

ภาคผนวกที่ 5-1
เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ
ในบรรยากาศโดยทั่วไป

J NAC
JIRANATHE ASSOCIATES CO., LTD.
63/14-15, 6/735-36
Petchkasem 7/71, Rd Wachapha, Bangkokya,
Bangkok 10600 (Thailand)
Tel : +6608860812
Mobile : +66853399453
E-mail : jnac-calibration@jiranatee.com
Web site : www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TIS-TIS 17025
CALIBRATION 0367
Flow measurement laboratory
Calibration service department.



NSC-TIS-TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

Certificate No. : CO-006-66

MEASUREMENT ITEM
MANUFACTURER : Top Load Office
MODEL/TYPE : TISCH
SERIAL NUMBER : TE-5025A
ID NUMBER : 710725
CONDITION AS-RECEIVED :
CUSTOMER : Used Item
Pacific Laboratory Co., Ltd.
14/5358 Moo14, T.Bang Bua Thong, A.Bang Bua Thong,
Nonthaburi 11110, Thailand.

RECEIVED DATE : 08 Jun 2023
MEASUREMENT DATE : 13 Jun 2023
ISSUE DATE : 13 Jun 2023

ENVIRONMENTAL CONDITIONS:
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION:
Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 24.3 °C and 57.1%RH.

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibrated by:
☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory: 
Mr. Panya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Rods Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (78.8 °F) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _{in}] °C	Temperature [T _{out}] °C	Δp_meter mmHg	Δp_Orifice mmHg	γ	Standard Flow [Q _s] m ³ /min
1	0.706	755.735	24.45	23.61	50.097	1.703	1.302	0.659
2	0.998	755.793	24.22	23.66	63.145	3.306	1.816	0.914
3	1.119	755.870	24.25	23.69	43.259	4.386	2.091	1.054
4	1.167	755.926	24.11	23.44	32.309	4.937	2.219	1.117
5	1.409	755.921	24.03	23.51	29.079	7.321	2.703	1.354

Slope (m): 2.01034

Intercept (b): -0.02337

Correlation coefficient (r): 0.99984

Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _{in}] °C	Temperature [T _{out}] °C	Δp_meter mmHg	Δp_Orifice mmHg	γ	Standard Flow [Q _s] m ³ /min
1	0.706	755.735	24.45	23.61	50.097	1.703	0.819	0.661
2	0.998	755.793	24.22	23.66	63.145	3.306	1.141	0.916
3	1.119	755.870	24.25	23.69	43.259	4.386	1.314	1.057
4	1.167	755.926	24.11	23.44	32.309	4.937	1.393	1.120
5	1.409	755.921	24.03	23.51	29.079	7.321	1.697	1.357

Slope (m): 1.25919

Intercept (b): -0.01871

Correlation coefficient (r): 0.99983

Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration



บริษัท เอ็นวีแอร์ เซอร์วิส จำกัด

43 ถนนสุขุมวิท 14 แขวง 9 เขตปทุมธานี กรุงเทพมหานคร 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9435201
บริษัท เอ็นวีแอร์ เซอร์วิส จำกัด
ENVIA SERVICE CO., LTD., 42 Ramkhamhaeng 14 yoke 9, Tha Rang Bangkok, Bangkok 10230 Tel: 02-9435814-5 Fax: 02-9435201

Analyzer Performance Test

Calibrated Date: 11 Aug 2023

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer: Thermo Environmental S/N: 43C-65967-350
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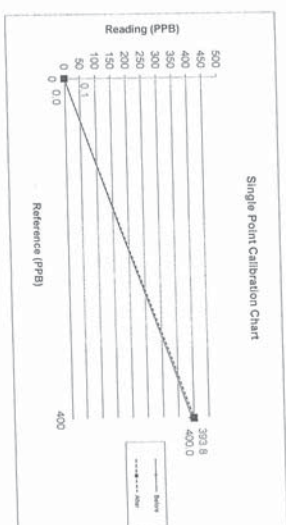
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705	NO Conc 46.05 PPM SO2 Conc 46.01 PPM CO Conc 4.487 PPM
ZERO AIR Generator API MODEL 701 S/N: 1924	Expire Date: 19 Sep 2020

Environment: Temperature 25.5 °C Humidity: 51 %RH

Calibration Report

Status	Reference (ppb)	Zero Reading (ppb)	Drift (ppb)	Reference (ppb)	Span Reading (ppb)	Drift%
Before	0.0	0.1	0.1	400.0	393.8	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By:
Mr. PASAGORN SAMOL



ENVIRO SERVICE CO., LTD.
42 Ramitrin 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.enviro-service.co.th

Analyzer Performance Test

Calibrated Date: 21 March 2023

Instruments Information

Analyzer Type: SO₂ Analyzer
Model: 43C

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

Calibrator Unit

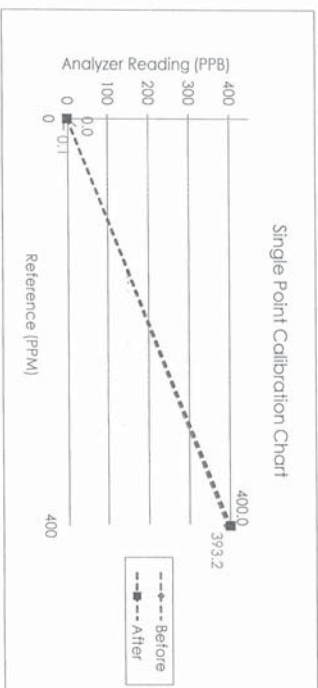
Dilutor Model: Dasibi Model 5008
Serial Number: 705
ZERO AIR Generator: API MODEL 701
Serial Number: 1924
Standard Gas Concentration
Nitric Oxide (NO): 55.47 PPM
Sulphur Dioxide (SO₂): 55.11 PPM
Carbon Monoxide (CO): 4.535 PPM
Cylinder number: EB0129027
Expire Date: 29 Oct. 2027

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

Single Point Calibration Chart



Calibrate By:

MR. KITTISAK JANSANGWATANA

Approve by:

MR. PASAGORN SAMOL



ENVIRO SERVICE CO., LTD.
42 Ramitrin 14 Yeak 9, Tha Raeng, Bang Khen, Bangkok 10230
Tel. 02-9435814-5 Fax. 02-9438201 www.enviro-service.co.th

Analyzer Performance Test

Calibrated Date: 21 March 2023

Instruments Information

Analyzer Type: SO₂ Analyzer
Model: 43C

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

Calibrator Unit

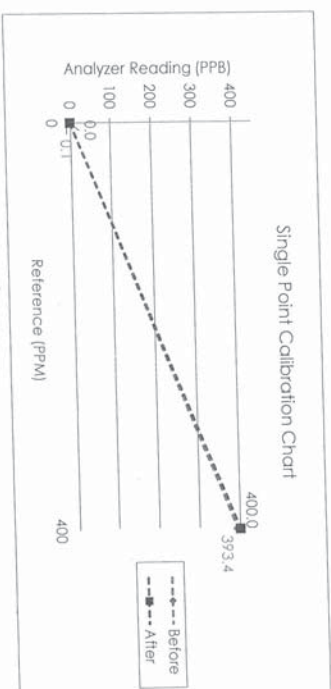
Dilutor Model: Dasibi Model 5008
Serial Number: 705
ZERO AIR Generator: API MODEL 701
Serial Number: 1924
Standard Gas Concentration
Nitric Oxide (NO): 55.47 PPM
Sulphur Dioxide (SO₂): 55.11 PPM
Carbon Monoxide (CO): 4.535 PPM
Cylinder number: EB0129027
Expire Date: 29 Oct. 2027

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

Single Point Calibration Chart



Calibrate By:

MR. KITTISAK JANSANGWATANA

Approve by:

MR. PASAGORN SAMOL

32751 ถนนประชาอุทิศ แขวงทุ่งครุ เขตทุ่งครุ กรุงเทพมหานคร 10140

โทร. 0-2873-6045-6 โทรสาร 0-2873-6046

ห้องปฏิบัติการวิเคราะห์นอกชนไปเมื่อวันที่ 22 สิงหาคม 2566

CALIBRATION REPORT

Equipment : SO₂ Analyzer
Serial No. : 1626

Brand/Model: Teledyne-API/T100
Date of Calibrate : January 8, 2024

Reference Standard

Cylinder No.: EB0128767

Certification Date: October 29, 2019

Expiry Date: October 29, 2027

Component: SO₂: 55.62 ppm, NO: 57.21 ppm, CO: 4.551 ppm

CO: 4,551 ppm

Calibration Check (Before adjust)						
Serial No.	Reading Value (ppb)	Zero		Span		
		Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)
1626	0.2	0	0.2	400.8	400	0.8

Calibration Check (After adjust)						
Serial No.	Reading Value (ppb)	Zero		Span		
		Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)
1626	0	0	0	400	400	0

ในภาพเบื้องบนเป็นภาพการทํางานร่วมกันของนักคิด บิดาของเมืองไทย CONSULTANT
limited partnership

นาง อรุณรัตน์
(นางสาวนิศา อมัตต์สุวรรณ์ชัย)
ผู้จัดการกองปฏิบัติการ



บริษัท เจริญรุ่งเรือง จำกัด

02-9435814-5 02-943820

42 Ramintra 14 yank 9, Tha Rang, Bangkok, Bangkok 10250 Tel.: 02-9455814-5 Fax.: 02-9458250
Uthairatthakul Import-Export
EXPORT SERVICE CO., LTD.

Analyzer Performance Test

Calibrated Date: 11 August 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer
Model: 42C

Manufacturer Thermo Environmental
S/N: 42C-69273-362

Calibration System

Calibration System		Standard Gas
Calibrator Unit		
Dilutor Model	Dastib Model 5008	
S/N:	705	NO Conc 46.05 PPM
		SO ₂ Conc 46.01 PPM
ZERO AIR Generator API Model	701	CO Conc 4.487 PPM
S/N:	1924	Expiry Date: 19 Sep 2020

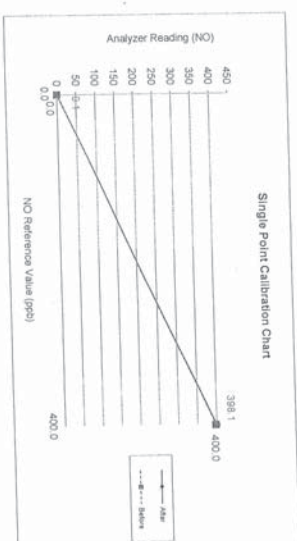
Environment: Temperature 25.5 °C Humidity 51 %RH

Check (Before adjust)

GAS	Zero		Span		Drifts
	Reading Value (ppb)	Expected Value (ppb)	Reading Value (ppb)	Expected Value (ppb)	
NO	0.1	0.0	398.1	400.0	-0.5
NOx	0.1	0.0	400.0	400.0	0.0

Calibration Check (After adjust)

Gas	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drifts
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 : Mr. Pasagorn Samol

บริษัท เอ็นวีอาร์ เซอร์วิส จำกัด

Analyzer Performance Test

Calibrated Date: 11 August 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer	Manufacturer: Thermo Environmental
Model: 42C	S/N: 42C-63476-339

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dastbi Model 5008	NO Conc 48.05 PPM
S/N: 705	SO2 Conc 46.01 PPM
ZERO AIR Generator API Model 701	CO Conc 4.487 PPM
S/N: 1924	Expire Date: 19 Sep 2020

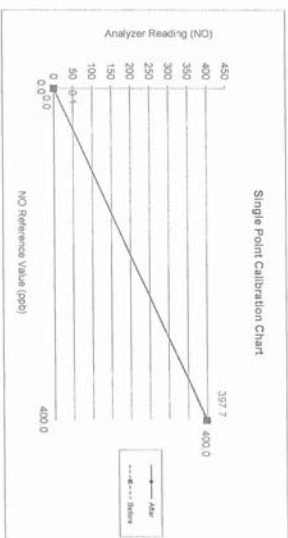
Environment: Temperature 25.5 °C Humidity 51 %RH

Calibration Check (Before adjust)

Zero			Span		
Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	397.7	400.0	-0.6
NOx	0.1	0.0	400.0	400.0	0.0

Calibration Check (After adjust)

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



Calibrate By: Mr. Pasagon Samol

บริษัท เอ็นวีอาร์ เซอร์วิส จำกัด

Analyzer Performance Test

Calibrated Date: 11 August 2023

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer	Manufacturer: Thermo Environmental
Model: 42C	S/N: 65850-350

Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dastbi Model 5008	NO Conc 48.05 PPM
S/N: 705	SO2 Conc 46.01 PPM
ZERO AIR Generator API Model 701	CO Conc 4.487 PPM
S/N: 1924	Expire Date: 19 Sep 2020

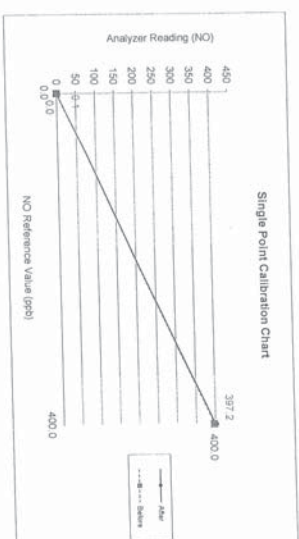
Environment: Temperature 25.5 °C Humidity 51 %RH

Calibration Check (Before adjust)

Zero			Span		
Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	397.2	400.0	-0.7
NOx	0.1	0.0	400.0	400.0	0.0

Calibration Check (After adjust)

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



Calibrate By: Mr. Pasagon Samol

ห้างหุ้นส่วนจำกัด บลู คอนซัลแตนท์ Blue Consultant Limited Partnership

32751 ถนนประชาอุทิศ แขวงทุ่งครุ เขตทุ่งครุ กรุงเทพฯ 10140

โทร 0-2873-6045-6 โทรสาร 0-2873-6046

ห้องปฏิบัติการวิเคราะห์เอกสารมีใบอนุญาตลงวันที่ 22 สิงหาคม 2566

CALIBRATION REPORT

Equipment: NOx Analyzer Brand/Model: Teledyne-API/T200
Serial No.: 374 Date of Calibration: February 14, 2024

Reference Standard Cylinder No.: EB0128767
Certification Date: October 29, 2019 Expiry Date: October 29, 2027
Component: SO2: 55.62 ppm, NO: 57.21 ppm, CO: 4.551 ppm

Calibration Check (Before adjust)						
Serial No.	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)

374	NO/NO2/NOx	0/0/0	4.6/2.3/6.9	NO/NO2/NOx	398.9/4.2/403.1	400/0/400	-1.1/4.2/3.1
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Calibration Check (After adjust)

Serial No.	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift Value (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift Value (ppb)
374	NO/NO2/NOx 0/0/0	NO/NO2/NOx 0/0/0	NO/NO2/NOx 0/0/0	NO/NO2/NOx 400/0/400	NO/NO2/NOx 400/0/400	NO/NO2/NOx 0/0/0

นางสาวนิศา อัมมสุวรรณชัย
BLUE CONSULTANT
Limited Partnership

นางสาวนิศา อัมมสุวรรณชัย
(นางสาวนิศา อัมมสุวรรณชัย)
ผู้ดำเนินการห้องปฏิบัติการ

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 : 7 February, 2024 Certification No. 075/24
Page : 1 of 6

Object : Precision Weather Station
Manufacturer : Davis Instruments
Mode No. : 6152C Model No. : 6152C
Mfg Code : Display BD181211032 Transmitter BD181211032
Customer : Blue Consultant Limited Partnership,
32/751 Pracha Uthit Road, Thung Khru,
Thung Khru, Bangkok 10140.
Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Afloat Plotting Board

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94, Wet No. 8389/94
: Thermoschneider No.9188 : testo 645 Serial No. 02848057

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V2200415
Calibrated by : *Nithapong* Signed : *Mr. Pisedol Promsut*
Mr. Wacharapol Subwat
Mechanical Engineer



THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469
The Result of Calibration

7 February, 2024 Certification No. 075/24
Page : 2 of 6

Standard	HOOK GAGE NO. 1425		TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Correction
Ultrasonic Anemometer	mb/sec	mb/sec	mb/sec	mb/sec
1.00	-	-	0.9	0.10
3.02	-	-	2.7	0.32
5.00	-	-	4.9	0.10
7.00	-	-	6.7	0.30
9.02	-	-	9.0	0.02
11.01	-	-	10.9	0.11
13.01	-	-	13.0	0.01
15.01	-	-	15.0	0.01
17.02	-	-	17.0	0.02
20.02	-	-	20.0	0.02

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

Calibrated by : *Nithapong*
Mr. Wacharapol Subwat
Mechanical Engineer





The Result of Calibration

7 February, 2024

Certification No. 075/24

Page : 3 of 6

Standard Barometer Pressure	Tested Barometer Pressure	Correction
758.19	759.5	-1.31
758.01	759.4	-1.39
758.84	760.2	-1.36
758.19	760.4	-1.21
759.29	760.6	-1.31
759.25	760.6	-1.35
759.65	760.9	-1.25
759.77	761.0	-1.23
760.20	761.5	-1.30
760.68	761.8	-1.12
761.90	763.2	-1.30
762.08	763.3	-1.22
761.96	763.2	-1.24
761.83	763.1	-1.27
758.69	760.1	-1.41
758.91	760.3	-1.39
759.11	760.5	-1.39
759.67	760.9	-1.23
759.98	761.2	-1.22
760.18	761.3	-1.12
Average		-1.28

Calibrated by :

Wachanapol Subwat

Mr. Wachanapol Subwat

Mechanical Engineer



The Result of Calibration

7 February, 2024

Certification No. 075/24

Page : 4 of 6

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.3	45.3	0.0
30.2	30.2	0.0
15.8	15.9	-0.1

Calibrated by :

Wachanapol Subwat

Mr. Wachanapol Subwat

Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

7 February, 2024

Certification No. 07524

Page : 5 of 6

Standard Humidity % R.H.	Relative Humidity Sensor Reading	
	Reading % R.H.	Correction % R.H.
45.1	47	-1.90
65.5	67	-1.50
95.2	96	-0.80

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



Date of Issue 7 February, 2024

Certification No. 07524

Page: 6 of 6

ใบรับรอง

หนังสือฉบับนี้ขอรับรองว่า เครื่องวัดฝน ยี่ห้อ Davis Instruments แบบ TIPPING BUCKET Product No. 6152C Mfg. Code. AZ170619040 ทำการสอบเทียบกับแก้ววัดฝนแบบ แก้ววัดวง GAUGE DIAMETER 8.0 INCHES, NEGRETTI & ZAMBRA LONDON No. 71082 และสามารถนำไปใช้ได้เป็นค่าถูกต้องตามรายละเอียดของเครื่องมือ (0.01 in./TIP)



ลงชื่อ..... วัช วัช-วัช

(นายวัชรพล ทรัพย์สิน)

วิศวกรชำนาญการ

เอกสารประกอบพิธีการขอขึ้นทะเบียน
เครื่องวัดปริมาณสารติดไฟ
ภาคผนวกที่ 5-3

Enviro-Service Co., Ltd.
EES

Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tambon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E24-010009
Page: 1 of 6

CERTIFICATE OF CALIBRATION

Customer : Pacific Laboratory Co., Ltd.
Address : 14/5358 Moo 14, Tambon Bang Bua Thong, Amphoe Bang Bua Thong, Nonthaburi 11110
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-OV
Serial Number : 1306033
ID/Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 08/01/2024
Issue Date : 08/01/2024

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

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Fuchin)
Technical Manager



Enviro-Service Co., Ltd.
EES

Certificate No. : E24-010009
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	08/01/2024	10:45 AM	Std Temp	293	K
Console Serial Number	1306033	Calibration Reference No.	SER24-010002			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	761.24			K1	0.386	
DGM Serial Number	00009149	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Metering Console					Calibration Meter				
Run Time	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(Pa)	(V _{in})	(V _{out})	(t _{in})	(t _{out})	(V _{wi})	(V _{wf})	(t _{in})	(t _{out})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.60	13.0	414.8650	415.0050	26	26	189.02242	189.16326	26	26
12.60	13.0	415.0050	415.1450	26	26	189.16326	189.30454	26	26
8.58	26.0	415.1530	415.2930	26	26	189.30622	189.44564	26	26
8.58	26.0	415.2930	415.4330	27	27	189.44564	189.58478	26	26
13.95	40.0	415.4410	415.7210	27	27	189.59760	189.87728	26	26
13.95	40.0	415.7210	416.0010	27	27	189.87728	190.15784	26	26
10.38	70.0	416.0120	416.2920	27	27	190.16956	190.44818	25	25
10.38	70.0	416.2920	416.5720	27	27	190.44818	190.72676	25	25
9.10	90.0	416.5860	416.8660	27	27	190.73910	191.01656	25	25
9.10	90.0	416.8660	417.1460	27	27	191.01656	191.29332	25	25



**METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT**

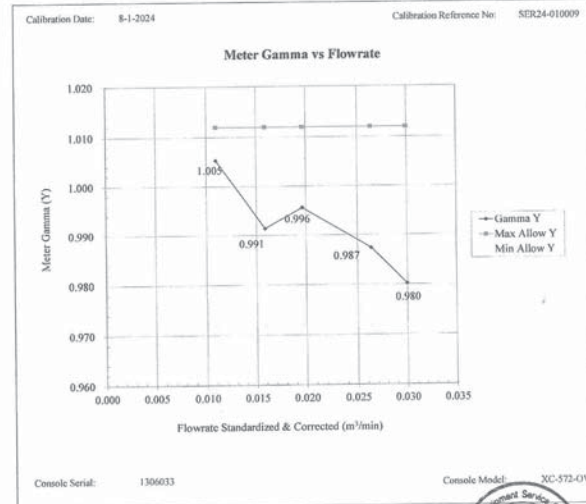
Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-OV	Date	Time	Std Temp	293 K
Console Serial Number	1306033	Calibration Reference No.	SER24-010002	Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	761.24 mmHg	K _i	0.386
DGM Serial Number	00009149	Calibration Meter Gamma	0.999	Console Leak Check	PASS

Calibration Data						
Results						
Standardized Data			Dry Gas Meter			
Dry Gas Meter	Calibration Meter	Calibration Factor	Flowrate	Std & Corr	.0212 m ³ /min	Variation
(V _{meas})	(Q _{ref})	(V _{meas})	(Q _{ref})	(Y)	(ΔY)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min	m ³ /min	mm H ₂ O	
0.138	0.011	0.138	0.011	1.004	0.012	0.011
0.138	0.011	0.139	0.011	1.007	0.015	0.011
0.138	0.016	0.137	0.016	0.992	0.000	0.016
0.138	0.016	0.136	0.016	0.990	-0.002	0.016
0.276	0.020	0.274	0.020	0.994	0.002	0.020
0.276	0.020	0.275	0.020	0.997	0.005	0.020
0.278	0.027	0.274	0.026	0.987	-0.005	0.026
0.278	0.027	0.274	0.026	0.987	-0.005	0.026
0.278	0.031	0.273	0.030	0.981	-0.011	0.030
0.278	0.031	0.272	0.030	0.979	-0.013	0.030
		0.992	Y Average			ΔH _g Average
					46.017	

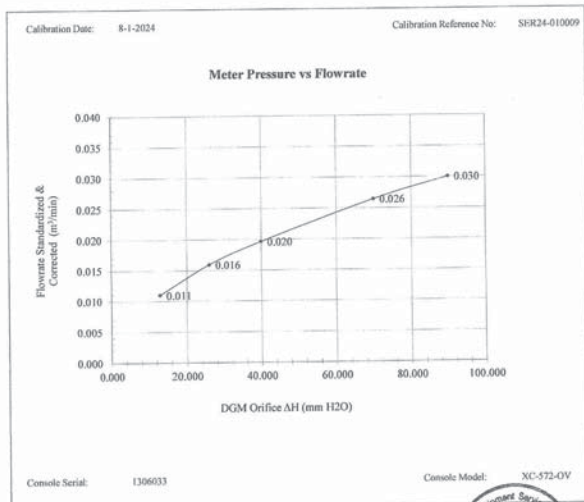
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.2.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm).



Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-OV	Date	Time	Std Temp	293 K
Console Serial Number	1306033	Calibration Reference No.	SER24-010002	Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	761.24 mmHg	K _i	0.386
DGM Serial Number	00009149	Calibration Meter Gamma	0.999	Console Leak Check	PASS



Meter Console Information		Calibration Conditions		Factors/Conversions	
Console Model Number	XC-572-OV	Date	Time	Std Temp	293 K
Console Serial Number	1306033	Calibration Reference No.	SER24-010002	Std Press	760 mm Hg
DGM Model Number	SK25EX	Barometric Pressure	761.24 mmHg	K _i	0.386
DGM Serial Number	00009149	Calibration Meter Gamma	0.999	Console Leak Check	PASS



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-OV	Date	Time
Console Serial Number	1306033	08/01/2024	01:25 PM
DGM Model Number	SK25EX	Calibration Reference No.	SER24-010002
DGM Serial Number	00009149	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 13335		

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	1038.0
Stack	-19.0	24.0	37.0	91.0	147.0	257.0	370.0	482.0	594.0	1040.0
Aux	-	-	-	-	-	-	-	-	-	-
Probe	-19.0	24.0	37.0	91.0	147.0	-	-	-	-	-
Filter	-19.0	24.0	37.0	91.0	147.0	-	-	-	-	-
Oven	-	-	-	-	-	-	-	-	-	-
Exit	-18.0	24.0	37.0	-	-	-	-	-	-	-

Tolerance Range		Meter	
Stack	± 1.50% Absolute	Exit	± 3.0 °C
Probe	± 3.0 °C		
Filter	± 3.0 °C		



CERTIFICATE OF CALIBRATION

Customer : Pacific Laboratory Co., Ltd.
Address : 14/5358 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-SHV
Serial Number : -
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 08/01/2024
Issue Date : 08/01/2024

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

Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mana Fuchthong)
Technical Manager



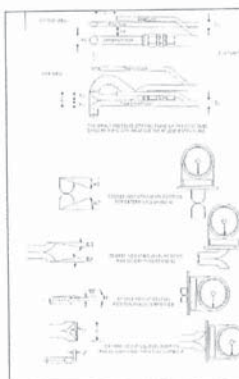
CALIBRATION RESULTS S-Type Geometric Pitot Tube Calibration

Sampling System Equipment Information

Probe Model : PS-SHV
Probe Number : -
Pitot Number : -
Pitot Tube Type : S-type

Calibration Condition

Date : 8 January 2023
Barometric Pressure : 761.24 mm Hg
Digital Caliper : CD-6" ASX
Serial number : A18008059



Pitot tube/Probe: # PS-SHV			
Parameter	Value	Allowable Range	Check
Assembly level?	Yes	Yes	Pass
Ports Damage?	No	No	Pass
$\alpha 1$	0	$-10^\circ < \alpha 1 < +10^\circ$	Pass
$\alpha 2$	1	$-10^\circ < \alpha 2 < +10^\circ$	Pass
B1	0	$-5^\circ < B1 < +5^\circ$	Pass
B2	0	$-5^\circ < B2 < +5^\circ$	Pass
y	0	N/A	-
a	0	N/A	-
Dt	0.375	.188" to .375"	Pass
A	0.9125	$2.1Dt \leq A \leq 3Dt$	Pass
A/2Dt	1.217	$1.05 \leq A/Dt \leq 1.5$	Pass
Z = A tan y	0.046	$Z \leq .125"$	Pass
W = A tan a	0.019	$W \leq .031"$	Pass

Remark:

I certified that probe model: PS-SHV 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	
Probe Model Number	PS-SHV
Probe Serial Number	-
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 13335

Calibration Conditions			
Date	Time	08/02/2023	03:20 PM
Calibration Reference No.	E24-010002		
Reference Thermometer	DIGICON		
Serial Number	183169105		

Thermocouple of Standard Probe method 5 = length 5 foot			
Set Point	Reference Thermocouple	Probe Thermocouple	Difference
100	100.0	98.0	0.54
250	250.0	248.0	0.38
300	300.0	297.0	0.52
350	350.0	347.0	0.48



CERTIFICATE OF CALIBRATION

Customer : Pacific Laboratory Co., Ltd.
Address : 14/5358 Moo 14, Tambon Bang Bua Thong, Amphoe Bang Bua Thong, Nonthaburi 11110
Description of Equipment : Stainless Steel Nozzle
Manufacturer : Apex Instrument
Model Number : NS-SET-ODD
Serial Number : -
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 08/01/2024
Issue Date : 08/01/2024

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

Calibrated by : Mr. Sanya Sangnil

Approved by : (Mr. Mana Fuchthong)
Technical Manager



CALIBRATION RESULTS

Sampling System Equipment Information

Nozzle Model : NS-SET-ODD
Nozzle Number :
Nozzle Type : Stainless Steel

Calibration Condition

Date : 08 January 2023
Barometric Pressure : 761.24 mm Hg
Calibration Device : Vernier, 0-150 mm
Method Reference : US EPA Method

Nozzle ID	Nozzle Diameter				Different	(D1 + D2 + D3) / 3
Size	D1	D2	D3	ΔD	Davg	
mm	mm	mm	mm	mm	mm	mm
NS-5	3.97	3.90	3.92	0.012	3.913	
NS-7	5.55	5.40	5.40	0.000	5.400	
NS-9	7.14	7.02	7.02	0.000	7.020	
NS-11	8.73	7.81	7.83	0.010	7.820	
NS-13	10.31	10.18	10.20	0.010	10.190	
NS-15	11.91	11.68	11.67	0.006	11.673	
NS-17	13.49	13.46	13.44	0.012	13.453	

Remark:

D1, D2, D3 = There difference nozzle diameters, mm; diameter must be within 0.025 mm
ΔD = Maximum difference between any two diameters, must be ≤ 0.100 mm
Davg = (D1 + D2 + D3) / 3



บริษัท อีเอส อีเอ็นจิเนียริ่ง จำกัด (มหาชน)
CALL ME ENGINEER COMPANY LIMITED. (Head Office)
89/553 หมู่ 5 ตำบลบางคูเวียง อำเภอบางบัวทอง จังหวัดนนทบุรี 11140
89/553 หมู่ 5 ตำบลบางคูเวียง อำเภอบางบัวทอง จังหวัดนนทบุรี 11140
นนทบุรี
unitedcallme@gmail.com (Tax ID)
0125564024574



GASES AND FIRE DETECTION
Contact Us
Tel : +66(0)89 890 8246
E-Mail : service@callmeeng.com
Web Site : www.callmeeng.com
Line ID : @Callmeeng

Certificate of Calibration

CUSTOMER

Name
Pacific Laboratory Co., Ltd.
Address
14/5558 Moo 14, Tambon Bang Bua Thong,
Amphoe Bang Bua Thong, Nonthaburi 11110
Department / Division / Vessel
N/A

Reference Standard

Description	Cert. No.	Expired Date
- TSG Standard Nitrogen - 99.99 %Vol	DNHQ-44747-169640-10	18-Jul-28
- Linde Mixture Gas in Nitrogen	3278/22	17-Oct-24
Component : CO - 106 PPM, O2 = 18.1 %		

Test Result

Visual Check	Criteria	Result
Structure	Proper	Good
Indication, Symbol and letter	Proper	Good
Gas sampling hose & probe	Proper	Good

Calibration Result

Parameter	Zero				Span				Response time Sec.				Judgment	Notes
	Std.	Acc.	Before	Cal.	After	Err.	Std.	Acc.	Before	Cal.	After	Err.		
O2 (ppm)	0.0	±1.5	0.0	0.0	0.0	0.0	18.1	±1.0	18.2	18.1	0.0	±30	Pass	- Response time must be within 30 sec.
CO (ppm)	0.0	0.0	0.0	0.0	0.0	0.0	106.0	±5.0	101.0	106.0	106.0	±30	Pass	- Respond time must be within 30 sec. to reach to 90% of Std. concentration.

Comment/ Suggestion :

This UIC 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 UIC being tested. This result of calibration was found accurate as show on date and place of calibration only.

Engineer Signatory Mr. Baitasak Yonbunpue (Technical Specialist) Date : 05-Jan-24	Approval Signatory Mr. Chaiwat Chuekrunthod (Sales Division Chief) Date : 05-Jan-24	Company Stamp CALL ME ENGINEER CO., LTD.
---	---	--

UNIT UNDER CALIBRATION (UUC)				Cert. No. SE-GM245E0008			
Description				Cal. Date : 05-Jan-24			
Flue gas analyzer				Cal. Due : 04-Jan-25			
Manufacturers				Work Order No. : SE-CM245E0008			
Testo Model 310				Cal. Temp. : 25.0 ± 1°C			
S/N: 42989591				Cal. Humidity : 25.0 ± 10 %RH			
Measuring Range							
O2 : 0-21 %Vol, CO : 0-4000 PPM							

Function Setup

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



MS-715A-715.11/25
CALIBRATION 0010

Certificate of Calibration

Certificate No. : 66-200247-2

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 :

Electronic Balance
Manufacturer : SHIMADZU Model : AP225WD
Serial No. : D316301828 ID No. : LAB-BL-003
Capacity : 220 g Resolution : 0.00001g/102g, 0.0001g/220g

Environment :

On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd.
Ambient Temperature : (25.1 to 25.4) °C
Relative Humidity : (62.3 to 64.8) %
Air Pressure : 1007.0 mbar

Date of Received :

31 July 2023

Date of Calibration :

31 July 2023
02 August 2023

Date of Issue :

02 August 2023

Calibrated by :

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

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E264	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

(Sirachai Poonthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%
This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co., Ltd.



Certificate of Calibration

Certificate No. : 66-200247-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty ± (g)
0.001	0.00001	0.000020
0.01	0.00001	0.000021
0.05	0.00001	0.000019
0.1	0.00001	0.000024
1	-0.00001	0.000030
2	0.00000	0.000036
5	-0.00001	0.000046
20	-0.00002	0.000073
50	-0.00004	0.00011
100	-0.00005	0.00020
150	-0.0001	0.00038
200	-0.0001	0.00040

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 $k = 2.52$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g	Load test : 200 g
A B C D E	A B C D E
0.00002 0.00003 0.00001 0.00004 0.00000	0.000048 g



Repeatability

Load test : 200 g	Sidev. :
0.000048 g	0.000048 g

-o0o-





SCIMET Co., Ltd.
1194 Soi Wachirathamsakhi 57, Bangchak,
Phraekhanong, Bangkok 10260 Thailand
Email:scimet2022@gmail.com, Tel:095-552-4939



Certificate No. C07230008

Calibration Certificate

Equipment: SPECTROPHOTOMETER

Model: DR3900

Serial No.(or ID): 2076219

Manufacturer: HACH

Condition: In Condition

Job No.: KSM72300196

Received Date: 14 July 2023

Issued Date: 14 July 2023

Page: 1 of 3

Customer

Pacific Laboratory Co., Ltd.

14/5358 Moo 14, Bang Bua Thong, Bang Bua Thong, Nonthaburi 11110 Thailand

Calibration Place

Pacific Laboratory Co., Ltd.(แขวงวัดบ้านจั่น Zone B)

14/5358 Moo 14, Bang Bua Thong, Bang Bua Thong, Nonthaburi 11110 Thailand

Calibration Date

14 July 2023

Environment Condition

Temperature: 29.9 °C ± 0.1 °C

Humidity: 62.4 %RH ± 0.4 %RH

The Method used

In-house method, W107, based 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. 108691 and 108692

The standard for Photometric Certificate No. 109010

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 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 SCIMET Co., Ltd.

(Mr. Dumrong Boonsopon)

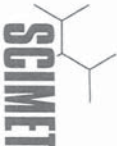
Person in charge



(Mr. Thalemgkeat Pongngam)

Authorized signatory

FC07-03-30 MAY 2023



Certificate No.: C07230008

Page 2 of 3

Calibration Results: Without Adjustment

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

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
361.02	361	0.02	0.59
417.80	417	0.80	0.59
441.29	441	0.29	0.59
471.51	471	0.51	0.59
479.88	480	-0.12	0.59
513.75	514	-0.25	0.59
528.59	528	0.59	0.59
537.75	537	0.75	0.59
585.56	585	0.56	0.59
641.95	642	-0.05	0.59
684.70	684	0.70	0.59
747.61	747	0.61	0.59
807.04	807	0.04	0.59
879.68	879	0.68	0.59

บริษัท สยามเซ็นเตอร์ (SCIMET CO., LTD.)

1194 Soi Wachirathamsakhi 57, Bangchak, Phraekhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 095 552 4939

FC07-03-30 MAY 2023

Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(± Abs)
420 nm	0.0000	0.000	0.0000	0.0045
	0.5617	0.560	0.0017	0.0045
	0.7392	0.737	0.0022	0.0045
440 nm	1.0550	1.054	0.0010	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5513	0.550	0.0013	0.0045
465 nm	0.7230	0.721	0.0020	0.0045
	1.0324	1.031	0.0014	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.5036	0.505	-0.0014	0.0045
	0.6735	0.673	0.0005	0.0045
	0.9615	0.964	-0.0025	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5176	0.517	0.0006	0.0045
	0.6930	0.691	0.0020	0.0045
635 nm	0.9908	0.990	0.0008	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5530	0.552	0.0010	0.0045
	0.7196	0.717	0.0026	0.0045
	1.0301	1.027	0.0031	0.0045
	0.0000	0.000	0.0000	0.0045
	0.5370	0.536	0.0010	0.0045
	0.6862	0.684	0.0022	0.0045
	0.9822	0.981	0.0012	0.0045

The End of Certificate

ภาคผนวกที่ 5-4
เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียง



Professional Calibration & Services Co., Ltd.
 50/888, 50/889 Moo 2, Rungt-H-Nakomroyok Rd., Bungeeetho, Thunaburi,
 Pathumthani 12130 Thailand
 Tel : (+66)2150-6641 (Audio), (+66)2569-5158
 Email : info@p-cal.com www.p-cal.com



Certificate of Calibration

Page 1 of 3



Certificate Number : EL14068/24
 Control Number : PCAL163759
 Customer Control : -
 Description : Sound Calibrator
 Manufacturer : Tannars
 Model : TM-100
 Serial Number : 220501964
 Customer : Pacific Laboratory Co., Ltd.
 14/5358 Moo 14, Tambol Bang Bua Thong, Amphoe Bang Bua Thong,
 Nonthaburi 11110

Date of Receipt : 16-Mar-24
 Date of Calibration : 18-Mar-24
 Environment : Temperature 23 °C ± 2 °C
 : Relative Humidity 50 % ± 20 %
 Calibration Method : Calibration Procedure Number CP-EL35
 Calibration Results : See data attached

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

This certificate is issued in accordance with ISO/IEC17025 and the conditions of accreditation
 granted by the Accreditation Body which has assessed the measurement capability of the laboratory
 and its traceability to recognized national standards and to the units of measurement realized at
 the corresponding national standards laboratory. The results relate only to the item calibrated.

This certificate shall not be reproduced other than in full except without the prior written approval
 of the Head of Calibration Laboratory of Professional Calibration & Services Co., Ltd.

Calibrated By

Authorized Signature

28-Mar-24

Mt. Wachurapof Morasit

(Mt. Jumphong Jumphong)

Issued Date

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate Number : EL14068/24

Page 2 of 3

Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Sound Level Meter	030606101	ANAB : AC-2590	EL09782/23	29-Mar-24
Sound Level Calibrator	141208123	ANAB : AC-2590	EL12312/24	04-Mar-25

Condition as received : Normal
 Definitions :-

* ANAB - The ANSI National Accreditation Board

CALIBRATION REPORT
Professional Calibration & Services Co., Ltd.

Certificate No.: EL14068/24

Page: 3 of 3

Calibration Results

Sound Calibration

Nominal	Measured Value	Uncertainty (±)	Tolerance Limit Values
94 dB	93.9 dB	0.2 dB	93.5 ~ 94.5 dB
114 dB	113.9 dB	0.2 dB	113.0 ~ 115.0 dB

Notes:

- 1). Tolerances or specifications report in table above are base on the product data sheet Sound Level Calibrator TM-100.

...End...



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50/40 Moo 5 T. Lat Sawai, A. Lamjuka, Pathumthani 12150
Tel.: +66 2103-6290 Fax: +66 2103-6291
Email: sales@apitech-cal.com

CERTIFICATE OF CALIBRATION

Certificate Number : SC240007

Customer : Pacific Laboratory Co., Ltd.
Address : 14/3358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC240007
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222020	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 04-Jan-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24

APITECH

Authority of Calibration

Approved Signatory

Signature

- ☒ Ms. Siranalan Lertmarasetsiri [Quality Manager]
☐ Mr. Sompoch Srisunart [Technical Manager]

Calibration Date : 05-Jan-2024
Issued Date : 12-Jan-2024
Calibrated By : Ms. Hathachanok Kaewrisai

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 APITECH CALIBRATION CO., LTD.

CALIBRATION REPORT

Certificate Number : SC240007

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	93.8 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	113.7 dB	-0.17 dB	0.60 dB

--- End of Certificate ---

CERTIFICATE OF CALIBRATION

Certificate Number : SC240032

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	: SC240032
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222167	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 19-Feb-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24



Authority of Calibration

Approved Signatory
Sirint
Ms. Siranalan Lertmaneechitsri | Quality Manager |
☒ Mr. Somphot Srirumart | Technical Manager |

Calibration Date : 20-Feb-2024
Issued Date : 23-Feb-2024
Calibrated By : Ms. Hathacharok Kaewrisai

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

CALIBRATION REPORT

Certificate Number : SC240032

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	113.7 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	93.9 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

--- End of Certificate ---

CERTIFICATE OF CALIBRATION

Certificate Number : SC240004

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

Description : Sound Level Meter
Manufacturer : ACO
Model : 6236
Serial Number : 222017
ID. Number : N/A
W/O Number : SC240004
Calibration Location : Laboratory
Ambient Temperature : 22 ± 2 °C
Ambient Humidity : 55 ± 15 %RH
Received Date : 04-Jan-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24

Authority of Calibration

Approved Signatory
Siripha
Ms. Siranalan Lertmarasetsiri | Quality Manager |
Mr. Sompoch Srisunat | Technical Manager |
Calibration Date : 05-Jan-2024
Issued Date : 12-Jan-2024
Calibrated By : Ms. Hathacharak Kaewrisai

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.
Page 1 of 2
FM-7-8-01-001(R00, 04/09/15)



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50/40 Moo 5 T. Lat Sawai, A. Lamluaka, Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email. sales@aptitech-cal.com



CALIBRATION REPORT

Certificate Number : SC240004

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	(H) 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	113.7 dB	-0.17 dB	0.60 dB

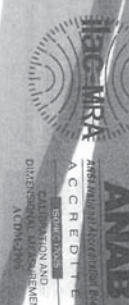
Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(H) 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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50/40 Moo 5 T. Lat Sawai, A. Lamluaka, Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email. sales@aptitech-cal.com



CERTIFICATE OF CALIBRATION

Certificate Number : SC240024

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	: SC240024
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222132	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 12-Jan-24

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	CP2030261EA	TISI: 22-LB0119	05-Jul-24



Authority of Calibration

Approved Signatory

S. Srisaeng

- ☒ Ms. Siranalan Lertmaneechai (Quality Manager)
☐ Mr. Sampoch Srisuan (Technical Manager)

Calibration Date : 15-Jan-2024
Issued Date : 18-Jan-2024
Calibrated By : Ms. Hathachanok Kaewrsai

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CALIBRATION REPORT

Certificate Number : SC240024

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 ---

CERTIFICATE OF CALIBRATION

Certificate Number : SC240028

Customer : Pacific Laboratory Co., Ltd.
Address : 14/S358 Moo 14 Tambol Bang Bua Thong, Amphoe Bang Thong,
Nonthaburi 11110

Description	: Sound Level Meter	W/O Number	: SC240028
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222136	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 19-Feb-24

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 (G3003). 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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24



Authority of Calibration

Approved Signatory

Ms. Siranalan Lertmaneeesiri [Quality Manager]
☐ Mr. Somdech Srisuwan [Technical Manager]

Calibration Date : 20-Feb-2024
Issued Date : 23-Feb-2024
Calibrated By : Ms. Hathichanok Kaewrisai

CALIBRATION REPORT
Certificate Number: SC240028

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 ---

CERTIFICATE OF CALIBRATION
Certificate Number: SC240021


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	: SC240021
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222048	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 12-Jan-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24

Authority of Calibration

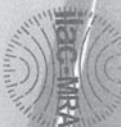
Approved Signatory


☒ Ms. Siranalan Lertmaneechai [Quality Manager]
☐ Mr. Sompoch Srisurat [Technical Manager]

Calibration Date : 15-Jan-2024
Issued Date : 18-Jan-2024
Calibrated By : Ms. Hathachanok Kaewsrisei



APTITECH CALIBRATION CO., LTD.
50/40 Moo 5 T. Lat Sawai, A. Lamjukka, Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email. sales@aptitech-cal.com



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ACDMS-285

CALIBRATION REPORT

Certificate Number : SC240021

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	(H) 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

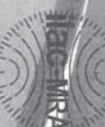
Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(H) 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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50/40 Moo 5 T. Lat Sawai, A. Lamjukka, Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email. sales@aptitech-cal.com



ANAB
ACCREDITED
CALIBRATION AND
DIMENSIONAL MEASUREMENT
ACDMS-285

CERTIFICATE OF CALIBRATION

Certificate Number : SC240037

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	: SC240037
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: $22 \pm 2^\circ\text{C}$
Serial Number	: 222174	Ambient Humidity	: $55 \pm 15\%\text{RH}$
ID. Number	: N/A	Received Date	: 19-Feb-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24



Authority of Calibration

Approved Signatory

Surin

- ☒ Ms. Siranalan Lertmanesetisit [Quality Manager]
☐ Mr. Sompoch Srisunart [Technical Manager]

Calibration Date : 20-Feb-2024
Issued Date : 23-Feb-2024
Calibrated By : Ms. Hathichanok Kaewsrisai

Calibration certificate 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.

CALIBRATION REPORT

Certificate Number : SC240037

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	113.9 dB	0.03 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 ---

CERTIFICATE OF CALIBRATION

Certificate Number : SC240047

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

Description	: Noise Dose Meter	W/O Number	: SC240047
Manufacturer	: Soundtek	Calibration Location	: Laboratory
Model	: ST-130	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 220100163	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 09-Feb-24

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	CP20230261EA	TISI: 22-LB0119	05-Jul-24

Authority of Calibration

Approved Signatory
Sunhs

☒ Ms. Siranalan Lertmaneeesrisri [Quality Manager]
☐ Mr. Sompoch Satsunart [Technical Manager]

Calibration Date : 10-Feb-2024
Issued Date : 13-Feb-2024
Calibrated By : Ms. Hathachanok Kaewsrisai

CALIBRATION REPORT

Certificate Number : SC240047

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 ---

CERTIFICATE OF CALIBRATION

Certificate Number : SC240043

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

Description	: Noise Dose Meter	W/O Number	: SC240043
Manufacturer	: Soundtek	Calibration Location	: Laboratory
Model	: ST-130	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 220100153	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 09-Feb-24

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24



Authority of Calibration

Approved Signatory
Sirirak
Ms. Siranalan Lertmanesesthi | Quality Manager |
Mr. Sompoch Srisunat | Technical Manager |
Calibration Date : 10-Feb-2024
Issued Date : 13-Feb-2024
Calibrated By : Ms. Hathichanok Kaewrisai

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



APITTECH CALIBRATION CO., LTD.
50/40 Moo 5 T. Lat Sawai, A-Lanluka, Pathunthani, 12150
Tel.: +66 2103-6290 Fax: +66 2103-6291
Email: sales@apitech-cal.com



CALIBRATION REPORT

Certificate Number: SC240043

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	113.7 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

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 ---



Professional Calibration & Services Co., Ltd.
50/888, 50/889 Moo 2, Rungtith-Nokornvok Rd., Bungeeetho, Thunvaburi
Pathunthani 12130 Thailand
Tel: (+66)2150-6641 (Audio/line) (+66)2569-5158
Email: info@p-ccl.com www.p-ccl.com



Certificate of Calibration

Page 1 of 3



Certificate Number : EL33305/23
Control Number : PCAL153035
Customer Control :
Description : Sound Calibrator
Manufacturer : SOUNDTEK
Model : ST-120
Serial Number : 211203764
Customer : Pacific Laboratory Co., Ltd.
14/5358 Moo 14, Tambol Bang Bua Thong, Amphoe Bang Bua Thong,
Nonthaburi 11110
Date of Receipt : 01-Sep-23
Date of Calibration : 01-Sep-23
Environment : Temperature 23 °C ± 2 °C
Relative Humidity 50 % ± 20 %
Calibration Method : Calibration Procedure Number CP-EL35
Calibration Results : See data attached

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%.
This certificate is issued in accordance with ISO/IEC17025 and the conditions of accreditation granted by the Accreditation Body which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. The results relate only to the item calibrated.
This certificate shall not be reproduced other than in full except without the prior written approval of the Head of Calibration Laboratory of Professional Calibration & Services Co., Ltd.

Calibrated By

Authorized Signature

Mr. Varavut Sirpanyachon

(Mr. Songpol Nakgunrak)

02-Sep-23

Issued Date

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate Number : EL39305/23

Page 2 of 3

Equipment Standards Used

Description	Serial No.	Traceability to	Certificate No.	Cal. Due Date
Sound Level Meter	030606101	ANAB : AC-2590	EL09782/23	28-Mar-24
Sound Level Calibrator	141208123	NSC : Calibration 0037	EEL.BP.160366	05-Mar-24

Condition as received : Normal

Definitions :-

- * ANAB - The ANSI National Accreditation Board
- * NSC - National Standardization Council of Thailand

CALIBRATION REPORT

Professional Calibration & Services Co., Ltd.

Certificate No. : EL39305/23

Page : 3 of 3

Calibration Results

Sound Calibration

Nominal	Measured Value	LUC Error	Uncertainty (±)
94 dB	93.90 dB	0.10 dB	0.2 dB
114 dB	113.75 dB	0.25 dB	0.2 dB

...End...



APITECH CALIBRATION CO., LTD.
50/40 Moo 5 T. Lat Sawai A. Lamjuka Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email: sales@apitech-cal.com



CERTIFICATE OF CALIBRATION

Certificate Number: SC230375

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	: SC230375
Manufacturer	: Scarlet Tech	Calibration Location	: Laboratory
Model	: ST-11D	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 820968	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 25-Aug-2023

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.

Description	Serial No.	Certificate No.	Traceability	Due Date
Sound Level Calibrator	141011576	CP20230261EA	TISI: 22-LB0119	05-Jul-24

Approved Signatory

S. M.

☒ Ms. Siranulan Lertmaneechitri [Quality Manager]
☐ Mr. Sompoth Srisunart [Technical Manager]

Authority of Calibration

Calibration Date : 25-Aug-2023
Issued Date : 28-Aug-2023
Calibrated By : Mr. Rattapong Jampanya



APITECH CALIBRATION CO., LTD.
50/40 Moo 5 T. Lat Sawai A. Lamjuka Pathumthani 12150
Tel. +66 2103-6290 Fax. +66 2103-6291
Email: sales@apitech-cal.com



CALIBRATION REPORT

Certificate Number: SC230375

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 Calibration : A
- Frequency Weighting : 0.1 dB
- Resolution

Sound Level Measurement (Slow Mode)

Parameter	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
L _{Fp}	20-140 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
L _{Sp}	20-140 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
L _{lp}	20-140 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)

Parameter	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
L _{Fp}	20-140 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
L _{Sp}	20-140 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
L _{lp}	20-140 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 ---



SCARLET | TECH

CERTIFICATE OF CALIBRATION

NO. 20221215052

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820385
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2023-12-15
Due Date:	2024-12-14

Calibrated by:

Jim Lin

- 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: AWA1442S-52473
3. Adjustments to indicated sound levels: 4. Measuring up limit: 140 dBA
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	-71.1	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.4	-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	-26.2	-0.8	-0.1	8000	1.2	-0.8	0.0
125	-16.3	-0.1	-0.2	12500	-5.7	-7.2	0.1
250	-8.5	0.2	0.0	16000	-11.7	-13.5	0.2
500	-3.2	0.1	0.1	20000	-23.9	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

7.3 dB(A)	11.2 dB(C)	13.3 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.3
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			
	$L_{min}-L_A$	$L_{center}-L_A$	L_A-L_A	$L_{max}-L_A$
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	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle			
	nominal value	Positive half	nominal value	Negative half
$L_{peak-C}(dB)$	3.5	2.3	2.4	2.3

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
Items			
Laq,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



CERTIFICATE OF CALIBRATION

NO. 20221215051

Name of Product:

Sound Level Meter

Model:

ST-110

Serial Number:

820384

Specification:

Class 1

Conclusion:

Pass

Date of calibration:

2023-12-15

Due Date:

2024-12-14

Calibrated by: *Jim Lin*

- 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 Scarlett 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)
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7. F85 Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.4
Deviation of F85	-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 _{max} -L _a	L _{max} -L _a	L _a -L _a	L _{av} -L _a
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
L _{Cpeak} (CdB)	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
L _{Aeq,T}	103.2	103.2	0.0
L _S	110.8	110.8	0.0
L _{T0}	108.8	108.8	0.0
L _{S0}	92.9	92.8	0.1
L _{T0}	76.9	76.8	0.1
L _{S5}	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

เอกสารขอเทียบเครื่องมือการวัด
ภาคผนวกที่ 5-5

CAL

Calibratech Co.,Ltd.

7106-7 Moo 2, Sukhaphrachan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120
Tel: (02) 964-6211 Fax: (02) 964-5155, e-mail : calibratech_cali@yahoo.com, calibratech_cali@hotmail.com



Certificate of Calibration

Certificate No. : 66-420070-2 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. : 3052953
ID No. : LAB-PH-002
Environment : On site calibration was carried out at the Laboratory Pacific Laboratory Co.,Ltd.
Ambient Temperature : (25.0 to 25.6) °C
Relative Humidity : (45 to 47) %
Date of Received : 31 July 2023
Date of Calibration : 31 July 2023
Date of Issue : 05 August 2023
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)

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61270213	915161	19 Jul 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61275614	898428	28 May 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	915163	19 Jul 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0011-03

CAL

Calibratech Co.,Ltd.

7106-7 Moo 2, Sukhaphrachan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120
Tel: (02) 964-6211 Fax: (02) 964-5155, e-mail : calibratech_cali@yahoo.com, calibratech_cali@hotmail.com

Certificate of Calibration

Certificate No. : 66-420070-2 Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement
pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (pH)	Correction (mV)	Uncertainty (± mV)
4, 7, 10	177.4800	4	4.00	177.5	0.0
	0.0000	7	7.00	-0.1	0.086
	-177.4800	10	10.00	-177.5	0.0

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
	6.985	7.00	-0.01	0.011
	9.997	10.01	-0.01	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-F0011-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachan 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yohoo.com, calibratech.cal@gmail.comNISC-TIS-1017025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400424-1 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. : PI1STEMB01P 049 ID No. : LAB-PH-002

Environment : On site calibration was carried out at the Laboratory, Pacific Laboratory Co., Ltd
Ambient Temperature : (25.0 to 25.6) °C
Relative Humidity : (45 to 47) %
Line Voltage : (220.0 to 222.0) VAC

Date of Received : 31 July 2023
Date of Calibration : 31 July 2023
Date of Issue : 05 August 2023
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 : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-P0031-03



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachan 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yohoo.com, calibratech.cal@gmail.com

Certificate of Calibration

Certificate No. : 66-400424-1 Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
115	25.005	24.8	0.2	0.19

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown in 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%

Approved by : 
(Bunjerd Masri)
Supervisor



CAL-P0031-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachan 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yohoo.com, calibratech.cal@gmail.comNISC-TIS-1017025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-420070-1 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
ID No. : LAB-PH-002

Environment : On site calibration was carried out at the Laboratory Pacific Laboratory Co., Ltd
Ambient Temperature : (25.0 to 25.6) °C
Relative Humidity : (45 to 47) %

Date of Received : 31 July 2023
Date of Calibration : 31 July 2023
Date of Issue : 05 August 2023
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	61270213	915161	19 Jul 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.985	61275614	898428	28 May 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	915163	19 Jul 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by : 
(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-P0031-03



CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachan 3 Rd., Banggood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yohoo.com, calibratech.cal@gmail.com

Certificate of Calibration

Certificate No. : 66-420070-1 Page : 2 of 2

Result of Calibration : Good

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 (pH) (mV)	Correction (mV)	Uncertainty (± mV)
4, 7, 10	177.4800	4	4.00 177.5	0.0	0.12
	0.0000	7	7.00 0.1	-0.1	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
	6.985	7.00	-0.01	0.011
	9.997	10.01	-0.01	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%

CAL-P0031-03



Certificate of Calibration

Certificate No. : 66-400442-1

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-014

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

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 03 August 2023

Date of Calibration : 07 August to 09 August 2023

Date of Issue : 09 August 2023

Calibrated by : Chotrip 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

400001 TT-0016-22 07 Feb 2024 National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No. Cert. No. Due Date Traceability

400003 23E1866 01 Jun 2025 National Institute of Metrology Thailand (NIMT)

400004 23E1866 01 Jun 2025 National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%
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Certificate of Calibration

Certificate No. : 66-400442-1

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 -0.0925 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
29.8114	30	-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%

- o/fo -





Cert.No.: 23TW264
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : AZ
Model : 86031
Serial No. : 1041263
ID No. : LAB-DO-002
Received Date : 14 December 2023
Test Date : 15 December 2023
Reference : 2312-0336WN-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 : Watalek Sittituan

Approved by : Saithip
Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lemgatrakul
() Ponpan Paipim
Issue Date : 18 December 2023

B 0330751



Cert.No.: 23TW264
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	23CG1172	22 Mar 2025
2) Balance	1124013382	140RC006	23MM18	20 Feb 2024

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)
8.20	8.3	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

-00-

Saithip

a 1193970



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

Certificate of Calibration

Cert.No.: 23CH1197

Page.: 1 of 2

Equipment: Turbidity Meter
Manufacturer: EZONDO
Model: TUB-430
Serial No.: 1000048
ID. No.: LAB-TB-001
Condition As-Received: Used Item
Received Date: 22 September 2023
Calibration Date: 25 September 2023
Reference: 2309-0773WN-2
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: Waialak Sirthean
Approved by: *Warakorn.*
() Saithip Meangmal
(✓) Warakorn Lertgagatrakul
() Ponpan Palojin
Issue Date: 27 September 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.

A 0011923



Cert.No.: 23CH1197
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-Hygograph	1103328	130EC010	23C1361	13 June 2024
2) Electronic Balance	1124013382	140RC006	23MM18	20 Feb 2024

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	20.3	0.39	2.00
100	100.0	0.70	2.06
800	802	2.1	2.07

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 %.

-00o-

Warakorn

a 1181446

Certificate of Calibration

Certificate No. : 66-400422-5

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 : Air Chamber (lineubar)

Manufacturer : Aqua Lytic

Model : TC 135S

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 0614/000033

ID No. : LAB-IB-001

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

Ambient Temperature : (23.5 to 24.2) °C

Relative Humidity : (40 to 45) %

Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 2023

Calibrated by : Permpoon Champu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert. No.

Due Date

Traceability

400029 & 400048 66-400067-1

04 Aug 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Mastri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400422-5

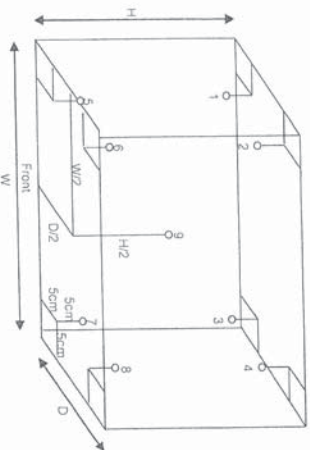
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.51 m

D = 0.04 m

H = 0.70 m

Capacity = 0.02 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.								Uncertainty (± °C)	
			1	2	3	4	5	6	7	8		9
20.0	20.5	20.5	20.05	19.87	19.94	19.93	19.93	19.91	20.00	20.01	19.90	0.77
Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)									Overall Variation (°C)
			0.33									
			Measured Stability (°C)									
			0.39									
20.0	20.5	20.5										0.8

Remark The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2.

providing a level of confidence of approximately 95%

-o0o-

B





Certificate of Calibration

Certificate No. : 66-400422-3

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 : Air Chamber (Oven)

Manufacturer : Memmert

Model : UN 55

Range : N/A °C

Resolution : 0.1 °C

Serial No. : B214.1879

ID No. : LAB-OV-001

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

Ambient Temperature : (30.0 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 2023

Calibrated by : Permpon Chaiyap

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400029 & 400030 66-400227-1

24 Oct 2023

National Institute of Metrology (NIMT)

Approved by :

(Bangfud Masti)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400422-3

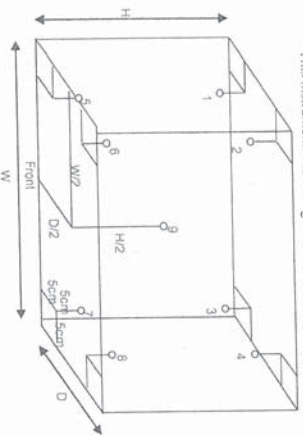
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As Received : Good

Function : Temperature measurement

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



Inside of Chamber
W = 0.40 m
D = 0.33 m
H = 0.40 m
Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.							Uncertainty (± °C)
			1	2	3	4	5	6	7	
104.0	107.0	107.0	104.9	104.7	104.2	103.1	103.2	102.9	104.2	103.5
180.0	184.0	184.0	180.5	180.3	179.7	180.3	176.9	176.8	177.0	179.4
										1.1
Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)			Measured Stability (°C)			Overall Variation (°C)	
			1	2	3	4	5	6	7	8
104.0	107.0	107.0	1.5							2.3
180.0	184.0	184.0	2.8							4.3

Remark: The uncertainty is not combine uniformity of the air chamber

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

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2.

providing a level of confidence of approximately 95%

- o0o -

B





Certificate of Calibration

Certificate No. : 66-400422-4

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd

14/538 Moo 14, T. Bang Bua Thong, A. Bang Bua Thong, Nonthaburi 11110 Thailand

Equipment : Water Bath

Manufacturer : Memmert Model : WNB 22

Range : N/A °C Resolution : 0.1 °C

Serial No. : L514.0184 ID No. : LAB-WB-001

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

Ambient Temperature : (30.0 to 32.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (220.0 to 222.0) V

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 05 August 2023

Calibrated by : Permpoon Champu

Calibration Method : This instrument was calibrated by In-house method CAL-M4006 based on ASTM E715-80

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD probe

ID No. Cert. No. Due Date Traceability

400029 & 400031 66-400225-1 28 Oct 2023 National Institute of Metrology Thailand (NIMT)

Approved by :

(Bungerd Mastri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

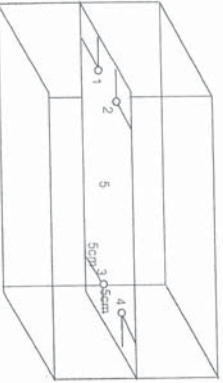
Certificate No. : 66-400422-4

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement



Front

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.					Uncertainty (± °C)	Measured Uniformity (°C)	Measured Stability (°C)
			1	2	3	4	5			
95.0	95.0	95.0	94.46	94.37	94.38	94.38	94.41	0.18	0.08	0.04

Remark: The uncertainty is not combine uniformity of the water bath

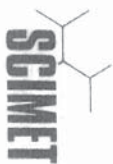
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k=2,

providing a level of confidence of approximately 95%

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SCIMET Co., Ltd.
1194 Soi Wachathamsathit 57, Bangchak,
Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 095-552-4939



Certificate No. C07230008

Calibration Certificate

Equipment: SPECTROPHOTOMETER

Model: DR3900

Serial No. (or ID): 2076219

Manufacturer: HACH

Condition: In Condition

Job No.: KSMIT2300196

Received Date: 14 July 2023

Issued Date: 14 July 2023

Page: 1 of 3

Customer

Pacific Laboratory Co., Ltd.

14/5358 Moo 14, Bang Bua Thong, Bang Bua Thong, Nonthaburi 11110 Thailand

Calibration Place

Pacific Laboratory Co., Ltd. (ในบริเวณพื้นที่ Zone B)

14/5358 Moo 14, Bang Bua Thong, Bang Bua Thong, Nonthaburi 11110 Thailand

Calibration Date

14 July 2023

Environment Condition

Temperature: 29.9 °C ± 0.1 °C

Humidity: 62.4 %RH ± 0.4 %RH

The Method used

In-house method, W107, based 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. 108691 and 108692

The standard for Photometric Certificate No. 109010

(Mr. Dumrong Boonsopon)

Person in charge



(Mr. Thalemgkeat Pongngam)

Authorized signatory

FC07-03: 30 MAY 2023



Certificate No.: C07230008

Page 2 of 3

Calibration Results:
Without Adjustment

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

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
361.02	361	0.02	0.59
417.80	417	0.80	0.59
441.29	441	0.29	0.59
471.51	471	0.51	0.59
479.88	480	-0.12	0.59
513.75	514	-0.25	0.59
528.59	528	0.59	0.59
537.75	537	0.75	0.59
585.56	585	0.56	0.59
641.95	642	-0.05	0.59
684.70	684	0.70	0.59
747.61	747	0.61	0.59
807.04	807	0.04	0.59
879.68	879	0.68	0.59

บริษัท ชยามูน จำกัด (SCIMET CO., LTD.)

1194 Soi Wachathamsathit 57, Bangchak, Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 095 552 4939

FC07-03: 30 MAY 2023



Calibration Results:
Without Adjustment

Photometric Accuracy (Absorbance)				
Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement (± Abs)
420 nm	0.0000 0.5617 0.7392 1.0550	0.000 0.560 0.737 1.054	0.0000 0.0017 0.0022 0.0010	0.0045 0.0045 0.0045 0.0045
440 nm	0.0000 0.5513 0.7230 1.0324	0.000 0.550 0.721 1.031	0.0000 0.0013 0.0020 0.0014	0.0045 0.0045 0.0045 0.0045
465 nm	0.0000 0.5036 0.6735 0.9615	0.000 0.505 0.673 0.964	0.0000 -0.0014 0.0005 -0.0025	0.0045 0.0045 0.0045 0.0045
546.1 nm	0.0000 0.5176 0.6930 0.9908	0.000 0.517 0.691 0.980	0.0000 0.0006 0.0020 0.0008	0.0045 0.0045 0.0045 0.0045
590 nm	0.0000 0.5530 0.7196 1.0301	0.000 0.552 0.717 1.027	0.0000 0.0010 0.0026 0.0031	0.0045 0.0045 0.0045 0.0045
635 nm	0.0000 0.5370 0.6862 0.9822	0.000 0.536 0.684 0.981	0.0000 0.0010 0.0022 0.0012	0.0045 0.0045 0.0045 0.0045

The End of Certificate



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-2320-0605

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02
Serial No. : 07430016101
Tube Heater : 25 Via Capacity
Accuracy : $\pm 2^{\circ}\text{C}$
Temperature Range : -10°C to 160°C
Temperature of Reaction : 150°C
Ambient Temperature : $(25 \pm 2)^{\circ}\text{C}$
Relative Humidity : $(50 \pm 15)\% \text{ RH}$
Manufacturer : Hanna Instruments
Made in : Romania
Condition As-Received : New Product
Reference : RE230837
Customer name : PACIFIC LABORATORY CO., LTD.
14/5358 Moo14, Tambol Bang Bua Thong,
Amphoe Bang Bua Thong, Nonthaburi 11110
Received date : 26 May 2023
Calibrate date : 29 May 2023
Issue date : 29 May 2023
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Jakkapob Pentisan
☐ Mr. Channarong Somak

Approved by :

Mr. Anan Suwanthaisakul



This certificate was certified only for the instrument we calibrated.

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

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

Condition of this calibration result

Reference Standard Instruments:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition	34970A	MY44065265	WK2207-065-1	WK Electric Co., Ltd.
Switch Unit				

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	± Uncertainty (°C)	± Tolerance of UUC (°C)	Acceptance Criteria
25 Vial	150.0	150.01	0.60	2	Pass

Figure: Shows the location of the temperature source.

(1A)	(2A)	(3A)	(4A)	(5A)
150.18°C	149.51°C	149.84°C	150.03°C	149.29°C
(1B)	(2B)	(3B)	(4B)	(5B)
149.82°C	150.88°C	150.64°C	150.18°C	149.63°C
(1C)	(2C)	(3C)	(4C)	(5C)
149.69°C	150.08°C	150.52°C	150.53°C	149.73°C
(1D)	(2D)	(3D)	(4D)	(5D)
150.02°C	149.85°C	149.92°C	150.01°C	149.37°C
(1E)	(2E)	(3E)	(4E)	(5)
150.24°C	149.46°C	150.38°C	150.77°C	149.63°C

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not More than the Tolerance value of UUC, therefore concluded that pass.

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 **

CERTIFICATE OF CALIBRATION

Equipment:

COD Test Tube Heater

Meter Model:

HI839800-02

Tube Heater:

25 Vial Capacity

Temperature Range:

(-10 to 160)°C

Manufacturer:

Hanna Instruments

Condition As-Received:

Used Product

Ambient Temperature:

(25 ± 2)°C

Customer name:

Pacific Laboratory Co., Ltd.

Received date:

23 February 2024

Calibrate date:

28 February 2024

Issue date:

29 February 2024

Calibrated Location:

Hanna Instruments (Thailand) Ltd.

Calibration Procedure:

This calibrator was conducted by using in-house calibration procedure

CP-04 by using certified reference standard instruments.

Calibrated by:

Mr. Pichit Pethong

Mr. Channamong Sonak

Approved by:

Mr. Anan Suwanchaisakul

Authorized Signatory
HANNA
instruments
(Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **

approval of the head of Hanna Instrument (Thailand).

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	149.7	0.51

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.089	149.882	149.793	149.236	149.232
(1B)	(2B)	(3B)	(4B)	(5B)
148.957	150.216	150.303	149.455	150.097
(1C)	(2C)	(3C)	(4C)	(5C)
150.178	150.454	150.425	149.388	149.209
(1D)	(2D)	(3D)	(4D)	(5D)
149.021	150.183	150.171	150.221	149.563
(1E)	(2E)	(3E)	(4E)	(5E)
149.125	149.200	149.952	150.236	149.346

Figure: Shows the location of the temperature source.

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

** End of certificate **

Certificate of Calibration

Certificate No. : 67-400217-1

Submitted by : Special Lab Envi and Consultant Co., Ltd.

47/91 Moo 3 Thambol Tha-it, Pakret, Nonthaburi 11120

Equipment : Temperature controlled enclosure(Inchubator)

Manufacturer : Lovibond

Range : N/A °C

Serial No. : 0925481-19

Model : FKU 1800
Resolution : 0.1 °C
ID No. : LB-Eq-005

Environment :

On site calibration was carried out at the Laboratory, Special Lab Envi and Consultant Co., Ltd.

Ambient Temperature : (24.0 to 25.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (226.0 to 226.5) V

Date of Received : 20 April 2024

Date of Calibration : 20 April 2024

Date of Issue : 26 April 2024

Calibrated by : Kittisak Kokaco

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

Standard Digital Thermometer with RTD Probe

ID No. Cert. No. Due Date Traceability

400046 & 400047 67-400047-2 26 Jul 2024 National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%
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Certificate of Calibration

Certificate No. : 67-400217-1

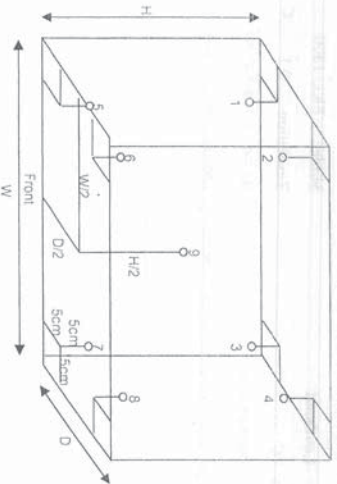
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.55 m
D = 0.73 m
H = 0.50 m
Capacity = 0.20 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.							Uncertainty (±°C)
			1	2	3	4	5	6	7	
30.0	30.0	30.0	30.09	30.21	30.18	30.17	30.52	30.49	30.13	0.31
35.0	35.0	35.0	34.95	35.17	35.13	35.14	35.62	35.67	35.04	0.32
37.0	37.0	37.0	36.94	37.16	37.13	37.11	37.60	37.64	37.02	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
30.0	30.0	30.0	0.42	0.03	0.46
35.0	35.0	35.0	0.50	0.04	0.77
37.0	37.0	37.0	0.51	0.06	0.79

Remark: The uncertainty is not combine uniformity of the air chamber

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

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

- 00 -

AB

Certificate of Calibration

Certificate No. : 66-300471-1

Page : 1 of 2

Submitted by : Special Lab Envi and Consultant Co., Ltd.

47/91-93,96 Moo 3, Tambol Tha-It, Pakret, Nonthaburi 11120

Equipment : Piston Pipette

Manufacturer : sartorius

Model : N/A

Serial No. : 4541601431

ID No. : LB-Eg-045

Capacity : 100 µl to 1000 µl Resolution : 5 µl

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (55 ± 10) %

Air Pressure : (1007.6 to 1007.7) mbar.

Date of Received : 03 August 2023

Date of Calibration : 07 August 2023

Date of Issue : 07 August 2023

Calibrated by : Awerat Sombun

Calibration Method : In-house method CAL-M3002 base on ISO 8655-6 : 2002-09

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	66-200196-4	02 Dec 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :

(Wipa Toradee)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-300471-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Test Volume (μ l)	Measuring Volume at 20 °C (μ l)	Systematic error (e_s %)	Coef. of Variation (CV%)	Uncertainty ($\pm \mu$ l)
100	97.92	0.21	0.15	0.69
500	496.58	0.34	0.04	0.69
1000	997.55	0.24	0.01	0.69

 e_s : Systematic error (%)

CV : Coefficient of variation (%)

UUC Calibrated by : Blue Tip

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

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

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ภาคผนวกที่ 5-6
เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์
ปริมาณฝุ่นละออง

Personal Pump Calibration Report

Calibrate No. : CP147/2567
Calibrate Date : April 17, 2024

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

[illegible]

Certificate of Calibration

Customer	
Name	Pacific Laboratory Co., Ltd.
Address	214/5358 Moo 14 Tambol Bang Bus Thong Amphoe Bang Bus Thong Nonthaburi 11110

Certificate No : 24-AFM-016
Request No : Req-2024-0078

Unit Under Calibration Details

Measurement Item	: Air Flow Meter
Manufacturer	: Bios
Model	: DCL-M
Serial Number	: 104699
Sensor Model : Low Flow	
Sensor Serial Number : 2014010014	

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature	: 23 °C ± 3 °C
Humidity	: 55 %RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 9 January 2024
Calibration Date	: 26 January 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU651882	TTA	7 November 2023

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.0

Note:

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : *ppc*

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By: _____

Calibration Engineer Supervisor

Issue Date : 26 January 2024





Certificate No : 24-AFM-016

Request No : Req-2024-0078

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
23.10	101.30	0.050	0.0496	-0.0004	0.0033
23.20	101.32	0.100	0.0994	-0.0006	0.0028
23.30	101.33	0.199	0.1981	-0.0009	0.0056
23.00	101.31	1.001	1.000	-0.001	0.014
23.20	101.24	2.001	1.998	-0.003	0.028
23.40	101.19	3.002	3.008	0.006	0.043

Note
STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate

CAL

Calibratech Co.,Ltd.

71/06- Moo 2, Subdaphuchisan 3 Rd., Bangpoo, Pakkret, Nonthaburi 11120
Tel (02) 964-6211 Fax (02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@namm.com

Certificate of Calibration

Certificate No. : 66-200247-2

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 : Electronic Balance

Manufacturer : SHIMADZU Model : AP225WD

Serial No. : D316301828 ID No. : LAB-BL-003

Capacity : 220 g Resolution : 0.00001g/102g, 0.0001g/220g

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

Ambient Temperature : (25.1 to 25.4) °C

Relative Humidity : (62.3 to 64.8) %

Air Pressure : 1007.0 mbar

Date of Received : 31 July 2023

Date of Calibration : 31 July 2023

Date of Issue : 02 August 2023

Calibrated by : Akaradath Thipphichai

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

Edition 5, July 2015

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

Standard Weights

ID No. Cert. No. Due Date Traceability

E261-E2624 C02222345 10 Nov 2023 National Institute of Metrology (Thailand) (NIMT)

Approved by :

AS

(Surachai Promthong)

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Certificate of Calibration

Certificate No. : 66-200247-2

Page : 2 of 2

Result of Calibration : Without Adjustment

U/C Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.001	0.00001	0.000020
0.01	0.00001	0.000021
0.05	0.00001	0.000019
0.1	0.00001	0.000024
1	-0.00001	0.000030
2	0.00000	0.000036
5	-0.00001	0.000046
20	-0.00002	0.000073
50	-0.00004	0.00011
100	-0.00005	0.00020
150	-0.0001	0.00038
200	-0.0001	0.00040

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 $k = 2.52$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g

A B C D E
0.00002 0.00003 0.00001 0.00004 0.00000 g



Repeatability

Load test : 200 g

Sidev : 0.000048 g

-0.00-

118



ภาคผนวกที่ 5-7
เอกสารสอบเทียบเครื่องมือตรวจวัดสภาพความร้อน



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

Calibration Certificate

THAI METEOROLOGICAL DEPARTMENT

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 29 January, 2024

Certification No. 039/24

Page : 1 of 2

Object : Thermal Environment Monitor

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTemp[®]34

Serial No. : TED060013


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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1016.2 hPa

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

: testo, testo 645 Serial No. 02946057 : Thermoschneider No.6169 , No.6178
: TT-3 Serial 43BE04

Japan Meteorological Agency

Calibrated by : 
Mr. Watchapol Subwat
Mechanical Engineer

Signed : 
Mr. Pisod Promsat



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

THAI METEOROLOGICAL DEPARTMENT


The Result of Calibration

29 January, 2024

Certification No. 039/24

Page : 2 of 2

Standard Temp. °C	Temperature Sensor Reading					
	Dry Bulb °C	Correction °C	Globe °C	Correction °C	Wet Bulb °C	Correction °C
50.12	50.2	-0.08	50.1	0.02	50.2	-0.08
40.24	40.3	-0.06	40.2	0.04	40.2	0.04
30.18	30.2	-0.02	30.1	0.08	30.2	-0.02

Calibrated by : 
Mr. Watchapol Subwat
Mechanical Engineer



เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพดิน
ภาคผนวกที่ 5-8



Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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

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

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services>

Introduction

Customer Information

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



Instrument Preventive Maintenance Checklist

Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- To access Agilent University, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections: Join the Agilent Community at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
 - Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
 - Only select those pages that relate to the system or module being serviced.
 - Complete empty fields with the relevant information.
 - Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
 - Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
 - Complete the Preventive Maintenance service in the order of the tasks listed.
 - Complete the Service Review section together with the customer.
 - Complete the fields for page numbers at the foot of each selected page.
 - Complete the total number of pages field in the Service Completion section.
 - Ask the customer to sign the Service Completion section including the customer's and your signature.
- This information is subject to change without notice.

Instrument Maintenance

System Information

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

Instrument System Name and ID	E40 FS AA / MV 13110001 / UAF-HEM-1555
Instrument System Site and Location	Heavy metal Analysis Unit / UNITED ANALYT AND ENERGY

List System Component Product Numbers	List the Serial Numbers of each Component
1. 59421A	MV13110001
2. 59444A	MV13150001
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☒ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the **SVD Power Supply diagnostic**.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the **SVD RBC frequency diagnostic**.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
- ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA, N/A

Optics components

- ☒ Check that external optical surfaces are clean - Clean or replace as required.
- ☒ Use SVD and perform **Mono Wavelength Correction**.
- ☒ Use SVD and perform **Slit Calibration**.
- ☒ Use SVD and perform **Grating Squareness Diagnostic**.
- ☒ Use SVD and perform **Zero Order Offset/Mono Correction**.
- ☒ Use SVD and perform **Wavelength Repeatability**.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel
- ☒ Check and clean the igniter electrode

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the **SVD Interlock monitoring diagnostic**.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

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FURNACE SYSTEM section

☒ Section not applicableElectronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.

- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems☒ Section NOT Applicable

- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory☒ Section NOT Applicable

- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 ® Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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Vapor generation accessory VGA (hydride generator)☐ Section NOT Applicable

- ☒ Inspect VGA gas supply hose.
- ☒ Inspect/replace VGA pump tubing.
- ☒ Check low gas pressure interlock setting – adjust if required.
- ☒ Check precision orifice gas flow setting – adjust if required.
- ☒ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☒ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltraAA lamp accessory (external)☒ Section NOT Applicable

- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☒ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

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

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Signature Page

Service Review

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

Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	45 %
Flame performance test with 5 ppm copper sample		
Air/acetylene, mixing paddle removed	Abs value > 0.5	0.53 %
Air/acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.4 %
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0 %	-
Abs value	≥ 0.10	-
%SR%	≥ 70 %	-

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mix 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM. Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please enter in this box:

Service Completion

Service request number: 600519633 Date service completed: Jan 30, 2023

Agilent signature: Nukoon L. Customer signature: Chontakorn

Total number of pages in this document: 13

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SVD Results Report



Report ID: Diagnostic Start Time: 30/01/2023 9:07:52 AM Diagnostic End Time: 30/01/2023 9:53:18 AM

Customer: UNITED ANALYSIS AND ENGINEERING CONSULTANT: Nukoon Lueangsangwan

Address: Contact Details: 02-637-6363

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic

Instrument Model: Varian AA140/240/280 Number Of Lamps: 4

Flame Instrument: True Mono Type: Automatic

Furnace Instrument: True Gasbox Type: "Y" Gas Box

Zeeman Present: False Auto Burner Adjuster: False

Internal Zeeman: False Mains Frequency: 50

Internal UltraAA: False Firmware Version: 2.11

Optics Type: Double Beam Photomultiplier Type: Normal(90nm)

D2 BG Correction Fitted: True PWB Version: 45

Boot Block Version:

EEPROM Data:

Instrument Run Hours: 59326.383 D2 Run Hours: 46984.500

Zero Wavelength Offset: 30.175 D2 Serial Number: not set

Mono Correction: 0.760 D2 Install Date: 01/01/1970

Flame Hours: 28887.084 D2 Original Intensity: 1.000

D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit: 51.00 Highest Measured Frequency: 50.00

Average Frequency: 50.00

Lower Limit: 49.00 Lowest Measured Frequency: 50.00

Result: Passed

Report Generated At: 30/01/2023 9:54:51 AM

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เอกสารไม่ควบคุม SVD

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

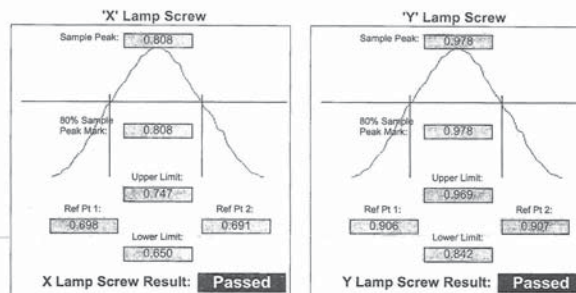
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.17	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.02	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type:
Lamp Socket Used:

Peak Selected:
Lamp Alignment: Performed



Grating Squareness:

Lamp Element(s): Cobalt/Chromium/Copp

Lamp Turret Position: 3

Lamp Current(mA): 10.00

Slit Width(nm): 0.2

1st Order Wavelength(nm): 324.80

Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.80	325.15	Passed
Second Order	649.23	649.55	649.97	Passed

Report Generated At: 30/01/2023 9:54:51 AM

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เอกสารไม่ทบทวน SVD

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3

เอกสารไม่ทบทวน SVD

Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal
Lamp Alignment: Performed

Lower Limit(nm)	324.768	324.888	Upper Limit(nm)
(Approach from Zero Order)		(Approach from end)	
Sample 1:	324.828	Sample 2:	324.828
Sample 3:	324.823	Sample 4:	324.823
Sample 5:	324.823	Sample 6:	324.823
Sample 7:	324.823	Sample 8:	324.819
Sample 9:	324.823	Sample 10:	324.819

Mean: 324.824
Standard Deviation: 0.002

Result: Passed

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	164	191	Passed
S2	271	296	332	Passed
S3	474	507	579	Passed
S4	825	917	1008	Passed
S5	1435	1528	1754	Passed
S6	2498	2768	3053	Passed
S7	4347	4749	5313	Passed

Interlocks:

Burner Fitted: Working
N2O Burner Fitted: Untested
Flame Shield Closed: Working
Gas Control Fitted: Untested
Pressure Release Bung Fitted: Working
Liquid Trap Fitted: Working
Flame Detect: Working
GCU Active: Working
Oxidant Pressure: Working
Oxidant Changeover: Untested
Ignition: Working

Report Generated At: 30/01/2023 9:54:51 AM

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เอกสารไม่ทบทวน SVD

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5

เอกสารไม่ทบทวน SVD

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected Lamp 5: Not Supported
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C Lamp 6: Not Supported
Lamp 3: 76 - Cobalt/Chromium/Copper/Iron/Manganese Lamp 7: Not Supported(Ni)
Lamp 4: Uncoded Lamp/Not Connected Lamp 8: Not Supported

Result: **Passed****GTA Temperature Monitoring:****Not Performed**

Notes:

Signatures:

UNITED ANALYSIS AND ENG Date: RING CONSULTANT Nukoon Lueangsangwan Date

Sequential by time report

30/01/2023 10:58 AM
Page 1 of 1

SpectrAA

Analyst
Date Started 30/01/2023 10:56 AM GMT: 30/01/2023 3:56 AM
Worksheet Cu 5 ppm Sensitivity
Comment
Methods Cu
Computer name HEM-212
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
Cu 5 ppm PreTest	UNCAL	0.1	0.5516
Readings			
0.5524	0.5512	0.5510	30/01/2023

Report Generated At: 30/01/2023 9:54:51 AM

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เอกสารไม่ควบคุม SVD

เอกสารไม่ควบคุม

Sequential by time report

30/01/2023 11:03 AM
Page 1 of 1

SpectrAA

Analyst
Date Started 30/01/2023 11:00 AM GMT: 30/01/2023 4:00 AM
Worksheet Cu 5 ppm Sensitivity 01
Comment
Methods Cu
Computer name HEM-212
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
Cu 5 ppm Precision ✓	UNCAL	0.4	0.5394
Readings			
0.5383	0.5418	0.5407	0.5358
0.5406	0.5429	0.5410	0.5367
			30/01/2023

Sequential by time report

30/01/2023 12:41 PM
Page 1 of 1

SpectrAA

Analyst
Date Started 30/01/2023 12:22 PM GMT: 30/01/2023 5:22 AM
Worksheet Hg
Comment
Methods Hg
Computer name HEM-212
Serial Number: MY13160001

Method: Hg (Vapor)

Sample ID	Conc. ug/L	%RSD	Mean Abs
Hg 10 ppb	UNCAL	0.2	0.1713
Readings			
0.1710	0.1716	0.1712	30/01/2023

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม