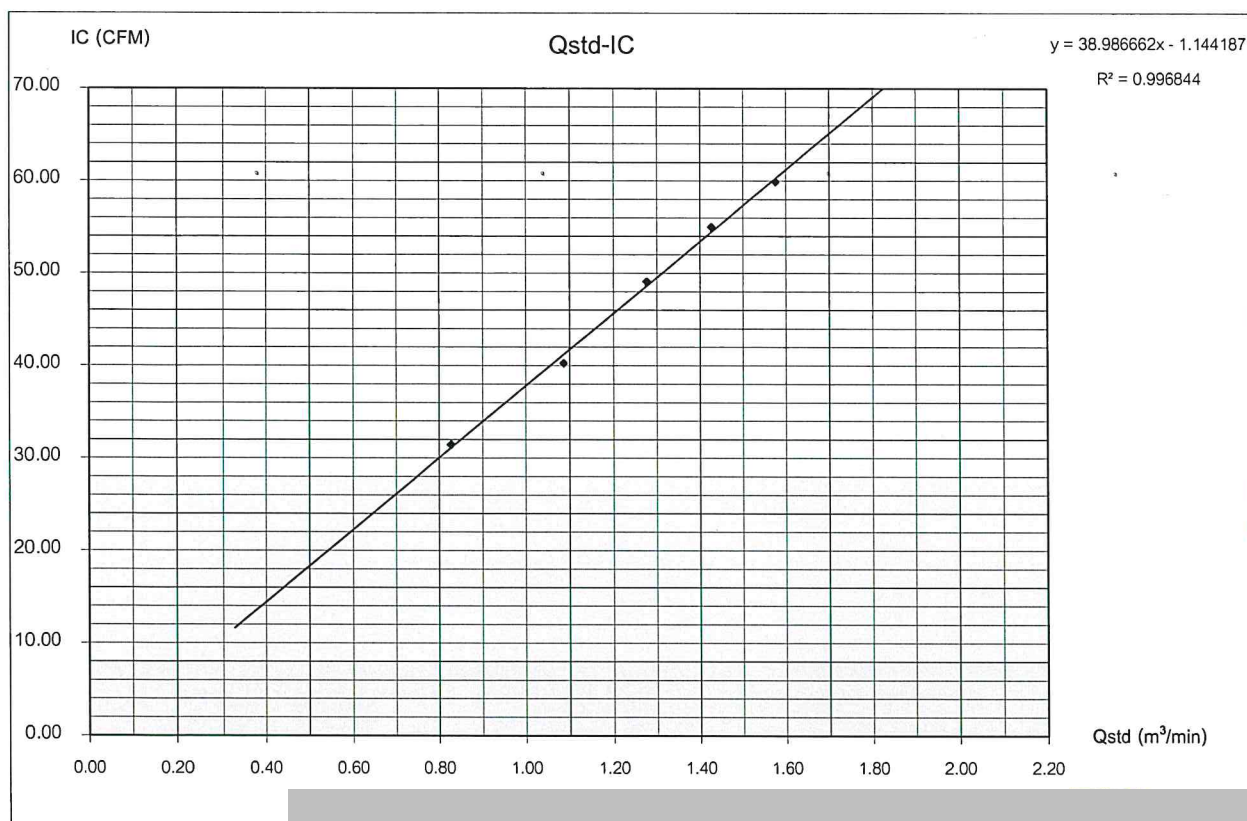
## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273	Date	June 6, 2024
Sampler Location	พื้นที่ทำเทียบเรือลานนา	Start Time	11:48 AM
Sampler Number	PM-10 No.21	Transfer Standard Type	Orifice
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A
Motor Serial Number	2132	Calibrator Serial Number	2914
Recorder Serial Number	2392	Calibrated By	Mr.Sittiporn Wongksam

Plate No.	(Delta H)			( A )	( X )	( I )	( Y )	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH <sub>2</sub> O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Qstd = (1/m)[(A-b)]$	Sample Flow Rate Indication	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$				
	Positive	Negative	$\Delta H_2O$		( m <sup>3</sup> /min )	( ft <sup>3</sup> /min )		(°K = °C+273)	( mmHg )		
5	1.5	1.5	3.0	1.70085	0.82718	32.0	31.42	307.0	755.0		
7	2.6	2.6	5.2	2.23927	1.08619	41.0	40.26	307.0	755.0		
10	3.6	3.6	7.2	2.63495	1.27654	50.0	49.10	307.0	755.0		
13	4.5	4.5	9.0	2.94596	1.42616	56.0	54.99	307.0	755.0		
18	5.5	5.5	11.0	3.25688	1.57573	61.0	59.90	307.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	307.0	755.0		
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.996844	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)		1.133	r	0.9984208	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)			0.96429796
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5			0.981986741

### COMMENT

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## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	บ้านพักอาศัยด้านทิศเหนือ			Start Time	12:26 PM
Sampler Number	PM-10 No.17	Transfer Standard Type	Orifice	Stop Time	12:36 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Watcharapon On-nom
Motor Serial Number	2065	Calibrator Serial Number	2914		
Recorder Serial Number	2217				

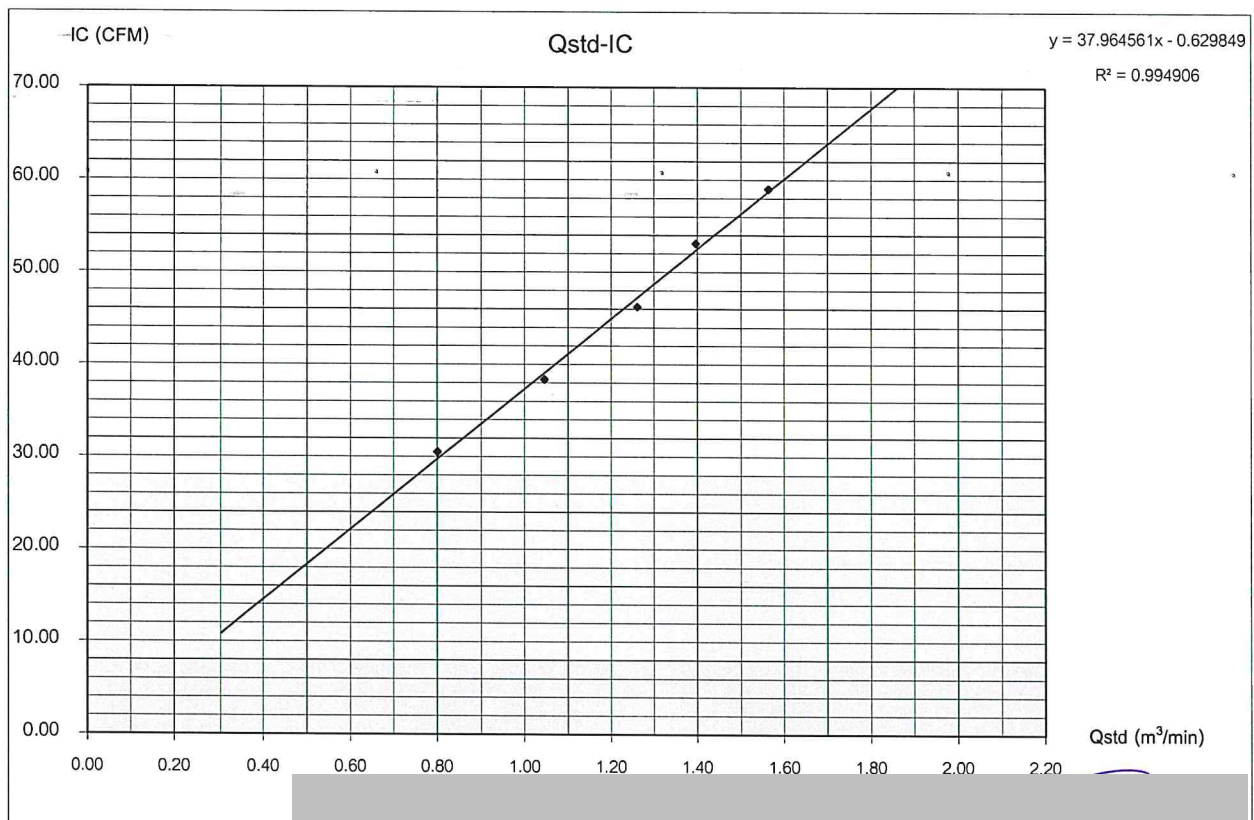
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	ample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = I[(P/P_{std})(T_{std}/T_a)]^{1/2}$	(*K = °C+273)	(mmHg)		
5	1.4	1.4	2.8	1.64586	0.80072	31.0	30.49	306.0	755.0		
7	2.4	2.4	4.8	2.15494	1.04562	39.0	38.36	306.0	755.0		
10	3.5	3.5	7.0	2.60233	1.26085	47.0	46.23	306.0	755.0		
13	4.3	4.3	8.6	2.88445	1.39657	54.0	53.11	306.0	755.0		
18	5.4	5.4	10.8	3.23241	1.56396	60.0	59.02	306.0	755.0		

Linear Regression Y ON X : Y= mX + b

1	Slope ( m )	2.07871	Linear Equation		Average	306.0	755.0		
2	Intercept ( b )	-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)	1.133	r <sup>2</sup>	0.994906	Pstd(mmHg)	760.0	
3	Correlation Coefficient ( r )	0.99984	Final Set Flow Rate = ( I )	0	r	0.9974497	T <sub>NTP</sub>	298.0	
Result							(Pa/Pstd)*(Tstd/Ta)	0.96744926	
							C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.983589986	

COMMENT

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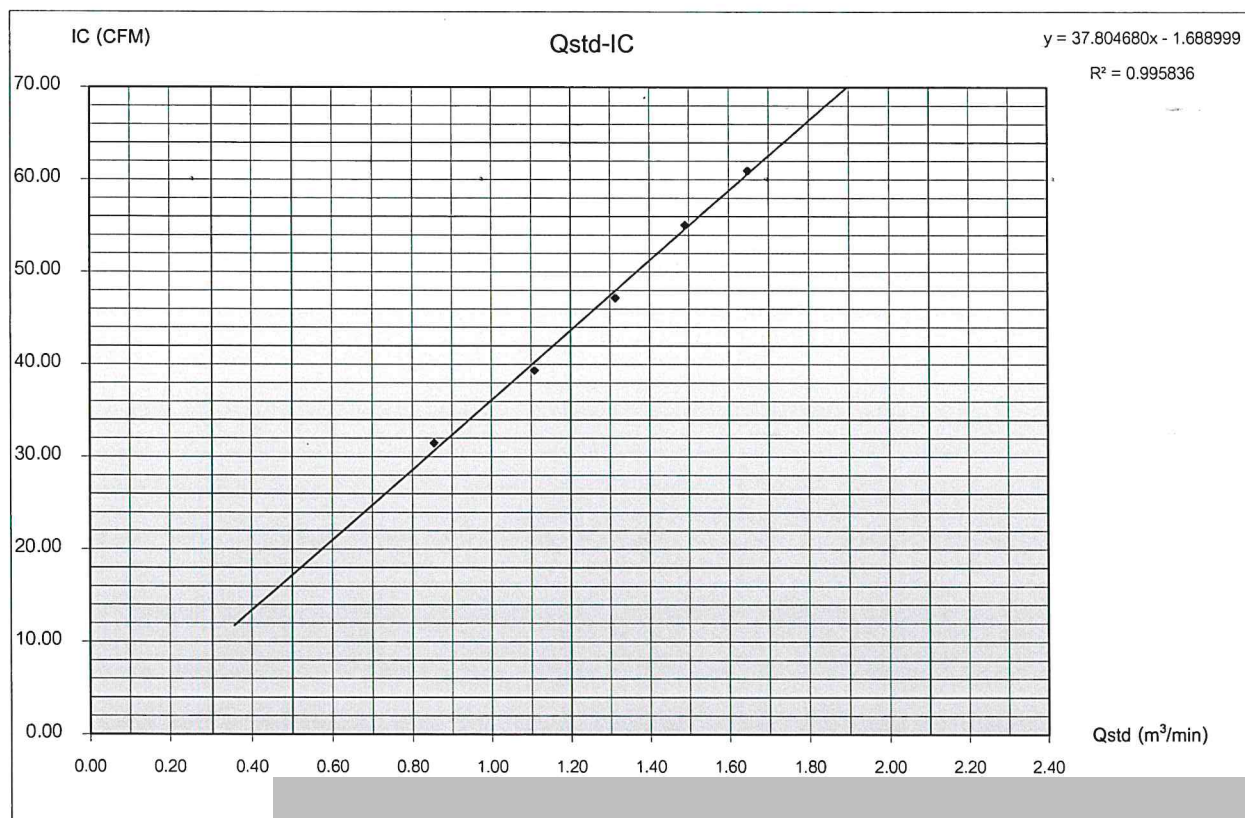
## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	A4 ชุมชนบ้านมอญ			Start Time	12:15 PM
Sampler Number	PM-10 No.18	Transfer Standard Type	Orifice	Stop Time	12:25 PM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Anan Kongnguenok
Motor Serial Number	2139	Calibrator Serial Number	2914		
Recorder Serial Number	2390				

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 )	Sample Flow Rate Indicator ( 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	1.6	1.6	3.2	1.75950	0.85539	32.0	31.47	306.0	755.0		
7	2.7	2.7	5.4	2.28566	1.10851	40.0	39.34	306.0	755.0		
10	3.8	3.8	7.6	2.71157	1.31340	48.0	47.21	306.0	755.0		
13	4.9	4.9	9.8	3.07912	1.49022	56.0	55.08	306.0	755.0		
18	6.0	6.0	12.0	3.40726	1.64807	62.0	60.98	306.0	755.0		
Linear Regression Y ON X : Y= mX + b							Average	306.0	755.0		
1	Slope ( m )			2.07871	Linear Equation			r <sup>2</sup>	0.995836	Pstd(mmHg)	760.0
2	Intercept ( b )			-0.01861	Set Point Flow Rate ( X ) ( m <sup>3</sup> /min)		1.133	r	0.9979158	T <sub>NTP</sub>	298.0
3	Correlation Coefficient ( r )			0.99984	Final Set Flow Rate = ( I )		0	(Pa/Pstd)*(Tstd/Ta)		0.96744926	
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5		0.983589986	

COMMENT

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Checked By



## PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Quotation	2024-00273			Date	June 6, 2024
Sampler Location	A5 อบต.ปอไทย			Start Time	10:55 AM
Sampler Number	PM-10 No.20	Transfer Standard Type	Onifice	Stop Time	11:05 AM
Instrument Model	HIVOL-BMBBE	Calibrator Model	TE-5025A	Calibrated By	Mr.Anan Kongnguenok
Motor Serial Number	2140	Calibrator Serial Number	2914		
Recorder Serial Number	2393				

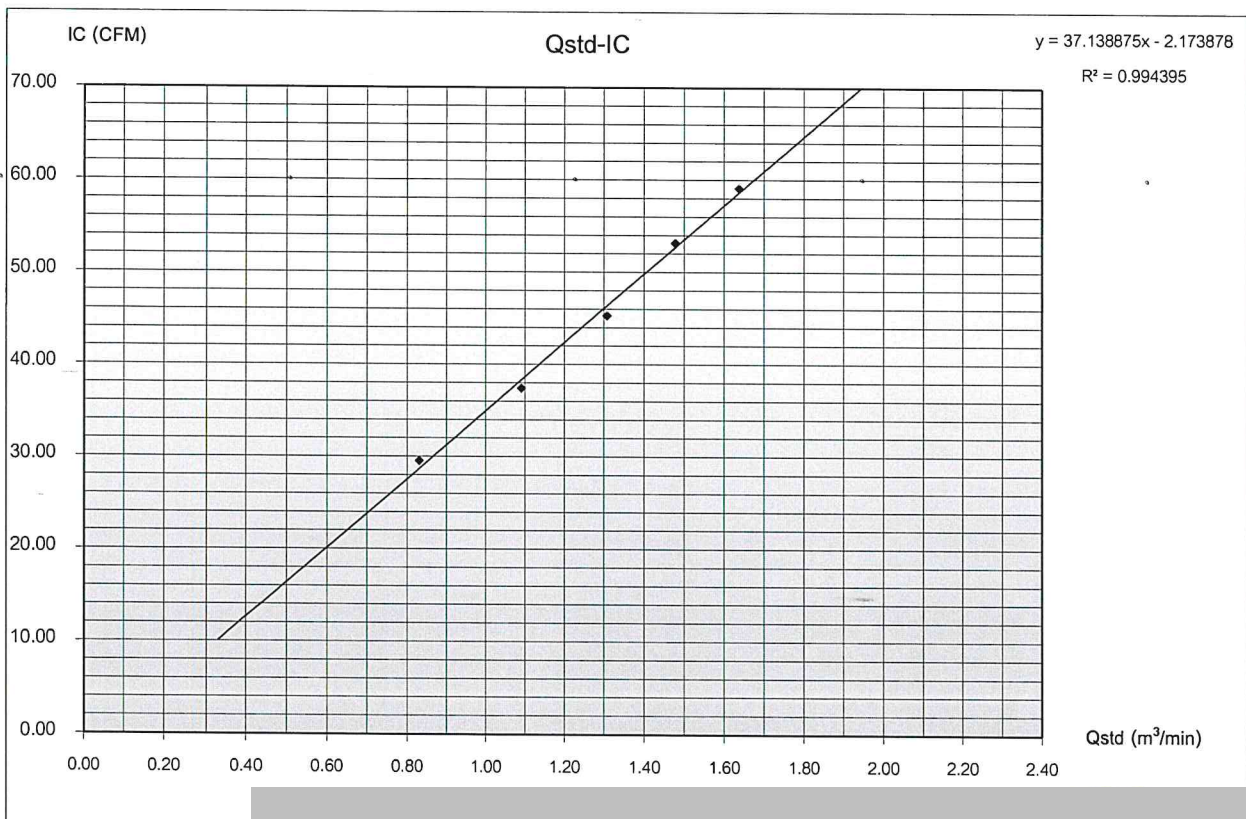
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Positive	Negative	$\Delta H_2O$	$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m <sup>3</sup> /min)	Sample Flow Rate Indication (ft <sup>3</sup> /min)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	(°K = °C+273)	Pressure (mmHg)	Meter	Meter
5	1.5	1.5	3.0	1.70642	0.82986	30.0	29.56	305.0	755.0		
7	2.6	2.6	5.2	2.24660	1.08972	38.0	37.44	305.0	755.0		
10	3.7	3.8	7.5	2.69808	1.30691	46.0	45.32	305.0	755.0		
13	4.8	4.8	9.6	3.05253	1.47743	54.0	53.20	305.0	755.0		
18	5.9	5.9	11.8	3.38428	1.63702	60.0	59.11	305.0	755.0		

Linear Regression Y ON X : Y= mX + b

1	Slope ( m )	2.07871	Linear Equation		Average	$r^2$	0.994395	Pstd(mmHg)	760.0
2	Intercept ( b )	-0.01861	Set Point Flow Rate ( X ) (m <sup>3</sup> /min)	1.133	r	0.9971936	T <sub>NTP</sub>	298.0	
3	Correlation Coefficient ( r )	0.99984	Final Set Flow Rate = ( I )	0	(Pa/Pstd)*(Tstd/Ta)	0.970621225			
Result						C=(Pa/Pstd)*(Tstd/Ta)^0.5	0.985201109		

COMMENT

Andersen Instruments, Inc.



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## CERTIFICATE OF CALIBRATION

Certificate No. : COF-006-66

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Top Load Orifice  
**MANUFACTURER** : TISCH  
**MODEL/TYPE** : TE-5025A  
**SERIAL NUMBER** : 2914  
**ID NUMBER** : -  
**CONDITION AS-RECEIVED** : Used item  
**CUSTOMER** : Environment Research & Technology Co., Ltd.  
25/114 Moo 6 Soi Chinaket 1, Ngamwongwan Road,  
Toongsonghong, Laksi, Bangkok 10210

**RECEIVED DATE** : 27 Jul 2023  
**MEASUREMENT DATE** : 31 Jul 2023  
**ISSUE DATE** : 31 Jul 2023

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 24.3 °C and 50.5 %RH.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

**NOTED:** The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol





**MEASUREMENT RESULTS:**

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

**Table 1:** The results of  $Q$  Standard calibration data

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $m^3/min$
1	0.699	755.476	24.24	23.40	53.510	1.786	1.334	0.649
2	1.000	755.470	24.17	23.68	58.170	3.598	1.894	0.921
3	1.111	755.481	24.19	23.60	40.793	4.682	2.160	1.050
4	1.167	755.465	23.87	23.48	31.004	5.323	2.305	1.118
5	1.411	755.522	24.29	23.78	30.145	7.846	2.796	1.352

Slope ( $m$ ): **2.07871**  
 Intercept ( $b$ ): **-0.01861**  
 Correlation coefficient ( $r$ ): **0.99984**  
 Uncertainty ( $k=2$ ): **0.015**  $m^3/min$

**Table 2:** The results of  $Q$  actual calibration data

Plate	Flow rate $m^3/min$	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	$\Delta p_{meter}$ mmHg	$\Delta p_{Orifice}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_a$ ] $m^3/min$
1	0.699	755.476	24.24	23.40	53.510	1.786	0.839	0.651
2	1.000	755.470	24.17	23.68	58.170	3.598	1.190	0.924
3	1.111	755.481	24.19	23.60	40.793	4.682	1.357	1.053
4	1.167	755.465	23.87	23.48	31.004	5.323	1.447	1.121
5	1.411	755.522	24.29	23.78	30.145	7.846	1.758	1.357

Slope ( $m$ ): **1.30200**  
 Intercept ( $b$ ): **-0.01171**  
 Correlation coefficient ( $r$ ): **0.99984**  
 Uncertainty ( $k = 2$ ): **0.015**  $m^3/min$

\*\*\*End of Certificate of Calibration\*\*\*



Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

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MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025  
CALIBRATION 0062

## Accuracy Calibration Certificate

### Customer

**Company:** Environment Research & Technology Co., Ltd.  
**Address:** 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Rd., Toongsonghong  
**City:** Laksi **Contact:** Ramita Taengthai  
**Zip / Postal:** 10210  
**State / Province:** Bangkok  
**Order Number:**   
0 3 3 2 9 6 3 6 1 1

### Weighing Device

**Manufacturer:** Mettler Toledo **Instrument Type:** Weighing Instrument  
**Model:** AB204-S **Asset Number:** ERTC-L-IN-0048  
**Serial No.:** 1123103723 **Terminal Model:** N/A  
**Building:** N/A **Terminal Serial No.:** N/A  
**Floor:** 4 **Terminal Asset No.:** N/A  
**Room:** 406

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

### Procedure

**Calibration Guideline:** EURAMET cg-18 v. 4.0 (11/2015)  
**METTLER TOLEDO Work Instruction:** CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 25.4 °C	End: 25.3 °C	Start: 36.4 %	End: 34.9 %
As Left	Start: 25.3 °C	End: 25.2 °C	Start: 34.9 %	End: 34.1 %

**As Found Calibration Date:** 15-Jan-2024  
**As Left Calibration Date:** 15-Jan-2024  
**Issue Date:** 15-Jan-2024

**Calibrator:**

**Approved Signature**

## Measurement Results

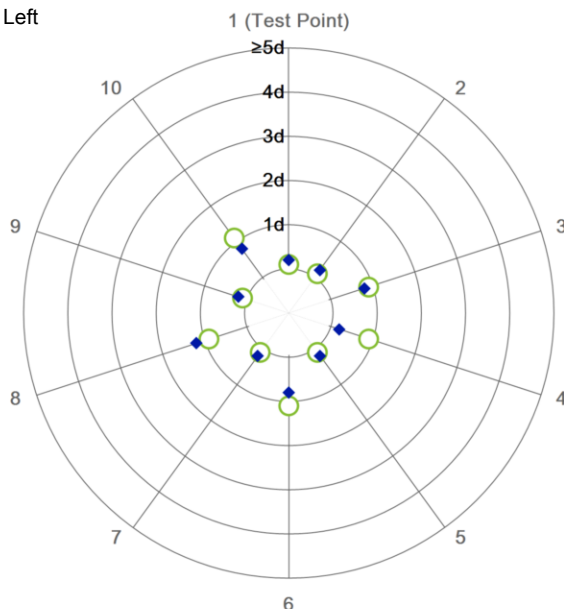
### Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9993 g	100.0002 g
2	99.9993 g	100.0002 g
3	99.9992 g	100.0003 g
4	99.9992 g	100.0002 g
5	99.9993 g	100.0002 g
6	99.9994 g	100.0003 g
7	99.9993 g	100.0002 g
8	99.9992 g	100.0001 g
9	99.9993 g	100.0002 g
10	99.9994 g	100.0003 g

Standard Deviation	0.00007 g	0.00006 g
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○ As Found  
◆ As Left



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

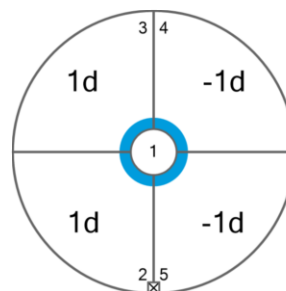
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

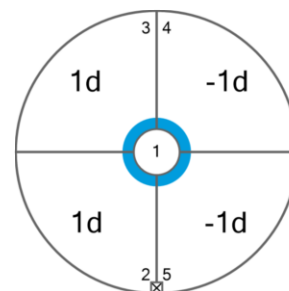
Test Load: 100 g

Position	As Found	As Left
1	99.9993 g	100.0002 g
2	99.9994 g	100.0003 g
3	99.9994 g	100.0003 g
4	99.9992 g	100.0001 g
5	99.9992 g	100.0001 g

Maximum Deviation	0.0001 g	0.0001 g
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As Found



As Left

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

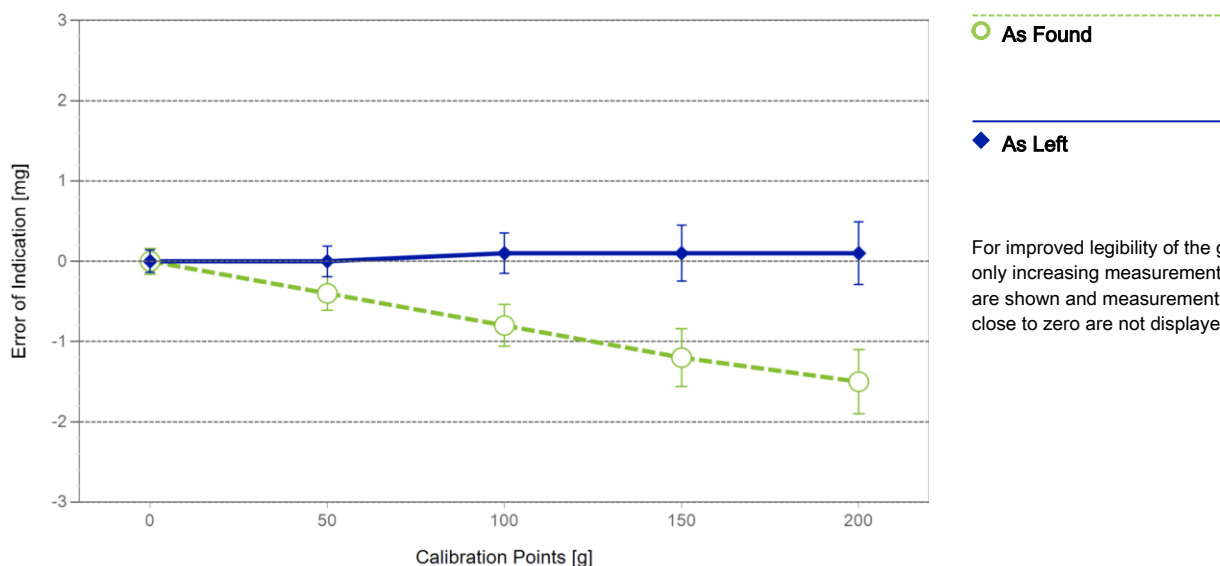
## Error of Indication

### As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.16 mg	2
2	0.0500 g	0.0501 g	0.0001 g	0.17 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.17 mg	2
4	0.5000 g	0.5001 g	0.0001 g	0.17 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.17 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.17 mg	2
7	10.0000 g	9.9998 g	-0.0002 g	0.18 mg	2
8	50.0000 g	49.9996 g	-0.0004 g	0.21 mg	2
9	100.0001 g	99.9993 g	-0.0008 g	0.26 mg	2
10	150.0001 g	149.9989 g	-0.0012 g	0.36 mg	2
11	200.0000 g	199.9985 g	-0.0015 g	0.40 mg	2

### As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.14 mg	2
2	0.0500 g	0.0500 g	0.0000 g	0.15 mg	2
3	0.1000 g	0.1000 g	0.0000 g	0.15 mg	2
4	0.5000 g	0.5000 g	0.0000 g	0.15 mg	2
5	1.0000 g	1.0000 g	0.0000 g	0.15 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
7	10.0000 g	10.0000 g	0.0000 g	0.16 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.19 mg	2
9	100.0001 g	100.0002 g	0.0001 g	0.25 mg	2
10	150.0001 g	150.0002 g	0.0001 g	0.35 mg	2
11	200.0000 g	200.0001 g	0.0001 g	0.39 mg	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.  
The results of this calibration certificate relate only to the calibrated item.



## Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

### Weight Set 1: OIML E2

Weight Set No.:	WS52	Date of Issue:	22-Nov-2022
Certificate Number:	182272	Calibration Due Date:	21-May-2024

### Thermo Hygrometer

Equipment No.:	IN302	Date of Issue:	11-Oct-2023
Certificate Number:	SG-H-00656/66	Calibration Due Date:	08-Oct-2024

## Remarks

Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory

### End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

## Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value  $R$  represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

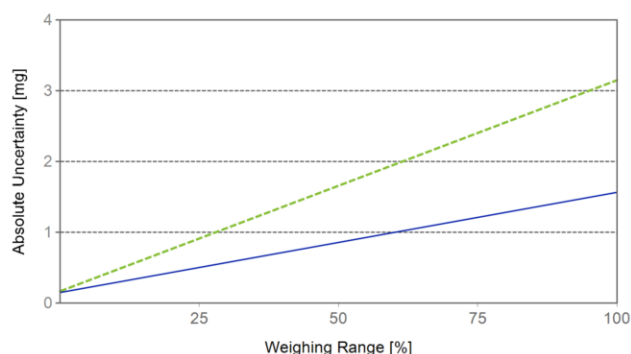
### Linearization of Uncertainty Equation

Range			As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.17 \text{ mg} + 0.0136 \text{ mg/g} \cdot R$	$U_1 = 0.15 \text{ mg} + 0.00644 \text{ mg/g} \cdot R$

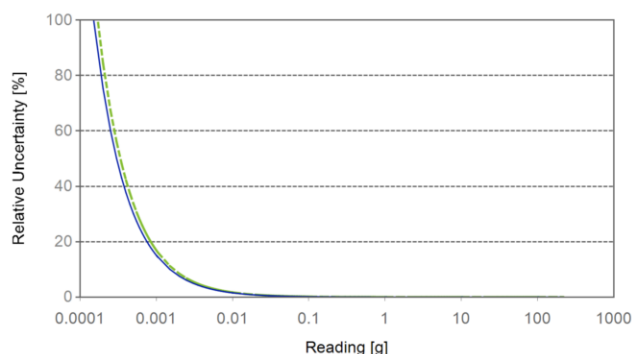
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

### Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.17 mg	0.77%	0.15 mg	0.68%
0.2200 g	0.17 mg	0.079%	0.15 mg	0.069%
2.2000 g	0.20 mg	0.0091%	0.16 mg	0.0075%
22.0000 g	0.47 mg	0.0021%	0.29 mg	0.0013%
220.0000 g	3.2 mg	0.0014%	1.6 mg	0.00071%



As Found



As Left

# GWP® Certificate



As  
Found



As  
Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:



As Found



As Left

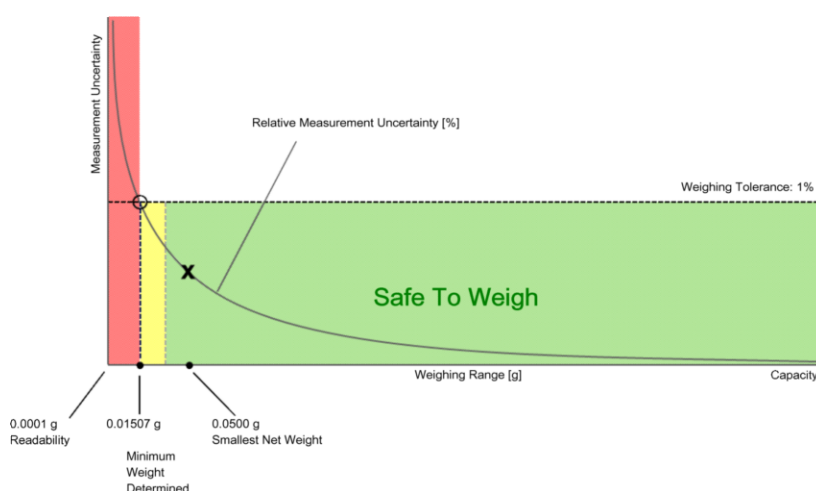
## Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.0500 g

Safety Factor: 2

### Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

# Minimum Weight

## As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.17097 g	0.34671 g	0.52742 g	0.90460 g	1.95110 g
0.2%	0.08490 g	0.17097 g	0.25823 g	0.43643 g	0.90460 g
0.5%	0.03382 g	0.06783 g	0.10202 g	0.17097 g	0.34671 g
1%	0.01689 g	0.03382 g	0.05080 g	0.08490 g	0.17097 g
2%	0.00844 g	0.01689 g	0.02535 g	0.04231 g	0.08490 g
5%	0.00337 g	0.00675 g	0.01013 g	0.01689 g	0.03382 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

## As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.15153 g	0.30504 g	0.46056 g	0.77780 g	1.60910 g
0.2%	0.07552 g	0.15153 g	0.22803 g	0.38254 g	0.77780 g
0.5%	0.03015 g	0.06038 g	0.09068 g	0.15153 g	0.30504 g
1%	0.01507 g	0.03015 g	0.04525 g	0.07552 g	0.15153 g
2%	0.00753 g	0.01507 g	0.02261 g	0.03770 g	0.07552 g
5%	0.00301 g	0.00602 g	0.00904 g	0.01507 g	0.03015 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with  $k = 2$  and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

### Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.



# Measurement Results

## Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

## Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	N/A	0.00007 g*	N/A	0.00006 g*	N/A
0.2%	0.00005 g		✗		✗
0.5%	0.00013 g		✓		✓
1%	0.00025 g		✓		✓
2%	0.00050 g		✓		✓
5%	0.00125 g		✓		✓

\*The calculated standard deviation value is below the rounding error of the balance. The  $0.41 \cdot d$  rule is used for the assessment of this repeatability test and the calculation of the minimum weight.

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

## Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

**Error of Indication****As Found**

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	-0.0004 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	-0.0008 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	-0.0012 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	-0.0015 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

**As Left**

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

## Calibration Data of NOx Analyzer

### Analyzer Performance Test

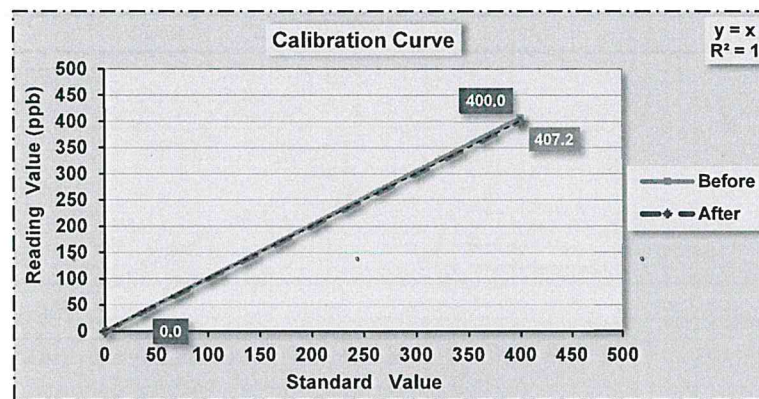
Equipment	Gas Analyzer ( NOx )	Customer Name	ทีแอลพี คอนซิลแดนส์
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00271, 2024-00273, 2024-00271
Serial No.	VLR55LT4	Calibration Date	April 17, 2024
Analyzer Unit	ppb	Time	2:49 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-0.3	0.0	-0.4	0.0	0.1	0.0	-	-	-
Span	400	408.4	400.0	407.2	400.0	1.2	0.0	-	-	1.8



### STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL APNA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal NO	mV	0.5	0.8	Voltage of the measured NO value
Signal NOx	mV	86.0	8.7	Voltage of the measured NOx value
Detector	°C	41.8	41.8	43 °C ± 5 °C
Ambient	kPa	99.7	99.7	Current atmospheric pressure
DC 24V	V	23.5	23.0	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.19250	1.18450	0.50000 - 2.0000
NOx Slope	-	1.19650	1.19150	0.50000 - 2.0000

Calibrate By :

Calibration Data of SO<sub>2</sub> Analyzer

Analyzer Performance Test

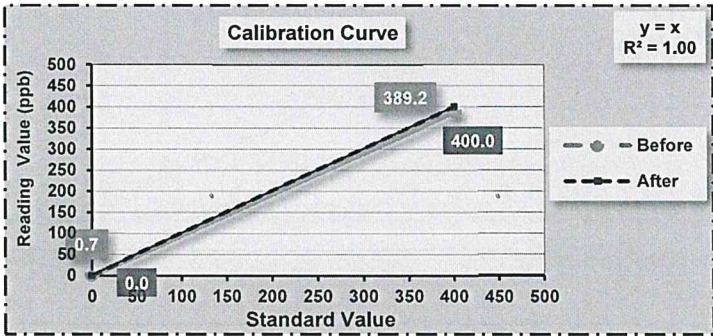
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	JH9GS3FU	Calibration Date	May 31, 2024
Analyzer Unit	ppb	Time	3:06 PM

Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.7	0.0	-	-	-
Span	400	389.2	400.0	-	-	2.7





## Calibration Data of CO Analyzer

### Analyzer Performance Test

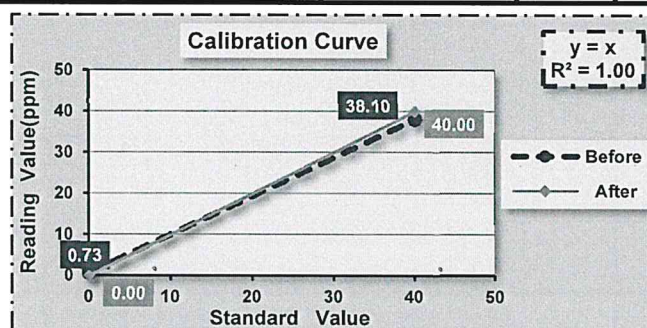
Equipment	Gas Analyzer ( CO )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Thermo	Location	Envi Research
Model	48C	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	0415406563	Calibration Date	May 21, 2024
Analyzer Unit	ppm	Time	5:52 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300T	0165
Standard Gas Components	CO = 4,516	ppm	
Cylinder No : EB0123013	NO = 55.3	ppm	
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9	ppm	

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.73	0.00	-	-	-
Span	40	38.10	40.00	-	-	4.75



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL 48C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppm	50	50	0 - 100 standard
Internal Temp	INTERNAL TEMP	°C	37.9	38.0	8.0 to 47.0
Chamber Temp	CHAMBER TEMP	°C	45.4	45.4	40.0 to 59.0
Pressure	PRESSURE	mmHg	731.1	731.0	250 to 1,000
Sample Flow	FLOW	LPM	0.924	0.942	0.350 to 1.500
Bias Voltage	BIAS VOLT	V	-115.3	-155.4	-130 to -100
AGC Intensity	AGC	Hz	202,642	201,517	150,000 to 300,000
Motor Speed	SPEED	%	100	100	100
Concentration	Conc.	ppm	0.768	0.613	0 to 10,000
Motherboard Status	MOTHERBOARD	-	OK	OK	OK
Interface Status	INTERFACE	-	OK	OK	OK

Calibrate B



## Calibration Data of NOx Analyzer

### Analyzer Performance Test

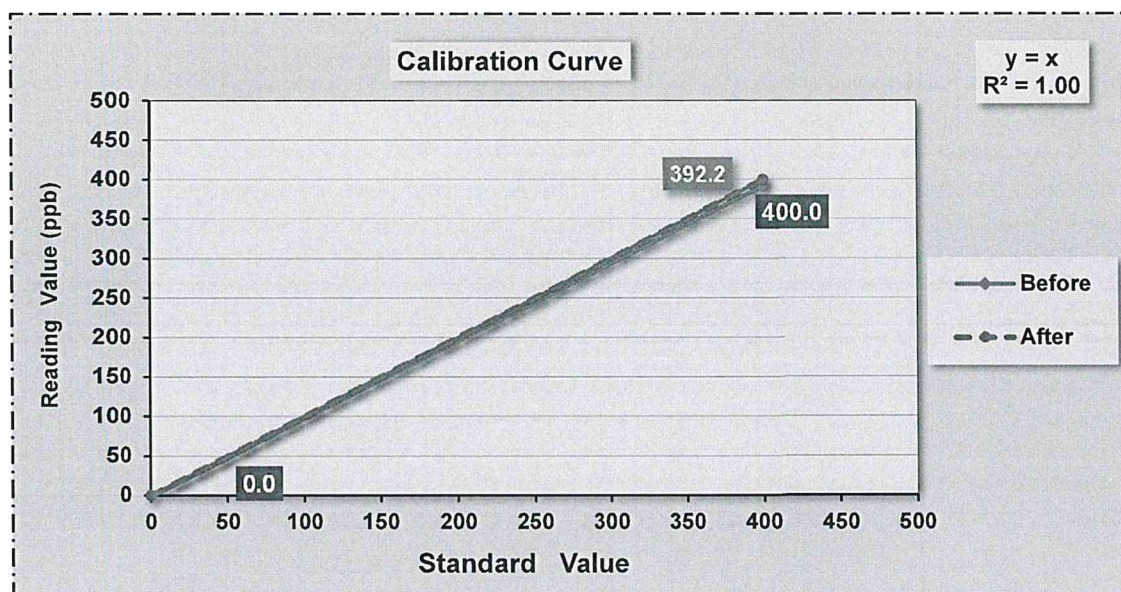
Equipment	Gas Analyzer ( NOx )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	API	Location	Envi Research
Model	200A	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	56	Calibration Date	May 31, 2024
Analyzer Unit	ppb	Time	1:54 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-4.4	0.0	-1.2	0.0	-3.2	0.0	-	-	-
Span	400	389.7	405.0	392.2	400.0	-2.5	5.0	-	-	2.0



## STATUS TEST AND VALIDATION OF NO<sub>x</sub> ANALYZER MODEL 200A

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Stability	STABIL	ppb	0.2	0.4	< 2 with zero air
Sample Flow	SAMP FL	cc / min	458.0	469.0	500 +/- 50
Ozone Flow	OZONE FL	cc / min	77.0	77.0	80 +/- 10
PMT signal	PMT	mV	51.4	26.2	0 to 5,000
Auto - Zero	AZERO	mV	37.2	36.1	-20 to 150
High Voltage Power Supply	HVPS	V	79.0	792.0	450 to 900
Reaction Cell Temperature	RCELL TEMP	°C	49.8	49.9	50 +/- 1
Box Temperature	BOX TEMP	°C	34.2	34.3	Ambient temp. +3 / -7
PMT Temperature	PMT TEMP	°C	6.4	6.4	7 +/- 1
Converter Temperature	MOLY TEMP	°C	314.7	314.9	315 +/- 5
Reaction Cell Pressure	RCEL	In - Hg - A	10.0	10.0	2 to 10 ( Constant )
Sample Pressure	SAMP	In - Hg - A	29.8	29.9	Ambient - 1 ( Constant )
NO <sub>x</sub> Slope	NO <sub>x</sub> SLOPE	-	1.077	1.062	1.000 +/- 0.300
NO <sub>x</sub> Offset	NO <sub>x</sub> OFFSET	mV	-1.1	-1.1	0 +/- 20
NO Slope	NO SLOPE	-	1.064	10.510	1.000 +/- 0.300
NO Offset	NO OFFSET	mV	-1.6	-1.6	0 +/- 20

Calibrate By :





## Calibration Data of SO<sub>2</sub> Analyzer

### Analyzer Performance Test

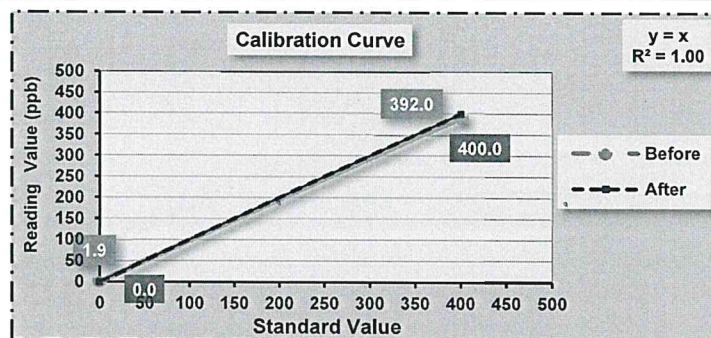
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Horiba	Location	Envi Research
Model	APSA-370	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	J000EMWB	Calibration Date	May 17, 2024
Analyzer Unit	ppb	Time	5:31 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	1.9	0.0	-	-	-
Span	400	392.0	400.0	-	-	2.0



### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL APSA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal (SO <sub>2</sub> )	mV	16.2	16.1	Voltage of the measured SO <sub>2</sub> value
LAMP	mV	396.5	396.1	200 mV - 1200 mV
CELL	°C	35.7	35.8	Ambient temperature + 5 °C - 15 °C
PUMP	Kpa	45.1	45.0	65 kPa or less
AMBIENT	kPa	100.5	100.4	Current atmospheric pressure
DC 24V	V	23.9	23.9	24 V ±0.5 V
DC 5V	V	5.0	5.0	5 V ±0.5 V

Calibrate By :

## Calibration Data of CO Analyzer

### Analyzer Performance Test

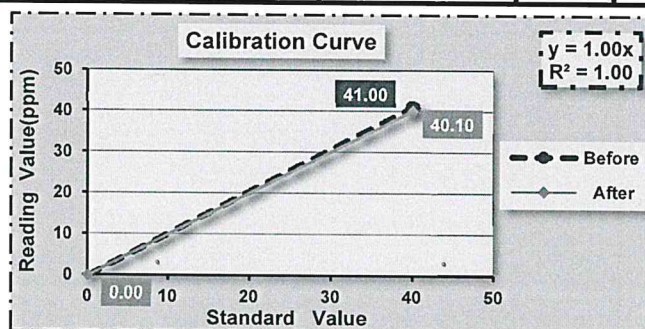
Equipment	Gas Analyzer ( CO )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Thermo	Location	Envi Research
Model	48C	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	0508011071	Calibration Date	May 17, 2024
Analyzer Unit	ppm	Time	3:27 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300T	0165
Standard Gas Components	CO = 4,516	ppm	
Cylinder No : EB0123013	NO = 55.3	ppm	
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9	ppm	

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	-0.14	0.00	-	-	-
Span	40	41.00	40.10	-	-	2.25



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL 48C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppm	50	50	0 - 100 standard
Internal Temp	INTERNAL TEMP	°C	36	39.4	8.0 to 47.0
Chamber Temp	CHAMBER TEMP	°C	46.1	46.1	40.0 to 59.0
Pressure	PRESSURE	mmHg	731.0	754.1	250 to 1,000
Sample Flow	FLOW	LPM	1.030	0.987	0.350 to 1.500
Bias Voltage	BIAS VOLT	V	-117.2	-115.8	-130 to -100
AGC Intensity	AGC	Hz	196,723	203709	150,000 to 300,000
Motor Speed	SPEED	%	100	100	100
Concentration	Conc.	ppm	0.816	0.375	0 to 10,000
Motherboard Status	MOTHERBOARD	-	OK	OK	OK
Interface Status	INTERFACE	-	OK	OK	OK

Calibrate By :



## Calibration Data of NOx Analyzer

### Analyzer Performance Test

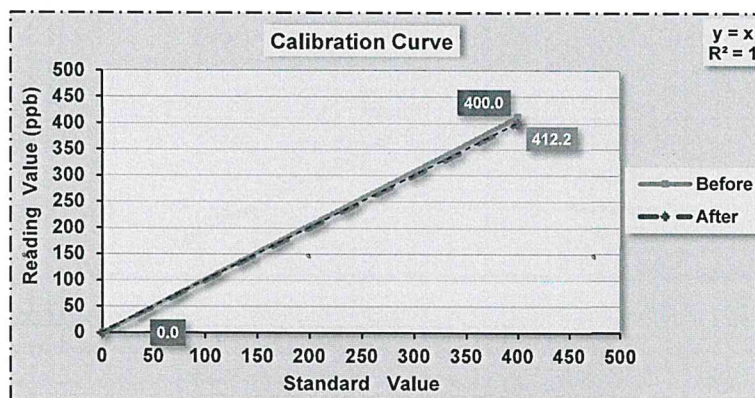
Equipment	Gas Analyzer ( NOx )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	HORIBA	Location	Envi Research
Model	APNA-370	Quotation	2024-00271, 2024-00273, 2024-00271
Serial No.	FC2E28YU	Calibration Date	April 30, 2024
Analyzer Unit	ppb	Time	3:10 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-2.7	0.0	-1.2	0.0	-1.5	0.0	-	-	-
Span	400	414.3	400.0	412.2	400.0	2.1	0.0	-	-	3.1



### STATUS TEST AND VALIDATION OF NOx ANALYZER MODEL APNA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
Range	ppb	500	500	0 - 500 Standard
Signal NO	mV	0.3	0.5	Voltage of the measured NO value
Signal NOx	mV	12.6	12.6	Voltage of the measured NOx value
Detector	°C	41.4	41.4	43 °C ± 5 °C
Ambient	kPa	99.2	99.2	Current atmospheric pressure
DC 24V	V	23.5	23.5	24V ±0.5
DC 5V	V	5.0	5.0	5V ±0.5
NO Slope	-	1.19250	1.18560	0.50000 - 2.0000
NOx Slope	-	1.19650	1.18950	0.50000 - 2.0000

Calibrate By :

## Calibration Data of SO<sub>2</sub> Analyzer

### Analyzer Performance Test

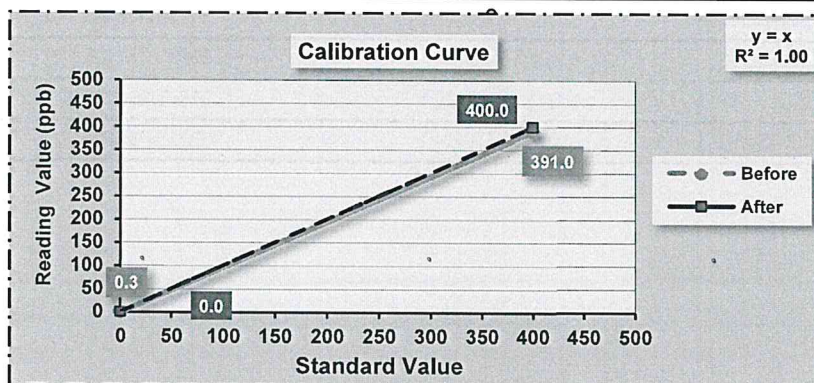
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Thermo	Location	Envi Research
Model	43i-BNSAA	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	CM14430004	Calibration Date	May 31, 2024
Analyzer Unit	ppb	Time	11:20 AM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.3	0.0	-	-	-
Span	400	391.0	400.0	-	-	2.3



### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL 43i-BNSAA

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Internal Temperature	INTERNAL	°C	34.3	35.3	8.0 °C to 45.0 °C
Chamber Temp	CHAMBER	°C	45.1	45.2	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	727.8	724.6	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.447	0.444	0.350 to 0.750
Lamp Intensity	LAMP INTENSITY	%	91	91	20 to 100
Lamp Voltage	LAMP VOLTAGE	V	863	868	500 to 1200
SO <sub>2</sub> Concentration	SO <sub>2</sub> CONCENTRATION	ppb	1.6	3.4	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :



## Calibration Data of CO Analyzer

### Analyzer Performance Test

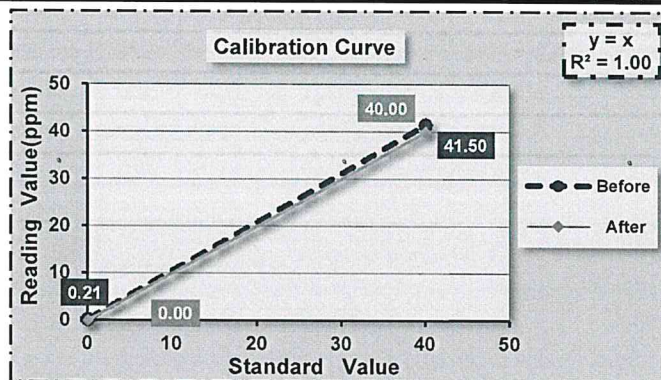
Equipment	Gas Analyzer ( CO )	Customer Name	ทีแอลที คอนซัลแตนต์
Manufacture	HORIBA	Location	Envi Research
Model	APMA-360 CE	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	576876072	Calibration Date	May 31, 2024
Analyzer Unit	ppm	Time	11:02 AM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.21	0.00	-	-	-
Span	40	41.50	40.00	-	-	3.75



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-360CE

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	3.7	4	Voltage of the measured CO Value
SIGNALI (COMP)	mV	1.9	2	Voltage of the interference component Value
CELL	°C	42.5	40	Ambient + (5 to 15 °C)
SAMPLE	L/min	1.6	1.4	1 L/min to 2 L/min
OVER FLOW	LPM	0.0	0.0	< 1.2

Calibrate By :

## Calibration Data of NOx Analyzer

### Analyzer Performance Test

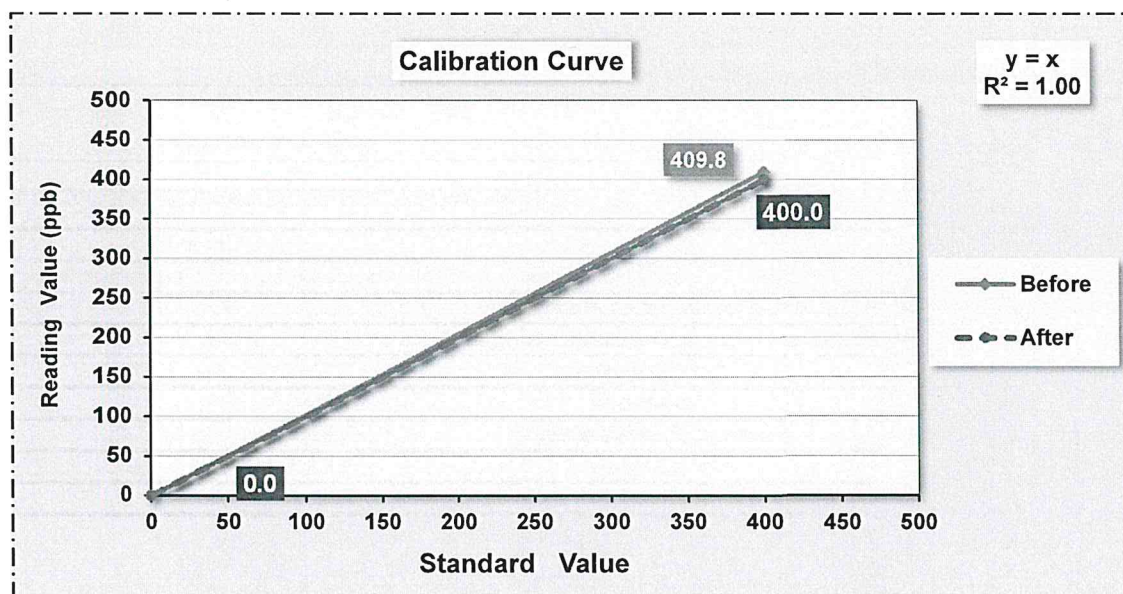
Equipment	Gas Analyzer ( NOx )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	API	Location	Envi Research
Model	200A	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	1650	Calibration Date	May 31, 2024
Analyzer Unit	ppb	Time	2:10 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-0.6	0.0	-0.4	0.0	-0.2	0.0	-	-	-
Span	400	411.0	405.0	409.8	400.0	1.2	5.0	-	-	2.5





## STATUS TEST AND VALIDATION OF NO<sub>x</sub> ANALYZER MODEL 200A

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Stability	STABIL	ppb	1.6	0.1	< 2 with zero air
Sample Flow	SAMP FL	cc / min	475.0	479.0	500 +/- 50
Ozone Flow	OZONE FL	cc / min	80.0	79.0	80 +/- 10
PMT signal	PMT	mV	50.7	44.7	0 to 5,000
Auto - Zero	AZERO	mV	37.4	36.7	-20 to 150
High Voltage Power Supply	HVPS	V	790.0	790.0	450 to 900
Reaction Cell Temperature	RCELL TEMP	°C	50.3	50.4	50 +/- 1
Box Temperature	BOX TEMP	°C	31.8	32.8	Ambient temp.+3 / -7
PMT Temperature	PMT TEMP	°C	7.1	7.1	7 +/- 1
Converter Temperature	MOLY TEMP	°C	314.3	314.5	315 +/- 5
Reaction Cell Pressure	RCEL	In - Hg - A	9.0	9.1	2 to 10 ( Constant )
Sample Pressure	SAMP	In - Hg - A	30.9	31.0	Ambient - 1 ( Constant )
NO <sub>x</sub> Slope	NO <sub>x</sub> SLOPE	-	1.3	1.3	1.000 +/- 0.300
NO <sub>x</sub> Offset	NO <sub>x</sub> OFFSET	mV	-1.8	-1.8	0 +/- 20
NO Slope	NO SLOPE	-	-1.3	1.3	1.000 +/- 0.300
NO Offset	NO OFFSET	mV	-0.4	-0.4	0 +/- 20

Calibrate By :



## Calibration Data of SO<sub>2</sub> Analyzer

### Analyzer Performance Test

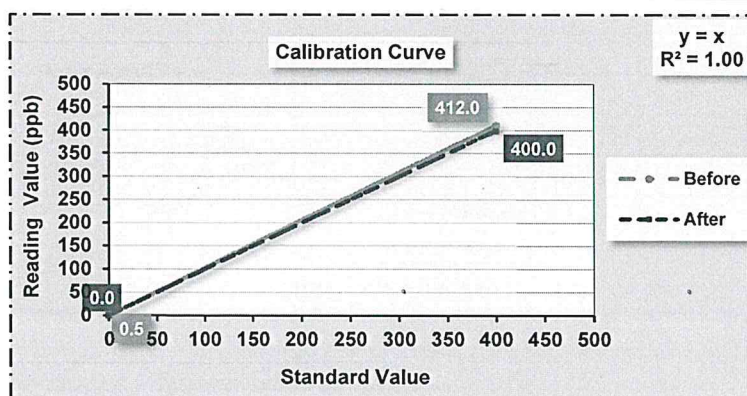
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	0607415768	Calibration Date	May 29, 2024
Analyzer Unit	ppb	Time	6:09 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.5	0.0	-	-	-
Span	400	412.0	400.0	-	-	3.0



### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL 43C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Internal Temperature	INTERNAL	°C	36.7	35.8	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	45.6	45.5	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	662.9	726.8	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.419	0.635	0.350 to 1.000
Lamp Intensity	INTENSITY	Hz	25,671	20,093	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	838	900	750 to 1,200
SO <sub>2</sub> Concentration	SO <sub>2</sub> CONCENTRATION	ppb	2.4	2.0	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :

(MF)

## Calibration Data of CO Analyzer

### Analyzer Performance Test

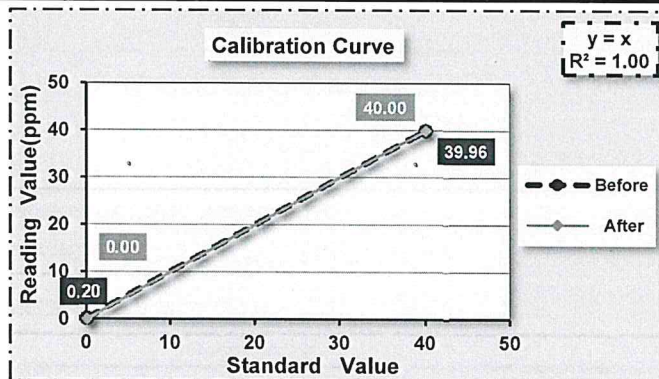
Equipment	Gas Analyzer ( CO )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	HORIBA	Location	Envi Research
Model	APMA-360 CE	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	577583094	Calibration Date	May 31, 2024
Analyzer Unit	ppm	Time	5:16 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.20	0.00	-	-	-
Span	40	39.96	40.00	-	-	0.10



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-360CE

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL (MAIN)	mV	5.3	8.4	Voltage of the measured CO Value
SIGNALI (COMP)	mV	0.2	2.5	Voltage of the interference component Value
CELL	°C	35.5	39.8	Ambient + (5 to 15 °C)
SAMPLE	L/min	1.2	1.4	1 L/min to 2 L/min
OVER FLOW	LPM	0.0	0.0	< 1.2

Calibrate By :



## Calibration Data of NOx Analyzer

### Analyzer Performance Test

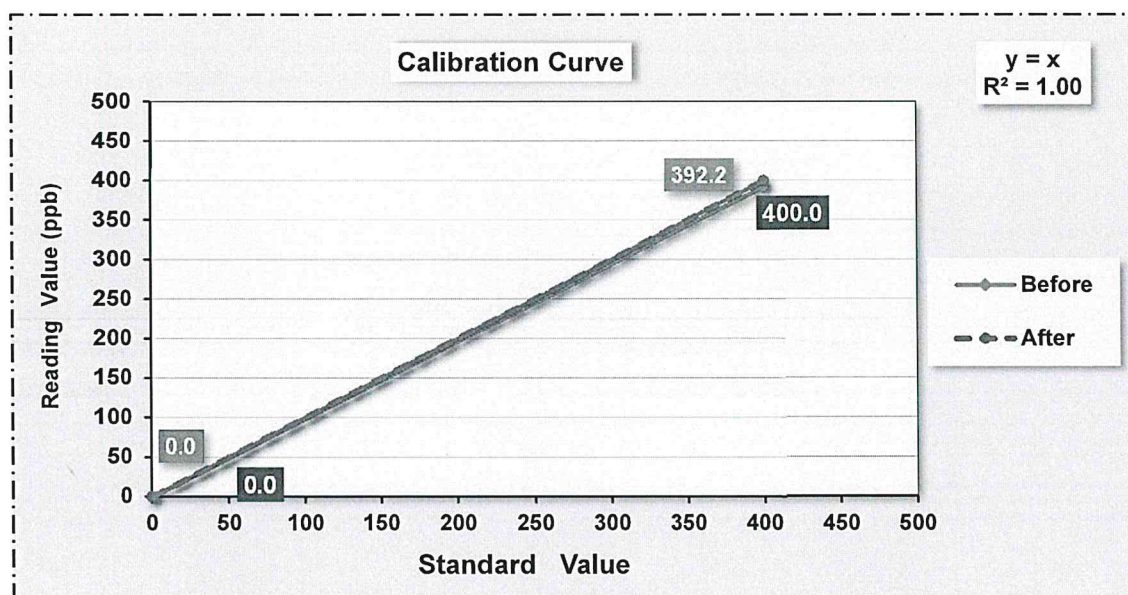
Equipment	Gas Analyzer ( NOx )	Customer Name	ทีแอลที คอนซัลแตนต์
Manufacture	API	Location	Envi Research
Model	200A	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	1975	Calibration Date	May 31, 2024
Analyzer Unit	ppb	Time	1:54 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value								% Abs Error
		NO <sub>x</sub> ( ppb )		NO ( ppb )		NO <sub>2</sub> ( ppb )		Stability		
		Before	After	Before	After	Before	After	Before	After	
Zero	0	-0.1	0.0	0.0	0.0	-0.1	0.0	-	-	-
Span	400	392.2	405.0	392.2	400.0	0.0	5.0	-	-	2.0





## STATUS TEST AND VALIDATION OF NO<sub>x</sub> ANALYZER MODEL 200A

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Stability	STABIL	ppb	0.40	0.10	< 2 with zero air
Sample Flow	SAMP FL	cc / min	523	5522	500 +/- 50
Ozone Flow	OZONE FL	cc / min	80	80	80 +/- 10
PMT signal	PMT	mV	44	41	0 to 5,000
Auto - Zero	AZERO	mV	40	39	-20 to 150
High Voltage Power Supply	HVPS	V	776	776	450 to 900
Reaction Cell Temperature	RCELL TEMP	°C	50	50	50 +/- 1
Box Temperature	BOX TEMP	°C	33	34	Ambient temp.+3 / -7
PMT Temperature	PMT TEMP	°C	7	7	7 +/- 1
Converter Temperature	MOLY TEMP	°C	315	315	315 +/- 5
Reaction Cell Pressure	RCEL	In - Hg - A	8	8	2 to 10 ( Constant )
Sample Pressure	SAMP	In - Hg - A	30	30	Ambient - 1 ( Constant )
NO <sub>x</sub> Slope	NO <sub>x</sub> SLOPE	-	0.930	1.050	1.000 +/- 0.300
NO <sub>x</sub> Offset	NO <sub>x</sub> OFFSET	mV	-8	-8	0 +/- 20
NO Slope	NO SLOPE	-	0.916	1.025	1.000 +/- 0.300
NO Offset	NO OFFSET	mV	-9	-9	0 +/- 20

Calibrate By :



## Calibration Data of SO<sub>2</sub> Analyzer

### Analyzer Performance Test

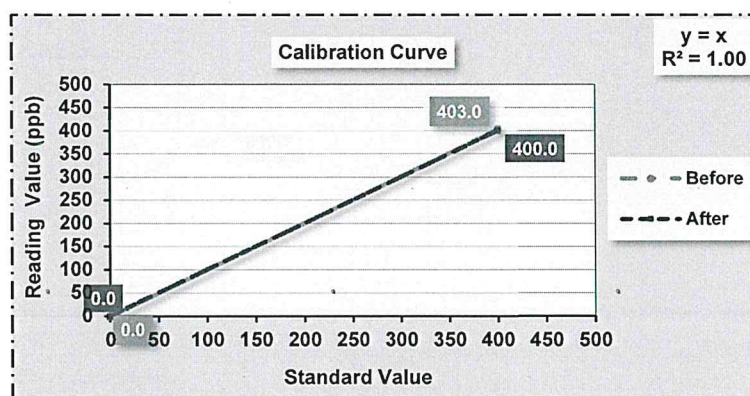
Equipment	Gas Analyzer ( SO <sub>2</sub> )	Customer Name	ทีแอลที คอนซิลแดนส์
Manufacture	Thermo	Location	Envi Research
Model	43C	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	64390-343/2	Calibration Date	May 16, 2024
Analyzer Unit	ppb	Time	5:31 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppb )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.0	0.0	-	-	-
Span	400	403.0	400.0	-	-	0.8



### STATUS TEST AND VALIDATION OF SO<sub>2</sub> ANALYZER MODEL 43C

Parameter	Display As	Unit	Observed Value		Nominal Range
			Before Adjust	After Adjust	
Range	RANGE	ppb	500	500	0 - 500 standard
Internal Temperature	INTERNAL	°C	30.9	31	8.0 °C to 47.0 °C
Chamber Temp	CHAMBER	°C	44.5	44.4	43.0 °C to 47.0 °C
Pressure	PRESSURE	mmHg	732.6	732.6	400.0 to 1,000
Sample Flow	SAMP FLOW	LPM	0.946	0.946	0.350 to 1.000
Lamp Intensity	INTENSITY	Hz	23,763	23,811	20,000 to 50,000
Lamp Voltage	LAMP VOLTAGE	V	855	853	750 to 1,200
SO <sub>2</sub> Concentration	SO <sub>2</sub> CONCENTRATION	ppb	2.1	1.5	0 to 10,000
Motherboard Status	MOTHERBOARD STATUS	-	OK	OK	OK
Interface Status	INTERFACE STATUS	-	OK	OK	OK

Calibrate By :

## Calibration Data of CO Analyzer

### Analyzer Performance Test

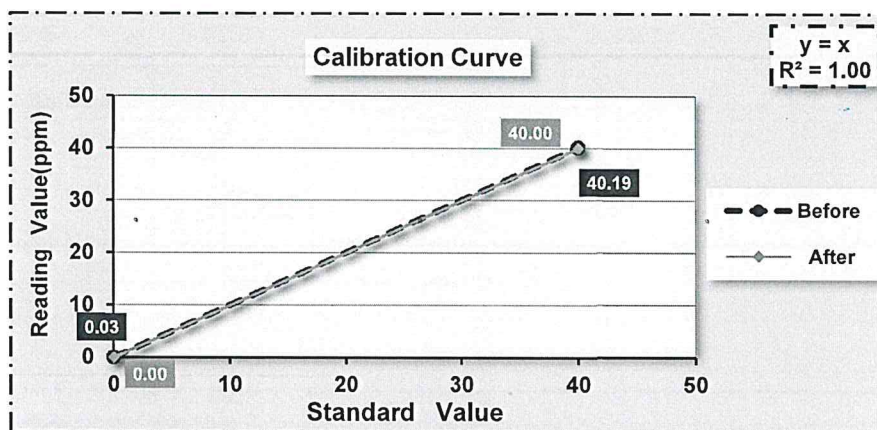
Equipment	Gas Analyzer ( CO )	Customer Name	ทีแอลที คอนซัลแตนท์
Manufacture	HORIBA	Location	Envi Research
Model	APMA-370	Quotation	2024-00271, 2024-00273, 2024-00275
Serial No.	FEYATYPA	Calibration Date	May 24, 2024
Analyzer Unit	ppm	Time	1:31 PM

### Instruments for Calibration

Instruments	Manufacture	Model	Serial Number
Zero Air Supply	Thermo Env.	111	0700419829
Dynamic Dilution Calibrator	Tanabyte	300	0165
Standard Gas Components	CO = 4,516 ppm		
Cylinder No : EB0123013	NO = 55.3 ppm		
Expire Date : Oct 22, 2027	SO <sub>2</sub> = 54.9 ppm		

### Single Point Calibration

Standard Gas	Standard Gas Value	Analyzer Value ( ppm )		Stability		% Abs Error
		Before	After	Before	After	
Zero	0	0.03	0.00	-	-	-
Span	40	40.19	40.00	-	-	0.47



### STATUS TEST AND VALIDATION OF CO ANALYZER MODEL APMA-370

Parameter	Unit	Observed Value		Nominal Range
		Before Adjust	After Adjust	
SIGNAL(MAIN)	mV	2.8	3.1	Voltage of the measured CO Value
SIGNAL (COMP)	mV	4.8	4.9	Voltage of the interference component Value
CELL	°C	31.2	31.3	Ambient + (5 to 10 C)
PUMP	kpa	40.7	4.0.8	less than 65
AMBIENT	kpa	101.0	101.0	Atmospheric pressure
DC 24V	mV	24.0	24.0	24+/- 0.5 V
DC 5V	mV	4.9	4.9	5+/- 0.5 V

Calibrate By :



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number:	E04NI99E15A0292	Reference Number:	160-401604495-1
Cylinder Number:	EB0123013	Cylinder Volume:	144.4 Cubic Feet
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Oct 22, 2019

**Expiration Date: Oct 22, 2027**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
NITRIC OXIDE	55.00 PPM	55.27 PPM	G1	+/- 0.8% NIST Traceable	10/14/2019, 10/22/2019
SULFUR DIOXIDE	55.00 PPM	54.93 PPM	G1	+/- 0.9% NIST Traceable	10/14/2019, 10/22/2019
CARBON MONOXIDE	4500 PPM	4516 PPM	G1	+/- 0.6% NIST Traceable	10/14/2019
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010429	KAL004123	97.6 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010429	KAL004123	97.6 PPM NOx/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	16010235	KAL004419	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021
NTRM	08012318	KAL004620	4857 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jun 07, 2024

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Sep 26, 2019
MKS FTIR - NO - 000928781	FTIR	Oct 18, 2019
MKS FTIR - NOx - 000928781	FTIR	Oct 18, 2019
MKS FTIR - SO2 - 000928781	FTIR	Oct 03, 2019

Triad Data Available Upon Request

NOTES: Gross Weight: 28.0 Kg, Net Weight: 4.6 Kg.







# 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 17 April, 2024

Certification No. 185/24

Page : 1 of 5

Object : Weather Station

Manufacturer : Davis Instruments Inc.

Type : Vantage Pro2

Serial No. : AS160105025 ID No. : No.24

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 1009.3 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: 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

Calibrated

Mr. Wat

Mech

testo 645 Serial No. 02828057

(Authorised Signatory)

for the Chief

Sub-Standard Instrument



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

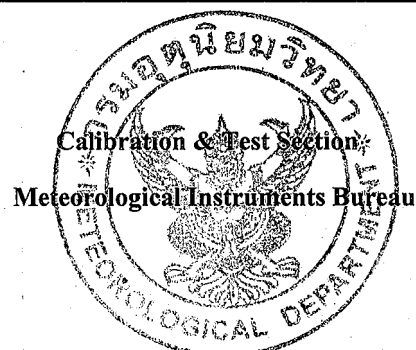
Certification No. 185/24

17 April, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Vacumm	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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





# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 185/24

17 April, 2024

Page : 3 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.3	45.3	0.0
30.1	30.2	-0.1
15.2	15.3	-0.1





# THAI METEOROLOGICAL DEPARTMENT

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

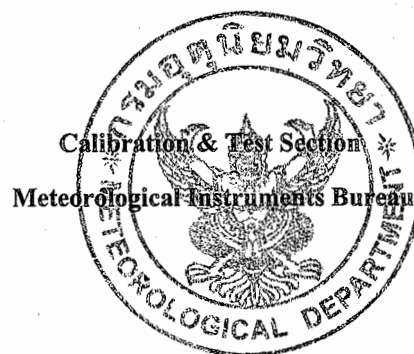
## The Result of Calibration

Certification No. 185/24

17 April, 2024

Page : 4 of 5

Standard Humidity % R.H.	Temperature Sensor Reading	
	Reading	Correction
	% R.H.	% R.H.
45.6	46	-0.4
65.2	67	-1.8
91.5	94	-2.5







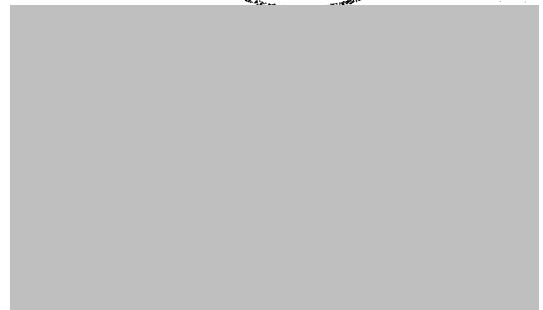
Date of Issue 17 April, 2024

Certification No. 185/24

Page: 5 of 5

## ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING  
BUCKET Product No. 7852 ID No. 24 ทำการสอบเทียบกับแก้ววัดฝนแบบแก้วตวง GAUGE  
DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถ  
นำไปใช้ได้ มีค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.2 mm./TIP)





## บริษัท ทีที เอ็นไวรอนเมนต์ จำกัด

67/107 หมู่ 10 ซอยบางเลน 23/4 ตำบลบางเลน อำเภอบางใหญ่ จังหวัดนนทบุรี 11140

67/107 moo 10 Soibanglan 23/4, Banglan, Bangyai, Nontaburi 11140

E-Mail : ttenvi2021@gmail.com เลขผู้เสียภาษี 0125564018426

# Opacity Test Report

Report No. : RP02-Opacity  
Calibrated Date : 07 December 2023

Equipment : Digital Smoke Meter  
Manufacturer : Wager, USA  
Model : 6500  
Serial Number : 011384

### Result Of Calibration

Reference Standard (% Opacity)	Reading (% Opacity)	Error (% Opacity)	Result
0	0.00	0.00	PASS
35.0	34.72	-0.28	PASS

Calibrated By :











THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0311

MTC No. EEL. BP. 116/0267

## CALIBRATION CERTIFICATE

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

Address : 25/114 Moo 6, Soi Chinaket 1, Ngamwongwan Road, 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 : Sound Calibrator

Manufacturer : BSWA

Model : CA111

Serial No. : 590331

### 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 Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 27 Feb. 2024

Date of Calibration : 5 Mar. 2024

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.

FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0311

MTC No. EEL. BP. 116/0267

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 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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	93.82	-0.18	$\pm 0.10$	$\pm 0.40$ 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	1000.5	0.5	$\pm 1.5$	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	2.80	$\pm 0.70$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 5 Mar. 2024

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FM.BL.MTC.002 Rev.4

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Thailand

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0311

MTC No. EEL. BP. 116/0267

Nominal Output of Unit Under Test = 114 dB re 20 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ 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	113.77	-0.23	$\pm 0.10$	$\pm 0.40$ 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	1000.6	0.6	$\pm 1.5$	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.60	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

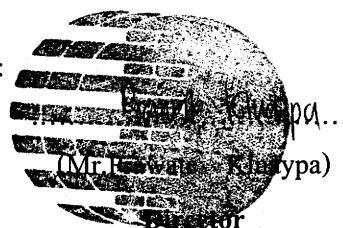
3. The microphone volume correction was not included.

Calibrated by :



(Mr. Weerachai Deechaiyae)

Approved by :



(Mr. Rattana Kiatypa)  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267022700825001

End of Certificate

3 / 3

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