

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING REFERENCE METER # WET TEST METER W-NK5A No. 540961
5-POINT METRIC UNIT

Meter Console Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.	HC65APE0023		
Barometric Pressure	758	mm Hg	
Calibration Meter Gamma	0.9980	unitless	

Factors/Conversions		
Std Temp	293	K
Std Press	760	mm Hg
K ₁	0.386	
Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Θ)	(P_m)	(V_{mi})	(V_{mf})	(t_{mi})	(t_{mf})	(V_{wi})	(V_{wf})	(t_{wi})	(t_{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
15.00	13.0	3826.4749	3826.6201	26	26	268.44500	268.59380	26	26
10.00	25.0	3826.6500	3826.7934	26	26	268.61426	268.76088	26	26
8.00	50.0	3826.8148	3826.9870	26	26	268.77850	268.95544	26	26
7.00	80.0	3827.0198	3827.2147	26	26	268.98871	269.19091	26	26
5.00	120.0	3827.5000	3827.6865	26	26	269.19122	269.38615	26	26

Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate	ΔH @	
($V_{m(std)}$)	($Q_{m(std)}$)	($V_{w(std)}$)	($Q_{w(std)}$)	Value	Variation	Std & Corr	.0212 m ³ /min	Variation
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	($Q_{m(std)corr}$)	(ΔH @)	($\Delta \Delta H$ @)
						m ³ /min	mm H ₂ O	
0.142	0.009	0.145	0.010	1.021	-0.002	0.010	61.378	12.190
0.140	0.014	0.143	0.014	1.018	-0.006	0.014	54.157	4.969
0.169	0.021	0.173	0.022	1.021	-0.003	0.022	47.830	-1.358
0.192	0.027	0.197	0.028	1.027	0.004	0.028	45.127	-4.051
0.184	0.037	0.190	0.038	1.031	0.007	0.038	37.447	-11.741
				1.024	Y Average		49.188	ΔH @ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ± 0.02 .

Note: For $\Delta H_{m, orifice}$ pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mm) H₂O.

Signature _____

Service Engineer

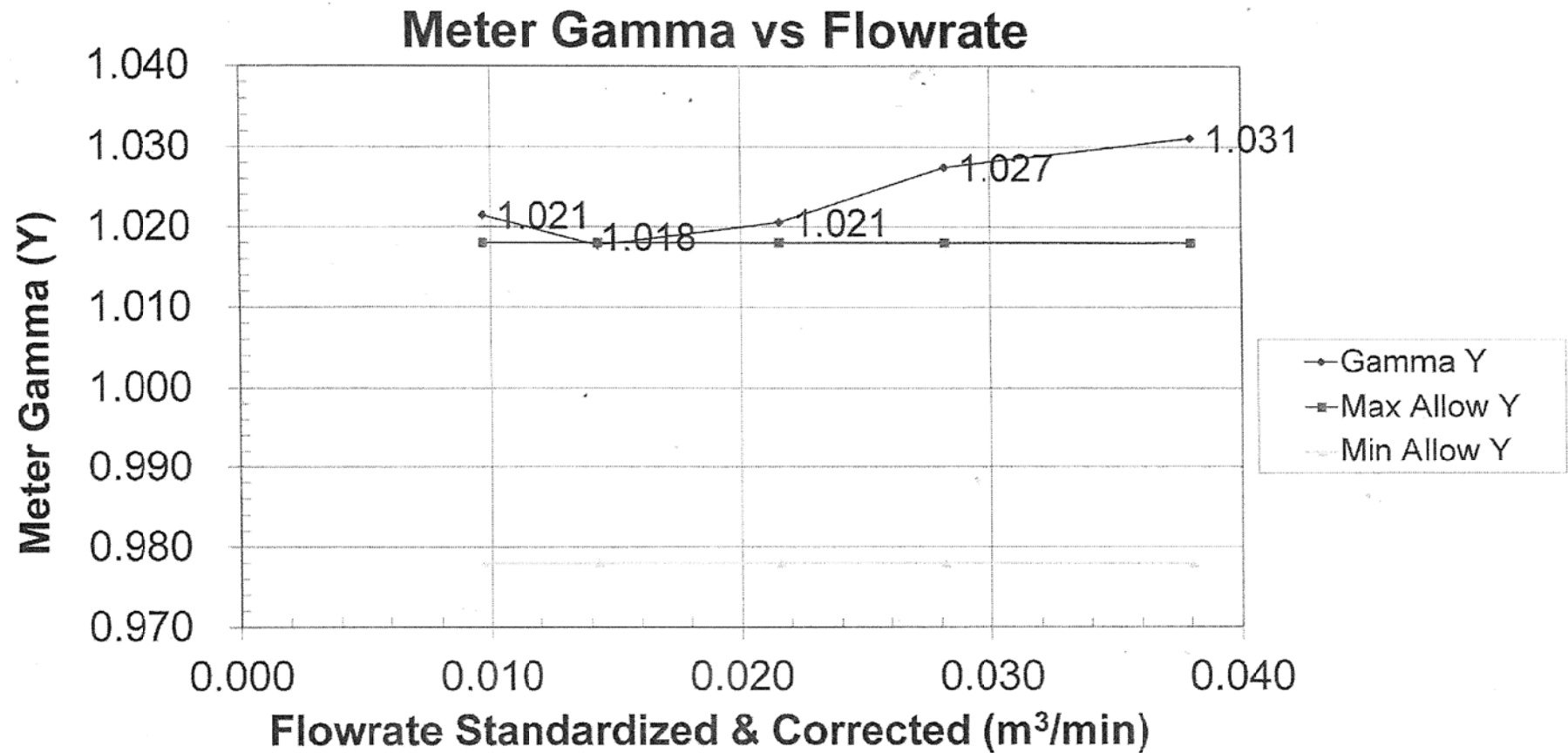
SITHIPHORN ASSOCIATES COMPANY

Date _____

24 / 02 / 2022

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023



Console Serial: 0509047

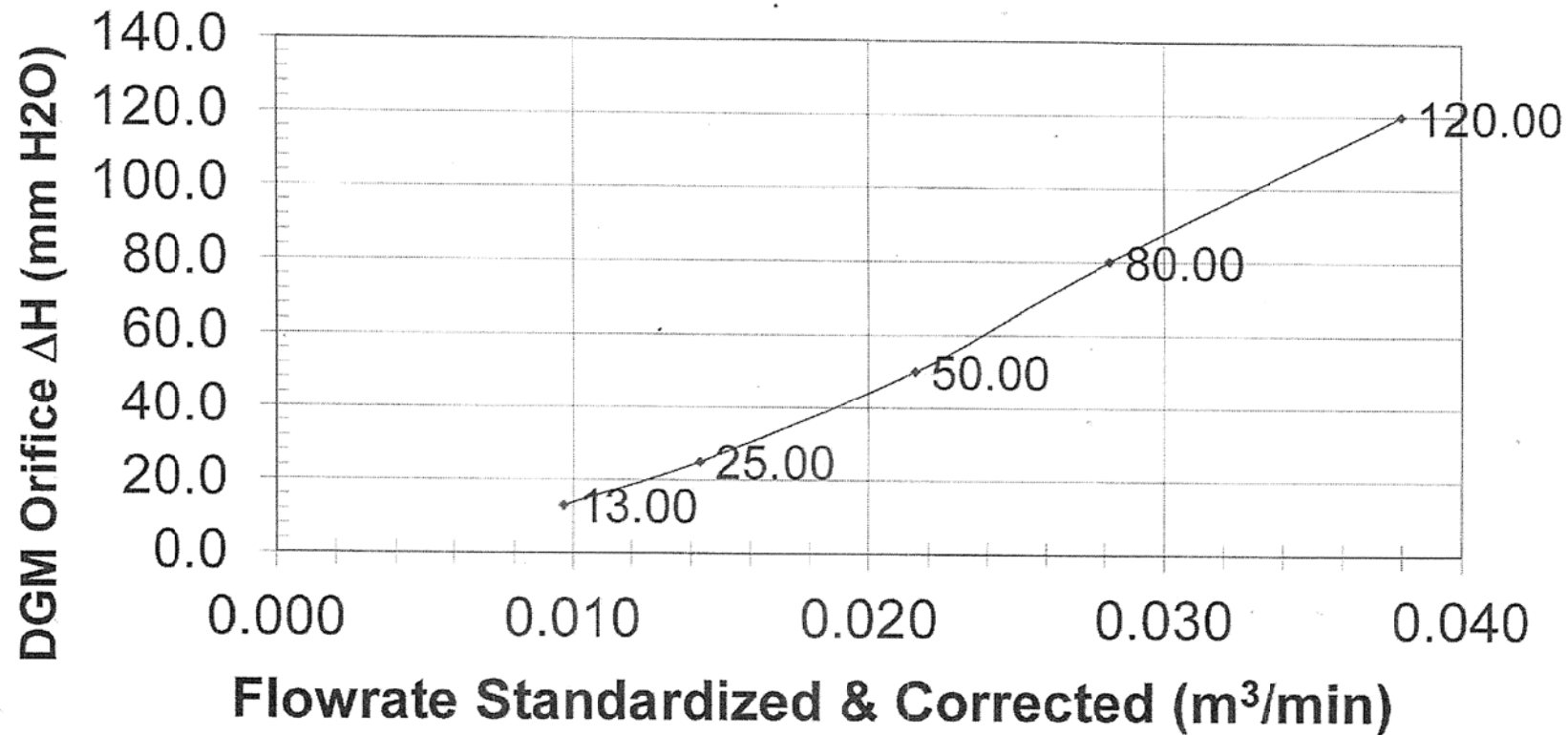
บริษัท สกทิพมอเสอไซเคิล จำกัด
SIMPORN ASSOCIATES COMPANY LIMITED

Console Model: XC572V

Calibration Date: 24-2-2022

Calibration Reference No: HC65APE0023

Meter Pressure vs Flowrate



Console Serial: 0509047

บริษัท สหวิทยาเทคโนโลยี จำกัด
SIMPORN ASSOCIATES COMPANY LIMITED

Console Model: XC572V

HEATER SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Probe Heater	Standard Method 5 Assemblies
Heated Filter Box	SB-2-V

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.	HC65APE0023		
Barometric Pressure	758	mm Hg	

Results				
System Heat	Control Acceptance	Reference thermometer temperature	Thermocouple potentiometer temperature	Temperature difference
	°C	°C	°C	°C
Probe Heater System for 5ft. Probe	120 °C \pm 14 °C	121	120.5	0.13
Heated Filter Box	120 °C \pm 14 °C	121	120	0.25

Note: Check Acceptance Limits, capable of maintaining 120 °C \pm 14 °C at 20-lpm flow rate

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Service Engineer

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SITHIPHORN ASSOCIATES COMPANY LIMITED

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Sithiphorn Associates Co., Ltd.

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451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC572V
Console Serial Number	0509047
DGM Model Number	SK25
DGM Serial Number	8001032
Meter Box Model Number	JENCO 765
Meter Box Model Number	REX-C100

Calibration Conditions			
Date	Time	24-Feb-22	8:30 AM
Calibration Reference No.		HC65APE0023	
Barometric Pressure		758	mm Hg
Reference Thermometer		FLUKE 714	
Serial Number		9038005	

Results												
Console Thermocouple Simulator												
Channel and test point	Meter Box Channel Temperature Reading (°C)											
	0.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0	
Stack	0	25	38	94	152	260	371	485	596	818	1041	
Probe	0	25	38	94	151							
Filter	0	25	38	94	151							
Aux	0	25	38	94	152							
Exit	0	25	38									
Meter	0	25	38									

Tolerance Range

Stack + 1.50% Absolute
Probe + 3.0 °C
Filter + 3.0 °C

Aux + 3.0 °C
Exit + 2.0 °C
Meter + 2.0 °C

Note. Cabel socket temp probe wrong + -

Signature _____



Service Engineer

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SITHIPORN ASSOCIATES COMPANY LIMITED

บริษัท สกทิพร แอสโซซิเอต จำกัด

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NOZZLE CALIBRATION

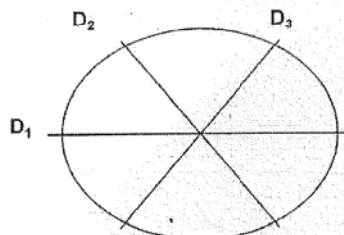
Sampling System Equipment Information		Inspection Conditions			
Console Model Number	XC572V	Date	Time	24-Feb-22	8:30 AM
Console Serial Number	0509047	Calibration Reference No.	HC65APE0023		
DGM Model Number	SK25	Barometric Pressure	758	mm Hg	
DGM Serial Number	8001032	Calibration	Vernier .0-150mm	0.01 mm increments	
		Method Reference	US.EPA Method		

Inspection Data					Results	
Nozzle ID	Nozzle Diameter				Different	$(D_1 + D_2 + D_3) / 3$
Sizes		D ₁	D ₂	D ₃	ΔD	Davg
	mm	mm	mm	mm	mm	mm
4	3.2	3.04	3.04	3.03	0.006	3.037
5	4.0	4.01	4.01	4.00	0.006	4.007
8	6.4	5.99	5.89	6.04	0.076	5.973
10	8.0	7.58	7.53	7.50	0.040	7.537
12	9.5	9.38	9.37	9.46	0.049	9.403
14	11.1	11.01	11.02	11.12	0.061	11.050
16	12.7	12.43	12.49	12.52	0.046	12.480

D1, D2, D3 = There difference nozzle diameters at 60 degrees to each other, each measured to the nearest 0.025 mm

ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm

Davg = $(D_1 + D_2 + D_3) / 3$



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Service Engineer

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SITHIPHORN ASSOCIATES COMPANY

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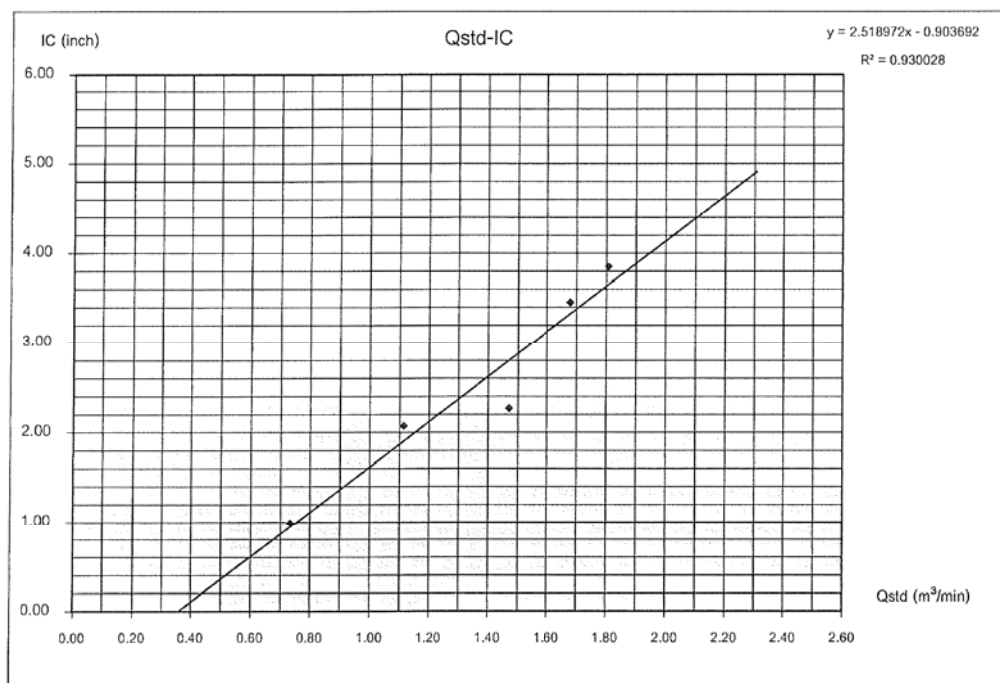
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 21, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.3	Transfer Standard Type	Onifice	Stop Time	9:35 AM
Motor Serial Number	BL-03	Calibrator Model	TE-5025A	Person	Mr.Preecha Srisuk
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (mmH ₂ O)			[ΔH ₂ O(Pa/P _{atm})(T _{ref} /Ta)] ^{1/2}	Qstd = (1/m)[(A-b)] (m ³ /min)	sample Flow Rate Indicator (inch)	IC = I[(Pa/P _{atm})(T _{ref} /Ta)] ^{1/2}	(°K = °C+273)	(mmHg)			
	Positive	Negative	ΔH ₂ O									
5	1.0	1.1	2.1	1.42958	0.73263	1.0	0.99	305.0	757.0			
7	2.4	2.4	4.8	2.16132	1.11505	2.1	2.07	305.0	757.0			
10	4.1	4.2	8.3	2.84209	1.47083	2.3	2.27	305.0	757.0			
13	5.4	5.4	10.8	3.24199	1.67982	3.5	3.45	305.0	757.0			
18	6.2	6.3	12.5	3.48782	1.80830	3.9	3.85	305.0	757.0			
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0		
1	Slope (m)			1.91345	Linear Equation			r ²	0.930028	Pstd(mmHg)	760	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.96437959	T _{std}	298	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)	0.973192407			
Result		C=(Pa/Pstd)*(Tstd/Ta)*0.5								0.986505148		

COMMENT

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Calibrated By

Field Environmental

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Division Manager

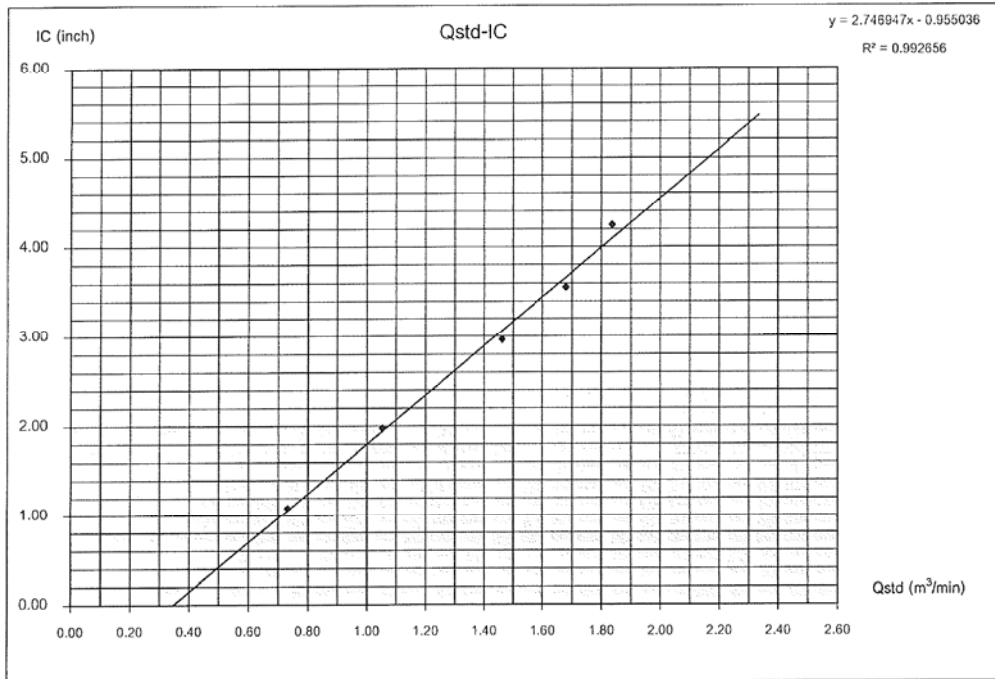
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location					Date	April 21, 2022
Project Site					Start Time	9:30 AM
Sampler Number	TSP No.6	Transfer Standard Type	Orifice	Stop Time	9:35 AM	
Motor Serial Number	BL-05	Calibrator Model	TE-5025A	Person Mr.Preecha Srisuk		
Recorder Serial Number	-	Calibrator Serial Number	1			

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_o C(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = \{1/m\}[(A \cdot b)]$	Sample Flow Rate Indicator	$IC = \{[(Pa/P_{std})(T_{std}/T_a)]^{1/2}\}$	(°K = °C+273)	(mmHg)		
	Positive	Negative	ΔH_o		(m ³ /min)	(inch)					
5	1.0	1.1	2.1	1.42958	0.73263	1.1	1.09	305.0	757.0		
7	2.1	2.2	4.3	2.04566	1.05460	2.0	1.97	305.0	757.0		
10	4.1	4.1	8.2	2.82492	1.46186	3.0	2.96	305.0	757.0		
13	5.4	5.4	10.8	3.24199	1.67982	3.6	3.55	305.0	757.0		
18	6.4	6.5	12.9	3.54319	1.83724	4.3	4.24	305.0	757.0		
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0	
1	Slope (m)			1.91345	Linear Equation			r^2	0.992656	Pstd(mmHg)	760.0
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.99632123	T _{std}	298.0
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta)	0.973192407	
Result								C=(Pa/Pstd)*(Tstd/Ta)*0.5		0.986505148	

COMMENT

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Division Manager

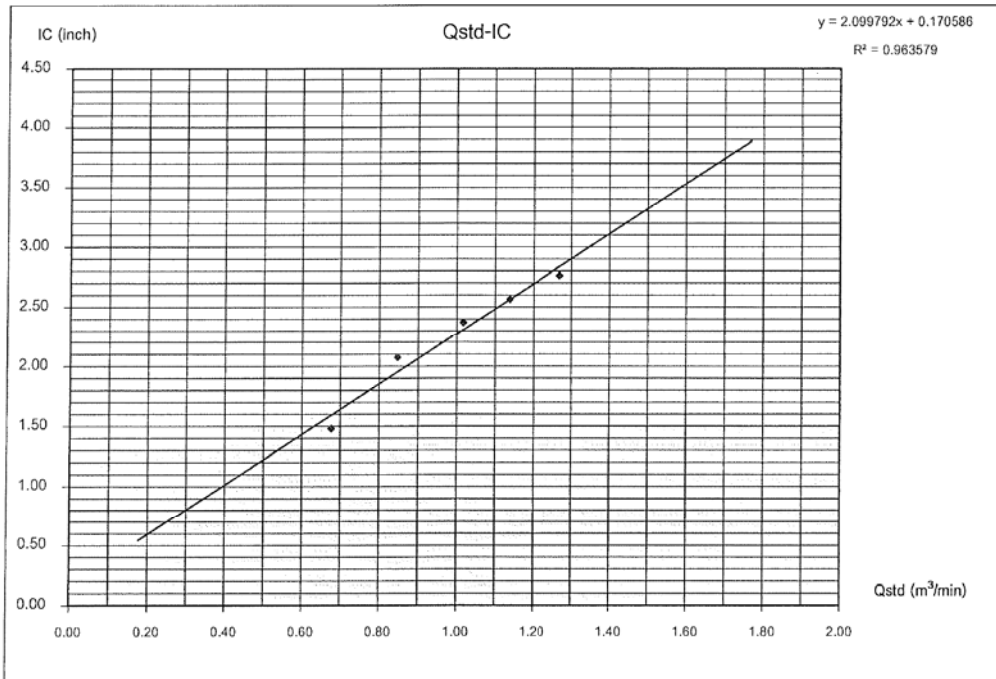
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	April 21, 2022
Project Site				Start Time	9:30 AM
Sampler Number	TSP No.7	Transfer Standard Type	Orifice	Stop Time	9:35 AM
Motor Serial Number	BL-07	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1		
				Person	Mr.Preecha Srisuk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (mH ₂ O)			$[\Delta H_2O(Pa/P_{atm})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = \{[(Pa/P_{atm})(T_{std}/Ta)]^{1/2}\}$	(°K = °C+273)	Pressure	Meter	Meter	
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(inch)			(mmHg)			
5	0.9	0.9	1.8	1.32354	0.67721	1.5	1.48	305.0	757.0			
7	1.4	1.4	2.8	1.65074	0.84821	2.1	2.07	305.0	757.0			
10	2.0	2.0	4.0	1.97301	1.01664	2.4	2.37	305.0	757.0			
13	2.5	2.5	5.0	2.20589	1.13834	2.6	2.56	305.0	757.0			
18	3.1	3.1	6.2	2.45638	1.26925	2.8	2.75	305.0	757.0			
Linear Regression Y ON X: Y= mX + b							Average	305.0	757.0			
1	Slope (m)			1.91345	Linear Equation			r ²	0.963579	Pstd(mmHg)	760.0	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9816206	T _{std}	298.0	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)			0	(Pa/Pstd)*(Tstd/Ta) ^{0.5}	0.973192407		
Result								C=(Pa/Pstd)*(Tstd/Ta) ^{0.5}				0.986505148

COMMENT

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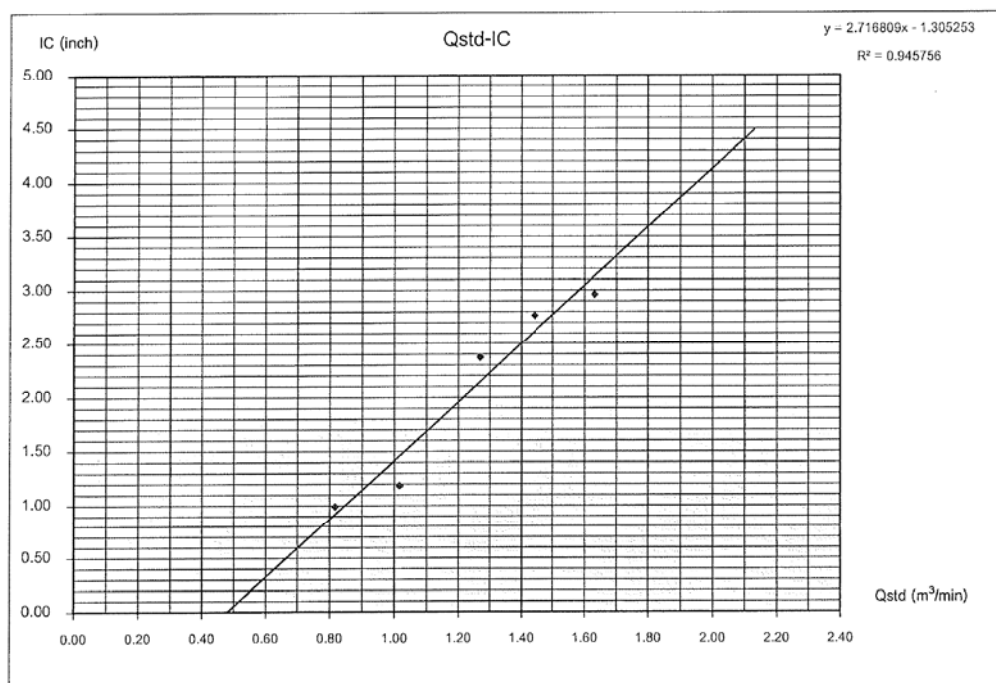
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location					Date	April 21, 2022
Project Site					Start Time	10:30 AM
Sampler Number		TSP No.10	Transfer Standard Type	Orifice	Stop Time	10:35 AM
Motor Serial Number		BL-10	Calibrator Model	TE-5025A	Person	
Recorder Serial Number		-	Calibrator Serial Number	I		
						Mr. Preecha Srisuk

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter	
	Pressure Drop Across Orifice (mmH ₂ O)			$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$	Sample Flow Rate Indicator	$IC = [(P/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)			
	Positive	Negative	ΔH ₂ O		(m ³ /min)	(inch)						
5	1.3	1.3	2.6	1.59069	0.81683	1.0	0.99	305.0	757.0			
7	2.0	2.0	4.0	1.97301	1.01664	1.2	1.18	305.0	757.0			
10	3.1	3.1	6.2	2.45638	1.26925	2.4	2.37	305.0	757.0			
13	4.0	4.0	8.0	2.79026	1.44374	2.8	2.76	305.0	757.0			
18	5.1	5.1	10.2	3.15064	1.63209	3.0	2.96	305.0	757.0			
Linear Regression Y ON X: Y= mX + b								Average	305.0	757.0		
1	Slope (m)			1.91345	Linear Equation			r ²	0.945756	Pstd(mmHg)	760.0	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.97249987	T _{std}	298.0	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)		0.973192407		
Result								C=(Pa/Pstd)*(Tstd/Ta)^0.5				0.986505148

COMMENT

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Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yek 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-33500-371
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

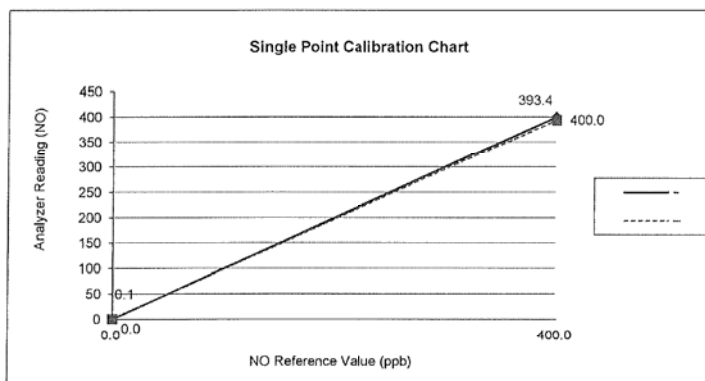
Humidity: 51 %RH


Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NOx	0.1	0.0	0.1	396.7	400.0	-0.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : 



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
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 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yek 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 29 December 2020

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 72706-374
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 46.05 PPM SO2 Conc 46.01 PPM CO Conc 4.487 PPM Cylinder number CC507080 Expire Date: 23 Jul. 2025

Environment: Temperature 25.5 °C

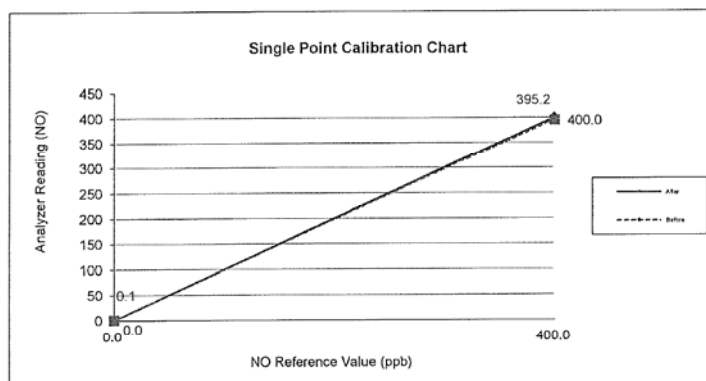
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	395.2	400.0	-1.2
NOx	0.1	0.0	0.1	400.0	400.0	0.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-601114773
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

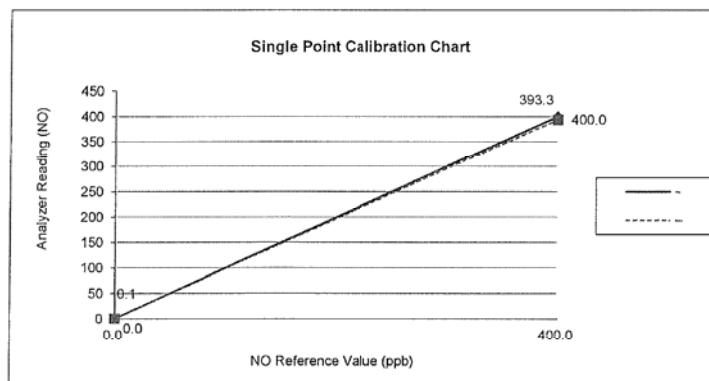
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.3	400.0	-1.7
NOx	0.1	0.0	0.1	396.4	400.0	-0.9

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แขวง 9 เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
 บริษัท เอ็นไวร์ เซอร์วิส จำกัด
 ENVIR SERVICE CO., LTD., 42 Raminthra 14 ycaok 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-601114783
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

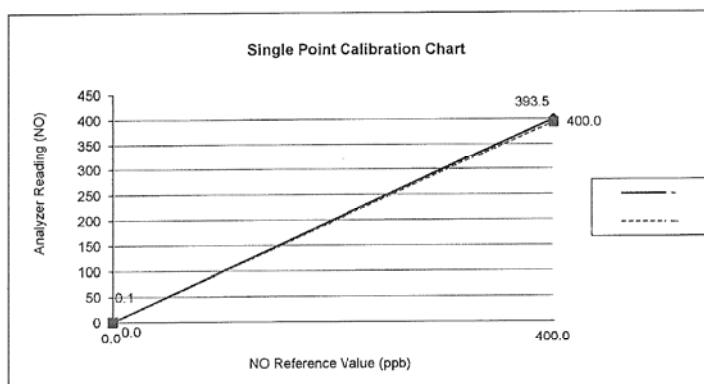
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.5	400.0	-1.6
NOx	0.1	0.0	0.1	396.2	400.0	-1.0

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-33500-719
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Calibration System

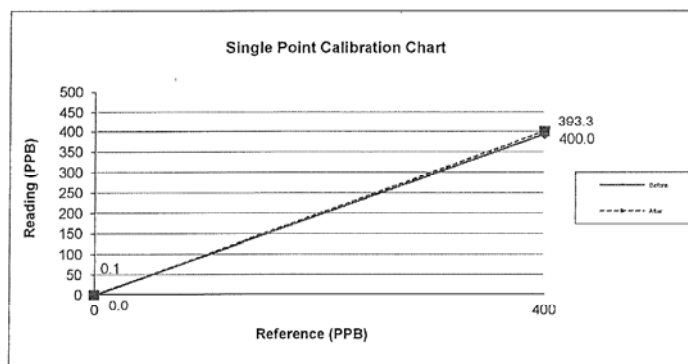
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.3	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By





บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-71354-368
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Calibration System

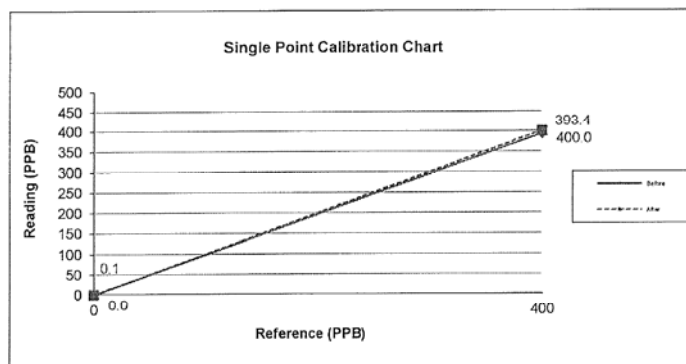
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: 193
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Calibration System

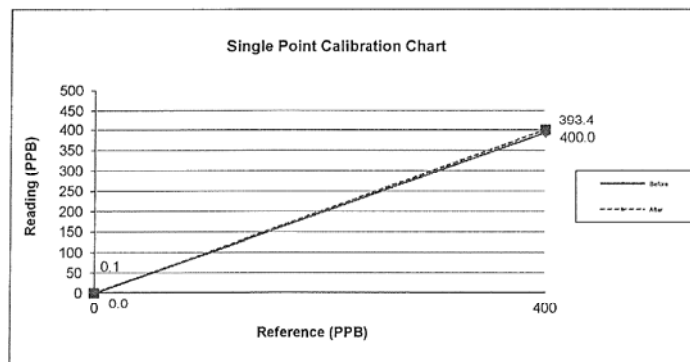
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.4	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :





บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD. 42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 16 March 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 100A	Manufacturer API S/N: 405
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Calibration System

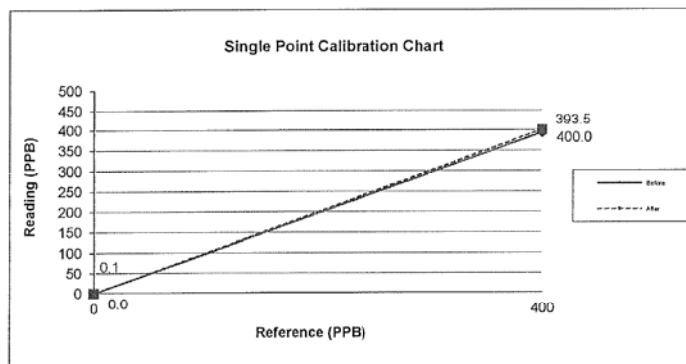
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

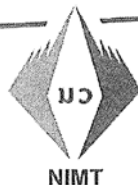
Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.5	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :





National Institute of Metrology (Thailand)

Certificate of Calibration

Certificate No. : AA-2013-21
Issued by : Acoustics Laboratory
Acoustics and Vibration Group



Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator
MANUFACTURER : RION
MODEL/TYPE : NC-75
SERIAL NUMBER : 34480442
CUSTOMER : MET Co., Ltd.
36/659 Moo 6, T. Bangrakphatthana,
Bangbuathong, Nonthaburi 11110
MEASUREMENT DATE : 6 September 2021

*The calibration results only marked with an asterisk * in this certificate are not included in Appendix C of the MRA drawn up by the CIPM.*

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 calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference
AUV084-01/21

Date
6 September 2021

Authorized Signatory



Person in charge



This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation
3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659
75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



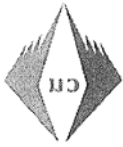
UNCERTAINTY OF MEASUREMENT

The stated uncertainty is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$. It has been determined in accordance with EA publication EA-4/02 M:2013 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of measurement data --Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measured lies within the assigned range of value with a probability of 95 %.

Parameter	Uncertainty at SPL94 dB	Maximum-permitted uncertainty of measurement for a coverage probability of 95%
1.Sound Pressure level	0.08	0.15
2. Frequency	0.1	0.2
3. THD+N	0.2	0.5

TRACEABILITY

This certificate provides traceability of measurement to recognized national standards, and to the realization of the International System of Units (SI).



ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature	: (23.0 ± 1.0)	°C
Pressure	: (101.325 ± 1.500)	kPa
Relative Humidity	: (50.0 ± 15.0)	%

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

Calibration Condition

Preconditionings : 16 hours at ambient conditions.

Measurement Con : The average values during measurement are
(100.965 ± 0.013) kPa, (22.3 ± 0.3) °C and (62.2 ± 2.6) %RH

MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

Reference Microphone

B&K Type 4180 serial no.1395446

TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 µPa are corrected to the values under the reference environmental conditions.

The microphone volume corrections and the calibrator pressure corrections are excluded in the calibration results.



MEASUREMENT RESULTS

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance Limit (dB)
Microphone 4180 Serial No.1395446			
94	94.12	0.12	0.25

Note ^[1] : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

2. Frequency*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance Limit (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	0.7

Note ^[2] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.



3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

Measured value ^[3] (%)	Maximum total distortion + Noise (%)
At the sound pressure level of 94 dB	
1.5	2.5

Note ^[3]: The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz. The measured value must not exceed the maximum total distortion + noise appeared in the table.

End of Certificate of Calibration



บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6504001

Calibrated Date : 21 April 2022

Acoustic Calibrator Data

Brand	:	RION	Serial No.	:	34480442
Model	:	NC-75	Last Calibration	:	6 September 2021
Range of Calibration	:	94 dB, 1000 Hz	Due Date	:	6 September 2022

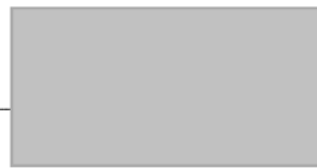
Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
ACO 6226	150067	93.3	94.0
ACO 6226	180009	93.0	94.0
ACO 6226	150084	93.2	94.0
ACO 6226	170103	93.4	94.0

Calibrated by : _____



Approved by : _____





บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110

36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

Sound Level Meter Calibration Report

Calibration Report No. : 6504002

Calibrated Date : 22 April 2022

Acoustic Calibrator Data

Brand	:	RION	Serial No.	:	34480442
Model	:	NC-75	Last Calibration	:	6 September 2021
Range of Calibration	:	94 dB, 1000 Hz	Due Date	:	6 September 2022

Calibration Data

Brand	Serial No.	Actual Reading [dB(A)]	
		Before Adjustment	After Adjustment
ACO 6226	080188	93.3	94.0
ACO 6226	180012	93.4	94.0
ACO 6226	080084	93.0	94.0
ACO 6226	110111	93.4	94.0
ACO 6226	170023	93.5	94.0
ACO 6226	170075	93.0	94.0
ACO 6226	180009	93.4	94.0
ACO 6226	110112	93.3	94.0
ACO 6226	080085	93.2	94.0
ACO 6226	080087	93.0	94.0

Calibrated by :



Approved by :





Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06210488
Model:	SP-2100	Issued Date:	21 October 2021
Serial No. (or ID.):	KJOGO5083001 (MET-SP 01/46)	Job No.:	KSPR2114279
Manufacturer:	Spectrum	Page:	1 of 2
Condition:	In Condition		

Customer: M E T CO.,LTD.
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Environment Condition: Temperature 27.4 °C ± 0.0 °C
Humidity 65.3 %RH ± 0.0 %RH

Calibration Place: M E T CO.,LTD. (Laboratory Room)
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Calibration By: Mr.Imron Ama
Calibration Date: 21 October 2021
The Method used: In house method, SPCC-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 80284 and 80285

The standard for Photometric Certificate No. 94010



Person in charge



Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 4 nm and UUC at 4 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.48	418	0.48	0.59
536.90	537	-0.10	0.59
637.94	638	-0.06	0.59
748.28	748	0.28	0.59
879.70	879	0.70	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5816	0.579	0.0026	0.0045
	0.7130	0.717	-0.0040	0.0045
	1.0151	1.018	-0.0029	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5649	0.563	0.0019	0.0045
	0.7012	0.701	0.0002	0.0045
	0.9982	0.997	0.0012	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5249	0.523	0.0019	0.0045
	0.6621	0.661	0.0011	0.0045
	0.9420	0.941	0.0010	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.520	0.0014	0.0045
	0.6982	0.695	0.0032	0.0045
	0.9947	0.990	0.0047	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5549	0.554	0.0009	0.0045
	0.7736	0.771	0.0026	0.0045
	1.1041	1.100	0.0041	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.561	0.0011	0.0045
	0.7630	0.761	0.0020	0.0045
	1.0890	1.086	0.0030	0.0045

The End of Certificate

Metrohm

Compliance Service

Calibration Certificate (CC) for 925 Eco IC

Instrument details

Type:	19250020
Serial No.:	221685/ME (1925002004284)
Manufacturer:	Metrohm AG Ionenstrasse CH-9100 Herisau Switzerland
Firmware:	5.850.0113
Customer instrument ID:	N/A
System Designation Number:	CAL220532/ME

Customer details

Name of company:	M E T COMPANY LIMITED
Address:	36/659 Moo 6, Tambon Bangrakpattana, Amphoe Bangbuatong, Changwat Nonthaburi 11110
Department:	Laboratory
Responsible person:	Khun Sasithorn Suwanwiko
Calibration place:	Laboratory M E T COMPANY LIMITED

Date and time of calibration:	12/07/2022 - 08:45
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Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Calibration Certificate (CC)

Introduction

The instrument stated above has been inspected in accordance with the corresponding test instructions of Metrohm Ltd. Servicing instructions are compiled and checked for correctness with account taken of the technical apparatus and ambient conditions available to the service engineer at the servicing location. This Calibration Certificate (CC) declares the results regarding calibration and operational status obtained when carrying out the test instructions referred to below.

Calibration status

We certify that the instrument stated above meets or exceeds the electrical specifications at the points tested. Test equipment is calibrated and traceable back to national and/or international standards (ISO 17025, NIST).

Operational status

We certify that the instrument stated above executes the instrument's specific functions tested except where detailed overleaf.

Declaration

Document

Test instructions used: C.1 Test instructions for 925 Eco IC, Version 1.1

Reference standards

Type / Model	Manufacturer	Serial No. / Batch No.	Certificate No.	Due date / Expiry date
Multimeter	Fluke	88490190	E1U222184	25/05/2023
High pressure gauge	Metrohm	05108	CAL0252-21Q0119	22/09/2022

Protocol

	Yes	No
Instrument had to be repaired beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Instrument had to be readjusted beforehand If yes, see Calibration Certificate (CC) No.:	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Conclusion of test results

	Yes	No
Instrument satisfies the specified technical requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Recommended date for next maintenance:		

Comments

Metrohm representative

	Yes	No
Metrohm representative confirms correct execution of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022		

Customer representative

	Yes	No
Customer representative accepts results of instrument calibration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Date	Name	Signature
12/07/2022		

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

Test results

No.	Title	Comments	Pass		
			Yes	No	N/A
100	Visual test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101	Safety test		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102	LED		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
103	Fan		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
104	Communication		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
105	Column plug interface		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
106	IC pump		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.1	Installation		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.2	Pump head detection		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.3	Dearate		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.4	Pump dynamics		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass				
			Yes	No	N/A		
106.5 Pulsation							
	Standard pump head Macro pump head	Maximum [MPa]					
		11.71	11.32	<5.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		N/A	N/A	<10.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.6 Pressure transducer							
		Nominal value [MPa]	Measured value [MPa]	Tolerance [%]			
		11.66	12	± 10.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
106.7 Flow rate							
	Standard pump head Macro pump head	Nominal value [mL]	Measured value [mL]	Tolerance [mL]			
		4.0	4.0	± 0.2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		20.0	N/A	± 1.0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
106.8 Shut off at minimum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.9 Shut off at maximum pressure			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
106.10 Leak test							
		Maximum [MPa]	Minimum [MPa]	Difference [MPa]			
		19.20	18.75	<1.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Document Type	Calibration Certificate (CC)
Description	CC for 925 Eco IC
Document ID	CC.925 Version 1.1 / 8.925.3002EN

No.	Title	Pass		
		Yes	No	N/A
107	Injector	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	107.1 Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Pass		
		Yes	No	N/A
108	MSM	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	108.1 Switching operation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No.	Title	Comments	Pass		
			Yes	No	N/A
109	Peristaltic pump		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	109.1 Rotation CW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	109.2 Rotation CCW		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	109.3 Speed control		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CC.925 Document history

Date	Version	Author	Description/Changes
14.12.2016	1.0	pr	Creation of document 8.925.3002EN
31.03.2021	1.1	pr	Test no. 103 Fan depends on the installed power supply version according C.3 notice of modification CRM-28908.

End of CC Document



MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 8000

Customer :	<u>M E T CO.,LTD.</u>	Date Tested:	<u>October 6, 2021</u>
		Recommendation Recertification	
Address :	<u>BANGBUATHONG,</u>	Period	<u>6</u> Months
	<u>NONTHABURI,11110</u>	Recertification Due:	<u>April 6, 2022</u>
	<u>BANGKOK 10160</u>	Date Last Certified:	<u>March 4, 2021</u>
User Name:	<u>KHUN SUPAPORN.</u>	Visit Number:	<u>2 of 2</u>
Phone:	<u>087-799-1303</u>	PerkinElmer Phone:	<u>02-719-6420 ext 206</u>
E-mail :	<u>laboratorymet@gmail.com</u>	PerkinElmer Fax:	<u>02-318-5597</u>

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
<u>OPTIMA 8000</u>	<u>078S1407053C</u>	<u>ICP Syngistix Version 1.0</u>
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Method</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>October 30,2022</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>October 30,2021</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1407053CDATE TESTED: October 6, 2021**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purge filters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

OPTIMA 8000

SERIAL NUMBER: 078S1407053C DATE TESTED: October 6, 2021

PARAMETER	SPECIFICATION				FINAL VALUE	
Spectral Resolution : UV						
	As	193.696 nm	≤ 0.009	nm	<u>0.00697</u>	nm
	Ni	231.604 nm	≤ 0.011	nm	<u>0.00855</u>	nm
	Ni	341.476 nm	≤ 0.015	nm	<u>0.01287</u>	nm
Spectral Resolution : VIS						
	Ba	455.403 nm	≤ 0.020	nm	<u>0.01541</u>	nm
Precision						
	Zn	206.200 nm	% RSD	≤ 1.0 %	<u>0.12</u>	%
	Mg	280.271 nm	% RSD	≤ 1.0 %	<u>0.61</u>	%
	Mg	285.213 nm	% RSD	≤ 1.0 %	<u>0.22</u>	%
	Ba	455.403 nm	% RSD	≤ 1.0 %	<u>0.08</u>	%
Detection Limits : Axial						
	Tl	190.801 nm	3(sd)		<u>6.31</u>	ppb
	As	193.696 nm	3(sd)		<u>6.72</u>	ppb
	Se	196.026 nm	3(sd)		<u>2.13</u>	ppb
	Pb	220.353 nm	3(sd)		<u>5.21</u>	ppb
Detection Limits : Radial						
	As	193.696 nm	3(sd)		<u>2.74</u>	ppb
	Zn	213.857 nm	3(sd)		<u>0.54</u>	ppb
	Mn	257.610 nm	3(sd)		<u>0.21</u>	ppb
	La	379.478 nm	3(sd)		<u>0.13</u>	ppb
	Ba	455.403 nm	3(sd)		<u>0.05</u>	ppb
	Ba	493.408 nm	3(sd)		<u>0.04</u>	ppb
BEC : Axial (IB X 1000)/(IS-IB)						
	Mn	257.610 nm	≤ 30 ppb		<u>10.46</u>	ppb
BEC : Radial (IB X 1000)/(IS-IB)						
	Mn	257.610 nm	≤ 30 ppb		<u>10.44</u>	ppb



MAINTENANCE AND IPV TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER: 078S1407053CDATE TESTED: October 6, 2021

Remarks :

Test all pass

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,
including warranty terms.**Service Department PerkinElmer Ltd.**

Customer Service Engineer:



Service Engineer



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkac Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : AD2111-099-0002

Date Issued : 15-Nov-21

Customer : MET CO.,LTD.
36/659 Moo 6 T. Bangrakpattana A.Bangbuatong Nonthaburi 11110

Equipment : Heat Stress Meter

Manufacturer : METROSONIC

Model : hs-32

Serial No. : MCE010018

ID No./Tag No. : HT-02

Date Received : 09-Nov-21

Date Calibrated : 12-Nov-21

Calibrated by : Ms. Yaowanuch Jirakiattikul

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by :



Page 1 of 2

Certificate No. : AD2111-099-0002

Environment : Ambient Temperature : $(25 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\%\text{RH}$

STD Reading ($^\circ\text{C}$)	UUC Reading ($^\circ\text{C}$)		UUC Error ($^\circ\text{C}$)	Measurement Uncertainty ($\pm^\circ\text{C}$)
	Before Adjusted	After Adjusted		
23.99	WET 24.0	-	0.01	0.35
27.99	DRY 27.9	-	-0.09	0.35
30.01	GLOBE 29.7	-	-0.31	0.35
26.99	WET 27.0	-	0.01	0.35
32.00	DRY 31.9	-	-0.10	0.35
35.01	GLOBE 34.8	-	-0.21	0.35
30.01	WET 29.8	-	-0.21	0.35
36.01	DRY 35.7	-	-0.31	0.35
39.99	GLOBE 39.7	-	-0.29	0.35

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0 to 100 $^\circ\text{C}$
Resolution 0.1 $^\circ\text{C}$

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. AD2111-077-0001 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 11-Nov-22

End of Certificate



GIIC Calibration Laboratory

700/20-21 Phaholyothin Rd., Samsennai, Phayathai,
Bangkok 10400 Thailand

Tel : +66 (02) 615 4999

Fax : +66 (02) 615 4644

E-mail : cal@giic.co.th



NSC-TISI-TIS 17025
CALIBRATION 0256

CERTIFICATE No.CAL01652-21..... PAGE4..... OF3.....

Certificate of Calibration

Equipment : DIGITAL LIGHT METER

Manufacturer : DIGICON

Model / Type : LX-73

Serial No. : T.017761

ID No. : -

Customer : M E T CO., LTD.
36/659 Moo 6 T.Bangrakpattana A.Bangbuathong Nonthaburi
11110.

C.S.R. No. : L0001697-21

Received Date : 15 December 2021

Calibration Date : 17 December 2021

Calibrated By : TONTRAKARN SRIKACHA

Approved By : NATTAPOL KINGKAEW

Issue Date : 18 December 2021

The uncertainties are for a level of confidence of approximately 95%.

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.



CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement

U.U.C. Range (lux)	Standard Setting (lux)	U.U.C. Reading (lux)	Error (lux)	Uncertainty of measurement \pm (lux)
400	0	0.0	0.0	0.60
	50	49.4	-0.6	1.6
	250	242.1	-7.9	6.5
4000	500	504	4	13
	1000	1012	12	26
	1500	1515	15	36
	2000	2017	17	48
	3000	3007	7	72
40000	4000	4000	0	96
	5000	5010	10	0.12 klux

- U.U.C. = Unit Under Calibration

This result of calibration was found accurate as show on data and place of calibration only.

- END -

CAL

Calibratech Co.,Ltd.

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-420003-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific **Model :** pH 150

Range : N/A **pH** **Resolution :** 0.01 pH

Serial No. : 2913288 **ID No. :** MET-PH05/63

Electrode

Model : N/A **Serial No. :** 48393

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$

Relative Humidity : $(50 \pm 15) \%$

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Bunjerd Masri

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	21E997	17 Mar 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.004	61218215	769926	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61223875	769927	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.963	61208865	769928	15 May 2022	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420003-2

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

Performing standard curve by Multiproduct Calibrator at pH (4,7,10)

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.060
	0.0000	7	7.00	0.2	-0.2	0.058
	-177.4800	10	10.00	-177.2	-0.3	0.060

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.004	4.01	0.00	0.011
	6.985	7.00	-0.01	0.011
	9.963	10.01	-0.04	0.016

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- 000 -



Certificate of Calibration

Certificate No. : 65-400021-2

Page : 1 of 2

Submitted by : M E T Company Limited
6/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Digital Thermometer with Thermistor Probe
Temperature Indicator

Manufacturer :	Thermo Scientific	Model :	pH 150
Range :	N/A	Resolution :	0.1 °C
Serial No. :	2913288	ID No. :	MET-PH05/63
Thermistor Probe			
Model :	PHWPTM01W	Sheath Material :	Stainless
Diameter :	3 mm.	Length :	85 mm.
Serial No. :	459	ID No. :	MET-PH05/63

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 13 January 2022

Date of Calibration : 19 January 2022

Date of Issue : 19 January 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.
The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-400021-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
85	10.0024	10.1	-0.1	0.11
85	50.0038	50.4	-0.4	0.11

Remark

UUC : Unit Under Calibration

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$,
providing a level of confidence of approximately 95%

- ๐0๐ -



Certificate of Calibration

Certificate No. : 64-400425-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400032	64-400106-1	30 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-5

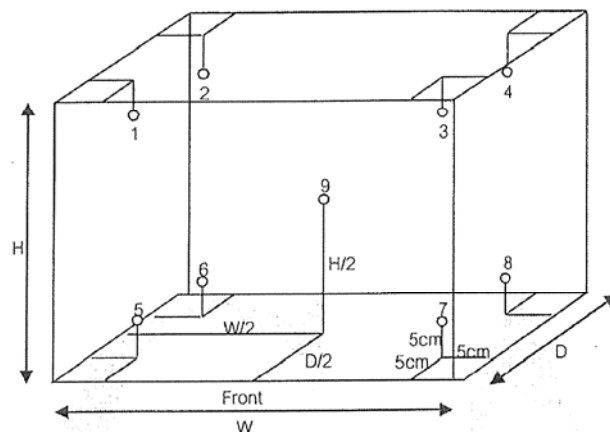
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.9	19.8	19.7	19.5	20.4	20.4	20.3	20.1	20.4	0.57

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	1.0	0.1	1.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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CAL

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-7

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRR3-0687 AR

Range : N/A °C

Resolution : 1 °C

Serial No. : SRR3675A-210400065 R

ID No. : MET-RE04/64

Environment :

On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (28.6 to 30.5) °C

Relative Humidity : (55 to 58) %

Line Voltage : (220.0 to 220.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Bunjerd Masri

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400022 & 400028

64-400103-1

02 Sep 2021

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-7

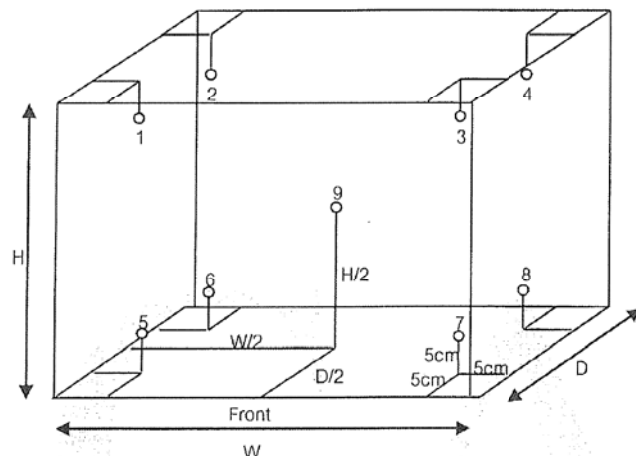
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	3	3	3.5	3.6	3.4	3.2	3.1	2.7	3.1	3.0	3.1	0.83

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	3	3	0.6	0.2	1.4

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

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Hanna Instruments (Thailand) Ltd.

410/67-68 Soi Ratchadapisek 24, Ratchadapisek Rd., Samsen-nok,

Huaykwang, Bangkok 10310 Tel: 0-2541-4199 Fax: 0-2541-4198

Certificate No. : HIT-2137-1039

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HI839800-02 **Serial No. :** 1021810

Manufacturer : Hanna Instruments

Made in : Romania

Condition As-Received : Used Product

Reference : RE211263

Customer name : MET Co., Ltd.
36/659 Moo. 6, Bang Rak Phatthana,
Bang Bua Thong, Nonthaburi 11110

Received date : 1 September 2021

Calibrate date : 1 September 2021

Issue date : 6 September 2021

Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) % RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by :



Calibration Engineer

Approved by :



Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

*** This certificate may not be reproduced other than in full, except with the prior written ***
approval of the head of Hanna Instrument (Thailand)

Condition of this result of calibration
Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceable
Thermometer With Sensor	HI935005	03250060101	21T167	Technology Promotion Association (Thailand-Japan)

Reference / Procedure :

This equipment was calibration by comparison to the reference standard (Standard platinum resistance thermometer) whose accuracy is traceable to the national standard. The calibration was performed by generating the specified working point of temperature then recorded the temperature reading values against the reference standard according to Hanna Calibration Laboratory work Instruction No. 141.

This temperature scale used was based on ITS-90

All data shown below were as-received values without adjustment.

SITE CALIBRATION

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Result of Calibration :

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	150.2 (°C)	150.5 (°C)	1.3 (°C)	±0.40 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	149.9	150.7	150.9	151.1	150.2
	6	7	8	9	10
	150.0	149.9	150.4	150.9	150.6
	11	12	13	14	15
	150.3	150.8	151.1	150.9	150.5
	16	17	18	19	20
	149.9	149.9	150.5	151.0	150.5
	21	22	23	24	25
	150.5	150.7	150.6	150.4	149.8

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

**** End of certificate ****

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-2

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Binder

Model : ED53

Range : N/A °C

Resolution : 1 °C

Serial No. : 13-07419

ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030

64-400104-1

29 Sep 2021

National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-2

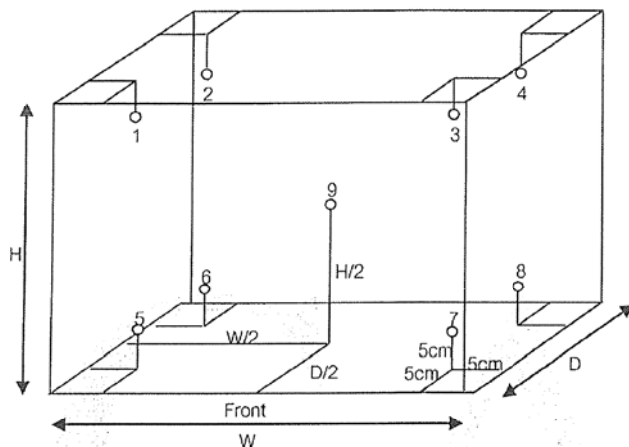
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	109	109	104.8	105.0	104.4	104.6	103.4	103.5	103.6	103.7	103.7	0.96
180	184	184	180.8	181.8	179.9	180.6	180.6	180.8	180.6	180.9	180.5	1.1

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	109	109	1.5	0.2	1.8
180	184	184	1.6	0.2	2.3

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- o0o -



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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 64-400425-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Air Chamber (Oven)

Manufacturer : Memmert

Model : UM 100

Range : N/A °C

Resolution : 0.1 °C

Serial No. : b197.0985

ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (31.0 to 33.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2021

Date of Calibration : 23 August 2021

Date of Issue : 23 August 2021

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400032	64-400106-1	30 Sep 2021	National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 64-400425-1

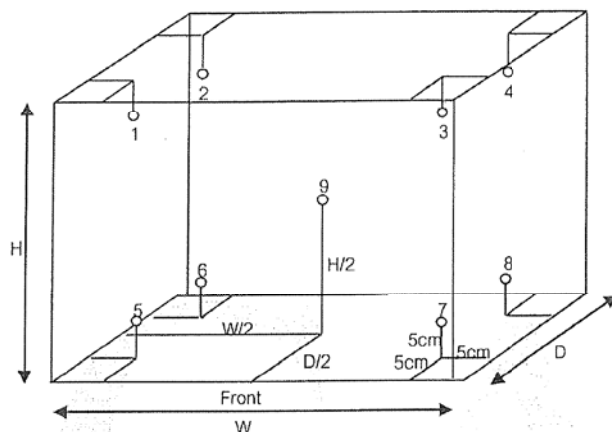
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.32 m

D = 0.18 m

H = 0.24 m

Capacity = 0.01 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	180.9	181.2	180.7	181.0	181.1	181.3	180.6	180.7	179.6	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.9	0.2	2.0

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -



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NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-200064-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : METTLER TOLEDO Model : AG285
Serial No. : 1122140126 ID No. : MET-EB01/46
Capacity : 210 g Resolution : 0.00001g/81g, 0.0001g/210g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.2 to 26.8) °C
Relative Humidity : (55.3 to 64.1) %
Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 2022

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02213103	18 Nov 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-200064-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

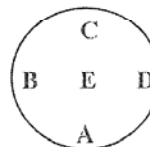
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.01	0.00000	0.000016
0.1	0.00001	0.000021
1	-0.00001	0.000029
5	-0.00002	0.000043
10	-0.00006	0.000053
20	-0.00015	0.000071
50	-0.00035	0.00011
100	-0.0006	0.00021
150	-0.0009	0.00038
200	-0.0012	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.23$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g
A B C D E
0.00044 0.00006 -0.00052 -0.00019 0.00000 g



Repeatability

Load test : 200 g
Stdev. : 0.000052 g

-o0o-



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Certificate of Calibration

Certificate No. : 65-200064-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : AND Model : FX-2000i
Serial No. : 15639789 ID No. : MET-EB03/61
Capacity : 2200 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (26.1 to 26.2) °C
Relative Humidity : (55.5 to 61.9) %
Air Pressure : 1011.0 mbar

Date of Received : 09 March 2022

Date of Calibration : 09 March 2022

Date of Issue : 16 March 2022

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
F181-F1821	65-210044-1	31 Jul 2022	National Institute of Metrology (Thailand), (NIMT)

Approved by :



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 65-200064-2

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)	Error before Adjustment (g)
200	0.00	0.0083	-0.08
500	0.00	0.0085	-0.20
600	0.00	0.0086	-0.24
700	0.00	0.0087	-0.28
800	0.00	0.0089	-0.34
1000	0.01	0.0093	-0.41
1200	0.01	0.011	-0.50
1500	0.01	0.011	-0.61
2000	0.00	0.012	-0.79
2200	0.00	0.023	-0.87

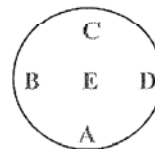
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.00$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 500 g

A	B	C	D	E	
0.00	0.01	0.00	0.00	0.00	g



Repeatability

Load test : 2000 g

Stdev. : 0.000 g

-o0o-



Packing List

Unit : K-446 Kjeldigester standard



151111112791000281006111

Serial Number

1000281006

Page 1(1)

Item	Pieces	Description		
11059833	1.0000	Packing parts Kjeldigester K-446/K-449 Beipackteile K-446/K-449		✓ OK
037377	5.0000	Sample tubes 300 ml (set of 4) Probengläser 300 ml (Set à 4 Stück)		✓ OK
11059754	1.0000	Rack 20 cpl. Rack 20 kpl.		✓ OK
11058955	1.0000	Aspiration device Kjeldigester K-446/K-449 cpl. Absaugeinheit K-446/K-449		✓ OK
040444	1.0000	Weighing boat 20pcs. Wägeschiffchen 20 Stk.		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11058825	1.0000	Fume collection tube with ball joint Dampfsammelrohr mit Kugelschliff		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
11593546	1.0000	Operation Manual K-446/K-449 english Bedienungsanleitung K-446/K-449 englisch		✓ OK
11593635	1.0000	Supplementary sheet Kjeldigester K-446/K-449 Beiblatt K-446/K-449		✓ OK

Packed by





BUCHI Certificate Final Test Inspection

Unit : BÜCHI KjelDigester K-446

Serial number 1000281006

Examination Procedure

- | | |
|--|------|
| 1. <u>Visual control of the glass parts and the unit</u> | ✓ OK |
| <ul style="list-style-type: none">- No scratches on the coated surface- Mounted in accordance to the specific drawing | |
| 2. <u>Security tests</u> | ✓ OK |
| <ul style="list-style-type: none">- High voltage test in accordance with EN 61010-1 (IEC 1010)- Ground connection test in accordance with EN 61010-1 (IEC 1010) | |
| 3. <u>Functional tests</u> | ✓ OK |
| <u>Operating panel</u> | ✓ OK |
| <ul style="list-style-type: none">- All buttons are working- Cooling system is working after the instrument has been switched on | |
| <u>Connector plugs</u> | ✓ OK |
| <ul style="list-style-type: none">- Scrubber connector is working | |
| <u>Heating element</u> | ✓ OK |
| <ul style="list-style-type: none">- Heating-up temperature 420 °C is reached after 40 minutes- Temperature calibration at 420 °C (3 measuring points) | |
| 4. <u>Completeness of order checked</u> | ✓ OK |

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Signature, Date:



Packing List

Unit : K-415 TripleScrub 230V



151111112781000281005111

Serial Number

1000281005

Page 1(1)

Item	Pieces	Description		
11057332	1.0000	Tray for adsorption storage Ablage für Adsorption		✓ OK
048355	1.0000	Silicone hose D6/9 L=3m Silikonschlauch D6/9 L=3.0m		✓ OK
033701	1.0000	Glass wool 30g Glaswolle 30g		✓ OK
028737	2.0000	Hose clamp Anschlussklemme		✓ OK
11064971	1.0000	Activated Charcoal 2-6mm, 150g Aktivkohle 2-6mm, 150g		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11593505	1.0000	Operation Manual K-415 english Bedienungsanleitung K-415 englisch		✓ OK

Packed by



BUCHI
LABORATORY



BUCHI Certificate Final Test Inspection

Unit : BÜCHI Scrubber K-415

Serial number 1000281005

Examination Procedure

1. Visual control of the glass parts and the unit ✓ OK
- No scratches or splinters on the glass parts
- Mounted in accordance to the specific drawing
2. Security tests ✓ OK
- High voltage test in accordance with EN 61010-1 (IEC 1010)
- Ground connection test in accordance with EN 61010-1 (IEC 1010)
3. Functional tests
Vacuum test ✓ OK
- Bypass valve open: Pressure is 0 - 65 mbar below the atmospheric pressure
- Bypass valve closed: Pressure is 400 mbar (+/- 10 %) below the atmospheric pressure
4. Completeness of order checked ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Signature, Date:



Packing List

Unit : K-360 Plastik Basic









151111113001000281014111

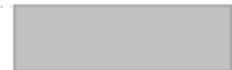
Serial Number

1000281014

Page 1(1)

Item	Pieces	Description		
043410	3.0000	Canister 10L thin-walled Kanister 10L dünnwandig		✓ OK
043603	1.0000	Packing parts K-360 Beipackteile K-360		✓ OK
047871	1.0000	Suppl. sheet distillation unit Beiblatt Distillation Unit		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
093176	1.0000	Operation Manual K-360 english Bedienungsanleitung K-360 englisch		✓ OK

Packed by





BUCHI Certificate Final Test Inspection

Unit : BÜCHI BÜCHI KjelFlex K-360

Serial number 1000281014

Examination Procedure

1. **Visual control of the glass parts and the unit** ✓ OK

 - No scratches on the coated surface or splinters on the glass parts
 - Mounted in accordance to the specific drawing
2. **Security tests** ✓ OK

 - High voltage test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)
 - Ground connection test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)
 - Safety door sensor checked
3. **Functional tests** ✓ OK

Electronics

 - Electronic modul is tested with the checking device PG157
 - Connector plugs are working

Operating panel ✓ OK

 - Display is working
 - All buttons of the keypad are working

Pump testing ✓ OK

 - All pumps are working
 - All pumps (exception: water pump of the steam generator) are precalibrated

Valve testing ✓ OK

 - All valves are working

Steam generator testing ✓ OK

 - The steam generator is filled with water
 - The steam generator valve is working
 - The amount of distillate corresponds to specifications

Further testing ✓ OK

 - Beeper is working
4. **Unit configuration and completeness of order checked** ✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Signature, Date:

