

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location		บริเวณที่ทำการของกรมบริหารส่วนตำบล สามเมือง		Date	March 23, 2024		
Sampler Number				TSP No.14	Transfer Standard Type	Orifice	Stop Time
Motor Serial Number		BL-14	Calibrator Model		TE-5025A	Person Mr.Jirayut Seehabut	
Recorder Serial Number		-	Calibrator Serial Number		1		

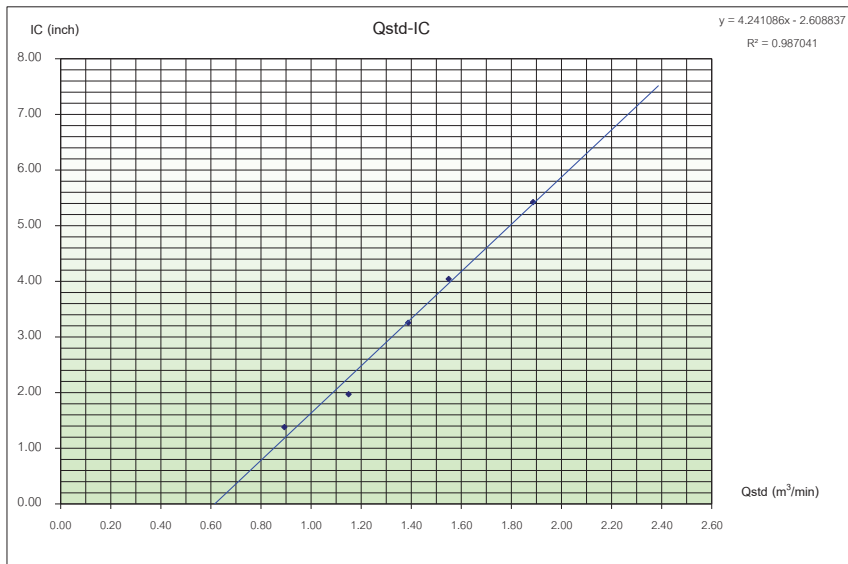
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH_2O	$[\Delta H_2O(Pa/P_{atm})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{atm})(T_{std}/Ta)]^{1/2}$ ($K = ^\circ C + 273$)	($^\circ K = ^\circ C + 273$)	Pressure (mmHg)	Meter	Meter
5	1.5	1.6	3.1	1.73692	0.89325	1.4	1.38	305.0	757.0		
7	2.5	2.6	5.1	2.22784	1.14981	2.0	1.97	305.0	757.0		
10	3.7	3.7	7.4	2.68358	1.38799	3.3	3.26	305.0	757.0		
13	4.6	4.6	9.2	2.99222	1.54929	4.1	4.04	305.0	757.0		
18	6.8	6.8	13.6	3.63805	1.88681	5.5	5.43	305.0	757.0		

Linear Regression Y ON X : $Y = mX + b$

1	Slope (m)	1.91345	Linear Equation		r^2	0.97882	$P_{std}(mmHg)$	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.9893533	T_{ref}	298.0
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	(Pa/P_{std})(T_{std}/Ta)	0.973192407	Result	
					$C = (Pa/P_{std})(T_{std}/Ta)^{0.5}$	0.986505148		

COMMENT

Andersen Instruments, Inc.



Calibrated By
(Mr.Jirayut Seehabut)
Field Environmental

Approved By
(Mr.Jarung Jammongbut)
Division Manager



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
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Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location			Date	March 23, 2024	
บริเวณที่ทำการองค์การบริหารส่วนตำบลสามเมือง			Start Time	1:15 PM	
Sampler Number	PM-10 No.1	Transfer Standard Type	Orifice	Stop Time	1:20 PM
Motor Serial Number	HVL-01	Calibrator Model	TE-5025A	Person Mr.Jirayut Seehabut	
Recorder Serial Number	-	Calibrator Serial Number	1		

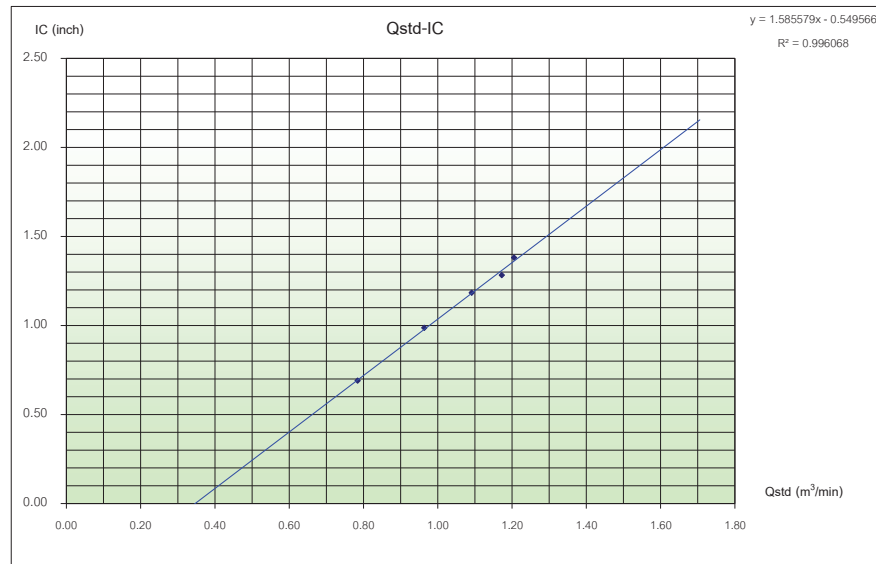
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH_2O	$[\Delta H_2O(Pa/P_{atm})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{atm})(T_{std}/Ta)]^{1/2}$ ($K = ^\circ C + 273$)	($^\circ K = ^\circ C + 273$)	Pressure (mmHg)	Meter	Meter
5	1.2	1.2	2.4	1.52829	0.78422	0.7	0.69	305.0	757.0		
7	1.8	1.8	3.6	1.87176	0.96372	1.0	0.99	305.0	757.0		
10	2.3	2.3	4.6	2.11582	1.09127	1.2	1.18	305.0	757.0		
13	2.6	2.7	5.3	2.27111	1.17242	1.3	1.28	305.0	757.0		
18	2.8	2.8	5.6	2.33450	1.20555	1.4	1.38	305.0	757.0		

Linear Regression Y ON X : $Y = mX + b$

1	Slope (m)	1.91345	Linear Equation		r^2	0.987743	$P_{std}(mmHg)$	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m^3/min)	1.133	r	0.993852606	T_{ref}	298.0
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	(Pa/P_{std})(T_{std}/Ta)	0.973192407	Result	
					$C = (Pa/P_{std})(T_{std}/Ta)^{0.5}$	0.986505148		

COMMENT

Andersen Instruments, Inc.



Calibrated By
(Mr.Jirayut Seehabut)
Field Environmental

Approved By
(Mr.Jarung Jammongbut)
Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 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 SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

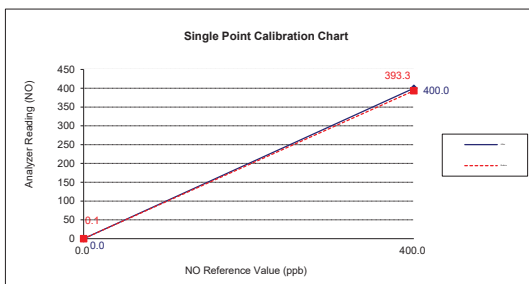
Environment: Temperature 25.5 °C Humidity: 51 %RH

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
NO _x	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
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: SO ₂ Analyzer Model: 100A	Manufacturer: API S/N: 193
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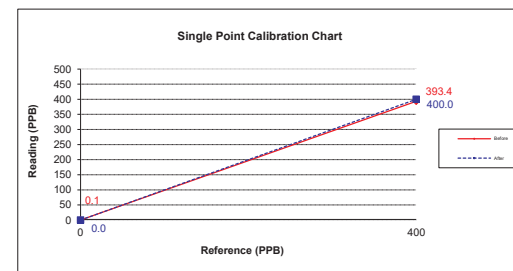
Calibration System

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 SO ₂ 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 :
Mr.PASAGORN SAMOL



ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Calibration Test

Calibrated Date: 04 February 2025

Certificate No. 021/24

Instruments Information

Manufacturer : YOUNG Instrument

Type :

four blade helicoid propeller

Model : 05103

Serial Number :

Logger 14091

Environment : Temperature 25.5 °C Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	2.9	0.12
5.04	-	-	-	-	-	4.9	0.14
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.6	0.41
15.03	-	-	-	-	-	14.6	0.43
17.05	-	-	-	-	-	16.6	0.45
20.02	-	-	-	-	-	19.5	0.52

Wind Aloft Plotting Board. US. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION	Deviation	Result
0	0	0	Pass
90	90	0	Pass
180	180	0	Pass
270	270	0	Pass

Calibrate By :

MR. KITTISAK JANSANGWATTANA

Approve by :

MR. PASAGORN SAMOL



บริษัท เมต คี ที จำกัด MET CO., LTD.

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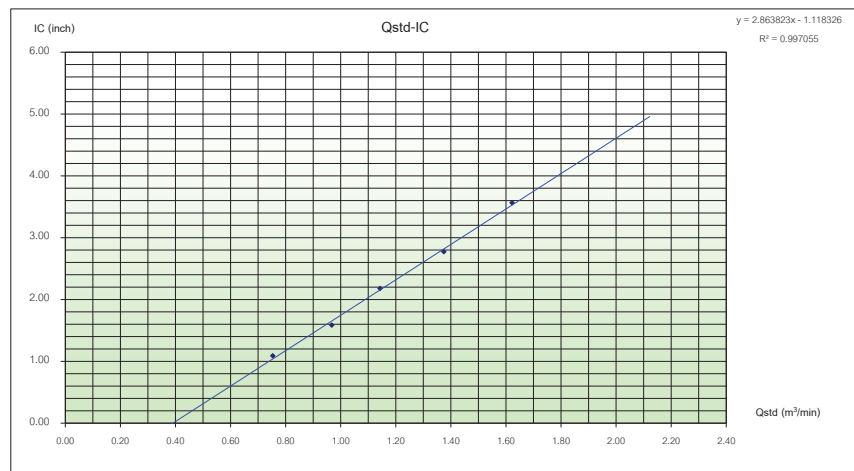
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jti@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 23, 2025
บริษัท เมทีเอส				Start Time	10:05 AM
Sampler Number	TSP No.16	Transfer Standard Type		Stop Time	10:10 AM
Motor Serial Number	BL-16	Calibrator Model	TE-5025A	Person Mr. Jinyul Seehabud	
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH ₂ O	ΔH ₂ O(Pa/P _{atm} (T _{atm} /T _{atm})) ^{1/2}	Qstd = (1m)[(A-B)] ³ (m ³ /min)	Sample Flow Rate Indication (inch)	IC = [(P _{atm} P _{atm} (T _{atm} /T _{atm})) ^{1/2}				
5	1.1	1.1	2.2	1.46901	0.75324	1.1	1.09	303.0	758.0		
7	1.8	1.8	3.6	1.87917	0.96759	1.6	1.58	303.0	758.0		
10	2.5	2.5	5.0	2.21462	1.14291	2.2	2.18	303.0	758.0		
13	3.6	3.6	7.2	2.67555	1.37438	2.8	2.77	303.0	758.0		
16	5.0	5.0	10.0	3.13195	1.62231	3.6	3.57	303.0	758.0		

Linear Regression Y ON X : Y = mX + b							
1	Slope (m)	1.91345	Linear Equation				
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)				
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)				
Result							
COMMENT							
Andersen Instruments, Inc.							



Calibrated By

Field Environmental

Approved By

Division Manager



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakputtana Amphur Bangbustong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	March 23, 2025
บริเวณบ้านเลขที่				Start Time	1:20 PM
Sampler Number	PM-10 No.2	Transfer Standard Type	Orifice	Stop Time	1:25 PM
Motor Serial Number	HVL-02	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr.Jirayut Seehabut

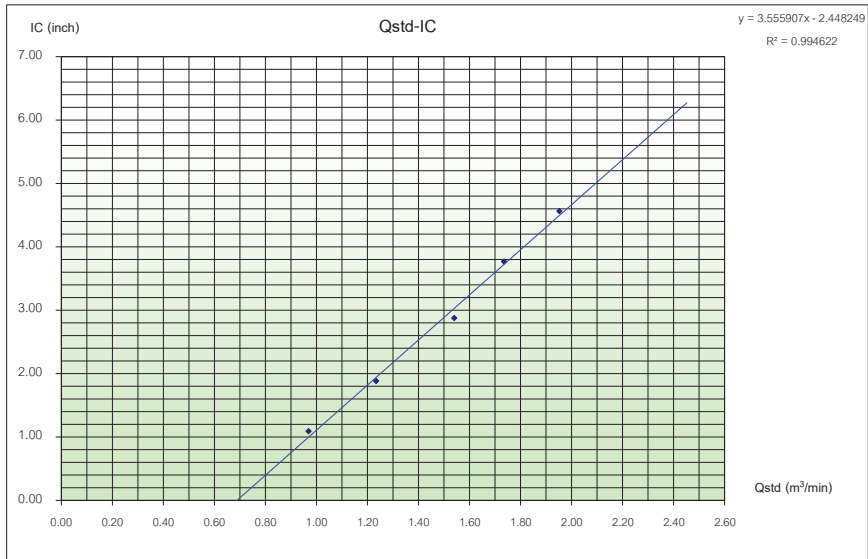
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)			$[\Delta H_0(Pa/P_{atm})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1.19)[(A-b)]^3$ (m ³ /min)	Sample Flow Rate Indication (mmHg)	$IC = [(P_{atm}/P_{std})(T_{std}/T_a)]^{1/2}$	("K = "C+273)	Pressure (mmHg)	Meter	Meter
	Positive	Negative	ΔH_0								
5	1.8	1.8	3.6	1.88165	0.96889	1.1	1.09	303.0	760.0		
7	2.9	2.9	5.8	2.38837	1.23371	1.9	1.88	303.0	760.0		
10	4.5	4.5	9.0	2.97514	1.54037	2.9	2.88	303.0	760.0		
13	5.7	5.7	11.4	3.34841	1.73544	3.8	3.77	303.0	760.0		
18	7.2	7.2	14.4	3.76329	1.95227	4.6	4.56	303.0	760.0		

Linear Regression: Y = mX + b

1	Slope (m)	1.91345	Linear Equation		r^2	0.950727	Pstd(mmHg)	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9750523	T _{std} (°C)	298.0
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	(Pa/Pstd)*(Tstd/Ta)			0.98349835
Result					C=(Pa/Pstd)*(Tstd/Ta)*0.5			0.991714853

COMMENT

Andersen Instruments, Inc.



Calibrated By

Field Environmental

Approved By

Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
42 Raminthra 14 year 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 72706374
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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 SO ₂ Conc 46.01 PPM CO Conc 4.487 PPM Cylinder number CC507080 Expire Date: 23 Jul. 2025

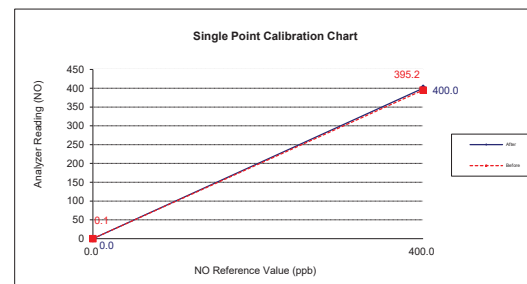
Environment: Temperature 25.5 °C Humidity 51 %RH

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
NO _x	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
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. Pasagorn Samol



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: <u>SO2 Analyzer</u> Model: <u>43C</u>	Manufacturer <u>Thermo Environmental</u> S/N: <u>335003719</u>
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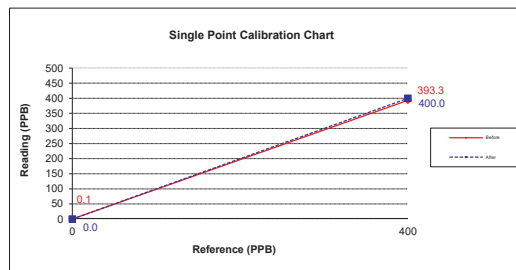
Calibration System

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 :



ENVIr SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Calibration Test

Calibrated Date: 23/3/2025

Certificate No. 024/24

Instruments Information

Manufacturer : YOUNG Instrument Type : four blade helicoid propeller
Model : 40C Serial Number : Logger 309018964

Environment : Temperature 25.5 °C Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	2.8	0.22
5.04	-	-	-	-	-	4.9	0.14
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.6	0.41
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.5	0.55
20.02	-	-	-	-	-	19.4	0.62

Wind Aloft Plotting Board.

US. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION	Deviation	Result
0	0	0	Pass
90	90	0	Pass
180	180	0	Pass
270	270	0	Pass

Calibrate By :



Approve by :





บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

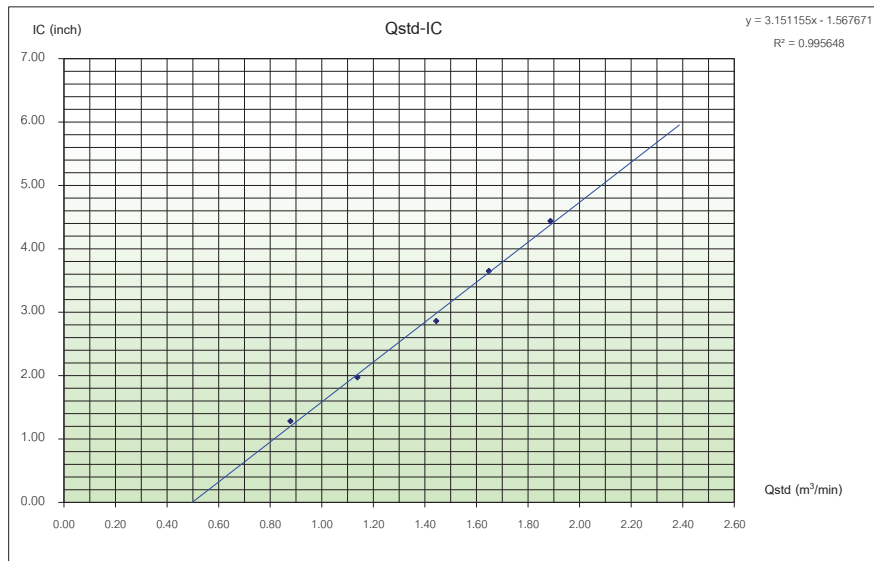
Sampler Location		Date	
บริเวณบ้านหนองไผ่เตี้ย		March 23, 2025	
Sampler Number		Start Time	
TSP No.8		10:05 AM	
Motor Serial Number		Stop Time	
BL-06		10:10 AM	
Recorder Serial Number		Person	
-		Mr.Jirayut Seehabut	

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH ₂ O								
5	1.5	1.5	3.0	1.70868	0.87849	1.3	1.28	305.0	757.0		
7	2.5	2.5	5.0	2.20589	1.13834	2.0	1.97	305.0	757.0		
10	4.0	4.0	8.0	2.79026	1.44374	2.9	2.86	305.0	757.0		
13	5.2	5.2	10.4	3.18138	1.64815	3.7	3.65	305.0	757.0		
18	6.8	6.8	13.6	3.63805	1.86681	4.5	4.44	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	0.97882	Pstd(mmHg)	760.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.98935332	T _{exp}	298.0			
3	Correlation Coefficient (r)	0.99996	Final Set Flow Rate = (I)		0	(Pa/Pstd)*(Tstd/Ta)	0.973192407				
Result		C=(Pa/Pstd)*(Tstd/Ta)*0.5								0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated

Field Environmental

Approved By

Division Manager



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

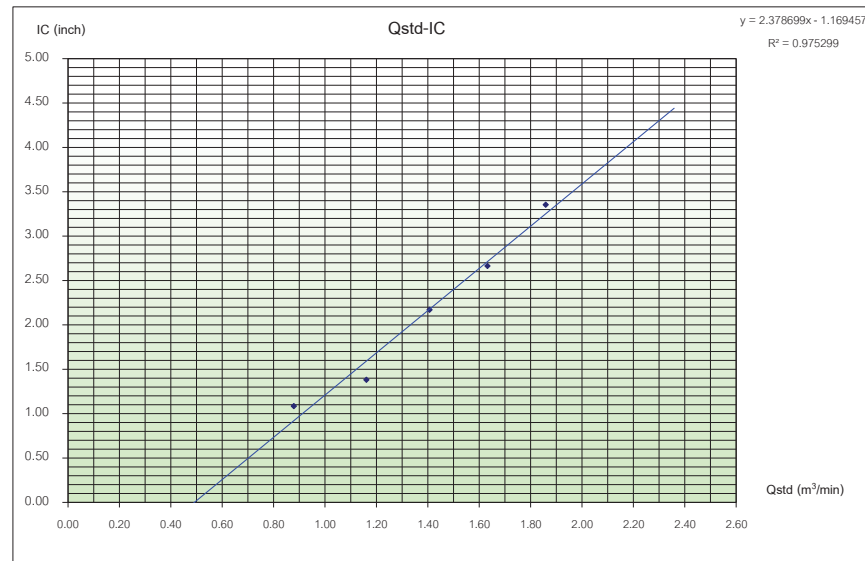
Sampler Location		Date	
บริเวณบ้านหนองไผ่เตี้ย		March 23, 2025	
Sampler Number		Start Time	
PM-10 No.6		12:40 PM	
Motor Serial Number		Stop Time	
HVL-06		12:45 PM	
Recorder Serial Number		Person	
-		Mr.Jirayut Seehabut	

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature (°K = °C+273)	Barometric Pressure (mmHg)	Start Meter	Stop Meter
	Positive	Negative	ΔH ₂ O								
5	1.5	1.5	3.0	1.70868	0.87849	1.1	1.09	305.0	757.0		
7	2.6	2.6	5.2	2.24958	1.16117	1.4	1.38	305.0	757.0		
10	3.8	3.8	7.6	2.71961	1.40682	2.2	2.17	305.0	757.0		
13	5.1	5.1	10.2	3.15064	1.63209	2.7	2.66	305.0	757.0		
18	6.6	6.6	13.2	3.58415	1.85864	3.4	3.35	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	0.997347	Pstd(mmHg)	760.0	
2	Intercept (b)		0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9986726	T _{stop}	298.0		
3	Correlation Coefficient (r)		0.99996	Final Set Flow Rate = (I)		0		(Pa/Pstd)*(Tstd/Ta)		0.973192407		
Result									C=(Pa/Pstd)*(Tstd/Ta)*0.5			0.986505148

COMMENT

Andersen Instruments, Inc.



Calibrated By

Field Environmental

Approved By

Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 40	Manufacturer: ECOTECH S/N: E020040
--	---------------------------------------

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 SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

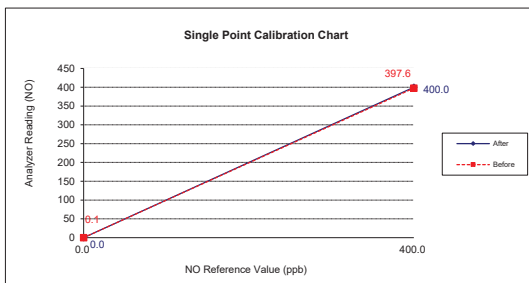
Humidity: 51 %RH

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	397.6	400.0	-0.6
NO _x	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
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By : Mr. [REDACTED]



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: SO ₂ Analyzer Model: 43C	Manufacturer: Thermo Environmental S/N: 71354368
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Calibration System

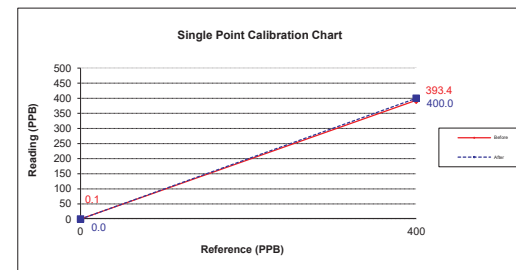
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO ₂ Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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 : Mr. [REDACTED]

**ENVIR SERVICE CO., LTD.**

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

CALIBRATION TEST REPORT FOR Partisol® Model 2000-H Air Sampler

Calibrated Date: 05 April 2024

Report No: PM-202404002

Calibrated Due on: 04 April 2025

Instruments Information

Description: Thermo Scientific Partisol FRM

2000 Air Sampler for PM-2.5

Model: 2000I-D

Sample flow control and reporting : 5 - 18 L/min

Serial No. : 200ID2 01151103

Instrument used for calibration [STD]

Description: Flow Meter

BIOS DryCal DC-Lite

Model: DCL-M REV. 1.08

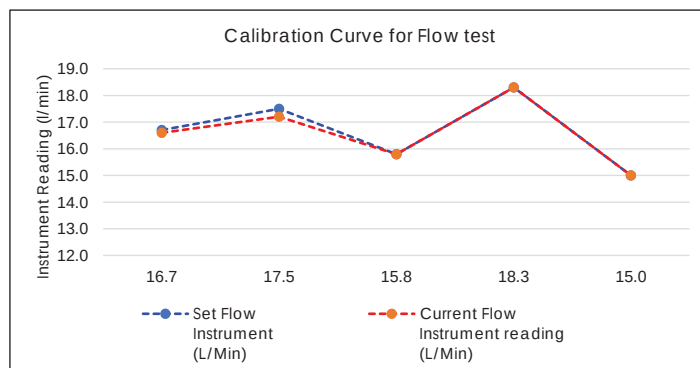
Range: 200 ml/min - 20 L/min

Serial No. : 1519

Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Filter	Set Flow Instrument (L/Min)	Current Flow Instrument reading (L/Min)	Actual Flow Reference standard (L/Min)	Flow Offset	Flow Span
47 mm.	16.7	16.6	16.7	0.0078	1.0000
	17.5	17.2	17.4	0.0078	0.9180
	15.8	15.8	15.7	0.0078	0.9534
	18.3	18.3	18.3	0.0078	0.9540
	15.0	15.0	15.1	0.0078	0.9633



Calibrate By :

Approve by :

M

**ENVIR SERVICE CO., LTD.**

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Calibration Test

Calibrated Date: 23/3/2025

Certificate No. 022/24

Instruments Information

Manufacturer: YOUNG Instrument

Type:

four blade helicoid propeller

Model: 40C

Serial Number:

Logger 428003082

Environment: Temperature 25.5 °C Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.8	0.20
3.02	-	-	-	-	-	2.8	0.22
5.04	-	-	-	-	-	4.9	0.14
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.6	0.41
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.5	0.55
20.02	-	-	-	-	-	19.3	0.72

Wind Aloft Plotting Board.

US. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION	Deviation	Result
0	0	0	Pass
90	90	0	Pass
180	180	0	Pass
270	270	0	Pass

Calibrate By :

Approve by :

MR. F



ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

CALIBRATION TEST REPORT FOR Partisol® Model 2000-H Air Sampler

Calibrated Date: 17 April 2024 Report No: PM-202404004
Calibrated Due on: 16 April 2025

Instruments Information

Description : Thermo Scientific Partisol FRM
2000 Air Sampler for PM-2.5
Model : 2000

Instrument used for calibration [STD]

Description : Flow Meter
BIOS DryCal DC-Lite
Model : DCL-M REV. 1.08

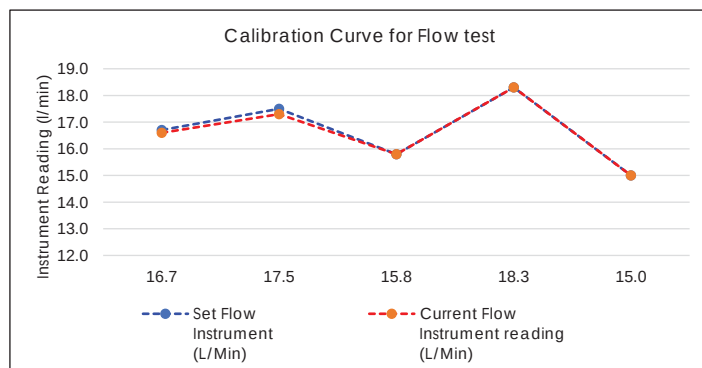
Sample flow control and reporting : 5 - 18 L/min
Serial No. : 200FB2 12201102

Range : 200 ml/min - 20 L/min
Serial No. : 1519

Environment : Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Filter	Set Flow Instrument (L/Min)	Current Flow Instrument reading (L/Min)	Actual Flow Reference standard (L/Min)	Flow Offset	Flow Span
47 mm.	16.7	16.6	16.6	0.0084	0.9992
	17.5	17.3	17.4	0.0084	0.9351
	15.8	15.8	15.8	0.0084	0.9544
	18.3	18.3	18.2	0.0084	0.9534
	15.0	15.0	15.0	0.0084	0.9686



Calibrate By :

Approve by :

MF



บริษัท เอ็ม ซี ที จำกัด MET CO., LTD.
36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

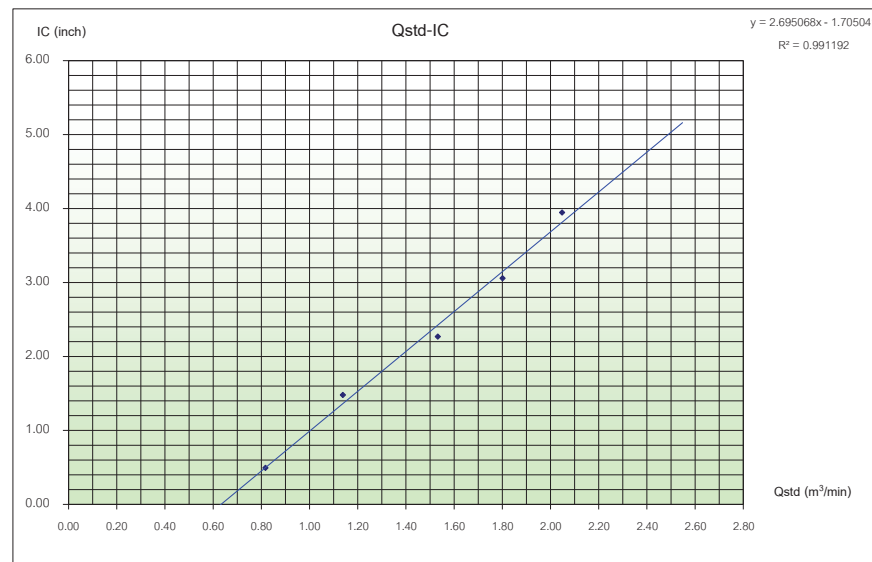
Sampler Location				Date	March 23, 2025
บริเวณวัดเมืองสุพรรณบุรี				Start Time	9:45 AM
Sampler Number	TSP No.6	Transfer Standard Type	Orifice	Stop Time	9:50 AM
Motor Serial Number	BL-06	Calibrator Model	TE-5025A	Person	Mr.Jirayut Seehabut
Recorder Serial Number	-	Calibrator Serial Number	1		

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)	$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{std})(T_{std}/T_a)]^{1/2}$ (°K = °C+273)		Pressure (mmHg)	Meter	Meter
	Positive Negative ΔH ₂ O								
5	1.3 1.3	2.6	1.59069	0.81683	0.5	305.0	757.0		
7	2.5 2.5	5.0	2.20589	1.13834	1.5	305.0	757.0		
10	4.5 4.5	9.0	2.95952	1.53220	2.3	305.0	757.0		
13	6.2 6.2	12.4	3.47384	1.80099	3.1	305.0	757.0		
18	8.0 8.0	16.0	3.94602	2.04776	4.0	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	0.996321233	T _{std}	298.0	
3	Correlation Coefficient (r)	0.99998	Final Set Flow Rate = (I)		0		(Pa/Pstd)*(Tstd/Ta)	0.973192407		
Result							C=(Pa/Pstd)*(Tstd/Ta)*0.5	0.986505148		

COMMENT

Andersen Instruments, Inc.



Calibrated By ...

Field Environmental

Approved By

Division Manager



บริษัท เอ็ม ซี ที จำกัด MET CO.,LTD.
36/659 หมู่ 6 ตำบลรังสิตพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110
36/659 Moo 6 Tambol Bangrakpattana Amphur Bangsuatong Nontaburi 11110
Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jij@yahoo.com

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location			Date	March 23, 2025	
บริเวณวัดเมื่อสูงพื้นแนวราบ			Start Time	2:05 PM	
Sampler Number	PM-10 No.7	Transfer Standard Type	Orifice	Stop Time	2:10 PM
Motor Serial Number	HVL-07	Calibrator Model	TE-5025A	Person	Mr.Jirayut Seehabut
Recorder Serial Number	-	Calibrator Serial Number	1		

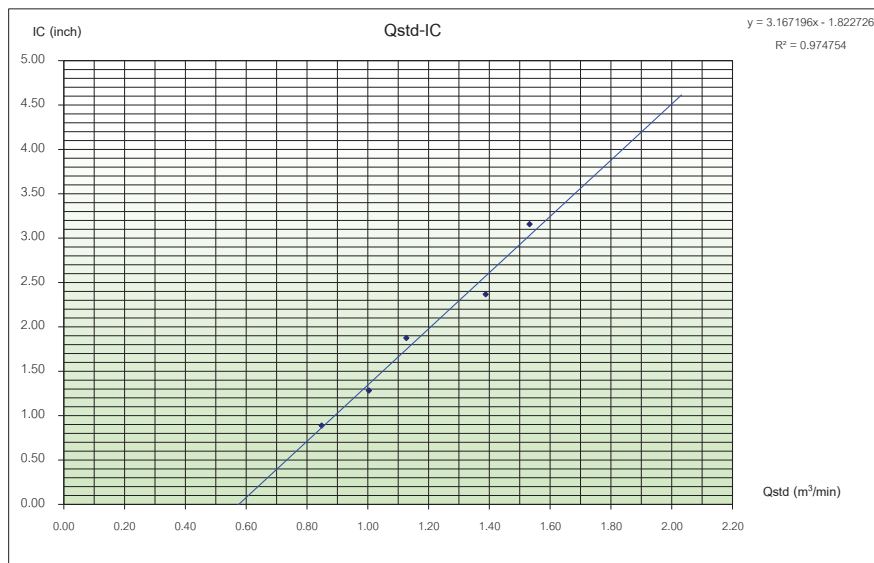
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Pressure Drop Across Orifice (inH ₂ O)	Positive	Negative	$[\Delta H_2O(Pa/P_{atm})(T_{atm}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	Sample Flow Rate Indication (inch)	$IC = [(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	Pressure (mmHg)	Meter	Meter
5	1.4	1.4	2.8	1.65074	0.84821	0.9	0.89	305.0	757.0		
7	1.9	2.0	3.9	1.94819	1.00366	1.3	1.28	305.0	757.0		
10	2.4	2.5	4.9	2.18372	1.12676	1.9	1.87	305.0	757.0		
13	3.7	3.7	7.4	2.68358	1.38799	2.4	2.37	305.0	757.0		
18	4.5	4.5	9.0	2.95952	1.53220	3.2	3.16	305.0	757.0		

Linear Regression Y ON X : Y= mX + b

1	Slope (m)	1.91345	Linear Equation		r^2	0.9933306	Pstd(mmHg)	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)	1.133	r	0.9966474	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

Andersen Instruments, Inc.



Calibrated By

Field Environmental

Approved By

Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 72706371
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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 SO ₂ Conc 55.11 PPM CO Conc 4.535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

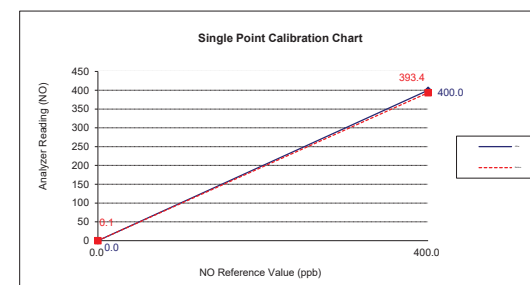
Environment: Temperature 25.5 °C Humidity: 51 %RH

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
NO _x	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
NO _x	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
42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 23 March 2025

Instruments Information

Analyzer Type: <u>SO2 Analyzer</u>	Manufacturer <u>ECOTECH</u>
Model: <u>50</u>	S/N: <u>E020050</u>

Calibration System

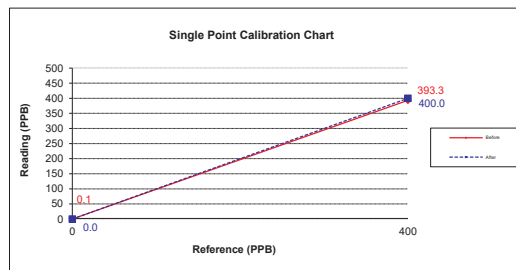
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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:



ENVIR SERVICE CO., LTD.

42 Ramintra 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.envirservice.co.th

Calibration Test

Calibrated Date: 08 August 2024

Certificate No. 049/24

Instruments Information

Manufacturer : YOUNG Instrument Type : four blade helicoid propeller
Model : 05103 Serial Number : Logger 30904801

Environment : Temperature 25.5 °C Humidity: 51 %RH

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563
: HOOK GAGE NO 1425 : Wind Aloft Plotting Board
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586) JAPAN QUALITY ASSURANCE ORGANIZATION

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO 1425			TESTED ANEMOMETER			
	Pressure inches	Vacuum inches	Pressure hPa	Pressure hPa	Correction hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	-	-	0.9	0.10
3.02	-	-	-	-	-	3.0	0.07
5.04	-	-	-	-	-	4.8	0.22
7.03	-	-	-	-	-	6.8	0.23
9.01	-	-	-	-	-	8.8	0.21
11.03	-	-	-	-	-	10.7	0.33
13.01	-	-	-	-	-	12.7	0.31
15.03	-	-	-	-	-	14.4	0.63
17.05	-	-	-	-	-	16.5	0.55
20.02	-	-	-	-	-	19.3	0.72

Wind Aloft Plotting Board. U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION	TESTED WIND DIRECTION	Deviation	Result
0	0	0	Pass
90	90	0	Pass
180	180	0	Pass
270	270	0	Pass

Calibrate By:



Approve by :



Calibration certificate Kalibrier-Zertifikat

5645477

Object Gegenstand Control Unit t350 Measuring Box testo 350
 Manufacturer Hersteller TESTO SE & Co. KGaA TESTO SE & Co. KGaA
 Type description Typ 0632 3511 0632 3510
 Serial no. Serien Nr. 64477010 64499052
 Inventory no. Inventar Nr. --- ---
 Test equipment no. Prüfmittel Nr. --- ---
 Equipment no. Equipment Nr. 15776378 15777153
 Location Standort --- ---
 Customer Auftraggeber MET COMPANY LIMITED; 36/659 Village No.6
 Bangrak Phatthana Subdistrict,
 Bang Bua Thong District
 TH-11110 Nonthaburi Province
 Customer ID no. Kunden Nr. 1031994
 Order no. Auftrags Nr. 12345108 / 0520 0055

Hereby we confirm that the performing calibration laboratory is working with a management system according to ISO 9001:2015 and DIN EN ISO/IEC 17025:2018. Accreditation certificates can be found under www.testotis.de. The measuring installations used for calibration are regularly calibrated and traceable to the national standards of the German Federal Physical Technical Institute (PTB) or other national standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement. The documents established for this procedure are available for viewing. All the necessary measured data can be found on this calibration certificate.

Hiermit bestätigen wir, dass das durchführende Kalibrierlabor ein Managementsystem nach ISO 9001:2015, sowie DIN EN ISO/IEC 17025:2018 eingeführt hat. Die Urkunden finden Sie auf www.testotis.de. Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch Technischen Bundesanstalt (PTB) Deutschlands oder auf andere nationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln und Normen. Die für diesen Vorgang angefertigte Dokumentation kann eingesehen werden. Alle erforderlichen Messdaten sind in diesem Kalibrier-Zertifikat aufgelistet.

Date of calibration Datum der Kalibrierung 15.05.2024
 Date of the recommended re-calibration Datum der empfohlenen Rekalibrierung 15.05.2025

Conformity statement Konformitätsaussage Pass

The expanded uncertainty of measurement was calculated according to EA-4/02 M:2022 with a coverage probability of about 95% and contains the uncertainty of the reference, the uncertainty of the method and the uncertainty of the test specimen. The conformity statement is made according to the decision rule "confidence level 50".

Die erweiterte Messunsicherheit wurde nach EA-4/02 M:2022 mit einer Überdeckungswahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".

This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid.
 Dieser Kalibrierschein darf nur vollständig weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift und Stempel haben keine Gültigkeit.

Seal Stempel



Supervisor Fachverantwortlicher

Technician Bearbeiter

Martin Förderer

Johannes Wängler

Calibration certificate Kalibrier-Zertifikat

5645477

Measuring equipment Messeinrichtungen

Index	Reference Referenz	Traceability Rückführung	Next cal. Rekal.	Certificate-no. Zertifikat-Nr.	Eq.-no. Eq.-Nr.
a	Test gas medium 1 Prüfgas Medium 1	SCS-SCS0026 2024-02	2025-02	5514470	12898976
b	Test gas medium 3 Prüfgas Medium 3	SCS-SCS0026 2024-02	2025-02	5524380	12898982
c	Test gas medium 5 Prüfgas Medium 5	SCS-SCS0026 2024-02	2025-02	5501047	12898984
d	Test gas medium 8 Prüfgas Medium 8	SCS-SCS0026 2023-07	2024-07	5163030	12898987
e	Test gas medium 7 Prüfgas Medium 7	SCS-SCS0026 2024-02	2025-02	5514483	12898986
f	Test gas medium 11 Prüfgas Medium 11	SCS-SCS0026 2023-07	2024-07	5163035	14087964
g	Test gas medium 6 Prüfgas Medium 6	SCS-SCS0026 2024-02	2026-02	5514478	12898985
h	Test gas medium 12 Prüfgas Medium 12	SCS-SCS0026 2023-07	2025-07	5163042	14087984

Reference certificates are available at www.primasonline.com Referenzzertifikate sind auf www.primasonline.com abrufbar

Ambient conditions Umgebungsbedingungen

Temperature Temperatur (20...26) °C Humidity Feuchte (20...60) % RH % rF

Measuring procedure Messverfahren

The calibration was carried out by comparison measurement with calibrated test gases.
 Die Kalibrierung erfolgte durch Vergleichsmessung mit kalibrierten Prüfgasen.

Measuring results Messergebnisse

Channel Kanal ---

Reference value Bezugswert		Indicated measured value probe Angezeigter Messwert Kalibriergegenstand		Deviation Abweichung		Allowed deviation ²⁾ Zulässige Abweichung ²⁾		Measurement uncertainty (k=2) Messunsicherheit (k=2)		Confirmation Bewertung
ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	ppm	Vol.-%	
CO										
100,6 ^a	---	99	---	-1,6	---	± 11	---	3,3	---	pass
401,0 ^b	---	402	---	1,0	---	± 21	---	8,4	---	pass
700,0 ^c	---	703	---	3,0	---	± 36	---	14,4	---	pass
NO										
150,2 ^a	---	148	---	-2,2	---	± 9	---	4,0	---	pass
300 ^d	---	298	---	-2	---	± 16	---	6,9	---	pass
NO2										
100,4 ^a	---	99,3	---	-1,1	---	± 5,1	---	3,20	---	pass
SO2										
97,9 ^f	---	96	---	-1,9	---	± 6	---	3,5	---	pass
CO2										
---	16,970 ^g	---	16,99	---	0,020	---	± 0,48	---	0,350	pass
---	38,50 ^h	---	38,12	---	-0,38	---	± 1,09	---	0,775	pass
O2										
---	0,00 ^a	---	0,07	---	0,07	---	± 0,21	---	0,027	pass
---	2,52 ^c	---	2,56	---	0,04	---	± 0,21	---	0,055	pass
---	5,01 ^b	---	5,09	---	0,08	---	± 0,21	---	0,102	pass

²⁾ In accordance with the manufacturer gemäß Hersteller

Remarks Bemerkungen

Certificate of Calibration

Certificate No. : 67-200293-1 Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110Equipment : Electronic Balance
Manufacturer : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 gEnvironment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.9 to 26.2) °C
Relative Humidity : (32.6 to 45.5) %
Air Pressure : 1007.0 mbar

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-200293-1 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.05	0.0001	0.00012
0.1	0.0001	0.00012
0.5	0.0001	0.00013
1	0.0000	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
50	0.0001	0.00015
100	0.0000	0.00020
150	0.0000	0.00038
200	0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error	Load test :	50 g			
	A	B	C	D	E
	0.0001	-0.0001	-0.0001	0.0001	0.0000 g



Repeatability	Load test :	200 g
	Stdev.	0.00005 g

- o0o -



Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #:	XC-572V
Serial #:	0509047
DGM Model #:	SK25EX
DGM Serial #:	0008967
Bar. Pressure (mm Hg):	757.4
Ambient Temperature (°C):	25.6
Relative Humidity (%):	65
Altitude (m):	1.50
Bar. Pressure Corr. (mm Hg):	757.3

Calibration Conditions

Bar. Pressure (mm Hg):	757.4
Ambient Temperature (°C):	25.6
Relative Humidity (%):	65
Altitude (m):	1.50
Bar. Pressure Corr. (mm Hg):	757.3

Calibration Reference

Work No.:	SVC028131
Calibration No.:	SA2023001
Reference Equipment:	
WTM Model:	W-NK-5B
Gamma:	0.9976
Thermometer:	FLUKE714
Serial No.:	546321
Cal Due:	24-Mar-24
Serial No.:	9038005

Judgment:	Pass
Factors/Conversions:	
Std. Temp. (K):	288.15
Std. Press. (mm Hg):	760
K _t (K/mm Hg):	0.3923

UUT Meter (DGM)

Run Time (seconds)	Orifice ΔH (mm H ₂ O)	Volume	Meter Temperature (°C)	Meter Pressure (mm H ₂ O)	Volume (L)	Outlet Temperature (°C)
Initial (L)	Final (L)	Total (L)	Initial	Final	Initial	Final
0	V _m	V _{ref}	V _m	P _w	V _{ref}	V _m
900	13.00	1595.5	173.0	27.0	0.8	450528.64
600	25.00	1786.6	1945.4	158.8	1.4	450713.99
480	50.00	1955.4	2138.1	182.7	2.4	450878.62
420	80.00	2159.8	2385.3	205.5	3.6	451079.10
300	120.00	2382.2	2590.5	178.3	5.2	451297.17

Reference Meter (WTM)

Volume (L)	Initial	Final	Total	V _w	V _{ref}	V _m	Initial	Final
0	V _{ref}	V _{ref}	V _{ref}	V _w	V _{ref}	V _m	V _{ref}	V _m
167.20	11.15	171.45	157.56	15.6	0.9975	0.0011	47.1	1.251
155.58	15.56	187.11	171.55	15.6	0.9975	0.0011	47.1	1.251
180.14	22.52	202.66	180.14	22.5	0.9914	0.0060	45.3	-0.549
202.48	28.93	231.41	202.48	28.9	0.9878	0.0014	44.3	-1.538
176.77	35.35	212.12	176.77	35.4	0.9901	0.0037	45.0	-0.835

Standardized Data

Reference Meter (L)	UUT Meter (L)	Correction Factor	ΔH @ (mm H ₂ O)	Variance
Std. Vol.	Std. Flow	Value	Y	ΔH @
V _m (std)	V _m (std)	V _m (std)	Y	ΔH @
167.20	11.15	171.45	0.9752	-0.0112
155.58	15.56	187.11	0.9875	0.0011
180.14	22.52	202.66	0.9914	0.0060
202.48	28.93	231.41	0.9878	0.0014
176.77	35.35	212.12	0.9901	0.0037
			0.9864	= Y Avg.
			45.9	= ΔH @ Avg. (Mean)

Calibration Results

Reference Meter (L)	UUT Meter (L)	Correction Factor	ΔH @ (mm H ₂ O)	Variance
Std. Vol.	Std. Flow	Value	Y	ΔH @
V _m (std)	V _m (std)	V _m (std)	Y	ΔH @
167.20	11.15	171.45	0.9752	-0.0112
155.58	15.56	187.11	0.9875	0.0011
180.14	22.52	202.66	0.9914	0.0060
202.48	28.93	231.41	0.9878	0.0014
176.77	35.35	212.12	0.9901	0.0037
			0.9864	= Y Avg.
			45.9	= ΔH @ Avg. (Mean)

Note1: 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 50.02.

Note2: For ΔH_g, orifice pressure differential that equals to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2mches (5.1mm) H₂O.

Calibrator: VAERON RUANGARAI

Signature: Vaeon

Date: 09/Feb/24

Revised: 20230103

Sithiporn Associate Co., Ltd

Environmental / Hygiene Department (ENV)

Web site: www.sithiporn.com

E-mail: service2-env@sithiporn.com

Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Calibration No.: SA2023001

UUT Meter / Console Information

Model #:	XC 572-V
DGM Model #:	SK25EX
Serial number:	0509047
Serial number:	0008967

Check the Diagnosis

Check the system before calibrating.	Not Passed	Passed
-Visual instrument normalcy	☐	☒
-Electrical and Temperature Systems	☐	☒
-Inclined Manometer with Systems	☐	☒
-Pressure Gauge	☐	☒
-Leak Check	☐	☒
PM and Calibration	☐	☒

Nomenclature

Pb - Barometric Pressure
DGM - Dry Gas Meter
K _t - Constant based on standard temp and press
Θ - Run time, in minutes
P _m - ΔH (Meter Pressure, gauge)
V _m - Volume collected by test meter, corrected for STP
Q _{ref} - Calculated flow rate of test meter
K' - Critical orifice coefficient
P _m - Measured pressure of reference meter
L _m - Temperature measured in reference meter
L _m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice

Equations

$$K_t = \frac{T_{std}}{P_{std}}$$

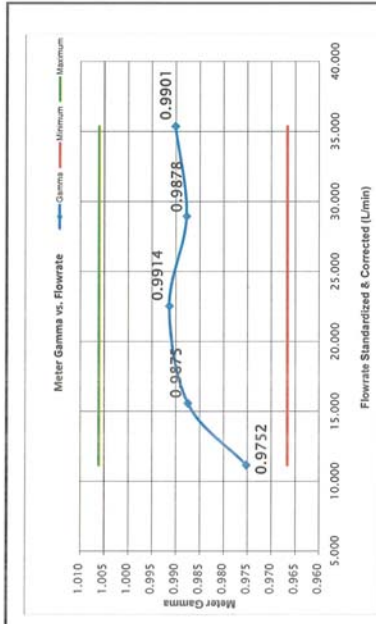
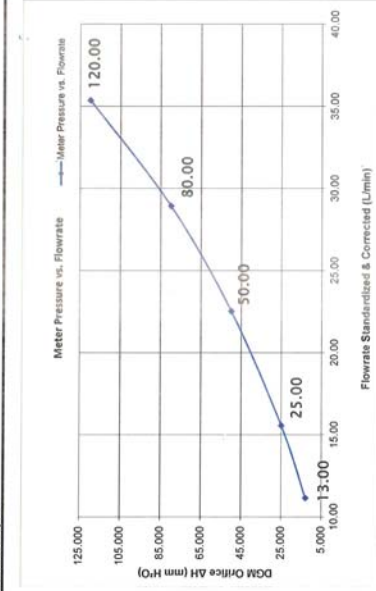
$$V_{w(std)} = Y * K_1 * \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{P_{m(std)} * (P_{bar} + \frac{P_{m(g)}}{13.6})}$$

$$Y' = \frac{V_{w(std)}}{V_{m(std)}}$$

$$Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.0011636 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m} * (\frac{T_m + \Theta}{V_w * P_{bar}})^2$$

Calibration Graphs



Revised: 20230103

Sithiporn Associate Co., Ltd

Environmental / Hygiene Department (ENV)

Web site: www.sithiporn.com

E-mail: service2-env@sithiporn.com

Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572V
Serial #: 0509047
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 30.00
Humidity (%): 65%
Amb. Temp. (°C): 25.6
Altitude (m): 100.0
Corrected Pbar (mm. Hg): 29.90

Calibration No. : SA2023001

Work No. : SVO28131

Reference Devices

TC Calibrator Model: FLUKE 714
Serial No.: 9038005
Digital Manometer Model: Dwyer DPGA-00
Serial No.: 721

Audit Data

Reference Point	Reference Temp.	Console Thermocouple Audit						Reference Point Status ¹
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	26.5	27	27	27	27	27	27	PASS
Acceptance criteria		±3.0°C, 5.4°F		1.50%		3.0°C, 5.4°F		1.0°C, 2.0°F

Reference Thermocouple ID: 90728323

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	ΔT _{abs}	Maximum	Reference Status (±1%)
#	°C	°C	°C	%	Pass/Fail
Ice Water	1.2	1	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Internal temperature thermocouple is not audited to EPA standards, and should not be used as an official reference for ambient temperature.

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ³
#	mm. Hg	mm. Hg	Pass/Fail
1	25.37	25.00	PASS

Notes

¹For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1-6.1.1.8)

²For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (12.5 mm Hg)

บริษัท สิทิพอร์นแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Signal

Date: 09/Feb/24

I certify that the above Thermocouple, Barometric, and Vacuum Sensors were calibrated and audited in accordance with US EPA Methods, CFR 40 Part 60.

Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

page: 1/1

Console Information

Model #: XC-572V
Serial #: 0509047
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 757.40
Humidity (%): 65
Tamb (°C): 25.6
Elevation (m): 1.5
Corr. Pbar (mm. Hg): 757.40

Calibration Reference

Calibration No. : SA2023001
Work No. : SVO28131
Reference Devices
TC Calibrator Model: FLUKE 714
Serial No.: 9038005

Temperature Sensors Calibration Data

Reference Temp.	Test Thermocouple Calibrations							Reference Point Status ²
	Aux	Stack	Probe	Oven	Filter	Exit		
Point	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-18		-17	-17	PASS
2	38	38	38	38		38	38	PASS
3	93	94	94	94		94	94	PASS
4	149	151	150	150		150	150	PASS
5	260	261	261	261		261		PASS
6	371		374					PASS
7	482		484					PASS
8	593		595					PASS
9	816		821					PASS
10	1038		1051					PASS
		±3.0°C, 5.4°F		1.50%		±3.0°C, 5.4°F		±3.0°C, 5.4°F
								±1.0°C, 2.0°F
								PASS

Overall Audit Status

DGM Temperature Sensor

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	ΔT _{abs}	Maximum	Reference Status ² (±1%)
#	°C	°C	°C	%	Pass/Fail
Ice Water	1.2	1	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Temperature Controller

Heater Controller	Reference Measure	XC-572V	Deviated	ΔT _{abs}	Temp. Controller Status ³
Set point	(μ)	Thermometer	to set point	±3%	
120 °C	°C	°C	°C	°C	Pass/Fail
Probe	115	117	-2	0.52%	PASS
Filter	116	117	-1	0.26%	PASS

Notes

¹ Suggested, minimum reference points 300, 400, 750, 900, 1100, 1500, 1900 °F. See test for more.

² For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1-6.1.1.8)

³ Heater control acceptance limit Temperature can be maintained at 120 °C ±14 °C, ±57 °F within ±1.5% (°C) at a flow rate of 20 lpm.

Signature:

Date: 09/Feb/24

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60.

Nozzle Calibration

Nozzle Information

Manufacturer: Apex

Type: Stainless Steel

Identification: _____

Calibration Conditions

Bar. Pressure (mm Hg): 757.4

Ambient Temperature (°C): 25.6

Relative Humidity (%): 65

Calibration Reference

Calibration No.: SA2023001

SITHIPORN
Work No.: SVO28131

Units: Metric

Reference Equipment

Vernier, 0-250mm 0.01 mm increments model Mitutoyo

Serial No

3038570

Cal No.:

L202310355-0001

Cal. due:

07/Nov/24

Calibration Method

Follow the USEPA Method 5 nozzle size calibration procedure. (ref. 40 CFR PART 60).

Calibration Result

ID No.	Sizes		measured every 60° nozzle			(D ₁ + D ₂ + D ₃) / 3		Different ≤ 0.100 mm.	
	mm.	D ₁	D ₂	D ₃	D _{avg}			I	Judgment
4	3.1	3.01	2.98	3.01	3.000			0.030	PASS
5	3.9	3.89	3.90	3.89	3.893			0.010	PASS
7	5.3	5.38	5.34	5.38	5.367			0.040	PASS
8	6.2	5.95	6.00	5.94	5.963			0.060	PASS
9	7.1	7.18	7.19	7.19	7.187			0.010	PASS
12	9.4	9.35	9.36	9.43	9.380			0.080	PASS
16	12.6	12.35	12.45	12.30	8.217			0.050	PASS

Where :

D₁, D₂, D₃ = There difference nozzle diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm or 0.001 inch

Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm or 0.004 inch

D_{avg} = (D₁ + D₂ + D₃) / 3

Signature: _____

Date: 09/Feb/24

Sampling Probe and Pitot validation

Sampling Probe Information

Manufacturer: Apex

Probe Type: SS, 3ft

Probe No.:

Pitot tube Type: S Type 3/8 In.

Pitot tube No.: A10664

Calibration Conditions

Bar. Pressure (mm Hg): 757.4

Ambient Temperature (°C): 25.6

Relative Humidity (%): 65

Units: Metric

Calibration Reference

Calibration No.: SA2023001

Work No.: SVO28131

Reference Devices

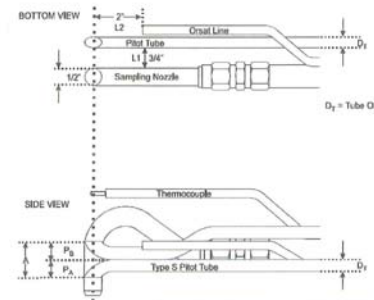
- Vernier, 0-250mm 0.01 mm increments

Model: Mitutoyo, ID No.: EPD1-VER-57-1-CEN-01

Validation method : Follow the USEPA Method 5 pitot tubes (S type) calibration procedure. (ref. 40 CFR PART 60).

Sampling Probe Validation with Tune up

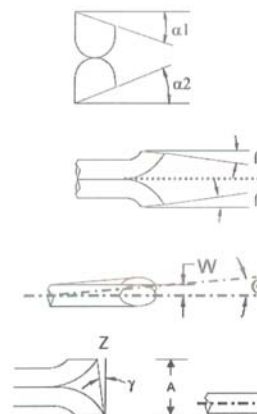
☐ : Measuring and aligning with 1/2" sample nozzle (12.7 mm)



Measured	Acceptance Standard
L ₁ = 18.86 mm	(19.05 mm. or 0.75 in.)
L ₂ = 45.53 mm	(50.8 mm. or 2.0 in.)
D _T = 9.55 mm	(9.525 mm., 0.375 in.)
A = 21.67 mm	(2.1 D _T ≤ A ≤ 3D _T)
A/2D _T = 1.135 mm	(1.05 P _A / D _T ≤ A ≤ 1.5)

Pitot Tube Validations and Engles measurement Result

☐ : Measure results after maintenance and adjustments.



P _B Size	Acceptance of correctness
α ₁ = 1.85 °	≤ 10°
β ₁ = 0.95 °	≤ 5°
P _A Size	
α ₂ = 1.25 °	≤ 10°
β ₂ = 1.10 °	≤ 5°

Engles measurement	Calculated Result	Acceptance Criteria
W = 0.75 °	0.292 mm	W < 0.0794 mm. (0.03125 in)
Z = 1.55 °	0.586 mm	Z < 3.175 mm. (0.125 in.)

Can be use 0.84 for Cp(s) if the type of face-opening misalignment show above with not affect the base line value of Cp(s)
Solong as standard range.บริษัท สิทธิพรแอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Signature: _____

Date: 09/Feb/24

Certificate of Calibration

Certificate No. : 67-400505-2

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Temperature controlled enclosure (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 : (30.0 to 31.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

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 67-400246-1

25 Oct 2024

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400505-2

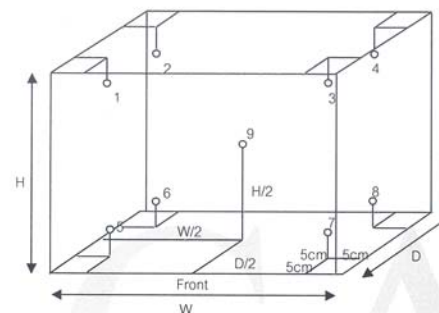
Page : 2 of 2

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	110	110	103.4	105.0	104.8	105.0	104.1	103.8	104.2	104.4	104.2	0.96
180	184	184	179.3	182.0	180.1	180.6	180.1	180.4	180.0	180.7	179.9	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.1	0.3	2.0
180	184	184	2.5	0.4	3.3

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 -



ใบรับรองการสอบเทียบ “เครื่อง Spectrophotometer”
(Calibration Certificate of Spectrophotometer)

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.
ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Maha Sawet, Phutthamonthon, Nakhon Pathom 73170, Thailand. Tel +66 3424 5299 Fax +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



Certificate No. : CAL-24-317

Page : 1 of 3

CERTIFICATE OF CALIBRATION

Equipment	:	Spectrophotometer
Manufacturer	:	Thermo Scientific
Model	:	Genesys 10S VIS
Serial No.	:	2E8R020104
ID No.	:	0402-0101-13
Customer	:	Emex Association Co., Ltd.
	:	27, 29 Soi Rama 2, Soi 30,
	:	Rama Road, Bangmod,
	:	Jomthong, Bangkok 10150
Location	:	ห้องปฏิบัติการ 4
Date of Receipt	:	19 July 2024
Date of Calibration	:	19 July 2024
Date of Issue	:	23 July 2024
Ambient Temperature	:	(25±10) °C
Relative Humidity	:	(60±20) %
Condition As-Received	:	Used Item

Calibrated by
Mr.Sompoph Duangnguan
Calibration Engineer

Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor k providing a level of confidence of approximately 95%.

This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

Indicated values are valid for the state of the Spectrophotometer at the time of calibration only.

EMEX Environmental
and Medical Expert
EMEX ASSOCIATION CO.,LTD.

ห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ว-244

ISSUE: 6 REV:5

FM-CAL-33/2

20/02/24



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Maha Sawat, Phutthamonthon, Nakhon Pathom 73170, Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



NSC-TISI-TIS 17925
CALIBRATION #131

Certificate No. : CAL-24-317

Page : 2 of 3

CALIBRATION REPORT

Conditions of this result of calibration

1. Reference Standard Material :

Material	Model	Serial No.	Cert.No.	Due date
Holmium Glass Filter	RM-HG	24563	109211	13 February 2025
Didymium Glass Filter	RM-DG	24562	109212	13 February 2025
Neutral Density Filter	RM-1N2N3N	24568	109249	14 February 2025

2. Traceability : This certification is traceable to the International System of Unit maintained at;

The Stama Scientific Ltd. Accredited Calibration Laboratory No. 0659.

3. Method of calibration :

The calibration procedure was carried out according to ASTM E275-08 (2022) and ASTM E925-09 (2014).

4. Result of calibration :

(☒) without adjustment

() after adjustment

5. Equipment Specifications:

Spectral Bandwidth :	5	nm
Data Interval :	1	nm
Scan Speed :	Slow	nm/min



ห้องปฏิบัติการ

เลขทะเบียน

ISSUE: 6 REV:5

FM-CAL-33/2



BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.
CALIBRATION LABORATORY

99/9 Moo 2, Maha Sawat, Phutthamonthon, Nakhon Pathom 73170, Thailand. Tel: +66 3424 5299 Fax: +66 3424 5250
E-mail: bkk@becthai.com Website: www.becthai.com



NSC-TISI-TIS 17925
CALIBRATION #131

Certificate No. : CAL-24-317

Page : 3 of 3

CALIBRATION REPORT

Wavelength Calibration

Certified Values of Reference Material	Nominal Value (nm)	UUC*Reading (nm)	Error (nm)	Uncertainty of Measurement (± nm)	k Factor
361.40	361.40	362	0.60	0.59	2.00
528.59	528.59	529	0.41	0.59	2.00
879.68	879.68	879	-0.68	0.59	2.00

Photometric Calibration for Visible

Wavelength (nm)	Certified Values of Reference Material (A)	UUC* Reading (A)	Error (A)	Uncertainty of Measurement (± A)	k Factor
420.0	Zero	0.000	0.0000	0.0028	2.00
	0.5835	0.587	0.0035	0.0045	2.00
	0.725	0.726	0.0010	0.0045	2.00
	1.0367	1.036	-0.0007	0.0045	2.00
440.0	Zero	0.000	0.0000	0.0028	2.00
	0.5662	0.569	0.0028	0.0045	2.00
	0.7106	0.710	-0.0006	0.0045	2.00
	1.0159	1.015	-0.0009	0.0045	2.00
465.0	Zero	0.000	0.0000	0.0028	2.00
	0.5257	0.528	0.0023	0.0045	2.00
	0.6682	0.669	0.0008	0.0045	2.00
	0.9547	0.955	0.0003	0.0045	2.00
546.1 (546.0)	Zero	0.000	0.0000	0.0028	2.00
	0.5226	0.524	0.0014	0.0045	2.00
	0.6939	0.694	0.0001	0.0045	2.00
	0.9919	0.991	-0.0009	0.0045	2.00
590.0	Zero	0.000	0.0000	0.0028	2.00
	0.5567	0.558	0.0013	0.0045	2.00
	0.7502	0.750	-0.0002	0.0045	2.00
	1.0732	1.072	-0.0012	0.0045	2.00
635.0	Zero	0.000	0.0000	0.0028	2.00
	0.5643	0.566	0.0017	0.0045	2.00
	0.7299	0.730	0.0001	0.0045	2.00
	1.0437	1.044	0.0003	0.0045	2.00

Remark : Each individual filter is measured against the empty filter holder (blank) used to zero the Spectrophotometer.

Note:

UUC* : Unit Under Calibration

ISSUE: 6 REV:5



- End of Report

FM-CAL-33/2

ใบรับรองการสอบเทียบ “เครื่องวัดก๊าซคาร์บอนมอนอกไซด์”

(Calibration Certificate of CO Analyzer)



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน ว-244



บริษัท ไคเนติกส์ คอร์ปอเรชั่น จำกัด

KINETICS CORPORATION LTD.

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : EMEX ASSOCIATION COMPANY LIMITED

วันที่ : 11 กันยายน 2567

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 92

TEST VALUES			
	API MODEL T300	BEFORE	AFTER
1	RANGE 1 - 1000 PPM	50.0	50.0
2	STABILITY ≤ 1 PPM	0.0	0.0
3	CO MEASURE 2500 - 4800 mV	3410.2	3431.7
4	CO REFERENCE 2000 - 4800 mV	2815.5	2827.1
5	MR RATION 1.1 $\pm$ 1.3	1.221	1.224
6	PRESEURE 25 - 35 in - Hg -A	29.6	29.7
7	SAMPLE FLOW 800 $\pm$ 10% cc/min	836	822
8	SAMPLE TEMP 48 $\pm$ 4 $^{\circ}$ C	46.7	47.2
9	BENCH TEMP 48 $\pm$ 2 $^{\circ}$ C	48.0	48.0
10	WHEEL TEMP 68 $\pm$ 2 $^{\circ}$ C	68.0	68.1
11	BOX TEMP AMBIENT $\pm$ 5 $^{\circ}$ C	32.4	35.4
12	PHT DRIVE 250-4750 Mv	2920.0	2891.4
13	CO SLOPE 1.0 $\pm$ 0.3	1.043	0.935
14	CO OFFSET 0.0 $\pm$ 0.3	0.012	0.013
15	CO READING (AMBIENT) PPM	0.9	0.3
16	ELECTRICAL TEST 40 $\pm$ 2 PPM	39.4	39.5
17	VOLTAGE TEST +5 V +12 V +15 V -15 V	5.22/12.11/16.65/-15.09	5.22/12.11/16.65/-15.09
18	ZERO GAS 0.00 PPM	-0.5	0.0
19	SPAN GAS 808.9 PPM	770.4	809.2

หมายเหตุ

- เปลี่ยน O-ring 2 ชิ้น , Spring 1 ชิ้น , Sintered Filter 1 ชิ้น, Filter 47 mm. 1 แผ่น

- Calibrate Multi-Point



ห้องปฏิบัติการวิเคราะห์เอกชน

เลขทะเบียน

ลงนามเจ้าหน้าที่ (Signature)

ต้องการข้อมูลเพิ่มเติมทางด้านเทคนิค กรุณาติดต่อ: คุณณนาคม มหาอาจ

โทรศัพท์: 0-2515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทราเกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์: 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : EMEX ASSOCIATION COMPANY LIMITED

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API

MODEL : T300

SERIAL NO : 92

STANDARD GAS CONCENTRATION (PPM) : 808.9

CYLINDER NO : CC739972

CYLINDER PRESSURE (psig) : 750

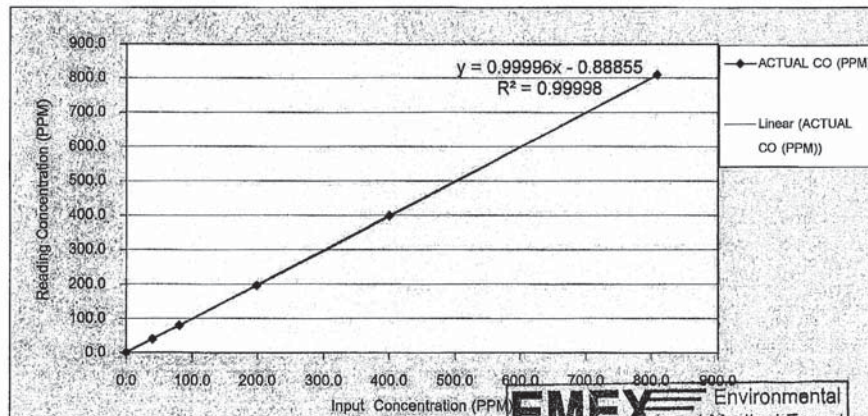
CERTIFIED DATE : Nov 05, 2020

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov 05, 2028

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.0	0.0	0.0	-
1	40.0	40.0	0.0	0.0
2	80.0	79.5	-0.5	-0.6
3	199.2	196.8	-2.4	-1.2
4	400.6	397.8	-2.8	-0.7
5	808.9	809.2	0.3	0.0
AVERAGE (%)				0.5



EMEX Environmental and Medical Expert
EME ASSOCIATION CO.,LTD.

CALIBRATED BY : คุณธนาคม มหาอาจ

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

DATE : 11 กันยายน 2567

เลขทะเบียน ว-246

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทระนอก เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8999 โทรสาร : 0-2515-8988 E-Mail : info@kinetics.co.th



National Institute of Metrology (Thailand)

Certificate of Calibration

Certificate No. : AA-2019-24

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, A.Bangbuathong,
Nonthaburi 11110

MEASUREMENT DATE : 17 July 2024

The reported measurement result relates only to the measurand and applies only at the time of measurement.

The calibration results only marked with an asterisk * in this certificate are not included in the scope of accreditation.

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
AUVCI32-01/24

Date
24 July 2024

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:2022 "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%	Unit
1.Sound Pressure level	0.07	0.15	dB
2. Frequency	0.1	0.2	%
3. THD+N	0.1	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 Conditions : The average values during measurement are
(99.947 ± 0.036) kPa, (22.5 ± 0.3) °C and (49.3 ± 2.1) %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

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 calibration results exclude the calibrator pressure correction but include the microphone volume correction, which was obtained from the manufacturer instruction manual of the sound calibrator, at the level of 0 dB.



MEASUREMENT RESULTS

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance Limit ^[2] (dB)
Microphone 4180 Serial No.1395446			
94	94.18	0.18	± 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.

Note ^[2] : The acceptance limit is obtained from IEC 60942: 2017.

2. Frequency*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[3] (%)	Acceptance Limit ^[4] (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	± 0.7

Note ^[3] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.

Note ^[4] : The acceptance limit is obtained from IEC 60942: 2017.



3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

Measured value ^[5] (%)	Maximum total distortion + Noise ^[6] (%)
At the sound pressure level of 94 dB	
0.2	2.5

Note ^[5] : The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz.

Note ^[6] : The maximum total distortion + noise is obtained from IEC 60942: 2017.

End of Certificate of Calibration

NIMT



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25010058-10

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222071

ID. Number : SLM-48

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 08 Jan 2025

Relative Humidity : 50 % $\pm$ 15 % Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :

Calibration Officer

Authorized Signatory

SP-FM-04-15 rev.0



ID LINE : IEC17024



Calibration Report

Certificate Number : SPR25010058-10

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research

SP-FM-04-15 rev.0



Result of Calibration

Certificate Number : SPR25010058-10

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010258-11

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222072

ID. Number : SLM-52

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 16 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Calibration Officer

Approved by :

(Mr. [Signature])

Authorized Signatory



ID LINE : IEC17029



Calibration Report

Certificate Number : SPR25010258-11

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR25010258-11

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25010258-14

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222101

ID. Number : SLM-53

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 16 Jan 2025

Relative Humidity : 50 % $\pm$ 15 % Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by

Calibration Officer

Approved by :

Authorized Signatory

SP-FM-04-15 rev.0



ID LINE : IEC17021



Calibration Report

Certificate Number : SPR25010258-14

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :

TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-14

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.2	94.2	0.2	0.2	0.15
114	114.1	114.1	0.1	0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010258-12

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222102

ID. Number : SLM-57

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 16 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR25010258-12

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-12

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.8	93.8	-0.2	-0.2	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.8	93.8	-0.2	-0.2	0.15
114	113.7	113.7	-0.3	-0.3	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010058-6

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222104

ID. Number : SLM-54

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 08 Jan 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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Calibrated by : Mr

Calibration Officer

Approved

Authorized Signatory



Calibration Report

Certificate Number : SPR25010058-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010058-6

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010058-11

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222105

ID. Number : SLM-31

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 08 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : M

Calibration Officer

Approved by

Authorized Signatory



Calibration Report

Certificate Number : SPR25010058-11

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010058-11

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Certificate of Calibration

Certificate No. : 67-400635-1

Page : 1 of 2

Submitted by : MET Company Limited

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

Equipment : Temperature controlled enclosure (Refrigerator)

Manufacturer : Sanden Intecool

Model : SRC-680SRTM

Range : N/A °C

Resolution : 1 °C

Serial No. : SRC680201-1107-00165

ID No. : MET-RE 01/54

Environment : On site calibration was carried out at the Laboratory, MET Company Limited

Ambient Temperature : (30.5 to 31.6) °C

Relative Humidity : (50 to 55) %

Line Voltage : (226.5 to 228.2) V

Date of Received : 05 November 2024

Date of Calibration : 05 November 2024

Date of Issue : 09 November 2024

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 RTD Probe

ID No. **Cert. No.** **Due Date** **Traceability**

400046 & 400042 67-400442-1 26 Jan 2025 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. : 67-400635-1

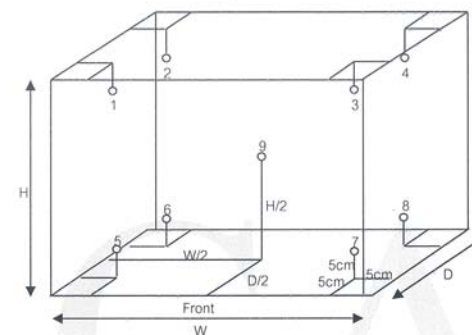
Page : 2 of 2

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 = 0.58 m

D = 0.60 m

H = 1.35 m

Capacity = 0.47 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	2	2	3.63	3.56	3.80	3.16	3.78	3.73	3.54	3.90	2.62	0.81

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.44	0.21	1.66

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

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 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. : 68-420008-1

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 : Eutech

Model : pH 150

Range : -2.00 to 16.00 pH

Resolution : 0.01 pH

Serial No. : 2657036

ID No. : MET-PH04/60

Electrode

Model : ECFC7252101B

Serial No. : 2603242122

ID No. : MET-PH04/60

Environment :

Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 16 January 2025

Date of Calibration : 23 January 2025

Date of Issue : 23 January 2025

Calibrated by : Permpon Chanpu

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
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440001	23E1240	24 Mar 2025	National Institute of Metrology Thailand (NIMT)
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2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
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4.008	61293328	1027612	15 Sep 2026	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
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6.987	61297593	1027614	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
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10.010	61306165	1027613	15 Sep 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
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Approved by

Supervisor

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Calibratech Co.,Ltd.

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

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

Certificate of Calibration

Certificate No. : 68-420008-1

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	177.1	0.4	0.060
	0.0000	7	6.98	-0.1	0.1	0.060
	-177.4800	10	10.00	-177.3	-0.2	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	4.008	4.01	0.00	0.0097
	6.987	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

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%

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Certificate of Calibration

Certificate No. : 68-400033-1

Page : 1 of 2

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

Equipment : Temperature Indicator with Thermistor Probe
Temperature Indicator

Manufacturer : Eutech

Model : pH 150

Range : -10 °C to 110 °C

Resolution : 0.1 °C

Serial No. : 2657036

ID No. : MET-PH04/60

Thermistor Probe

Model : PHWPTEM01W

Sheath Material : Stainless

Diameter : 3 mm.

Length : 85 mm.

Serial No. : N/A

ID No. : MET-PH04/60

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 16 January 2025

Date of Calibration : 21 January 2025

Date of Issue : 21 January 2025

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-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	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. : 68-400033-1

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)
80	20.0014	19.9	0.1	0.11
80	50.0020	50.0	0.0	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%

- o0o -



Certificate of Calibration

Certificate No. : 67-200293-1 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 : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.9 to 26.2) °C
Relative Humidity : (32.6 to 45.5) %
Air Pressure : 1007.0 mbar

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	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. : 67-200293-1 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.05	0.0001	0.00012
0.1	0.0001	0.00012
0.5	0.0001	0.00013
1	0.0000	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
50	0.0001	0.00015
100	0.0000	0.00020
150	0.0000	0.00038
200	0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g
A B C D E
0.0001 -0.0001 -0.0001 0.0001 0.0000 g



Repeatability Load test : 200 g
Stdev. : 0.00005 g

-o0o-



Certificate of Calibration

Certificate No. : 67-400505-2

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Temperature controlled enclosure (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 : (30.0 to 31.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

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 67-400246-1

25 Oct 2024

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. : 67-400505-2

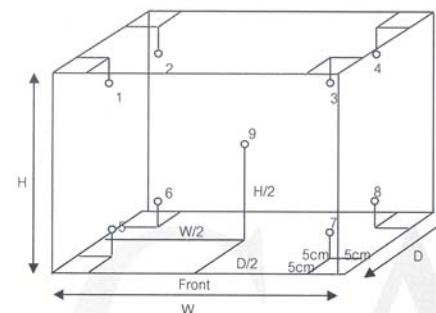
Page : 2 of 2

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	110	110	103.4	105.0	104.8	105.0	104.1	103.8	104.2	104.4	104.2	0.96
180	184	184	179.3	182.0	180.1	180.6	180.1	180.4	180.0	180.7	179.9	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.1	0.3	2.0
180	184	184	2.5	0.4	3.3

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%

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Certificate of Calibration

Certificate No. : 67-400509-1

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UF 55

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B223.1049

ID No. : N/A

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

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

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	67-400247-1	26 Oct 2024	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. : 67-400509-1

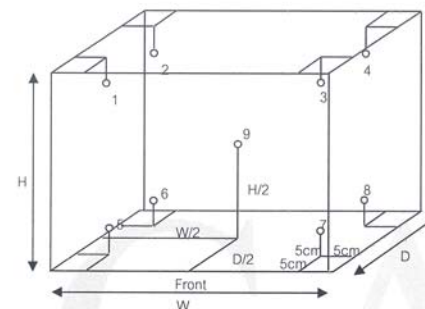
Page : 2 of 2

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 = 0.40 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	
180.0	180.0	180.0	180.1	180.2	179.5	180.2	180.2	180.2	179.2	179.4	180.8	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	1.7	0.1	1.7

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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Optima8000 Preventive Maintenance Report

Company Name: MET Company Limited.

Instrument Location: 36 659 Soi Mu Ban Monwadi Park 6,
Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Instrument Serial No.: 078S1407053C

Date: 02-Dec-2024

ICP-OES/Optima8000 Preventive Maintenance (PM)

Company Name:	MET Company Limited.		
Address (Instrument Location):	Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110		
Serial Number:	078S1407053C	PM Number:	1 of 2
Customer Name (if applicable):	K. Sasithon	Telephone Number:	065 850 0726
Service Engineer Name:	Khwanchai	Service Order Number:	WO-02950877
Date PM Performed: (DD-MMM-YYYY)	02-Dec-2024	Next PM Due Date: (DD-MMM-YYYY)	02-Jun-2025
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
09370140 Rev.5	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Optima8000 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
Optima8000	078S1407053C	Winlab V 5.5.0.0714
S10 Autosampler		

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	1
N077520	Air Filter-RF Generator	1
09992731	Axial Window	1
B0810377	Radial Window	1
N0770438	O-ring kit, injector support adapter	1
N0780437	O-ring kit, torch	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1	62-162CRX1	12/25
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	61-190CRY1	08/25

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ✓ Ask customer about unit's performance since last visit.
- ✓ Check incoming AC line voltage under load for proper levels and grounding.
- ✓ Is the instrument operational?

2. Mechanical:

- ✓ Inspect and clean all fans and filters.
- ✓ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No
If yes, list components replaced:

- ✓ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No
If yes, list tubing replaced:

- ✓ Inspect the peristaltic pump for proper operation.
- ✓ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ✓ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	35psi

- ✓ Check the shear gas nozzle for blockages and proper, uniform flow.
- ✓ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ✓ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ✓ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ✓ Drain air compressor surge tank.
- ✓ Clean exterior of instrument.

3. Electrical:

- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.
- ☒ Check all RF generator and spectrometer power supply voltages.
- ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

Spectrometer:

- ☒ Check the spectrometer status screens.
- ☒ Check for proper function of all motors from the Motor Control window.

4. Optical:

- ☒ Check the neon lamp for proper operation.
- ☒ Ensure that neon initialization passes at power up.
- ☒ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐ Yes ☒ No

- ☒ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☒ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☒ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☒ Check the shutter home sensor position.
- ☒ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☒ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☒ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☒ Yes ☐ No

Radial Window Replaced: ☒ Yes ☐ No

5. Post PM Performance Tests:

- ☒ Perform View Align.

5.1 Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009	0.00694	Passed
Ni 231.604 - Resolution	≤0.011	0.00847	Passed
Ni 341.476 - Resolution	≤0.015	0.01234	Passed
Ba 455.403 - Resolution	≤0.020	0.01552	Passed

5.2 Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD ≤ 1 %	0.99	Passed
Mg 280.856	%RSD ≤ 1 %	0.68	Passed
Mg 285.207	%RSD ≤ 1 %	0.27	Passed
Ba 455.403	%RSD ≤ 1 %	0.23	Passed

5.3 Mn BEC:

- ☒ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2% HNO_3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC: $\text{BEC} = (\text{IB} * \text{Conc of Std}) / (\text{IS} - \text{IB})$. Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS	
Mn 257.610	Radial	1,000 ppb	13533.7	651501.9	
Mn 257.610	Axial	1,000 ppb	79071.6	4397761.7	
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial	13533700	637968.2	21.21	<30 PPB	Passed
Axial	79071600	4318690.1	18.31	<30 PPB	Passed

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Optima8000 have been completed.

This ICP-OES/Optima8000 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative: 	Date: 02-Dec-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 02-Dec-2024 (DD-MMM-YYYY)



Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphen,
Samsaenok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

CERT.No.: HS-V083L

Calibration Date : 2 Dec 24

Submitted by : MET CO.,LTD

36/659 Moo. 6, Bang Rak Phatthana,

Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15G103969

Probe : YSI 5010

S/N : 15K100353

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.07	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.07	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.07	(PASS)	-
Measurement 8 (mg/l)	9.07	(PASS)	-
Measurement 9 (mg/l)	9.07	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-

Mean Measurement	9.07	mg/l	-
Inaccuracy	0.02	mg/l	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

(Kittipong Maekwong)

(Natenapha Pisatkunchon)

Certificate of Calibration

Certificate No. : 67-400708-1

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 1022

ID No. : MET-BI02/64

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

Ambient Temperature : (24.0 to 24.8) °C

Relative Humidity : (50 to 55) %

Line Voltage : (220.0 to 221.8) V

Date of Received : 20 December 2024

Date of Calibration : 20 December 2024

Date of Issue : 20 December 2024

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 RTD Probe

ID No. Cert. No. Due Date Traceability

400046 & 400047 67-400442-2 27 Jan 2025

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. : 67-400708-1

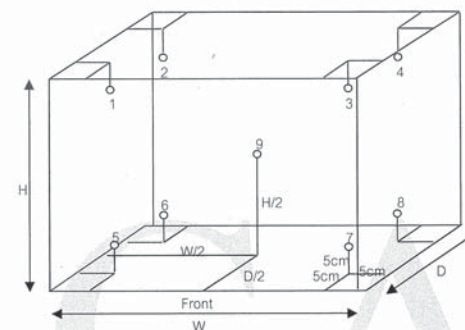
Page : 2 of 2

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 = 0.37 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	20.13	19.70	19.68	19.68	20.35	20.19	20.15	20.10	20.38	0.35

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.8	0.1	0.8

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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รายการใบรับรองสอบเทียบเครื่องมือหลักประจำห้องปฏิบัติการสำหรับวิเคราะห์คุณภาพน้ำ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักที่ใช้วิเคราะห์คุณภาพน้ำ									
1	Incubator	Coliform Bacteria	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
2	Incubator	Fecal Coliform Bacteria	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	24TM651	2 Apr 24	1 Apr 25	-
3	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	24TM614	1 Apr 24	31 Mar 25	-
4	Water Bath		Memmert	WNE 14 / L414.1410	Technology Promotion Association (Thailand-Japan)	24TM616	1 Apr 24	31 Mar 25	-
5	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2403982-001-01	7 Aug 24	6 Aug 25	-
6	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
7	Analytical Balance		OHAUS	PX623 / C236754745	DISH (Thailand) Ltd.	2402419-001-01	19 Apr 24	18 Apr 25	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

เอกสารไม่ควบคุม

บริษัท ปูนซีเมนต์ แอนด เอ็นจิเนียริ่ง คอนสัลแตนท์ จำกัด

ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

Page 1/1



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM648
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V615.0187
ID No. : UAE.MIC.003/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Approved Signatory

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-1

Cert. No.: 24TM648
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

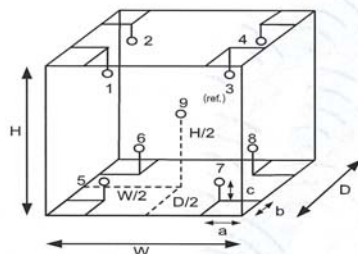
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	24
REL.Humid. (%)	54	57
AC Supply (Volt)	221	223

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM648
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.028	0.13	0.24	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.908	35.004	34.989	35.099	35.089	35.095	34.921	34.936	35.002	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม

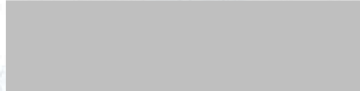


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TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM651
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V618.0033
ID No. : UAE.MIC.021/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : 
Approved by : 
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-3
Procedure Used :-

Cert. No.: 24TM651
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

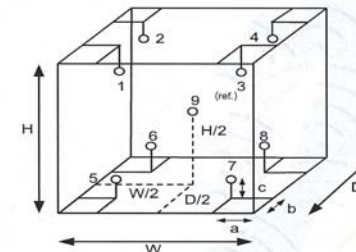
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	54	57
AC Supply (Volt)	221	224



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

Position :	Ref. Std. ID No.:
1	20-16RTD-01
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM651
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
22.0	22.0	22.0	0.039	0.22	0.42	2
44.0	44.0	44.0	0.048	0.50	0.90	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
22.0	22.008	22.034	22.039	22.021	21.746	21.698	21.668	21.668	21.846	0.30
44.0	44.267	44.602	44.293	44.402	44.004	43.961	43.756	44.000	44.205	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM614
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1407
ID No. : UAE.MIC.006/2558
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Approved Signatory

Issue Date : 25 April 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-7

Cert. No.: 24TM614
Page : 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	23LM95	TPA	19 May 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

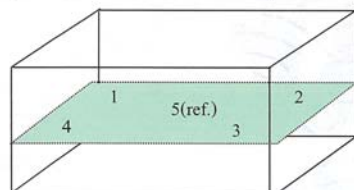
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	29	63	222
Finished of Calibration	27	66	221



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-7
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM614
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.529	44.462	44.470	44.482	44.489	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor <i>k</i>
44.5	0.077	0.049	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM616
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1410
ID No. : UAE.MIC.007/2558
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by :

Approved by :

- () Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 25 April 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-8
Procedure Used :-

Cert. No.: 24TM616
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	23LM95	TPA	19 May 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

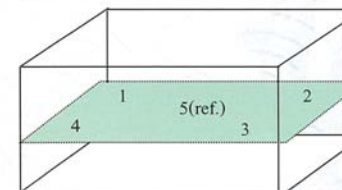
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	28	63	222
Finished of Calibration	27	69	221



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-8
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM616

Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
41.0	41.1	41.1	40.988	40.997	41.014	40.996	40.993	0.15
44.5	44.5	44.5	44.474	44.456	44.460	44.456	44.455	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
41.0	0.100	0.041	2
44.5	0.070	0.047	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-



มูลนิธิสถาบันพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



Calibration Certificate

Certificate No.: 2403982-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2403982
Operation No.: 2403982-001
Date of Receipt: 7 August 2024
Date of Calibration: 7 August 2024

Calibrated by Mr.Manas Somsak
Specialist

Approved by

Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 14 August 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

2008 อาคารนิคมอุตสาหกรรม 35 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, TH
Tel +66(0) 2422 8588 Fax +66(0) 2422 8545

เอกสารไม่ลับ
nfi.co.th



Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

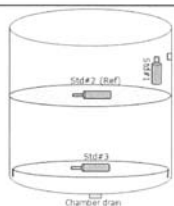
Date of Calibration: 7 August 2024

Page 3 of 3

Calibration point: 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	28.0	55	224
Max	30.0	65	226



Standard at Position
Std#1 = Attached to the load temperature probe, within 20 mm.
Std#2 = In the upper half of the chamber
Std#3 = In the chamber drain, within 100 mm.

Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	122.43	122.44	122.44	0.65

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
122	122	122	122	0.11	0.065	0.031	0.14

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity)" .

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

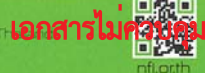
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F-CS-012 Revision: 01 Date: 20-04-65

2008 บางนาสุขาภิบาล 36 หมู่ 8 บางนาสุขาภิบาล แขวงบางนา เขตบางนา กรุงเทพมหานคร 10700

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand

Tel : +66(0) 2422 8588 Fax : +66(0) 2422 8545



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Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 7 August 2024

Page 2 of 3

Location: MICROBIOLOGY LABORATORY (301), UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition: Ambient Temperature (29 ± 1) °C
Relative Humidity (60 ± 5) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard Data loggers with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1:2021, Autoclaves for sterilization in laboratories
Part 1: Design, construction, safety and performance - Specification.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	OM-CP-HITEMP-140	Q88555	TE 670230-01	25-Feb-25	NATIONAL FOOD INSTITUTE
	OM-CP-HITEMP-140	R55951	TE 670231-01	25-Feb-25	NATIONAL FOOD INSTITUTE
	OM-CP-HITEMP-140	R56916	TE 670232-01	25-Feb-25	NATIONAL FOOD INSTITUTE

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 121 °C

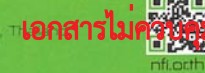
8. Result of Calibration : ☒ Without adjustment
☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65

2008 บางนาสุขาภิบาล 36 หมู่ 8 บางนาสุขาภิบาล แขวงบางนา เขตบางนา กรุงเทพมหานคร 10700

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand

Tel : +66(0) 2422 8588 Fax : +66(0) 2422 8545



nfi.or.th

Calibration Certificate

Certificate No.: 2402281-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Order No.: 2402281
Operation No.: 2402281-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong **Approved by** 
Scientist

Date of Issue: 9 April 2024

**Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team**

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (25 ± 1) °C
Relative Humidity (55 ± 7) %
Line Voltage (225 ± 5) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
- The temperature scale used was based on ITS - 90 .
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	R54918	TE 660383-01	8 April 2024	NATIONAL FOOD INSTITUTE
	HiTemp140-2	S25601	TE 670033-01	9 November 2024	MADGETECH INC.
	HiTemp140-2	S25602	TE 670034-01	9 November 2024	MADGETECH INC.

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 115.0 and 121.0 °C

8. Result of Calibration : ☒ Without adjustment
☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65



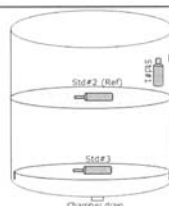
Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP

Date of Calibration: 2 April 2024
Calibration point: 115.0 and 121.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	24.4	48.6	220
Max	25.5	62.1	230



Standard at Position
Std#1 = Attached to the load temperature probe, within 20 mm.
Std#2 = In the upper half of the chamber.
Std#3 = In the chamber drum, within 100 mm.

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
115.0	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
115.0	115.0	115.1	115.0	0.08	0.19	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.17	0.10	0.38

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

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

----- End -----

Calibration Certificate

Certificate No.: 2402419-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: OHAUS

Model: PX623

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Order No.: 2402419

Operation No.: 2402419-001

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by [Signature]
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

Calibration Report

Certificate No.: 2402419-001-01

Equipment:

Electronic Balance

Manufacturer: OHAUS

Model: PX623

Resolution: 0.001 g

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Capacity: 620 g

Date of Calibration: 19 April 2024

Page 2 of 3

Environment Condition: Ambient Temperature: 26.0 ± 0.3 °C Relative Humidity: 57 ± 8.4 %

Place of Calibration: Room 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

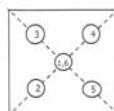
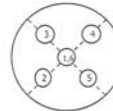
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00067
600	0.0010

2. Off-Center Error:

A mass of 200 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

		
☐	☒	☐

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
200.000	200.002	200.001	199.999	200.000	200.000	0.002

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2402419-001-01

Equipment:

Electronic Balance

Manufacturer: OHAUS

Model: PX623

Resolution: 0.001 g

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Capacity: 620 g

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00093	2.00
1	1.0000	1.000	0.000	0.00093	2.00
5	5.0000	5.000	0.000	0.00093	2.00
10	10.0000	10.000	0.000	0.00093	2.00
20	20.0000	20.000	0.000	0.00093	2.00
50	50.0000	50.001	-0.001	0.00093	2.00
100	100.0000	100.001	-0.001	0.00094	2.00
200	200.0000	200.001	-0.001	0.0011	2.00
300	300.0000	300.003	-0.003	0.0011	2.00
400	399.9999	400.003	-0.003	0.0012	2.00
500	499.9999	500.003	-0.003	0.0013	2.00
600	599.9999	600.002	-0.002	0.0014	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by

Approved by



Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,

Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand

Tel. 02-2435263, 02-6682436 Fax. 02-2437386

เอกสารไม่ควบคุม

Inspection result

ITEM		STANDARD	RESULT	JUDGE
1. Self Check	1.1 Heating		PASS	OK
	1.2 Cooling		PASS	OK
	1.3 Leak		PASS	OK
	1.4 Optical system		PASS	OK
	1.5 Drift		PASS	OK
2. Analytical curve inspection(AREA)				
	2.1 No Pretreatment (Low Conc.)	Correlation coefficient (r) $\geq$ 0.9990	0.9999	OK
3. Repeatability(AREA)				
	3.1 No Pretreatment 100ppb, n=3		1. 99.60 ppb 2. 101.84 ppb 3. 101.22 ppb	
		C.V. $\leq$ 5%	1.15%	OK
4. Blank				
		Below 1.0 (AREA)	0.1002	OK

เอกสารไม่ควบคุม

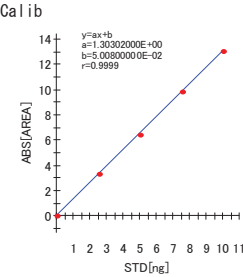
Counter

Maintenance

MAIN	SC	Counter	Parameter		
Measurement Count	20577(22-06-08)	Clear	P1 tube[H](2000h)	0h00m(24-07-08)	Clear
Mercury Exhaust Filter Amount[mq](1500mq)	1(22-06-08)	Clear	P2 tube[H](2000h)	0h01m(24-07-08)	Clear
Lamp Active time(5000h)	1h13m(24-07-08)	Clear	P3 tube[H](2000h)	0h00m(24-07-08)	Clear
Membrane Filter Usage Time(2000h)	0h58m(24-07-08)	Clear	P4 tube[H](2000h)	0h00m(24-07-08)	Clear
Main Pump tube(750h)	0h58m(24-07-08)	Clear	P5 tube[H](2000h)	0h00m(24-07-08)	Clear
Heating Lamp Time	580h23m(22-06-08)	Clear	P6 tube[H](2000h)	0h00m(24-07-08)	Clear
			P7 tube[H](2000h)	0h02m(24-07-08)	Clear

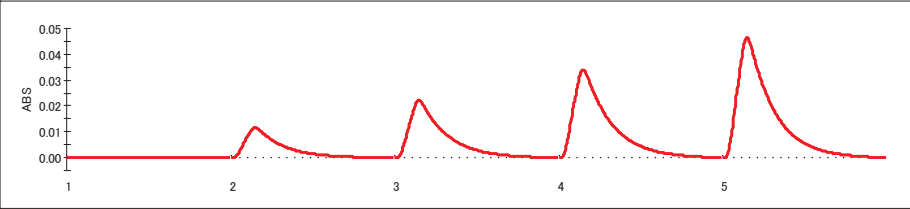
เอกสารไม่ควบคุม

Title : Preventive Maintenance RA-4500 sn:17780278
Date : 2024-07-09
Name : Coax Group
Memo : Calibration Curve 0-10ng



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000	0.100	5.000	5.000	10.000	13.1132	10.0253	0.3	



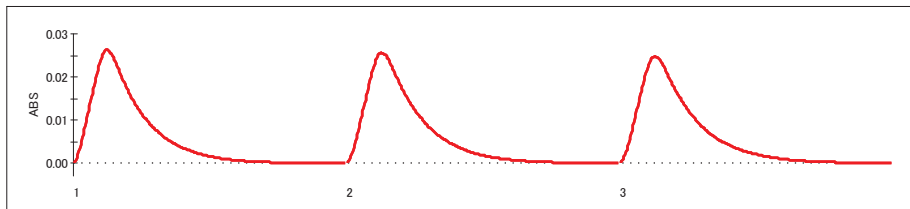
SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	100ppb	0.050	5.000	5.000	6.5389	4.9798	99.60	
2	100ppb	0.050	5.000	5.000	6.6848	5.0918	101.84	
3	100ppb	0.050	5.000	5.000	6.6446	5.0610	101.22	

Statistics

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb	3	100.887	1.15660	1.15

เอกสารไม่ควบคุม



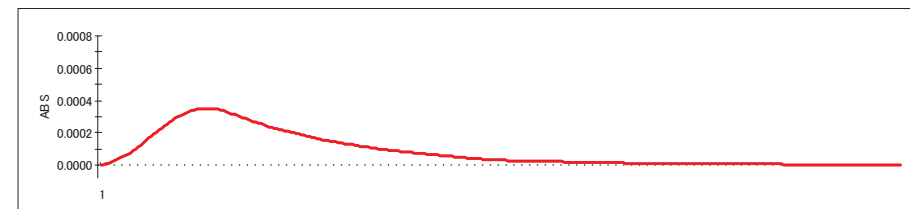
Self Check

Heat check:PASS!! (26.3degC[05:00] -> 30.3degC[02:29])
 Sensor check:PASS!! (53- 10= 43)
 Leak check:PASS!! (0.19L/min)
 Sig/Ref check:PASS!! (Sig:4.00V, Ref:4.02V)
 Drift check:PASS!! (0.0000061 - -0.0000179 = 0.0000240)

Title : Preventive Maintenance RA-4500 sn:17780278
 Date : 2024-07-09
 Name : Coax Group
 Memo : Blank

SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	Blank DI				0.1002	0.0385		



Certificate of Calibration

Certificate No. : 67-200293-1 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 : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.9 to 26.2) °C
Relative Humidity : (32.6 to 45.5) %
Air Pressure : 1007.0 mbar

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-200293-1 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.05	0.0001	0.00012
0.1	0.0001	0.00012
0.5	0.0001	0.00013
1	0.0000	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
50	0.0001	0.00015
100	0.0000	0.00020
150	0.0000	0.00038
200	0.0001	0.00038

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g
A B C D E
0.0001 -0.0001 -0.0001 0.0001 0.0000 g



Repeatability Load test : 200 g
Stdev. : 0.00005 g

- o0o -



Agilent CrossLab Start Up Services

Agilent 8890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.

Agilent 8890 GC Preventive Maintenance Checklist

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about [Agilent Technologies services](http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair), please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the [Agilent YouTube](https://www.youtube.com/user/agilent) channel at <https://www.youtube.com/user/agilent>.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- *Ask the customer to sign the Service Completion section including the customer's and your signature.*

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID	MET- GC02/65 / CN2138A118
Instrument System Site and Location	MET Co., Ltd / Laboratory

List System Component Product Numbers	List the Serial Numbers of each Component
1. B3640A	CN2138A118
2. G4513A	CN 22035277
3. G4514A	CN 22047055
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ Replace the split vent trap cartridge filter using the Maintenance procedure from either the Browser User interfaces on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ For the inlets installed, perform inlet maintenance using the Maintenance procedure from the Browser User interfaces. Record the results. (Leak and Restriction Test)
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors using the Browser interface.
- ☒ Perform inlet pressure decay test(s) from the diagnostics screen on the Browser User interface. Record if test passed or failed in the results table.

Note: If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.

ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

PM Test Results Table

Test description	Before PM Service	After PM Service
Front detector output	20.6	21.3
Back detector output	N/A	N/A
AUX 1 detector output	N/A	N/A
AUX 2 detector output	N/A	N/A
Test description	Expected test result	Actual test result
Leak and Restriction Test after front inlet maintenance	Pass	Pass
Leak and Restriction Test after back inlet maintenance	Pass	N/A
Leak and Restriction Test after front inlet Split Vent Trap replacement	Pass	Pass
Leak and Restriction Test after back inlet Split Vent Trap replacement	Pass	N/A
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	N/A

PM Parts List Table

Note: The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	8890 GC	N/A
SSL Capillary Inlet PM kit, Split	5188-6496	8890 GC	1
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	8890 GC	N/A
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	8890 GC	N/A
PP Inlet PM kit	5188-6498	8890 GC	N/A
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	8890 GC	N/A
MMI Cleaning Kit	G3510-60820	8890 GC	N/A
PTV Septumless Head Rebuild Kit	5182-9747	8890 GC	N/A
PTV Septumless Head Teflon Guide	5182-9748	8890 GC	N/A
Ignitor (glow plug) assembly with O-ring	19231-60680	8890 GC	1
FID Collector Rebuild/Cleaning Kit	G1531-67000	8890 GC	N/A
FID Collector Replacement Kit	G1531-67001	8890 GC	N/A
Standard .011-inch FID Jet	5200-0176	8890 GC	1
Universal .018-inch FID Jet	5200-0177	8890 GC	N/A

Agilent 8890 GC Preventive Maintenance Checklist



Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

Service request number [redacted] Date service completed [redacted]

Agilent signature [redacted] Customer signature [redacted]

Total number of pages in this document

9 pages

Revision: 2.01, Issued: September 14, 2021
Agile Document Number: D0013610
DE number: 44166.759722222
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Page 9 of 9

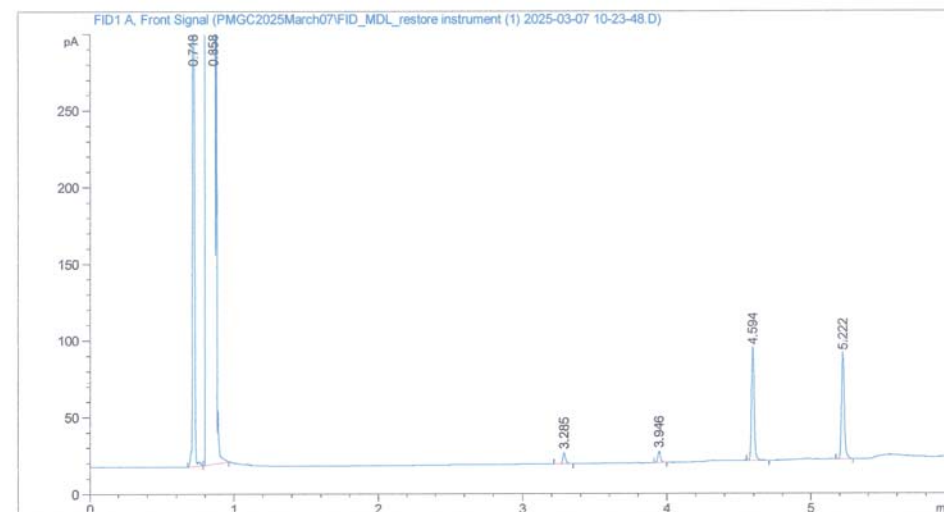


Data File C:\Users\P...\MGC2025March07\FID_MDL_restore instrument (1) 2025-03-07 10-23-48.D
Sample Name: FID_MDL_restore instrument

```
=====
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : GC1
Injection Date  : 3/7/2025 10:25:14 AM
Location       : 1 (F)
Inj            : 1
Inj Volume     : 1 µl

Acq. Method    : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\PMGC02.M
Last changed   : 3/7/2025 10:26:52 AM by SYSTEM
                (modified after loading)
Analysis Method: C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\PMGC02.M
Last changed   : 3/7/2025 10:37:45 AM by SYSTEM
                (modified after loading)
Method Info    : This method is used for cooldown instrument. 07 Apr 2022 Agilent

Sample Info    : PM GC at MET Co., Ltd. of GC02
=====
```



Area Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 3/7/2025 10:37:45 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: FID1 A, Front Signal

GC1 3/7/2025 10:38:17 AM SYSTEM

Page 1 of 2

Peak #	RetTime [min]	Type	Width [min]	Area [pA*s]	Area %	Name
1	0.718	BV	0.0122	393.81955	0.01592	?
2	0.858	VB S	0.0474	2.47336e6	99.97575	?
3	3.285	BB	0.0203	9.38152	0.00038	C-13
4	3.946	BB	0.0200	9.37078	0.00038	C-14
5	4.594	BB	0.0210	94.35705	0.00381	C-15
6	5.222	BB	0.0208	92.94677	0.00376	C-16

Totals : 2.47396e6

4 Warnings or Errors :

Warning : Invalid calibration curve, (C-13)
Warning : Invalid calibration curve, (C-14)
Warning : Invalid calibration curve, (C-15)
Warning : Invalid calibration curve, (C-16)

*** End of Report ***

Calibration Certificate

ENVIR SERVICE CO., LTD.
www.envirservice.co.th

ENVIR SERVICE CO., LTD. (HEAD OFFICE)

42 Ramintra 14, Yeak 9 Tha Raeng, Bang Khen, Bangkok 10230 Thailand
Tax ID: 0105555170865 Tel: 02-943-5814-5
Tel: 02-943-8201 Email: pasagorn@envirservice.co.th



Certificate No. EN202502005

CALIBRATION CERTIFICATE

Instrument Description : WET BULE GLOBE TEMPERATURE (WBG)T METER
Manufacture : Beijing JANTYTECH Technology Co., Ltd.
Instrument Model : JT2011-E2A
Serial No. : 3522210132
Customer Name : M E T CO., LTD.
Address : 36/659 Moc. 6, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Measurement standard used in the Calibration

Reference Standard: Standard Calibration Device, Manufacture: JANTYTECH, Model WBG)T (2011-E2A), SN: 241011001 Calibration Date : 2024 Oct. 27, Calibration Certificate No. : JTCD202410005

The verification result in the certificate can be traceable to international system of unit (SI) / social public measurement standards.

CALIBRATION RESULTS

Testing Result:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	35.1	-0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	25.1	-0.1	0.2
	30.0	30.1	-0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.9	0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.1	-0.1	0.2
	45.0	45.2	-0.2	0.2

Environment Condition: Temperature (25± 2) °C Relative Humidity (50±15) %RH

- The report applies to the item and shall not be reproduced except in full, without written approval by Calibration Laboratory, Envir Service Co., Ltd.
- This result of this report only to the item calibrated.

Date of Calibration : 2025-02-21
Valid to : 2026-02-20

Calibrated By :

(Technician)



Approved By :

(Technician manager)

- End of Calibrated -

ENVIR SERVICE CO., LTD. (HEAD OFFICE)

42 Ramintra 14, Yeak 9 Tha Raeng, Bang Khen, Bangkok 10230 Thailand
Tax ID: 0105555170865 Tel: 02-943-5814-5
Tel: 02-943-8201 Email: pasagorn@envirservice.co.th



Certificate No. EN202502006

CALIBRATION CERTIFICATE

Instrument Description : WET BULE GLOBE TEMPERATURE (WBGT) METER
Manufacture : Beijing JANTYTECH Technology Co., Ltd.
Instrument Model : JT2011-E2A
Serial No. : 3522210133
Customer Name : M E T CO., LTD.
Address : 36/659 Moc. 6, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Measurement standard used in the Calibration

Reference Standard: Standard Calibration Device, Manufacture: JANTYTECH, Model WBGT (2011-E2A), SN: 241011001 Calibration Date : 2024 Oct. 27, Calibration Certificate No.: JTCD202410005

The verification result in the certificate can be traceable to international system of unit (SI) / social public measurement standards.

CALIBRATION RESULTS

Testing Result:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	25.1	-0.1	0.2
	30.0	30.2	-0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	39.8	0.2	0.2
	45.0	45.2	-0.2	0.2
DRY	25.0	24.9	0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	25.2	-0.2	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	39.8	0.2	0.2
	45.0	44.9	0.1	0.2

Environment Condition: Temperature (25±2) °C Relative Humidity (50±15) %RH

- The report applies to the item and shall not be reproduced except in full, without written approval by Calibration Laboratory, Envir Service Co., Ltd.
- This result of this report only to the item calibrated.

Date of Calibration : 2025-02-21
Valid to : 2026-02-20

Calibrated By :

(Technician)

(Technician manager)

- End of Calibrated -



ENVIR SERVICE CO., LTD. (HEAD OFFICE)

42 Ramintra 14, Yeak 9 Tha Raeng, Bang Khen, Bangkok 10230 Thailand
Tax ID: 0105555170865 Tel: 02-943-5814-5
Tel: 02-943-8201 Email: pasagorn@envirservice.co.th



Certificate No. EN202502007

CALIBRATION CERTIFICATE

Instrument Description : WET BULE GLOBE TEMPERATURE (WBGT) METER
Manufacture : Beijing JANTYTECH Technology Co., Ltd.
Instrument Model : JT2011-E2A
Serial No. : 3522210134
Customer Name : M E T CO., LTD.
Address : 36/659 Moc. 6, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi
11110

Measurement standard used in the Calibration

Reference Standard: Standard Calibration Device, Manufacture: JANTYTECH, Model WBGT (2011-E2A), SN: 241011001 Calibration Date : 2024 Oct. 27, Calibration Certificate No.: JTCD202410005

The verification result in the certificate can be traceable to international system of unit (SI) / social public measurement standards.

CALIBRATION RESULTS

Testing Result:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	25.0	25.1	-0.1	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.1	-0.1	0.2
	45.0	44.8	0.2	0.2
DRY	25.0	24.8	0.2	0.2
	30.0	29.8	0.2	0.2
	35.0	34.9	0.1	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2
GLOBE	25.0	24.9	0.1	0.2
	30.0	29.9	0.1	0.2
	35.0	34.8	0.2	0.2
	40.0	40.2	-0.2	0.2
	45.0	45.1	-0.1	0.2

Environment Condition: Temperature (25±2) °C Relative Humidity (50±15) %RH

- The report applies to the item and shall not be reproduced except in full, without written approval by Calibration Laboratory, Envir Service Co., Ltd.
- This result of this report only to the item calibrated.

Date of Calibration : 2025-02-21
Valid to : 2026-02-20

Calibrated By :

- End of Calibrated -





Certificate of Calibration

Certificate Number : SPR25010258-13 Page : 1 of 3

Customer : MET CO.,LTD.
36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222068

ID. Number : SLM-49

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 16 Jan 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :
Calibration Officer

Approved :
Authorized Signatory



Calibration Report

Certificate Number : SPR25010258-13 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-13

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010258-16

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222069

ID. Number : SLM-29

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 16 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by



Calibration Officer

Approved by :



(M)

Authorized Signatory



Calibration Report

Certificate Number : SPR25010258-16

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-16

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010058-7

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222070

ID. Number : SLM-28

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 08 Jan 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. [Redacted]

Calibration Officer

Approved by [Redacted]

Authorized Signatory



Calibration Report

Certificate Number : SPR25010058-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR25010058-7

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.1	94.1	0.1	0.1	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25010258-17

Page : 1 of 3

Customer

: MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial Number : 00722042

ID. Number : SLM-46

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 16 Jan 2025

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

Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab

Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01

Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Approved by

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR25010258-17

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-17

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

– End of Certificate –



Certificate of Calibration

Certificate Number : SPR25010058-5

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : Rion

Model : NL-21

Serial Number : 00722043

ID. Number : SLM-45

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 08 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



Calibration Report

Certificate Number : SPR25010058-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010058-5

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select F

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010058-3

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 170400104

ID. Number : ND-10

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 08 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Approved by

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR25010058-3

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010058-3

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25010058-1 Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo.6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 200300135

ID. Number : ND-13

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 08 Jan 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 11 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 11 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 12 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Nanthawat Wanasit

Calibration Officer

Approved



Calibration Report

Certificate Number : SPR25010058-1 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR25010058-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25010258-10

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 220100177

ID. Number : ND-35

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 16 Jan 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 20 Jan 2025

Location of Calibration : In-Lab Recommend Due Date : 20 Jan 2026

Calibration Procedure : SP-CPE-04-01 Date of Issue : 21 Jan 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by



Calibration Officer

Approved by :





Calibration Report

Certificate Number : SPR25010258-10

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate Number : SPR25010258-10

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -

Calibration & Test Certificate

We hereby certify that the instrument under mentioned has been certainly calibrated according to our calibration standard and the testing result in the calibration procedure has been good enough within the tolerance regulated in our specification.

Test conditions

Model name Noise Dosimeter
Model number ST-130
Serial number 230600019
Temperature 23.0° C
Humidity 70.0%rh
Date of calibration 2024/09/07
Valid Until 2025/09/06

Test data

Test Item	Range	Results
M dBA	Range: 30...130 dB	PASS
M dBC	Range: 30...130 dB	PASS
M dBZ	Range: 30...130 dB	PASS

Calibrator

Model	Model Number	Serial Number	Due date
Standard SOUND LEVEL METER	B&K 2239	2449143	OCT/22/2024

The standard generators used for calibration procedure are proofed once a year and can be traceable to the standard authorized by public organization.

Approved by _____



Tim Lin
Scarlet Tech
Head of Engineering Department

Calibration & Test Certificate

We hereby certify that the instrument under mentioned has been certainly calibrated according to our calibration standard and the testing result in the calibration procedure has been good enough within the tolerance regulated in our specification.

Test conditions

Model name Noise Dosimeter
Model number ST-130
Serial number 230600020
Temperature 23.0° C
Humidity 70.0%rh
Date of calibration 2024/09/07
Valid Until 2025/09/06

Test data

Test Item	Range	Results
M dBA	Range: 30...130 dB	PASS
M dBC	Range: 30...130 dB	PASS
M dBZ	Range: 30...130 dB	PASS

Calibrator

Model	Model Number	Serial Number	Due date
Standard SOUND LEVEL METER	B&K 2239	2449143	OCT/22/2024

The standard generators used for calibration procedure are proofed once a year and can be traceable to the standard authorized by public organization.

Approved by _____



Tim Lin
Scarlet Tech
Head of Engineering Department



Certificate of Calibration

Equipment : DIGITAL LIGHT METER
Manufacturer : DIGICON
Model / Type : LX-73
Serial No. : T.068011
ID No. : -
Customer : M E T CO., LTD.
36/659 Moo 6 T.Bangrakpattana A.Bangbuathong Nonthaburi
11110.
C.S.R. No. : L0001459-23
Received Date : 29 September 2023
Calibration Date : 03 October 2023
Calibrated By : MR. TONTRAKARN SRIKACHA
Approved By : MR. NATTAPOL KINGKAWE
Issue Date : 03 October 2023

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

Condition of this calibration result :

1. Environment : Temperature : $(23 \pm 3) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$

2. Reference / Procedure Used :

- This Instrument was calibrated by substitution with reference illuminance meter, the instrument and reference illuminance meter were mounted with the plane of its diffuser vertical and normal to the direction of measurement. Calibration was illuminated by the luminous standard lamp (operated at colour temperature 2856K) according to GIIC Calibration Laboratory calibration procedure No.GIICLAB-CP-L01.

3. Reference Standard Instrument :

Instrument	Model	Serial No	Certificate No	Due Dated
Illuminance meter	PMA2200 / PMA2130	25531 / 025000	TP-1021-23	8 Jun 24

4. This Certification is traceable to the SI unit through :

- The National Institute of Metrology (Thailand) .

5. Uncertainty :

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

CERTIFICATE No.: CAL01441-23 PAGE: 3 OF: 3

CALIBRATION REPORT

All data shown below were as received value : Without adjustment

Calibration result :

Function: Illuminance Measurement

¹ UUC Range (lux)	Standard Setting (lux)	¹ UUC Reading (lux)	Error (lux)	Uncertainty of measurement ± (lux)
400	0	0.0	0.0	0.60
	50	50.4	0.4	1.6
	250	254.3	4.3	6.5
4000	500	512	12	13
	1000	1027	27	26
	1500	1541	41	36
	2000	2062	62	48
	3000	3074	74	72
40000	4000	4100	100	96
	5000	5140	140	0.12 klux

¹UUC = Unit Under Calibration

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

- END -