

ภาคผนวกที่ 5  
เอกสารสอบเทียบเครื่องมือตรวจวัด

ภาคผนวกที่ 5-1  
เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ  
ในบรรยากาศโดยทั่วไป



RECALIBRATION

DUE DATE:

August 3, 2023

# Certificate of Calibration

## Calibration Certification Information

Cal. Date: August 3, 2022      Rootsometer S/N: 438320      Ta: 296 °K  
 Operator: Jim Tisch      Pa: 748.3 mm Hg  
 Calibration Model #: TE-5025A      Calibrator S/N: 710725

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3740	3.2	2.00
2	3	4	1	0.9780	6.4	4.00
3	5	6	1	0.8730	7.9	5.00
4	7	8	1	0.8300	8.8	5.50
5	9	10	1	0.6870	12.8	8.00

## Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis)
0.9870	0.7183	1.4080	0.9957	0.7247	0.8895
0.9828	1.0049	1.9912	0.9914	1.0137	1.2579
0.9808	1.1234	2.2262	0.9894	1.1334	1.4064
0.9796	1.1802	2.3349	0.9882	1.1907	1.4750
0.9743	1.4182	2.8160	0.9829	1.4307	1.7789
QSTD	m=	2.00936	QA	m=	1.25823
	b=	-0.03294		b=	-0.02081
	r=	0.99998		r=	0.99998

## Calculations

Vstd =  $\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$       Va =  $\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$   
 Qstd = Vstd / ΔTime      Qa = Va / ΔTime

For subsequent flow rate calculations:

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

## Standard Conditions

Tstd: 298.15 °K

Pstd: 760 mm Hg

## Key

ΔH: calibrator manometer reading (in H2O)

ΔP: rootsometer manometer reading (mm Hg)

Ta: actual absolute temperature (°K)

Pa: actual barometric pressure (mm Hg)

b: intercept

m: slope

## RECALIBRATION

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

Tisch Environmental, Inc.  
 145 South Miami Avenue  
 Village of Cleves, OH 45002

www.tisch-env.com  
 TOLL FREE: (877)263-7610  
 FAX: (513)467-9009

## Analyzer Performance Test

Calibrated Date: 25 August 2022

## Instruments Information

Analyzer Type: SO2 Analyzer

Model: 43C

Manufacturer Thermo Environmental

S/N: 43C-85967-356

## Calibration System

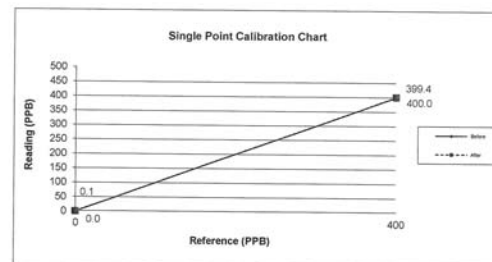
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4.535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

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	399.4	-0.2
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr. [Redacted]

## Analyzer Performance Test

Calibrated Date: 21 March 2023

### Instruments Information

Analyzer Type : SO<sub>2</sub> Analyzer  
Model : 43C

Manufacturer : Thermo Environmental  
Serial Number : 43C-58207-316

### Calibrator Unit

Dilutor Model : Dasibi Model 5008  
Serial Number : 705  
ZERO AIR Generator : API MODEL 701  
Serial Number : 1924

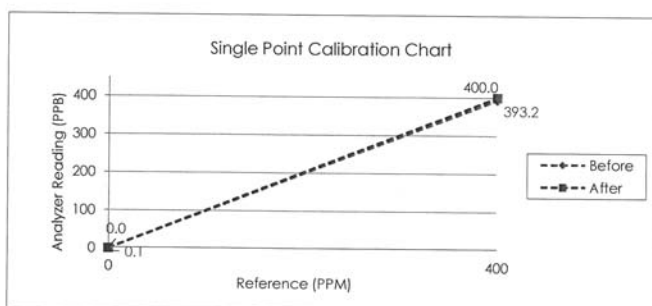
### Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM  
Sulphur Dioxide (SO<sub>2</sub>) 55.11 PPM  
Carbon Monoxide (CO) 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	393.2	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By

## Analyzer Performance Test

Calibrated Date: 21 March 2023

### Instruments Information

Analyzer Type : SO<sub>2</sub> Analyzer  
Model : 43C

Manufacturer : Thermo Environmental  
Serial Number : 43C-58286-317

### Calibrator Unit

Dilutor Model : Dasibi Model 5008  
Serial Number : 705  
ZERO AIR Generator : API MODEL 701  
Serial Number : 1924

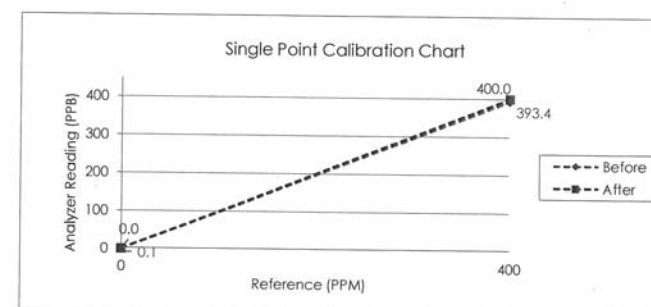
### Standard Gas Concentration

Nitric Oxide (NO) 55.47 PPM  
Sulphur Dioxide (SO<sub>2</sub>) 55.11 PPM  
Carbon Monoxide (CO) 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

## Analyzer Performance Test

Calibrated Date: 10 February 2023

### Instruments Information

Analyzer Type: SO2 Analyzer Model: 100	Manufacturer API S/N: 368
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### Calibration System

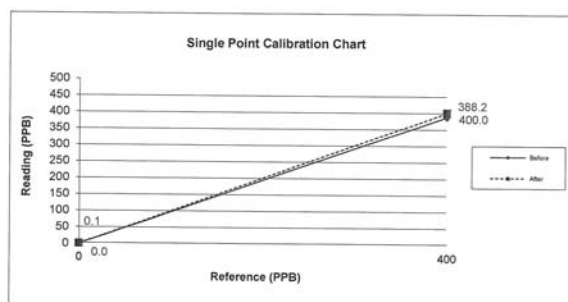
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

### Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	388.2	-3.0
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

## Analyzer Performance Test

Calibrated Date: 07 October 2022

### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-0362000000891
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### Calibration System

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

Environment: Temperature 25.5 °C

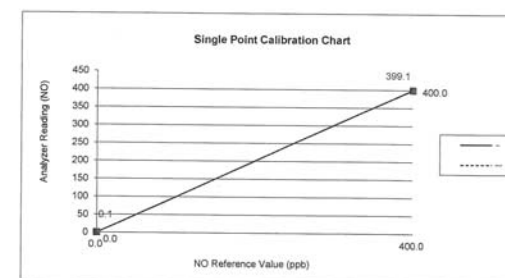
Humidity: 51 %RH

### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	399.1	400.0	-0.2
NOx	0.1	0.0	0.1	399.1	400.0	-0.2

### Calibration Check ( After adjust )

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



Calibrate

### Analyzer Performance Test

Calibrated Date: 26 January 2023

#### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 0514811452
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#### Calibration System

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

Environment: Temperature 25.5 °C

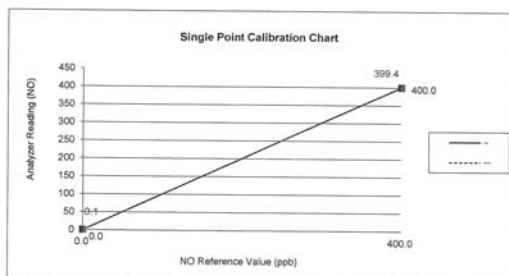
Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	399.4	400.0	-0.2
NOx	0.1	0.0	0.1	399.3	400.0	-0.2

#### Calibration Check ( After adjust )

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



Calibrate By :

### Analyzer Performance Test

Calibrated Date: 07 October 2022

#### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 0528012676
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#### Calibration System

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

Environment: Temperature 25.5 °C

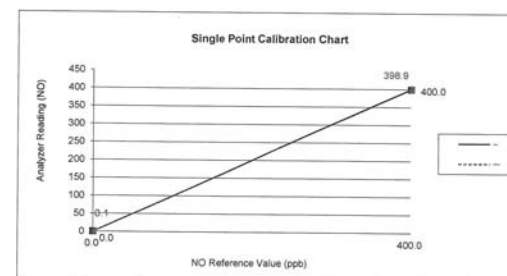
Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	398.9	400.0	-0.3
NOx	0.1	0.0	0.1	399.1	400.0	-0.2

#### Calibration Check ( After adjust )

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



Calibrate By :

### Analyzer Performance Test

Calibrated Date: 26 January 2023

#### Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 032830000000891
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#### Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4.535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

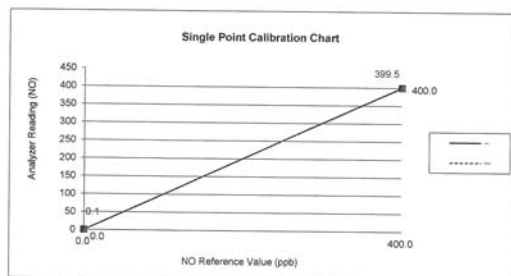
Environment: Temperature: 25.5 °C Humidity: 51 %RH

#### Calibration Check ( Before adjust )

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	399.5	400.0	-0.1
NOx	0.1	0.0	0.1	399.2	400.0	-0.2

#### Calibration Check ( After adjust )

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



Calibrate

ภาคผนวกที่ 5-2  
เอกสารสอบเทียบเครื่องมือตรวจวัด  
ความเร็วและทิศทางการลม





# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 January, 2023

Certification No. 010/23

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC01009A97

Customer : Pacific Laboratory Co.,Ltd.  
14/5358 Moo 14, T. Bang Bua,  
A.Bang Bua Thong, Nonthaburi 11110.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

: Theodor Friedrich : Dr. Theodor Friedrichs

: Thermo : Thermo



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 010/23

13 January, 2023

Page : 2 of 3

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.8	0.21
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.8	0.22

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

Calibrate



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

13 January, 2023

Certification No. 010/23

Page : 3 of 3

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.6	45.7	-0.1
30.9	30.9	0.0
15.7	15.9	-0.2

Calibrated



# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 15 November, 2022

Certification No. 401/22

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC91006A06

Customer : Pacific Laboratory Co., Ltd.  
14/5358 Moo 14, T. Bang Bua,  
A. Bang Bua Thong, Nonthaburi 11110.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8389/94





# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 2 of 3

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.5	0.50
7.04	-	-	-	6.7	0.34
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.7	0.31
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.7	0.32

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



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 3 of 3

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.5	45.4	0.1
30.2	30.3	-0.1
15.4	15.6	-0.2

ภาคผนวกที่ 5-3  
เอกสารสอบเทียบเครื่องมือตรวจวัดปริมาณสารเจือปน  
ในอากาศที่ระบายออกจากปล่อง

06/01/2023 14:02:53

EES

Envi Equipment Service Co., Ltd.

110254 Moo 3, Tambon Bang Rak Phuthana, Amphur Bang Bua Thong, Northaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ens.com

Certificate No. : E23-01009

Page : 1 of 6

CERTIFICATE OF CALIBRATION

Customer : Pacific Laboratory Co., Ltd.  
Address : 148358 Moo 14, Tambon Bang Bua Thong, Amphoe Bang Bua Thong, Northaburi 11110  
Description of Equipment : Console meter  
Manufacturer : Apex Instrument  
Model Number : XC-572-OV  
Serial Number : L366033  
ID-Control No. : -  
Environment Conditions : Temperature (25 ± 3) °C  
Humidity (50 ± 15) % RH  
Cal. Date : 06/01/2023  
Issue Date : 06/01/2023

Calibration Method or Calibration Procedure Used

(US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

This certificate may not be reproduced other than in full except with prior written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

06/01/2023 14:02:53

EES

Certificate No. : E23-01009

Page : 2 of 6

METHOD 5 CONSOLE CALIBRATION

USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425

5-POINT METRIC UNIT

Meter Console Information				Calibration Conditions				Factors/Conversions			
Console Model Number	XC-572-OV	Date	Time	06/01/2023	10:00	AM		Std Temp	293	K	
Console Serial Number	L366033	Calibration Reference No.	SE823-01083					Std Press	760	mm Hg	
DCGM Model Number	SK25EX	Reference Pressure	759.74			mmHg		K <sub>f</sub>	0.386		
DCGM Serial Number	00009149	Calibration Meter Gamma	0.999					Console Leak Check			
								PASS			

Calibration Data											
Metering Console						Calibration Meter					
Run Time	Elapsed	DCGM Volume (V <sub>g</sub> )	DCGM Volume (V <sub>w</sub> )	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
		(Q)	(Q)	(V <sub>g</sub> )	(V <sub>w</sub> )	(t <sub>out</sub> )	(t <sub>in</sub> )	(V <sub>ref</sub> )	(V <sub>ref</sub> )	(t <sub>out</sub> )	(t <sub>in</sub> )
	min	mm H <sub>2</sub> O	m <sup>3</sup>	m <sup>3</sup>	m <sup>3</sup>	°C	°C	m <sup>3</sup>	m <sup>3</sup>	°C	°C
12:42	13.0	0.1450	0.2850	24	24	118.59138	118.54402	118.54402	118.54402	25	25
12:40	13.0	0.2850	0.4250	25	25	118.64402	118.78246	118.78246	118.78246	25	25
8:75	26.0	0.4360	0.5760	25	25	118.78792	118.92572	118.92572	118.92572	25	25
8:75	26.0	0.5760	0.7160	26	26	118.92572	119.06308	119.06308	119.06308	25	25
14:02	40.0	0.7720	1.0020	27	27	119.06308	119.20044	119.20044	119.20044	25	25
14:02	40.0	1.0020	1.2820	28	28	119.24854	119.38648	119.38648	119.38648	25	25
10:53	70.0	1.2820	1.5720	28	28	119.43648	119.57448	119.57448	119.57448	25	25
10:50	70.0	1.5720	1.8520	28	28	119.61208	120.09082	120.09082	120.09082	25	25
9:17	90.0	1.8640	2.1440	29	29	120.20082	120.48048	120.48048	120.48048	25	25
9:15	90.0	2.1440	2.4240	29	29	120.48048	120.75954	120.75954	120.75954	25	25



## CERTIFICATE OF CALIBRATION

Customer	: Pacific Laboratory Co., Ltd.
Address	: 14/558 Moo 14, Tambon Bang Bua Thong, Amphoe Bang Bua Thong, Nonthaburi 11110
Description of Equipment	: Standard Probe Method 5
Manufacturer	: Apex Instrument
Model Number	: PS-4HV
Serial Number	: -
ID/Control No.	: -
Environment Conditions	: Temperature (25 ± 2) °C Humidity (50 ± 15) % RH
Cal. Date	: 06/01/2023
Issue Date	: 06/01/2023

## Calibration Method or Calibration Procedure Used

US EPA Method (United States Environmental Protection Agency)

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

## Result of Calibration

This certificate may not be reproduced other than in full except with prior written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

CALIBRATION RESULTS  
S-Type Geometric Pitot Tube Calibration

## Sampling System Equipment Information

Probe Model	: PS-4HV
Probe Number	: -
Pitot Number	: A9148
Pitot Tube Type	: S-type

## Calibration Condition

Date	: 6 January 2023
Barometric Pressure	: 759.74 mm Hg
Digital Caliper	: CD-6" ASX
Serial number	: A19008059

Pitot tube/Probe: # PS-4HV			
Parameter	Value	Allowable Range	Check
Assembly level?	Yes	Yes	Pass
Ports Damage?	No	No	Pass
e1	0	-10° < e1 < +10°	Pass
e2	1	-10° < e2 < +10°	Pass
B1	0	-5° < B1 < +5°	Pass
B2	0	-5° < B2 < +5°	Pass
Y	0	N/A	-
n	0	N/A	-
D1	0.374	.188" to .375"	Pass
A	0.966	2.1 DI ≤ A ≤ 3 DI	Pass
A/2DI	1.291	1.05 ≤ A/DI ≤ 1.5	Pass
Z = A tan γ	0.047	Z ≤ .125"	Pass
W = A tan θ	0.019	W ≤ .031"	Pass

## Remark:

I certified that probe model: **PS-4HV** meets or exceeds all specifications, criteria and/or applicable design and is hereby assigned a pitot tube certification factor of **0.84**. See 40 CFR Pt. 60, App. A, EPA Method 2.

## THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Probe Model Number	: PS-4HV	Date	: 06/01/2023
Probe Serial Number	: -	Time	: 01:00 PM
Meter Box Model Number	: JENCO 765 KF	Calibration Reference No.	: SER23-01003
Meter Box Serial Number	: JC 13335	Reference Thermometer	: DIGICON
		Serial Number	: 183169105

Thermocouple of Standard Probe method 5 = length 4 foot			
Set Point	Reference Thermocouple	Probe Thermocouple	Difference
100	100.0	97.0	0.80
250	250.0	247.0	0.19
300	300.0	298.0	0.35
350	350.0	347.0	0.48



บริษัท คอลมี เอ็นจิเนียริง จำกัด (สำนักงานใหญ่)  
CALL ME ENGINEER COMPANY LIMITED. (Head Office)  
89/553 หมู่ 5 ต.บางพลีใหญ่ อ.บางพลี จ.สมุทรปราการ 11140  
89/553 Moo 5, T. Bangplaiyue, A. Bangplai, Nonthaburi,  
11140 Thailand  
เลขประจำตัวผู้เสียภาษีอากร (Tax ID.)  
0125564024574



## GASES AND FIRE DETECTION

### Contact Us

E-Mail : service@callmeeng.com  
Web Site : www.callmeeng.com

Tel : +66(0)89 890 8246  
Line ID : @Callmeeng

## Certificate of Calibration



### CUSTOMER

Name  
Pacific Laboratory Co., Ltd.  
Address  
14/5358 Moo 14, Tambon Bang Bua Thong,  
Amphoe Bang Bua Thong, Nonthaburi 11110  
Department/ Division/ Vessel  
N/A

UNIT UNDER CALIBRATION (UUC)	Cert. No. SE-CM23SER117
Description Flue gas analyzer	Cal. Date : 10-Mar-23
Manufacturers testo Model 810	Cal. Due : 09-Mar-24
S/N. 42848034	Work Order No. : SE-CM23SER117
Measuring Range	Cal. Temp. : 25.0 ± 1°C
O2 : 0-21 %Vol, CO : 0-4000 PPM	Cal. Humidity : 55.0 ± 10 %RH

### Reference Standard

Description	Cert. No.	Expired Date
- GASCO Nitrogen = 99.99 %Vol	81-0078RK-01	6-May-25
- Linde Mixture Gas in Nitrogen	3278/22	17-Oct-24
Component : CO = 100 PPM, O2 = 18.0 %		

### Function Setup

Items	O2	CO
Low alarm	None	None
High alarm	None	None
Unit	%Vol	PPM

### Test Result

Visual Check	Criteria	Result	Operation Check	Criteria	Result
Structure	Proper	Good	Battery storage	Function	Pass
Indication, Symbol and letter	Proper	Good	Suction pump	Function	Pass
Gas sampling hose & probe	Proper	Good			

### Calibration Result

Parameter	Zero						Span						Respond time Sec.		Judgment	Note:
	Std.	Acc.	Before	Cal.	After	Err.	Std.	Acc.	Before	Cal.	After	Err.	Acc.	Read		
O2 (%Vol)	0.0	± 1.5	0.0	0.0	0.0	0.0	18.0	± 1.0	18.4	18.4	18.4	0.0	≤30	14.0	Pass	~ Respond time must be within 30 sec. to reach to 90% of Std. concentration.
CO (PPM)	0.0	0.0	0.0	0.0	0.0	0.0	100.0	± 5	85.0	85.0	85.0	0.0	≤30	18.0	Pass	

Std. = Standard, Read = Reading, Cal = Calibrate, Acc. = Acceptance, Err. = Error, Sec. = Second

### Comment/ Suggestion :

This UUC that has been tested and calibrated to meet the manufacturer's published specifications in accordance with our quality control system. The standards used for calibration are on record and traceable to the National Institute of Standard and Technology (NIST), and have accuracies equal to or greater than the UUC being tested. This result of calibration was found accurate as shown on date and place of calibration only.

Engineer Signature	Approved Signature

F-CER009-R01-040123 1/1

## SPC Calibration Center



## Certificate of Calibration

Equipment: SPECTROPHOTOMETER  
Model: DR3900  
Serial No. (or ID.): 2076219  
Manufacturer: HACH  
Condition: In Condition

Certificate No.: C06220310  
Issued Date: 18 July 2022  
Job No.: KSPR2207318  
Page: 1 of 2

Customer: PACIFIC LABORATORY CO.,LTD.  
14/5358 Moo 14 Tambon Bang Bua Thong,  
Amphoe Bang Bua Thong, Nonthaburi 11110

Environment Condition: Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.  
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakhnong, Bangkok 10260 Thailand

Calibration By: Miss. Kaewkan Suradech

Calibration Date: 18 July 2022

The Method used: In house method, SPCC-WI-24, base on ASTM E 275-08 and ASTM E 387-04

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

The standard for Wavelength Certificate No. 93907 and 93914

The standard for Photometric Certificate No. 94010

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

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

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

บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT CO., LTD.  
สาขาที่ 00003 1194 โซน Wachirathamsathit 57 ถนนสุขุมวิท 101/1 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
Branch 00003 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangkok, Prakhnong, Bangkok 10260 Thailand  
Tel: 0 2185 4333 Ext: 3300-3308 Fax: 0 2185 4424 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

SPCC-FM-C06-13: 05 Apr 2022

**Calibration Results:**

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.59
537.00	537	0.00	0.59
638.00	638	0.00	0.59
747.61	747	0.61	0.59
807.04	807	0.04	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5816	0.577	0.0046	0.0045
	0.7130	0.709	0.0040	0.0045
	1.0151	1.009	0.0061	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5649	0.560	0.0049	0.0045
	0.7012	0.700	0.0012	0.0045
	0.9982	0.995	0.0032	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5249	0.524	0.0009	0.0045
	0.6621	0.662	0.0001	0.0045
	0.9420	0.940	0.0020	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.519	0.0024	0.0045
	0.6982	0.699	-0.0008	0.0045
	0.9947	0.992	0.0027	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5549	0.552	0.0029	0.0045
	0.7736	0.771	0.0026	0.0045
	1.1041	1.099	0.0051	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.561	0.0011	0.0045
	0.7630	0.762	0.0010	0.0045
	1.0890	1.085	0.0040	0.0045

ภาคผนวกที่ 5-4

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียง

The End of Certificate





ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,

Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280

Tel: +66 2709 4860 Fax: +66 2324 0917



NSC-TISI-TIS 17025  
CALIBRATION 0119

Certificate No.: CP20230151EA  
Operation No.: CP2023030003

### Certificate of Calibration

Equipment: Sound Calibrator  
Manufacturer: TENMARS  
Model/Type: TM-100  
Serial No.: 220501964  
ID No.: -  
Customer: Pacific Laboratory Co., Ltd.  
Address: 14/5358 Moo 14 T. Bang Bua Thong  
A. Bang Bua Thong, Nonthaburi 11110  
Received Date: 3 March 2023  
Calibrated Date: 14 March 2023  
Issued Date: 16 March 2023  
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on 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 Electrical and Electronics Institute, Foundation for Industrial Development.



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230151EA

### Calibration Report

Equipment: Sound Calibrator  
Manufacturer: TENMARS  
Model/Type: TM-100  
Serial No.: 220501964  
ID No.: -  
Ambient Temperature:  $(23 \pm 2) ^\circ\text{C}$   
Relative Humidity:  $(50 \pm 15) \%$   
Pressure:  $(101.3 \pm 1.5) \text{ kPa}$

Method of Calibration :-

IEC 60942:2017

#### Condition of this result of calibration

##### 1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2661000	AA-1020-22	14 June 2023
2) Waveform Generator	33511B	MY52302264	CK20220058EA	19 June 2023
3) Audio Analyzing DMM	2015-P	4079144	E1U221042	16 March 2023
4) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P220024 CD20220164EA	17 March 2023 24 July 2023

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

3. This certification is traceable to the international system of unit maintained at :-

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- Electrical and Electronics Institute; NSC Accredited Calibration No.0119

#### Result of Calibration:-

##### 1. Function : Sound pressure level

Normal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value <sup>[1]</sup> (dB)	Acceptance limit <sup>[3]</sup> (dB)
1000	94	94.25	0.25	$\pm 0.40$
1000	114	114.39	0.39	$\pm 0.40$

##### 2. Function : Frequency

Normal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value <sup>[2]</sup> (%)	Acceptance limit <sup>[3]</sup> (%)
94	1000	970.1	-2.99	$\pm 1.7$
114	1000	967.4	-3.26	$\pm 1.7$



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230151EA

Calibration Report

3. Function : Total distortion + noise

Norminal Sound Pressure level (dB)	Norminal Frequency (Hz)	Measured value <sup>[4]</sup> (%)	Acceptance limit <sup>[5]</sup> (%)
94	1000	1.7	3.0
114	1000	1.4	3.0

Uncertainty of measurement

Function	Uncertainty	Maximum-permitted uncertainty of measurement
Sound pressure level	0.10 dB	0.35 dB
Frequency	0.10 %	0.20 %
Total distortion + noise	0.40 %	1.00 %

Note: [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.  
[2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.  
[3] The acceptance limit is for the deviated value.  
[4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.  
[5] The acceptance limit is for the Measured value.  
Remarks: 1. Acceptance limit was IEC 60942:2017 Class 2.  
2. The coverage factor  $k = 2.00$

-- End of Report --

PCL

PACIFIC  
LABORATORY CO., LTD.

Pacific Laboratory Co., Ltd.  
14/5358 Moo 14 Tambol Bang Bua Thong  
Amphoe Bang Bua Thong, Nonthaburi 11110  
Tel. : 0-2045-2446-7 Fax. : 0-2045-3991

Sound Level Meter Calibration Report

Calibrate No. : SLM 088/2566

Calibrate Date : March 31, 2023

Equipment : Sound Calibrator  
Manufacturer : TENMARS  
Model/Type : TM-100  
Serial No. : 220501964  
Customer Name : บริษัท อู่ทองกรีนพาวเวอร์ จำกัด

Item	Instrument	Manufacturer	Model	Serial No.	Before Adjust	After Adjust	Inspection Result
1.	Sound Level Meter	ACO Co., Ltd.	6226	200044	93.9	94.0	Pass
					114.1	114.0	Pass
2.	Sound Level Meter	ACO Co., Ltd.	6226	200032	94.4	94.0	Pass
					113.7	114.0	Pass
3.	Sound Level Meter	ACO Co., Ltd.	6226	170091	93.6	94.0	Pass
					114.5	114.0	Pass

Approved By





## CERTIFICATE OF CALIBRATION

NO. 20221215051

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820384
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14

Calibrated by:

- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-54570

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.0	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.4	2000	0.1	0.0	0.0
31.5	-39.4	-2.2	0.1	4000	1.3	-0.1	0.0
63	-26.1	-0.8	-0.1	8000	1.2	-0.8	0.0
125	-16.3	-0.2	-0.2	12500	-5.7	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.7	-13.7	0.2
500	-3.2	0.1	0.0	20000	-23.9	-25.8	-0.6

### 6. Self-generated noise

Microphone replaced by electrical input signal device

8.8 dB(A)	8.4 dB(C)	15.9 dB(Z)
-----------	-----------	------------

### 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F&S	-0.1

### 8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB

Max error at 10dB steps upper reference sound level -0.1 dB

Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB

Max error at 10dB steps below reference sound level 0.1 dB

Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

### 9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L <sub>A1max</sub> -L <sub>A</sub>	L <sub>A5max</sub> -L <sub>A</sub>	L <sub>A1</sub> -L <sub>A</sub>	L <sub>Aeq1</sub> -L <sub>A</sub>
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.1	-26.9	-26.9	-7.0
10	-27.2	/	-36.0	-7.0

### 10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	3.5	2.3	2.4	2.3	2.4

11. Overload indication: Pass

### 12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB

Sweep amplitude: 40 dB

Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
LAeq,T	103.2	103.2	0.0
L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

**Environment conditions:**

Air temperature: 20 °C

Relative humidity: 60 %

Static pressure: 101.8 kPa

**References:**

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



**APTITECH CALIBRATION CO., LTD.**

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Tel. +66 2103-6290 Fax. +66 2103-6291  
Email: sales@aptitech-cal.com



## CERTIFICATE OF CALIBRATION

Certificate Number : SC230108

Customer : Pacific Laboratory Co.,Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230108
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222171	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

**Standard Equipments**

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

**Authority of Calibration**

Calibration Date : 27-Feb-2023  
Issued Date : 2-Mar-2023  
Calibrated By : Mr. Sataporn Petnoi

☐ Mr.   
☒ Mr.

Calibration certificates without signatures are not valid. This certificate applied to only the item identified and shall not be reproduced other than in full, without the specific written approval by APTITECH CALIBRATION CO., LTD.





# APTITECH CALIBRATION CO., LTD.

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Email. sales@aptitech-cal.com



## CALIBRATION REPORT

Certificate Number : SC230108

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

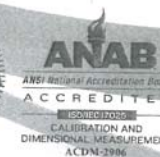
Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230103

Customer : Pacific Laboratory Co., Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230103
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222166	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

### Standard Equipments

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Calibration Date : 27-Feb-2023  
Issued Date : 2-Mar-2023  
Calibrated By : Mr. Sataporn Petnoi

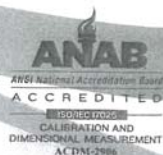
☐ Mr.  
☒ Mr.

Calibration certificates without signatures are not valid. This certificate applied to only the item identified and shall not be reproduced other than in full, without the specific written approval by APTITECH CALIBRATION CO., LTD.



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Email: sales@aptitech-cal.com



## CALIBRATION REPORT

Certificate Number : SC230103

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.9 dB	0.04 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.9 dB	0.04 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230107

Customer : Pacific Laboratory Co., Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230107
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222170	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

### Standard Equipments

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Calibration Date : 27-Feb-2023  
Issued Date : 2-Mar-2023  
Calibrated By : Mr. Sataporn Petnoi



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## CALIBRATION REPORT

Certificate Number : SC230107

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230097

Customer : Pacific Laboratory Co., Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230097
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222133	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

### Standard Equipments

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Approved Signatory

Calibration Date : 27-Feb-2023

Issued Date : 2-Mar-2023

Calibrated By : Mr. Sataporn Petnoi

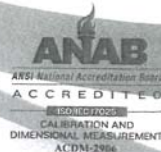
☐ Mr.  
☒ Mr.

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## CALIBRATION REPORT

Certificate Number : SC230097

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.8 dB	-0.07 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.8 dB	-0.06 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230040

Customer : Pacific Laboratory Co., Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230040
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222049	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 13-Jan-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

### Standard Equipments

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Approved Signatory



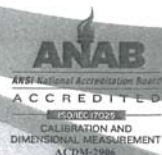
Calibration Date : 15-Jan-2023  
Issued Date : 20-Jan-2023  
Calibrated By : Mr. Sataporn Petnoi

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## CALIBRATION REPORT

Certificate Number : SC230040

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
 Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	94.00 dB	93.8 dB	-0.20 dB	0.60 dB
		114.00 dB	113.8 dB	-0.20 dB	0.60 dB
LC	40-130 dB	94.00 dB	93.8 dB	-0.20 dB	0.60 dB
		114.00 dB	113.8 dB	-0.20 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	94.00 dB	93.7 dB	-0.30 dB	0.60 dB
		114.00 dB	113.7 dB	-0.30 dB	0.60 dB
LC	40-130 dB	94.00 dB	93.8 dB	-0.20 dB	0.60 dB
		114.00 dB	113.7 dB	-0.30 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230038

Customer : Pacific Laboratory Co., Ltd.  
 Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
 Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230038
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222047	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 13-Jan-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor k=2 such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

Standard Equipments				
Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Approved Signatory



Calibration Date : 15-Jan-2023  
 Issued Date : 20-Jan-2023  
 Calibrated By : Mr. Sataporn Petnoi

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## CALIBRATION REPORT

Certificate Number : SC230038

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	( $\pm$ ) Uncertainty
LA	40-130 dB	94.00 dB	93.7 dB	-0.30 dB	0.60 dB
		114.00 dB	113.6 dB	-0.40 dB	0.60 dB
LC	40-130 dB	94.00 dB	93.7 dB	-0.30 dB	0.60 dB
		114.00 dB	113.6 dB	-0.40 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

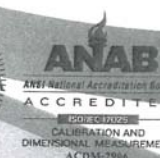
Function	UUC Range	Standard Value	UUC Reading	UUC Error	( $\pm$ ) Uncertainty
LA	40-130 dB	94.00 dB	93.7 dB	-0.30 dB	0.60 dB
		114.00 dB	113.7 dB	-0.30 dB	0.60 dB
LC	40-130 dB	94.00 dB	93.7 dB	-0.30 dB	0.60 dB
		114.00 dB	113.7 dB	-0.30 dB	0.60 dB

--- End of Certificate ---



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## CERTIFICATE OF CALIBRATION

Certificate Number : SC230020

Customer : Pacific Laboratory Co., Ltd.  
Address : 14/5358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,  
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC230020
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 $\pm$ 2 °C
Serial Number	: 222019	Ambient Humidity	: 55 $\pm$ 15 %RH
ID. Number	: N/A	Received Date	: 04-Jan-23

This certifies that the above instrument was calibrated in compliance with the Calibration Systems Requirement of ISO/IEC 17025:2017 in accordance with referenced procedures. Standards used to perform this calibration are certified by or traceable to National Institute of Metrology (Thailand) and/or other recognized national measurement institutes which realizes the units of measurement according to the International System of Units (SI Unit).

Measurement uncertainties at the time of test are given where applicable. They are calculated in accordance with the method described in The Expression of Uncertainty and Confidence in Measurement (M3003).

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor  $k=2$  such that the coverage probability corresponds to approximately 95%. This result of calibration was found accurate as shown on date and place of calibration only.

### Standard Equipments

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20220161EA	TISI: 22-LB0125	13-May-24

### Authority of Calibration

Approved Signatory



Calibration Date : 05-Jan-2023  
Issued Date : 10-Jan-2023  
Calibrated By : Mr. Rattapong Janpanya

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## CALIBRATION REPORT

Certificate Number : SC230020

### Calibration Method

The Unit Under Calibration (UUC) was calibrated by comparison measurement with sound level calibrator. The calibration has been accomplished in an ambient environment controlled, base on the in-house calibration procedure. The identification of the laboratory's calibration procedure employed are CP-7.2-01-107

### Calibration Results

Appearance and function of use : Good  
Results of Calibration : Without any adjustment

### Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

### Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

--- End of Certificate ---

ภาคผนวกที่ 5-5  
เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำ



# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 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. : 65-420108-1

Page : 1 of 2

Submitted by :

Pacific Laboratory Co.,Ltd.

14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment :

pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 700

Range : N/A

pH

Resolution : 0.01 pH

Serial No. : 2841305

ID No. : LAB-PH-002

Electrode

Model : N/A

Serial No. : 3093341

Environment :

On site calibration was carried out at the Laboratory Pacific Laboratory Co.,Ltd.

Ambient Temperature : (25.2 to 25.8) °C

Relative Humidity : (50 to 55) %

Date of Received : 17 December 2022

Date of Calibration : 17 December 2022

Date of Issue : 19 December 2022

Calibrated by : Bunjerd Masri

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

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

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
400005	SG-E-00473/64	27 Aug 2023	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61235182	857394	11 Dec 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61267169	857395	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
10.010	61260481	857396	11 Dec 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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

## Certificate of Calibration

Certificate No. : 65-420108-1

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	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.5	0.0	0.12

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
	6.986	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%

UUC :



CAL-F0031-03



# CAL

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## Certificate of Calibration

**Certificate No. :** 65-400648-1 **Page : 1 of 2**

**Submitted by :** Pacific Laboratory Co., Ltd  
14/5358 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

**Equipment :** Digital Thermometer with Thermistor probe  
Temperature Indicator  
Manufacturer : Eutech Model : pH 700  
Range : N/A °C Resolution : 0.1 °C  
Serial No. : 2841305 ID No. : LAB-PH-002  
Thermistor probe  
Model : N/A Sheath Material : Stainless  
Diameter : 3 mm. Length : 115 mm.  
Serial No. : PHSTEMB01P 049 ID No. : LAB-PH-002

**Environment :** On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd  
Ambient Temperature : (25.2 to 25.8) °C  
Relative Humidity : (50 to 55) %  
Line Voltage : (220.0 to 222.0) VAC

**Date of Received :** 17 December 2022  
**Date of Calibration :** 17 December 2022  
**Date of Issue :** 19 December 2022  
**Calibrated by :** Bunjerd Masri

**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
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400033	22E569	22 Feb 2024	National Institute of Metrology Thailand (NIMT)

Approved by

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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

## Certificate of Calibration

**Certificate No. :** 65-400648-1 **Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Immersion Depth	Standard Reading	UUC Reading	Correction	Uncertainty
( mm. )	( °C )	( °C )	( °C )	( ± °C )
115	25.003	24.9	0.1	0.19

**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%



CAL-F0031-03

# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpoed, 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. : 65-400656-1

Page : 1 of 2

Submitted by :

Pacific Laboratory Co., Ltd.

14/5358 Moo 14, T. Bang Bua Thong,

A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment :

Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : LAB-TG-017

Environment :

Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received :

17 December 2022

Date of Calibration :

20 December to 22 December 2022

Date of Issue :

22 December 2022

Calibrated by :

Chortip Samchusri

Calibration Method :

This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 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
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400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)
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2. Standard Digital Thermometer

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

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpoed, 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. : 65-400656-1

Page : 2 of 2

Result of Calibration :

Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC\* reading 0 °C Standard reading 0.3103 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
4.3008	4	0.3	0.31
30.0078	30	0.0	0.31
40.2272	40	0.2	0.31

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%



CAL-F0031-03



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 FAX. 0-2719-9484

Cert.No.: 23TW28  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : AZ  
Model : 86031  
Serial No. : 1041263  
ID No. : LAB-DO-002  
Received Date : 30 January 2023  
Test Date : 31 January 2023  
Reference : 2301-0980WN-1  
Submitted by : Pacific Laboratory Co.,Ltd.  
14/5358 Moo 14 Tambol Bang Bua Thong,  
Amphoe Bang Bua Thong, Nonthaburi 11110  
Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity (50 ± 20) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithean  
Approved by :   
( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagatrakul  
Issue Date : 2 February 2023



Cert.No.: 23TW28  
Page.: 2 of 2

### Condition of this result of calibration

#### 1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

#### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 10426897

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.14	8.12	0.045

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CALIBRATION AND TESTING EQUIPMENT SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Equipment : Turbidity Meter  
Manufacturer : EZONDO  
Model : TUB-430  
Serial No. : 1000048  
ID. No. : LAB-TB-001  
Condition As-Received: Used Item  
Received Date : 19 October 2022  
Calibration Date : 20 October 2022  
Reference : 2210-0648WN-1  
Submitted by : Pacific Laboratory Co., Ltd.  
14/5358 Moo 14 Tambol Bang Bua Thong,  
Amphoe Bang Bua Thong, Nonthaburi 11110  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 20) %  
Calibration Procedure : In - house method : CP-CH11  
based on direct measurement by  
using Formazin standard solution

Calibrated by : Walalak Sirithean

Approved by :

(✓) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagatrakul

Issue Date : 26 October 2022

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 Calibration and Testing Equipment Services.

Cert.No.: 22CH1439  
Page.: 1 of 2



Cert.No. : 22CH1439

Page. : 2 of 2

### Condition of this calibration result

#### 1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through  
Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023
2) Electronic Balance	B134206712	140RC007	22MM181	22 Feb 2023

#### 2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

### Calibration result

Performing three - Formazin suspension standard curve by using 0,100,800 NTU  
Turbidity Meter Serial Number : 1000048

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
0	0.00	0.0062	2.00
20	20.9	0.39	2.00
100	100.1	0.70	2.11
800	800	2.1	2.13

#### Remark

- UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

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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A 0009902

a 1132045





QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



CERTIFICATE No : 22T8890  
REFERENCE No : 66223-4

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : AQUA LYTIC  
MODEL : TC135S  
SERIAL No : 0614/000033  
ID No : LAB-IB-001  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : PACIFIC LABORATORY CO., LTD.  
14/5358 MOO. 14 TAMBOL BANGBUA THONG  
AMPHOE BANG NUA THONG, NONTABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 01-Aug-22

APPROVED BY :  
ISSUED DATE :  
RECEIVED DATE : 01-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



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CERTIFICATE No : 22T8890

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : AQUA LYTIC  
MODEL : TC135S  
ID No : LAB-IB-001  
RECEIVED DATE : 01-Aug-22  
AMBIENT TEMPERATURE : 26 °C ± 1 °C  
S/N : 0614/000033  
CALIBRATION DATE : 01-Aug-22  
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

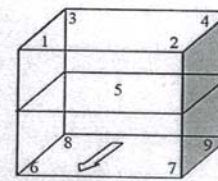
INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7512	05-Jul-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

##### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 7
Overall Line Voltage (V) variation : 10
Instrument Condition : Normal



FRONT

##### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.63	0.48	1.43

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
20.0	20.0	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
		20.07	20.08	20.07	20.07	20.11	20.07	20.01	19.96	19.83	0.91

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT





QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
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www.qcalibration.com



CERTIFICATE No : 22T8889  
REFERENCE No : 66223-3

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UN55  
SERIAL No : B214.1879  
ID No : LAB-OV-001  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : PACIFIC LABORATORY CO., LTD.  
14/5358 MOO. 14 TAMBOL BANGBUA THONG  
AMPHOE BANG NUA THONG, NONTHABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 01-Aug-22

APPROVED BY :  
ISSUED DATE : 02-Aug-22  
RECEIVED DATE : 01-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T8889

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UN55  
ID No : LAB-OV-001  
RECEIVED DATE : 01-Aug-22  
AMBIENT TEMPERATURE : 26 °C ± 1 °C  
S/N : B214.1879  
CALIBRATION DATE : 01-Aug-22  
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

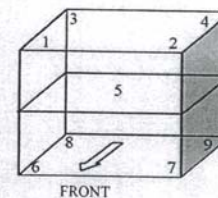
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7903007	22T7512	05-Jul-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0  
Overall Line Voltage (V) variation : 10  
Instrument Condition : Normal  
Chamber Size (W\*L\*H): 40\*33\*40 cm

#### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.41	1.27	1.41
180.0	180.0	0.67	2.27	2.44

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.09	103.96	103.60	103.84	103.93	103.57	103.64	103.15	103.76	0.83
180.0	180.0	179.96	179.74	179.20	179.71	180.02	179.24	179.40	178.55	179.70	1.2

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.  
NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT





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www.qcalibration.com



CERTIFICATE No : 22T8896  
REFERENCE No : 66224-2

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNB22  
SERIAL No : L514.0184  
ID No : LAB-WB-001  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : PACIFIC LABORATORY CO., LTD.  
14/5358 MOO. 14 TAMBOL BANGBUA THONG  
AMPHOE BANG NUA THONG, NONTHABURI 11110

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 01-Aug-22

APPROVED BY :  
ISSUED DATE : 02-Aug-22  
RECEIVED DATE : 01-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02



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235 Petchkasem 63/2 Road, Laksong, Bangkoe, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com

CERTIFICATE No : 22T8896

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : LAB-WB-001  
RECEIVED DATE : 01-Aug-22  
AMBIENT TEMPERATURE : 29 °C ± 1 °C  
MODEL : WNB22  
SERIAL NUMBER : L514.0184  
CALIBRATION DATE : 01-Aug-22  
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

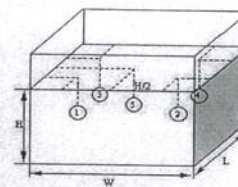
#### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Jul-23

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT



PROBE INSTALLATION  
POSITION IN THE BATH

#### GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 1.5
Overall Variation of Line Voltage (V) : 11
Instrument Condition : Normal

#### BATH PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
85.0	85.0	0.16	0.12	0.33
95.0	95.0	0.17	0.09	0.35

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
85.0	85.0	84.71	84.72	84.66	84.70	84.77	0.23
95.0	95.0	94.71	94.71	94.72	94.66	94.75	0.24

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



Hanna Instruments (Thailand) Ltd.

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

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

Certificate No. : HIT-2208-0177

Page : 1 of 3

## CERTIFICATE OF CALIBRATION

**Equipment :** COD Test Tube Heater  
**Meter Model :** HI839800-02 **Serial No. :** 04500100101  
**Manufacturer :** Hanna Instruments  
**Made in :** Romania  
**Condition As-Received :** Used Product  
**Reference :** RE220215  
**Customer name :** Pacific Laboratory Co., Ltd.  
14/5358 Moo. 14, Tambol Bang Bua Thong,  
Amphoe Bang Bua Thong, Nonthaburi 11110  
**Received date :** 18 February 2022  
**Calibrate date :** 25 February 2022  
**Issue date :** 28 February 2022  
**Ambient Temperature :** ( 25 ± 2 ) °C  
**Relative Humidity :** ( 50 ± 15 ) % RH  
**Calibrated Location :** Hanna Instruments (Thailand) Ltd.

Calibrated by :

Calibration Engineer

Approved by :

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

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approval of the head of Hanna Instrument (Thailand)



Certificate No. : HIT-2208-0177

Page : 2 of 3

### Condition of this result of calibration

#### Reference Standard Instruments :

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

#### Reference / Procedure :

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

This temperature scale used was based on ITS-90

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

#### SITE CALIBRATION

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

**Result of Calibration :**

Calibration Point	Unit Under Calibration Setting	Unit Under Calibration Reading	Temperature Stability	Uncertainty of Measurement
150.0 (°C)	150.8 (°C)	150.6 (°C)	1.6 (°C)	± 0.48 (°C)

Calibration Point (°C)	Average Standard Reading (°C)				
	Position				
150.0	1	2	3	4	5
	150.0	150.9	151.0	151.0	149.9
	6	7	8	9	10
	150.1	151.0	151.2	150.9	150.8
	11	12	13	14	15
	150.0	151.2	151.4	150.8	150.7
	16	17	18	19	20
	150.1	150.9	151.1	150.8	150.3
	21	22	23	24	25
	149.8	150.6	151.0	150.9	149.8

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

\*\* End of certificate \*\*



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

Cert. No.: 23LM28

Page.: 1 of 3

## Certificate of Calibration

Equipment : COD Tester

Manufacturer : Hanna

Model : HI839800-02

Serial No. : 04500100101

ID No. : LAB-CD-002

Submitted by : Pacific Laboratory Co.,Ltd.  
14/5358 Moo 14 Tambol Bang Bua Thong,  
Amphoe Bang Bua Thong,  
Nonthaburi 11110

Location : TPA Calibration Lab.

Received Order : 16 February 2023

Calibration Date : 2 March 2023

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :

( ) Pornthippa Tameyakul  
(✓) Malee Butkruea  
( ) Suwit Imjai

Issue Date : 9 March 2023

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 Calibration and Testing Equipment Services.





Equipment : COD Tester  
 Condition As-Received : Used Item  
 Reference : 2302-0617WN-1  
 Procedure Used :-

Cert. No.: 23LM28  
 Page.: 2 of 3

As agreed with customer the calibration was perform using in-house calibration method according to directed measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

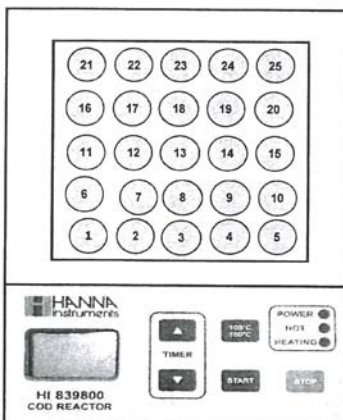
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Alumina (Aluminium Hydroxide)



Top View

Environment during calibration		
	Beginning	End
Temp.(°C)	25	24
REL.Humi.(%)	50	51
AC Supply (Volt)	220	221

Position :	21	22	23	24	25
Ref. Std./ID No.:	20-01TC-01	20-01TC-02	20-01TC-03	20-01TC-04	20-01TC-05
Position :	16	17	18	19	20
Ref. Std./ID No.:	20-01TC-06	20-01TC-07	20-01TC-08	20-01TC-09	20-01TC-10
Position :	11	12	13	14	15
Ref. Std./ID No.:	20-01TC-01	20-01TC-02	20-01TC-03	20-01TC-04	20-01TC-05
Position :	6	7	8	9	10
Ref. Std./ID No.:	20-01TC-06	20-01TC-07	20-01TC-08	20-01TC-09	20-01TC-10
Position :	1	2	3	4	5
Ref. Std./ID No.:	20-01TC-01	20-01TC-02	20-01TC-03	20-01TC-04	20-01TC-05



Equipment : COD Tester  
 Condition As-Received : Used Item  
 Reference : 2302-0617WN-1  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Calibration Point : 150.0 °C

Cert. No.: 23LM28  
 Page.: 3 of 3

UUC* Setting (°C)	UUC* Reading (°C)	Measured Temperature (°C)					Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
		Position							
150.0	150.0	21	22	23	24	25	0.29	1.1	2
		149.730	149.845	149.279	150.508	149.119			
		16	17	18	19	20			
		150.048	150.313	151.045	150.224	149.083			
		11	12	13	14	15			
		150.084	149.769	151.078	150.483	149.028			
		6	7	8	9	10			
		149.912	150.324	150.448	151.155	149.947			
		1	2	3	4	5			
		150.101	149.921	149.923	150.488	149.366			

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.

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-



Calibrate No. : CP174/2566  
Calibrate Date : March 31, 2023

Equipment Type : Personal Pump  
Calibration Type : DRYCAL DC-LITE FLOWMETER  
Volume for Calibration : 2.0, 2.5 l/min  
Environment Conditions : 29.0 Deg C.  
Environment Pressure : 758.0 mmHg.  
Customer Name : บริษัท อู่ทองกรีนฟาวเวอร์ จำกัด

[illegible]

Calibration By

## Technician



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-66/0141

MTC.No.23-66/0141

Number of page(s) 2

## CALIBRATION CERTIFICATE

**Nomenclature : DRYCAL DC-LITE FLOWMETER**

Manufacturer : BIOS International Corporation, USA.

Serial No.: 104699

Model : DCL-M, Rev 1.09

Scale range : 100 ml/min to 7 l/min

Subdivision : ( 0.0001, 0.001 ) l/min

**Submitted by : PACIFIC LABORATORY CO.,LTD.**

14/5358 Moo14, T.Bang Bua Thong, A.Bang Bua Thong,

Nonthaburi 11110, Thailand.

**Received date : 23 December 2022 Condition of measured item : Normal**

**Calibration date : 5 January 2023**

**Standard :**

Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 643/65	1-Jun-24	TISTR
Molbox/Pressure Transducer/UpStream	MP-0013-21	25-Jan-23	NIMT
Primary Flow Calibrator S/N 117982	MW-0011-21	8-Apr-23	NIMT
Primary Flow Calibrator S/N 119521	MW-0012-21	31-Mar-23	NIMT

**Calibrated by**

**Approved**

**Director**

**Mechanical Engineering Standards Laboratory**

Ref. 2013265122305450001

**Issued Date 5 January 2023**

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E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-66/0141

**2/2**

MTC.No.23-66/0141

**Calibration point : (0.05, 0.1, 0.2, 1.0, 2.0, 3.0 ) l/min**

**Ambient condition : Temperature ( 23 ± 3 ) °C , Relative humidity ( 55 ± 15 ) %**

Atmospheric pressure ( 1010±13) hPa

**Calibration method :** The flowmeter (UUC) was calibrated by comparison method with  
standard flowmeter according to CP-370.01.

The reported value is the value that converted to value at reference condition  
within pressure and temperature of the actual gas entering the UUC

**Measurement data :**

UUC Value (l/min)	Standard Value (l/min)	Temperature (°C)	Pressure (hPa)	Deviation (%)	Uncertainty (%)
0.0532	0.052339	22.933	1012.22	+1.58	1.05
0.1007	0.99507	22.940	1012.27	+1.20	1.00
0.2027	0.20121	22.989	1012.39	+0.76	0.98
1.013	1.0068	22.977	1012.93	+0.62	0.86
2.008	2.0000	22.955	1013.60	+0.42	0.85
3.010	2.9971	22.949	1014.31	+0.42	0.85

The reported expanded uncertainties are based on standard uncertainties multiplied by  
a coverage factor  $k=2$ , which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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235 Petchkasem 63/2 Road, Laksong, Bangkoe, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



CERTIFICATE No : 22M8888  
REFERENCE No : 66223-2

PAGE : 1 OF 2

### Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SHIMADZU  
MODEL : AF225WD  
SERIAL No : D316301828  
ID No : LAB-BL-003  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : PACIFIC LABORATORY CO., LTD.  
14/5358 MOO. 14 TAMBOL BANGBUA THONG  
AMPHOE BANG NUA THONG, NONTHABURI  
11110

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 01-Aug-22  
APPROVED BY :  
ISSUED DATE : 02-Aug-22  
RECEIVED DATE : 01-Aug-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
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F-G010 REV 02



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www.qcalibration.com

CERTIFICATE No : 22M8888

PAGE : 2 OF 2

### Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SHIMADZU  
ID No : LAB-BL-003  
AIR PRESSURE : 1005mbar  $\pm$  1mbar  
AMBIENT TEMPERATURE : 25° C  $\pm$  1° C  
MODEL : AF225WD  
S/N : D316301828  
RECEIVED DATE : 01-Aug-22  
CALIBRATION DATE : 01-Aug-22  
RELATIVE HUMIDITY : 56 %RH  $\pm$  10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-1-349	M2103235S	26-Mar-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

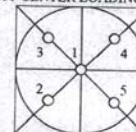
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

#### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000045 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.000	0.0000	0.0000	0.000075
0.001	0.0010	0.0000	0.000075
0.010	0.0100	0.0000	0.000075
0.050	0.0500	0.0000	0.000076
0.100	0.1000	0.0000	0.000075
1.000	1.0000	0.0000	0.000077
2.000	2.0000	0.0000	0.000077
5.000	5.0000	0.0000	0.000079
20.000	20.0000	0.0000	0.000086
50.000	50.0000	0.0000	0.00011
100.000	100.0001	-0.0001	0.00019
150.000	150.0001	-0.0001	0.00026
200.000	200.0000	0.0000	0.00032

#### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY  
COVERAGE FACTOR  $k=2$ , PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



ภาคผนวกที่ 5-7  
เอกสารสอบเทียบเครื่องมือตรวจวัดสภาพความร้อน



Request No. 22-66 / 0307

MTC No. PSL-H 0137 / 66

## Certificate of Calibration

Customer : Envilab Co.,Ltd.  
540, 540/1 Soi Bangkhac7, Bangkhac, Bangkok, 10160  
Item : Thermo-Hygrometer (Area Heat Stress Monitor)  
Model /Type : hs-32  
Serial Number : MCF070018  
Manufacturer : METROSONICS  
Date of Request : 6 February 2023  
Date of Calibration : 2 March 2023

The certifies the above equipment was calibrated in accordance with the recognised International Standard ISO/IEC 17025:2017 and the operation according to procedure no. WICP.18.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95 %.

Cal

(Ms. Panit Thummasri)

Approved

(Asst. Rajinai Singnapiwat)  
Director

Photometry and Temperature Standards Laboratory

Ref. No : 2012266020600526007

Issued Date : 8 March 2023

Page 1 of 4

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Request No. 22-66 / 0307

MTC No. PSL-H 0137 / 66

**Description of Unit Under Calibration :**

Customer : Envilab Co.,Ltd.  
Address : 540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok, 10160  
Item : Thermo-Hygrometer (Area Heat Stress Monitor)  
Serial Number : MCF070018  
Calibration Required : Temperature at (20, 30, 40) °C  
Ambient Condition : Ambient temperature (23 ± 3) °C  
Relative humidity (55 ± 20) %  
Laboratory Address : Photometry and Temperature Standards Laboratory  
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

**Reference Standard :**

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 0786/65.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

**Calibration Procedure :**

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

**Support Equipment :**

Temperature & Humidity Controlled Chamber, Model : 9141-5110, S/N : 1205101

Adjustments : NONE

Page 2 of 4

P.T.

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Request No. 22-66 / 0307

MTC No. PSL-H 0137 / 66

Results of Calibration :- ( / ) Without Adjustment ( ) After Adjustment

**Table : Temperature Measurement @ Wet Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.2	-0.3	0.50
30.1	30.0	0.1	0.50
40.1	39.9	0.2	0.50

**Table : Temperature Measurement @ Dry Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.50
30.1	30.0	0.1	0.50
40.1	39.9	0.2	0.50

Page 3 of 4

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FM.BL.MTC.002 Rev.4



Request No. 22-66 / 0307

MTC No. PSL-H 0137 / 66

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.3	-0.4	0.50
30.1	30.0	0.1	0.50
40.1	39.7	0.4	0.50

- Note :
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
  2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...

Page 4 of 4

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E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



Request No. 22-66 / 0307

MTC No. PSL-H 0138 / 66

## Certificate of Calibration

Customer : Envilab Co.,Ltd.  
540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok, 10160  
Item : Thermo-Hygrometer (Area Heat Stress Monitor)  
Model /Type : hs-32  
Serial Number : MCF070019  
Manufacturer : METROSONICS  
Date of Request : 6 February 2023  
Date of Calibration : 2 March 2023

The certifies the above equipment was calibrated in accordance with the recognised International Standard ISO/IEC 17025:2017 and the operation according to procedure no. WI.CP.18.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2$ , which for a normal distribution corresponds to a coverage probability of approximately 95 %.

Calit

Appro

Director  
Photometry and Temperature Standards Laboratory

Ref. No : 2012266020600526008

Issued Date : 8 March 2023

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FM.BLMTC.002 Rev.4



Request No. 22-66 / 0307

MTC No. PSL-H 0138 / 66

**Description of Unit Under Calibration :**

Customer : Envilab Co.,Ltd.  
Address : 540, 540/1 Soi Bangkhae7, Bangkhae, Bangkok, 10160  
Item : Thermo-Hygrometer (Area Heat Stress Monitor)  
Serial Number : MCF070019  
Calibration Required : Temperature at (20, 30, 40) °C  
Ambient Condition : Ambient temperature (23 ± 3) °C  
Relative humidity (55 ± 20) %  
Laboratory Address : Photometry and Temperature Standards Laboratory  
Soi 1, Bangpoo Industrial Estate, Sukhumvit Rd., Samutprakan

**Reference Standard :**

Digital Thermometer with Sensor, Model : F250H, S/N : 9345 008 2331, Sensor RTD Probe No. RTD-01 and RTD-02 which was calibrated by Industrial Metrology and Testing Service Centre, Certificate No. PSL-T 0786/65.

The temperature scale in use of this laboratory is the International Temperature Scale of 1990.

**Calibration Procedure :**

The certifies the above equipment was calibrated according to procedure no. WI.CP.18.

**Support Equipment :**

Temperature & Humidity Controlled Chamber, Model : 9141-5110, S/N : 1205101

Adjustments : NONE

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P.T.

The results relate only to the items tested/calibrated or value assigned.  
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MTC No. PSL-H 0138 / 66

Results of Calibration :- ( / ) Without Adjustment ( ) After Adjustment

**Table : Temperature Measurement @ Wet Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.52
30.1	30.1	0.0	0.50
40.1	40.0	0.1	0.50

**Table : Temperature Measurement @ Dry Bulb**

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.0	-0.1	0.52
30.1	30.1	0.0	0.50
40.1	39.9	0.2	0.50

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MTC No. PSL-H 0138 / 66

Results of Calibration :-

Table : Temperature Measurement @ Globe Bulb

Average Measured Temperature (°C)	Average Displayed of UUC (°C)	Correction Measured of UUC (°C)	Expanded Uncertainty of Measurement (± °C)
19.9	20.1	-0.2	0.50
30.1	30.1	0.0	0.50
40.1	39.8	0.3	0.50

- Note :
1. This calibration was done without removing reservoir cover, white plates and blackened copper sphere of the instrument.
  2. The calibration data for instrument in this report is reported within the condition existing at the time of measurement only.

...end of certificate...