

ภาคผนวกที่ 5-1
เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ
ในบรรยากาศโดยทั่วไป



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CO-006-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 710725
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : 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.

Calibration procedure:

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

Traceability:

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

Uncertainty of Measurement:

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

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory: ...



Calibration Department Manager

MEASUREMENT RESULTS:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	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 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_a] 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): -0.01471
 Correlation coefficient (r): 0.99983
 Uncertainty ($k = 2$): 0.015 m^3/min

End of Certificate of Calibration





บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 11 August 2023

Instruments Information

Analyzer Type: SO ₂ Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-65967-350
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Calibration System

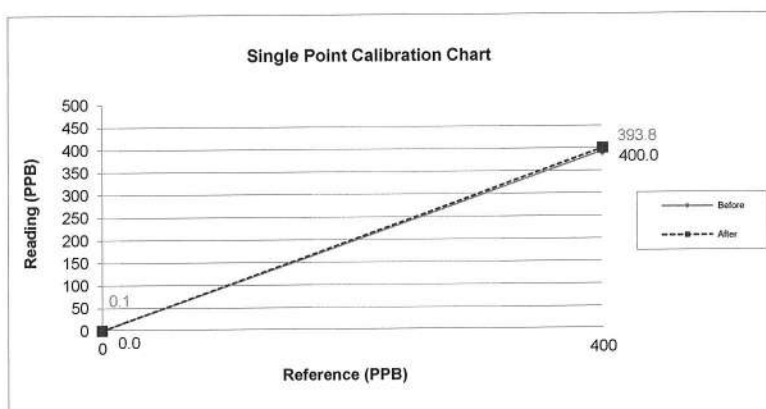
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 46.05 PPM SO ₂ Conc 46.01 PPM CO Conc 4,487 PPM Expire Date: 19 Sep. 2020

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	393.8	-1.6
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 25 August 2022

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-65967-356
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Calibration System

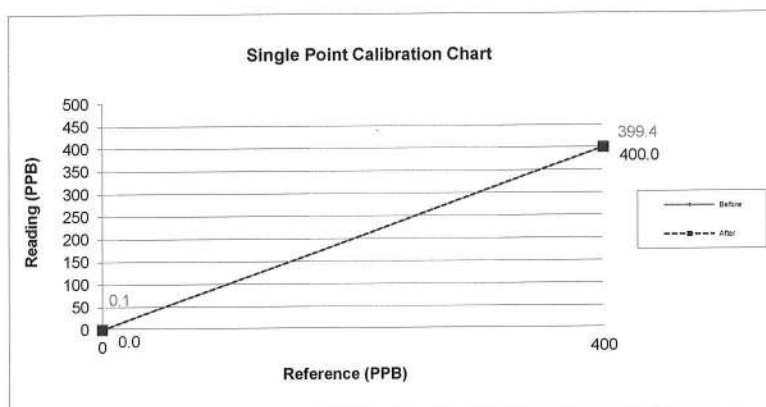
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	399.4	-0.2
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

Mr.PASAGORN SAMOL

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

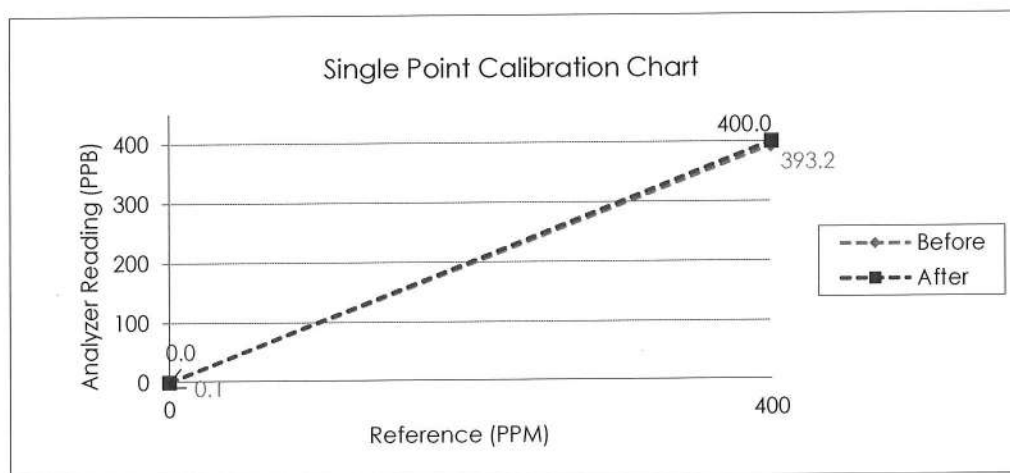
Standard Gas Concentration

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



Calibrate By :



Approve by



ENVIR SERVICE CO., LTD.

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

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

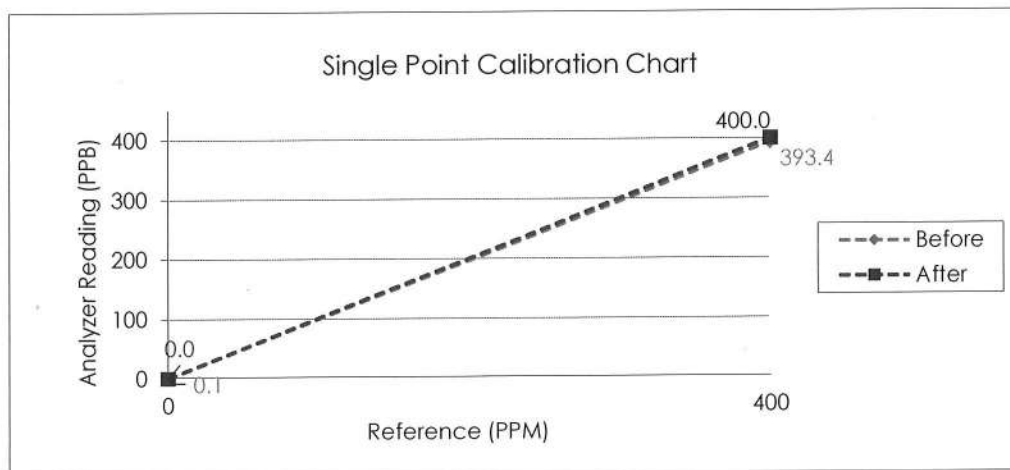
Standard Gas Concentration

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



Calibrate By :

Approve by :



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 07 October 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-03620000000891
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Calibration System

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

Environment: Temperature 25.5 °C

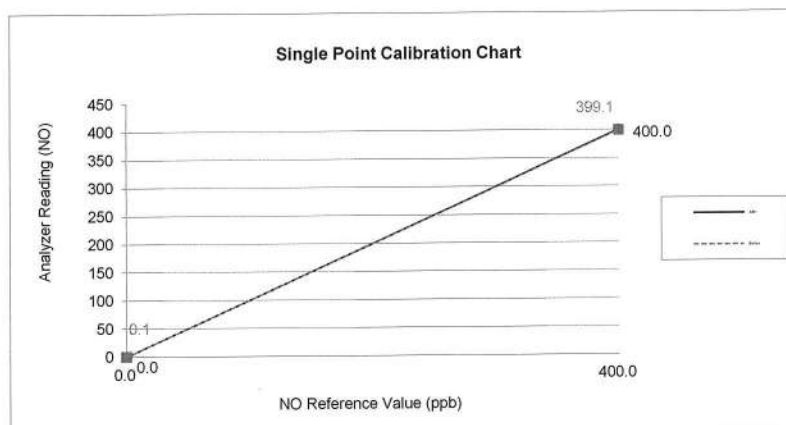
Humidity: 51 %RH

Calibration Check (Before adjust)

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

Calibration Check (After adjust)

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



Calibrate By: [Redacted]



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 26 January 2023

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 0514811452
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Calibration System

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

Environment: Temperature 25.5 °C

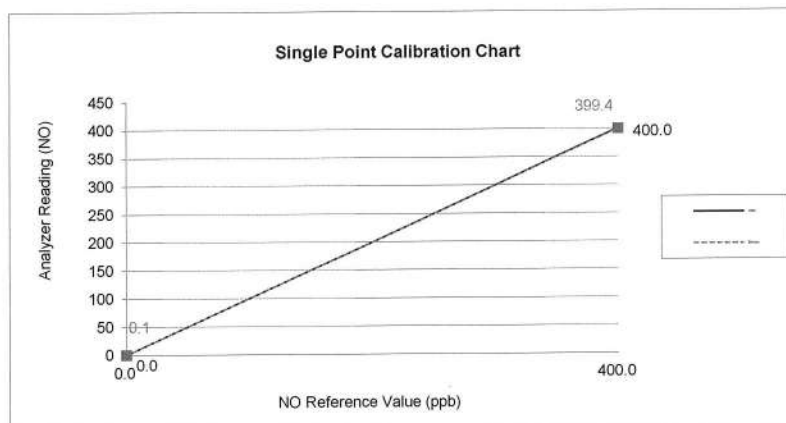
Humidity: 51 %RH

Calibration Check (Before adjust)

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

Calibration Check (After adjust)

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



Calibrate By



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 07 October 2022

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 0528012676
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Calibration System

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

Environment: Temperature 25.5 °C

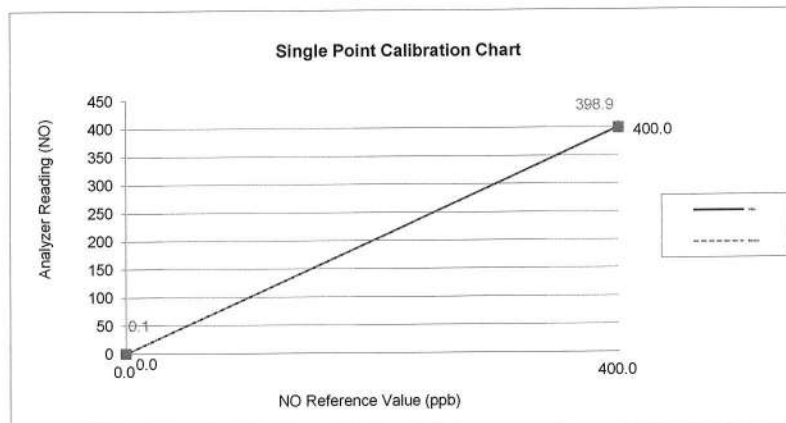
Humidity: 51 %RH

Calibration Check (Before adjust)

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

Calibration Check (After adjust)

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



Calibrate E



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

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

Analyzer Performance Test

Calibrated Date: 26 January 2023

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer: Thermo Environmental S/N: 032630000000891
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Calibration System

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

Environment: Temperature 25.5 °C

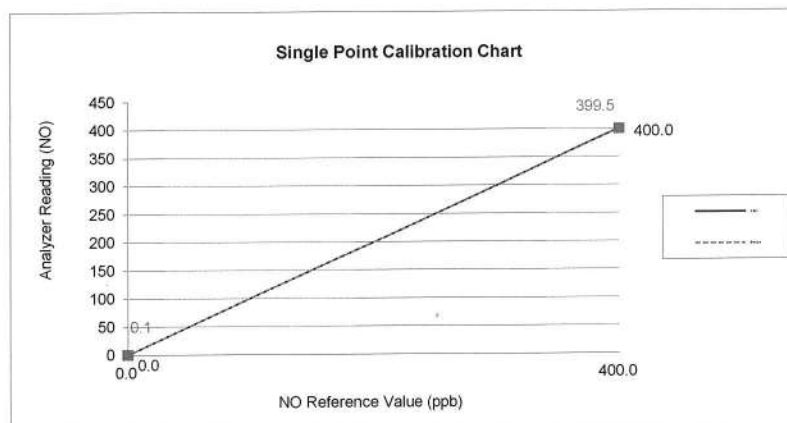
Humidity: 51 %RH

Calibration Check (Before adjust)

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

Calibration Check (After adjust)

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



Calibrate By [REDACTED]



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 15 November, 2022

Certification No. 401/22

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC91006A06

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

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

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

Serial Number 110730029 (sensor 120629586)

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

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

: Thermoschneider No.918802

Calibrated by :

Mr. Watcharapol

Mechanical Engineer

Signe

Mr. P





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 2 of 3

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

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

Calibrated by

Mr. Watcharaporn Suowat
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 3 of 3

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

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 January, 2023

Certification No. 010/23

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC01009A97

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

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

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

Serial Number 110730029 (sensor 120629586)

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

STANDARD THERMOMETER

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

: Thermo Schneider No.918802

Calibrated by

Mr. Watcharapol Subwat

Mechanical Engineer

Sign

Mr. J

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 010/23

13 January, 2023

Page : 2 of 3

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

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

Calibrated by



Mr. Watcharapol Subwat
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 010/23

13 January, 2023

Page : 3 of 3

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

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer



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 15 November, 2022

Certification No. 401/22

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC91006A06

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

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

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

Serial Number 110730029 (sensor 120629586)

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

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

: Thermoschneider No.918802

Calibrated by :

Mr. Watcharapol

Mechanical Engineer

Sign

Mr.

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 2 of 3

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

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

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 401/22

15 November, 2022

Page : 3 of 3

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

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 January, 2023

Certification No. 010/23

Page : 1 of 3

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III Product No. 7425

Serial No. : WC01009A97

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.2 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

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

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

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

Serial Number 110730029 (sensor 120629586)

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

STANDARD THERMOMETER

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

: Thermoschneider No.918802

Calibrated by

Mr. Watcharapol Subwat

Mechanical Engineer

Signed

Mr. Pisit

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 010/23

13 January, 2023

Page : 2 of 3

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

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

Calibrated by



Mr. Watcharapol Subwat
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 010/23

13 January, 2023

Page : 3 of 3

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

Calibrated by :



Mr. Watcharapol Subwat
Mechanical Engineer



ภาคผนวกที่ 5-3
เอกสารสอบเทียบเครื่องมือตรวจวัดปริมาณสารเจือปน
ในอากาศที่ระบายออกจากปล่อง

Envi Equipment Service Co., Ltd.
110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No. : E23-01009
Page : 1 of 6

CERTIFICATE OF CALIBRATION

Customer : Pacific Laboratory Co., Ltd.
Address : 14/5358 Moo 14, Tambon Bang Bua Thong, Amphoc 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 : 06/01/2023
Issue Date : 06/01/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

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 Fuekhud)
Technical Manger



Certificate No. : E23-01009
Page : 2 of 6

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-OV	Date	Time	06/01/2023	10:00 AM	Std Temp	293	K
Console Serial Number	1306033	Calibration Reference No.	SER23-01003			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	759.74		mmHg	K ₁	0.386	
DGM Serial Number	00009149	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _m)	(V _{mi})	(V _{mf})	(t _{mi})	(t _{mf})	(V _{wi})	(V _{wf})	(t _{wi})	(t _{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.42	13.0	0.1450	0.2850	24	24	118.50438	118.64402	25	25
12.40	13.0	0.2850	0.4250	25	25	118.64402	118.78246	25	25
8.75	26.0	0.4360	0.5760	25	25	118.78792	118.92572	25	25
8.75	26.0	0.5760	0.7160	26	26	118.92572	119.06308	25	25
14.02	40.0	0.7220	1.0020	27	27	119.06932	119.34854	25	25
14.02	40.0	1.0020	1.2820	28	28	119.34854	119.62648	25	25
10.53	70.0	1.2930	1.5730	28	28	119.63648	119.91388	25	25
10.50	70.0	1.5730	1.8530	28	28	119.91388	120.19082	25	25
9.17	90.0	1.8640	2.1440	29	29	120.20082	120.48048	25	25
9.15	90.0	2.1440	2.4240	29	29	120.48048	120.75954	25	25



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

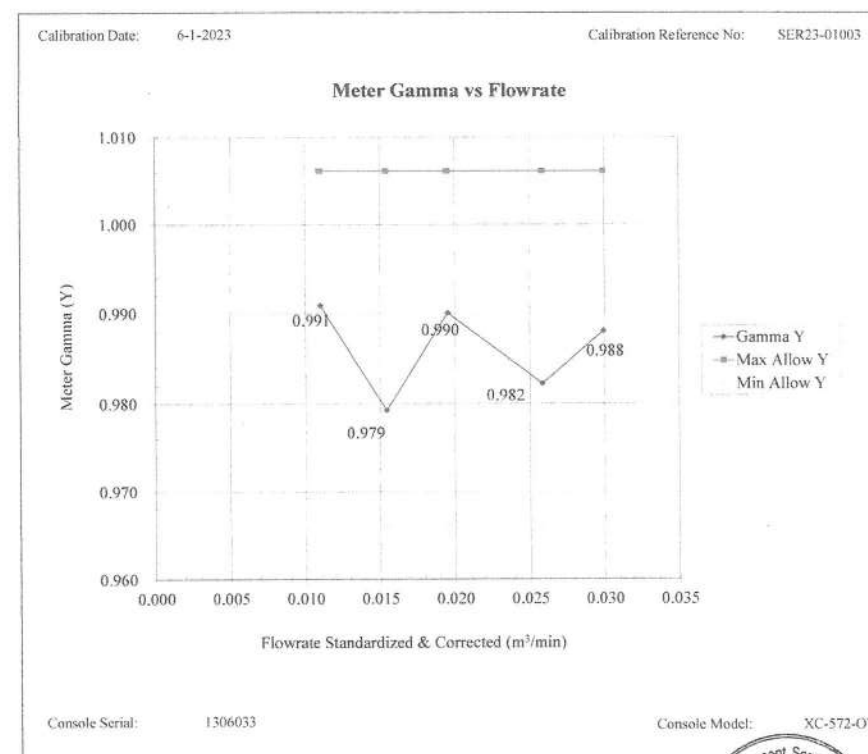
Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-OV	Date	Time	06/01/2023	10:10 AM	Std Temp	293	K
Console Serial Number	1306033	Calibration Reference No.	SER23-01003			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	759.74			K ₁	0.386	
DGM Serial Number	00009149	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
				Calibration Factor		Flowrate			
Dry Gas Meter	Calibration Meter			Value	Variation	Std & Corr	.0212 m ³ /min	Variation	
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	(Y)	(ΔY)	(Q _{m(std)corr})	(ΔH _g)	(ΔH _g)	
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		
0.138	0.011	0.137	0.011	0.995	0.009	0.011	47.368	0.286	
0.138	0.011	0.136	0.011	0.987	0.001	0.011	48.063	0.981	
0.138	0.016	0.135	0.015	0.981	-0.005	0.015	48.432	1.350	
0.138	0.016	0.135	0.015	0.978	-0.008	0.015	48.743	1.661	
0.276	0.020	0.274	0.020	0.992	0.006	0.020	46.695	-0.387	
0.276	0.020	0.273	0.019	0.988	0.002	0.019	47.126	0.044	
0.277	0.026	0.272	0.026	0.983	-0.003	0.026	47.026	-0.056	
0.277	0.026	0.272	0.026	0.981	-0.005	0.026	46.884	-0.198	
0.278	0.030	0.275	0.030	0.989	0.003	0.030	45.227	-1.855	
0.278	0.030	0.274	0.030	0.987	0.001	0.030	45.256	-1.826	
				0.986	Y Average			47.082	ΔH _g Average

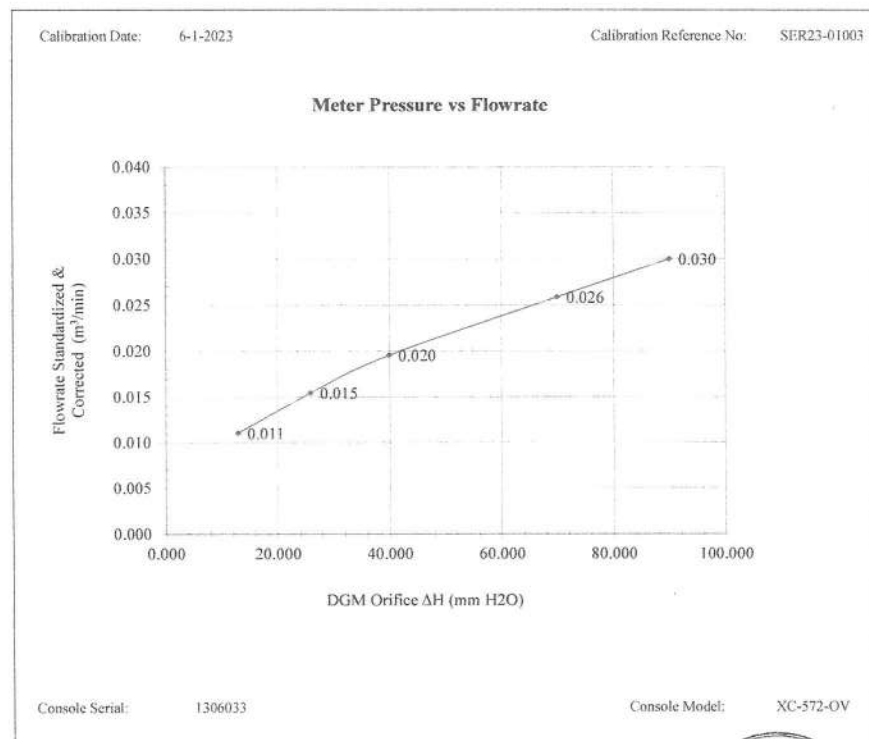
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.



Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-OV	Date	Time	06/01/2023	10:10 AM	Std Temp	293	K
Console Serial Number	1306033	Calibration Reference No.	SER23-01003			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	759.74			K ₁	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	06/01/2023	10:10 AM	Std Temp	293	K
Console Serial Number	1306033	Calibration Reference No.	SER23-01003			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	759.74 mmHg			K ₁	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	06/01/2023	12:10 PM
Console Serial Number	1306033	Calibration Reference No.	SER23-01003		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00009149	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
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	816.0	1038.0
Stack	-17.0	27.0	37.0	93.0	149.0	259.0	372.0	484.0	595.0	819.0	1042.0
Aux	-17.0	27.0	37.0	92.0	149.0						
Probe	-17.0	27.0	37.0	93.0	149.0						
Filter	-17.0	27.0	37.0	93.0	149.0						
Oven	-17.0	27.0	37.0	93.0	149.0						
Exit	-17.0	27.0	37.0								

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

Tolerance Range

Meter ± 3.0 °C
Exit ± 2.0 °C



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. : E23-01010
Page : 1 of 3

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-4HV
Serial Number : -
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 06/01/2023
Issue Date : 06/01/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

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 Fuchan)
Technical Manger

Certificate No. : E23-01010
Page : 2 of 3

CALIBRATION RESULTS S-Type Geometric Pitot Tube Calibration

Sampling System Equipment Information

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

Calibration Condition

Date : 6 January 2023
Barometric Pressure : 759.74 mm Hg
Digital Caliper : CD-6" ASX
Serial number : A18008059

Pitot tube/Probe: # PS-4HV			
Parameter	Value	Allowable Range	Check
Assembly level?	Yes	Yes	Pass
Ports Damage?	No	No	Pass
α1	0	-10 ° < α1 < +10 °	Pass
α2	1	-10 ° < α2 < +10 °	Pass
β1	0	-5 ° < β1 < +5 °	Pass
β2	0	-5 ° < β2 < +5 °	Pass
γ	0	N/A	-
θ	0	N/A	-
Dt	0.374	.188 " to .375 "	Pass
A	0.966	2.1Dt ≤ A ≤ 3Dt	Pass
A/2Dt	1.291	1.05 ≤ P _A /D _t ≤ 1.5	Pass
Z = A tan γ	0.047	Z ≤ .125"	Pass
W = A tan θ	0.019	W ≤ .031"	Pass

Remark:

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



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Probe Model Number	PS-4HV
Probe Serial Number	-
Meter Box Model Number	JENCO 765 KF
Meter Box Serial Number	JC 13335

Calibration Conditions			
Date	Time	06/01/2023	01:00 PM
Calibration Reference No.		SER23-01003	
Reference Thermometer		DIGICON	
Serial Number		183169105	

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



Certificate of Calibration



CUSTOMER

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

UNIT UNDER CALIBRATION (UUC)

Description
Flue gas analyzer
Manufacturers
testo Model 310
S/N.**42848034**
Measuring Range
O2 : 0-21 %Vol, CO : 0-4000 PPM

Cert. No. **SE-CM23SER117**

Cal. Date : 10-Mar-23
Cal. Due : 09-Mar-24
Work Order No. : SE-CM23SER117
Cal. Temp. : 25.0 ± 1°C
Cal. Humidity : 55.0 ± 10 %RH

Reference Standard

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

Function Setup

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

Test Result

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




Calibration Result

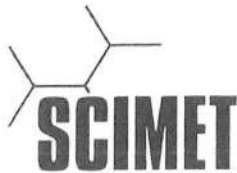
Parameter	Zero						Span						Respond time Sec.		Judgment	Note:
	Std.	Acc.	Before	Cal.	After	Err.	Std.	Acc.	Before	Cal.	After	Err.	Acc.	Read		
O2 (%Vol)	0.0	± 1.5	0.0	0.0	0.0	0.0	18.0	± 1.0	18.4	18.4	18.4	0.0	≤30	14.0	Pass	- Respond time must be within 30 sec. to reach to 90% of Std. concentration.
CO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

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

Comment/ Suggestion :

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

Engineer Signatory	Approval Signatory	Company Stamp
 Mr. Thaweechai Santawiro (Engineer Specialist) Date : 10-Mar-23	 Mr. Chaiwat Chuekhunthod (Gases Division Chief) Date : 10-Mar-23	 Call Me CALL ME ENGINEER CO., LTD.



SCIMET Co., Ltd.
1194 Soi Wachirathamsathit 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.: KSMT2300196

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.(ห้องปฏิบัติการทดสอบ 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, WI07, 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 national standard laboratories.

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

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

(Mr. Dumrong Boonsopon)

Person in charge



Authorized signatory

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

Calibration Results:
Without Adjustment
Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement(\pm 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
	1.0550	1.054	0.0010	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5513	0.550	0.0013	0.0045
	0.7230	0.721	0.0020	0.0045
	1.0324	1.031	0.0014	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5036	0.505	-0.0014	0.0045
	0.6735	0.673	0.0005	0.0045
	0.9615	0.964	-0.0025	0.0045
546.1 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
	0.9908	0.990	0.0008	0.0045
590 nm	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
635 nm	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

Certificate No.: CP20230169EA

Operation No.: CP2023030041

Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: TENMARS

Model/Type: TM-100

Serial No.: 190301469

ID No.: -

Customer: Pacific Laboratory Co., Ltd.

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

Received Date: 23 March 2023

Calibrated Date: 31 March 2023

Issued Date: 1 April 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

Group Manager

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

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20230169EA

Calibration Report

Equipment: Sound Calibrator
Manufacturer: TENMARS
Model/Type: TM-100
Serial No.: 190301469
ID No.: -
Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$
Pressure: $(101.3 \pm 1.5) \text{ kPa}$
Method of Calibration :-
IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

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

Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance limit ^[3] (dB)
1000	94	94.20	0.20	± 0.40
1000	114	114.25	0.25	± 0.40

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance limit ^[3] (%)
94	1000	970.5	-3.0	± 1.7
114	1000	965.9	-3.4	± 1.7

Certificate No.: CP20230169EA

Calibration Report

3. Function : Total distortion + noise

Normal Sound Pressure level (dB)	Normal Frequency (Hz)	Measured value ^[4] (%)	Acceptance limit ^[5] (%)
94	1000	1.8	3.0
114	1000	2.0	3.0

Uncertainty of measurement

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

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
 - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
 - [3] The acceptance limit is for the deviated value.
 - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
 - [5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 2.
2. The coverage factor $k = 2.00$

-- End of Report --



PACIFIC

LABORATORY CO., LTD.

Pacific Laboratory Co., Ltd.

14/5358 Moo 14 Tambol Bang Bua Thong

Amphoe Bang Bua Thong, Nonthaburi 11110

Tel. : 0-2045-2446-7 Fax. : 0-2045-3991

Sound Level Meter Calibration Report

Calibrate No. : SLM 221/2566

Calibrate Date : September 27, 2023

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

Item	Instrument	Manufacturer	Model	Serial No.	Before Adjust	After Adjust	Inspection Result
1.	Sound Level Meter	ACO Co., Ltd.	6226	170091	94.3	94.0	Pass
					113.9	114.0	Pass
2.	Sound Level Meter	ACO Co., Ltd.	6226	200039	94.1	94.0	Pass
					114.1	114.0	Pass
3.	Sound Level Meter	ACO Co., Ltd.	6226	200046	93.6	94.0	Pass
					114.3	114.0	Pass

Approved By

(Miss Sakuna Supparot)
Technician

Certificate No.: CP20230169EA

Operation No.: CP2023030041

Certificate of Calibration

Equipment: Sound Calibrator

Manufacturer: TENMARS

Model/Type: TM-100

Serial No.: 190301469

ID No.: -

Customer: Pacific Laboratory Co., Ltd.

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

Received Date: 23 March 2023

Calibrated Date: 31 March 2023

Issued Date: 1 April 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

Group Manager

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

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.

Certificate No.: CP20230169EA

Calibration Report

Equipment: Sound Calibrator
Manufacturer: TENMARS
Model/Type: TM-100
Serial No.: 190301469
ID No.: -
Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 15) \%$
Pressure: $(101.3 \pm 1.5) \text{ kPa}$
Method of Calibration :-
IEC 60942:2017

Condition of this result of calibration

1. Reference standards instrument :-

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

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

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

Result of Calibration:-

1. Function : Sound pressure level

Norminal Frequency (Hz)	Specified Sound Pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance limit ^[3] (dB)
1000	94	94.20	0.20	± 0.40
1000	114	114.25	0.25	± 0.40

2. Function : Frequency

Norminal Sound Pressure level (dB)	Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[2] (%)	Acceptance limit ^[3] (%)
94	1000	970.5	-3.0	± 1.7
114	1000	965.9	-3.4	± 1.7

Certificate No.: CP20230169EA

Calibration Report

3. Function : Total distortion + noise

Normal Sound Pressure level (dB)	Normal Frequency (Hz)	Measured value ^[4] (%)	Acceptance limit ^[5] (%)
94	1000	1.8	3.0
114	1000	2.0	3.0

Uncertainty of measurement

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

- Note:
- [1] The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.
 - [2] The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.
 - [3] The acceptance limit is for the deviated value.
 - [4] The measured value is the total distortion + noise, measured over the frequency range from 20 Hz to 20 kHz.
 - [5] The acceptance limit is for the Measured value.

Remarks: 1. Acceptance limit was IEC 60942:2017 Class 2.
2. The coverage factor $k = 2.00$

-- End of Report --

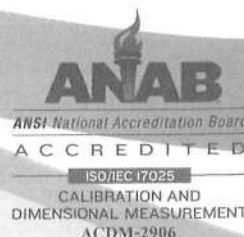


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Email. sales@aptitech-cal.com



CERTIFICATE OF CALIBRATION

Certificate Number : SC230098

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	: SC230098
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222134	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

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

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

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

Standard Equipments

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

Authority of Calibration

Approved Signatory



Calibration Date : 27-Feb-2023

Issued Date : 2-Mar-2023

Calibrated By : Mr. Sataporn Petnoi

☐ Mr. Anuwat Simsiriwat [Laboratory Manager]

☒ Mr. Sompoch Srisunart [Technical Manager]

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CALIBRATION REPORT

Certificate Number : SC230098

Calibration Method

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

Calibration Results

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

Sound Level Measurement (Slow Mode)

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

--- End of Certificate ---

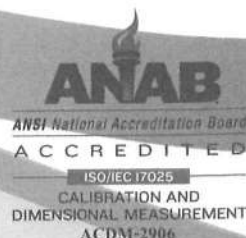


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CERTIFICATE OF CALIBRATION

Certificate Number : SC230017

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	: SC230017
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222016	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 04-Jan-23

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

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

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

Standard Equipments

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

APTITECH

Authority of Calibration

Approved Signatory



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

- ☐ Mr. Anuwat Simsiriwat [Laboratory Manager]
☒ Mr. Sompoch Srisunart [Technical Manager]

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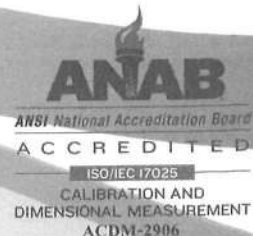


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CALIBRATION REPORT

Certificate Number : SC230017

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	113.6 dB	-0.27 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

Sound Level Measurement (Fast Mode)

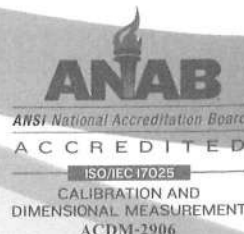
Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

--- End of Certificate ---



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CERTIFICATE OF CALIBRATION

Certificate Number : SC230101

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	: SC230101
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222137	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 24-Feb-23

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

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

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

Standard Equipments

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

Authority of Calibration

Approved Signatory

Calibration Date : 27-Feb-2023

Issued Date : 2-Mar-2023

Calibrated By : Mr. Sataporn Petnoi

- ☐ Mr. Anuwat Simsiriwat [Laboratory Manager]
☒ Mr. Sompoch Srisunart [Technical Manager]

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CALIBRATION REPORT

Certificate Number : SC230101

Calibration Method

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

Calibration Results

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

Sound Level Measurement (Slow Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(\pm) Uncertainty
LA	40-130 dB	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)

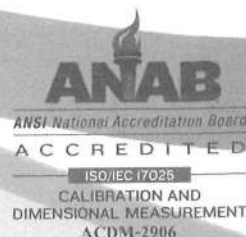
Function	UUC Range	Standard Value	UUC Reading	UUC Error	(\pm) Uncertainty
LA	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.7 dB	-0.16 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB

--- End of Certificate ---



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CERTIFICATE OF CALIBRATION

Certificate Number : SC230037

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	: SC230037
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222046	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 13-Jan-23

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

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

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

Standard Equipments

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

Authority of Calibration

Approved Signatory



Calibration Date : 15-Jan-2023

Issued Date : 20-Jan-2023

Calibrated By : Mr. Sataporn Petnoi

☐ Mr. Anuwat Simsiriwat [Laboratory Manager]

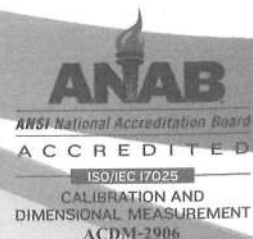
☒ Mr. Sompoch Srisunart [Technical Manager]

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CALIBRATION REPORT

Certificate Number : SC230037

Calibration Method

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

Calibration Results

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

Sound Level Measurement (Slow Mode)

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

Sound Level Measurement (Fast Mode)

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

--- End of Certificate ---

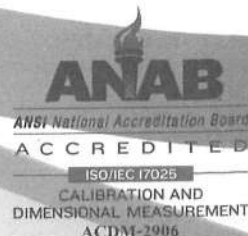


APTITECH CALIBRATION CO., LTD.

50/40 Moo 5 T. Lat Sawai, A. Lamlukka, Pathumthani 12150

Tel. +66 2103-6290 Fax. +66 2103-6291

Email: sales@aptitech-cal.com



CERTIFICATE OF CALIBRATION

Certificate Number : SC230016

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	: SC230016
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222015	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 04-Jan-23

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

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

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

Standard Equipments

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



Authority of Calibration

Approved Signatory



Calibration Date : 05-Jan-2023

Issued Date : 10-Jan-2023

Calibrated By : Mr. Rattapong Janpanya

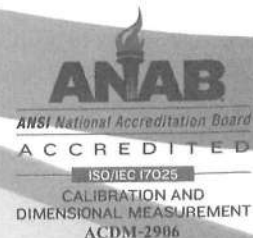
- ☐ Mr. Anuwat Simsiriwat [Laboratory Manager]
☒ Mr. Sompoch Srisunart [Technical Manager]

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CALIBRATION REPORT

Certificate Number : SC230016

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	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.7 dB	-0.17 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

Sound Level Measurement (Fast Mode)

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

--- End of Certificate ---

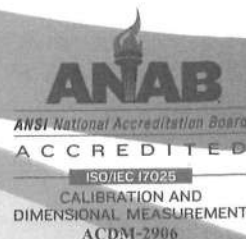


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CERTIFICATE OF CALIBRATION

Certificate Number : SC230018

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	: SC230018
Manufacturer	: ACO	Calibration Location	: Laboratory
Model	: 6236	Ambient Temperature	: 22 ± 2 °C
Serial Number	: 222017	Ambient Humidity	: 55 ± 15 %RH
ID. Number	: N/A	Received Date	: 04-Jan-23

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

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

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

Standard Equipments

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



Authority of Calibration

Approved Signatory



☐ Mr. Anuwat Simsiriwat [Laboratory Manager]

☒ Mr. Sompoch Srisunart [Technical Manager]

Calibration Date : 05-Jan-2023

Issued Date : 10-Jan-2023

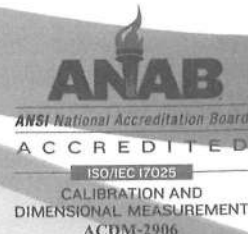
Calibrated By : Mr. Rattapong Janpanya

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CALIBRATION REPORT

Certificate Number : SC230018

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	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.5 dB	-0.37 dB	0.60 dB

Sound Level Measurement (Fast Mode)

Function	UUC Range	Standard Value	UUC Reading	UUC Error	(±) Uncertainty
LA	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.5 dB	-0.37 dB	0.60 dB
LC	40-130 dB	93.86 dB	93.6 dB	-0.26 dB	0.60 dB
		113.87 dB	113.6 dB	-0.27 dB	0.60 dB

--- End of Certificate ---



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CERTIFICATE OF CALIBRATION

Certificate Number : SC230033

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	: SC230033
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	: 13-Jan-23

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

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

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

Standard Equipments

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

Authority of Calibration

Approved Signatory



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

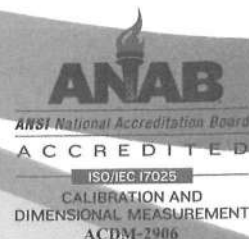
- ☐ Mr. Anuwat Simsiriwat [Laboratory Manager]
☒ Mr. Sompoch Srisunart [Technical Manager]

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CALIBRATION REPORT

Certificate Number : SC230033

Calibration Method

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

Calibration Results

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

Sound Level Measurement (Slow Mode)

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

Sound Level Measurement (Fast Mode)

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

--- End of Certificate ---

ภาคผนวกที่ 5-5
เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำ

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-420108-1

Page : 1 of 2

Submitted by : Pacific Laboratory Co.,Ltd.

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

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 700

Range : N/A pH

Resolution : 0.01 pH

Serial No. : 2841305

ID No. : LAB-PH-002

Electrode

Model : N/A

Serial No. : 3093341

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

Ambient Temperature : (25.2 to 25.8)°C

Relative Humidity : (50 to 55) %

Date of Received : 17 December 2022

Date of Calibration : 17 December 2022

Date of Issue : 19 December 2022

Calibrated by : Bunjerd Masri

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

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

1. Multiproduct Calibrator

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

2. Standard Buffer Solution

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

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-420108-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.5	0.0	0.12

Function : pH meter with electrode

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

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
	10.010	10.01	0.00	0.014

Remark

UUC : Unit Under Calibration

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

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

- 000 -



CAL

Calibratech Co.,Ltd.

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

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



Certificate of Calibration

Page : 1 of 2

Certificate No. : 65-400648-1

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

Equipment : Digital Thermometer with Thermistor probe
Temperature Indicator
Manufacturer : Eutech Model : pH 700
Range : N/A °C Resolution : 0.1 °C
Serial No. : 2841305 ID No. : LAB-PH-002

Thermistor probe
Model : N/A Sheath Material : Stainless
Diameter : 3 mm. Length : 115 mm.
Serial No. : PHSTEMB01P 049 ID No. : LAB-PH-002

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

Ambient Temperature : (25.2 to 25.8) °C
Relative Humidity : (50 to 55) %
Line Voltage : (220.0 to 222.0) VAC

Date of Received : 17 December 2022

Date of Calibration : 17 December 2022

Date of Issue : 19 December 2022

Calibrated by : Bunjerd Masri

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

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400002	TT-0074-22	20 Jun 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

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

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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

Certificate of Calibration

Certificate No. : 65-400648-1

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	25.003	24.9	0.1	0.19

Remark

UUC : Unit Under Calibration

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

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

~ () ~



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

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

2. Standard Buffer Solution

<u>pH</u>	<u>Cert. No.</u>	<u>Lot No.</u>	<u>Exp. Date</u>	<u>Traceability</u>
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 :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.1	-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 measurment was based on a standard uncertainty multiplied by a coverage factor $k = 2$,
providing a level of confidence of approximately 95%

- 000 -



Certificate of Calibration

Certificate No. : 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. : PHSTEMB01P 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

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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 on date and place of calibration only.

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

- 000 -



Certificate of Calibration

Certificate No. : 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 :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-420070-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.5	0.0	0.12
	0.0000	7	7.00	0.1	-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%

- o0o -



CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 65-400656-1

Page : 1 of 2

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

Equipment : Liquid in Glass Thermometer
Manufacturer : SK Model : N/A
Range : 0 °C to 100 °C Resolution : 1 °C
Serial No. : N/A Immersion : Total
ID No. : LAB-TG-017

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

Date of Received : 17 December 2022

Date of Calibration : 20 December to 22 December 2022

Date of Issue : 22 December 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400656-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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

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

Remark

UUC : Unit Under Calibration

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

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

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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 : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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. : 66-400442-1

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%

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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW28

Page.: 1 of 2

Certificate of Testing

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



Cert.No.: 23TW28

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

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

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 10426897

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

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

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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 22CH1439

Page.: 1 of 2

Certificate of Calibration

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

Calibrated by : Walalak Sirithean

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
() Saithip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 26 October 2022

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

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

A 0009902



Cert.No. : 22CH1439

Page. : 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

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

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

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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 (\pm NTU)	Coverage Factor k
0	0.00	0.0062	2.00
20	20.9	0.39	2.00
100	100.1	0.70	2.11
800	800	2.1	2.13

Remark

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

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

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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23CH1197

Page.: 1 of 2

Certificate of Calibration

Equipment :	Turbidity Meter
Manufacturer :	EZONDO
Model :	TUB-430
Serial No. :	1000048
ID. No. :	LAB-TB-001
Condition As-Received:	Used Item
Received Date :	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 \pm 2.5) °C
Relative Humidity :	(50 \pm 20) %
Calibration Procedure :	In - house method : CP-CH11 based on direct measurement by using Formazin standard solution
Calibrated by :	Walalak Sirithean
Approved by :	<u>Warakorn.</u> Approved Signatory
() Saithip Meangmai	
(✓) Warakorn Lerngagtrakul	
() Ponpan Paipim	
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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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 (\pm 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 %.

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Warakorn

a 1181446



CERTIFICATE No : 22T8890
REFERENCE No : 66223-4

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 01-Aug-22

APPROVED BY : [Signature]
K J.

ISSUED DATE : 02-Aug-22

RECEIVED DATE : 01-Aug-22

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T8890

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : INCUBATOR
MANUFACTURER : AQUA LYTIC
MODEL : TC135S
ID No : LAB-IB-001
RECEIVED DATE : 01-Aug-22
AMBIENT TEMPERATURE : 26 °C ± 1 °C

S/N : 0614/000033
CALIBRATION DATE : 01-Aug-22
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

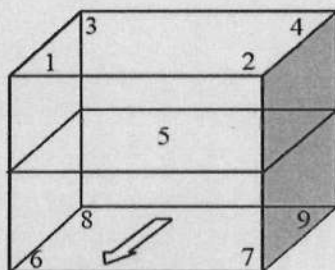
2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 7

Overall Line Voltage (V) variation : 10

Instrument Condition : Normal

CHAMBER PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

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

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

END OF CALIBRATION REPORT

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

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 (Incubator)

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 : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

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

ID No.

Cert. No.

Due Date

Traceability

400029 & 400048

66-400067-1

04 Aug 2023

National Institute of Metrology Thailand (NIMT)

Approved by



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 66-400422-5

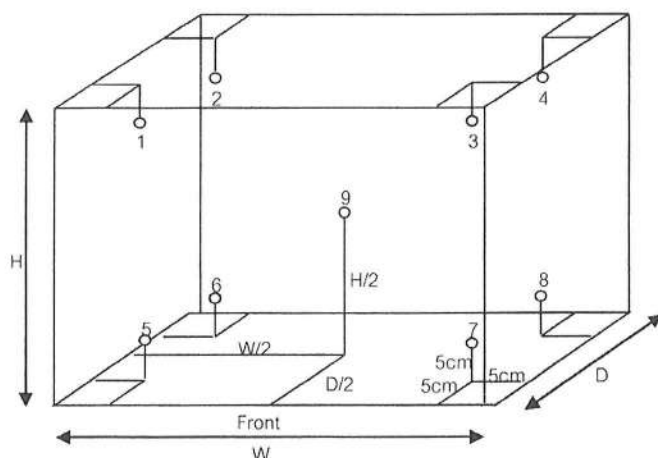
Page : 2 of 2

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)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.5	20.5	0.33	0.39	0.8

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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CERTIFICATE No : 22T8889
REFERENCE No : 66223-3

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 01-Aug-22

APPROVED BY : 

ISSUED DATE : 01-Aug-22

RECEIVED DATE : 01-Aug-22



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T8889

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

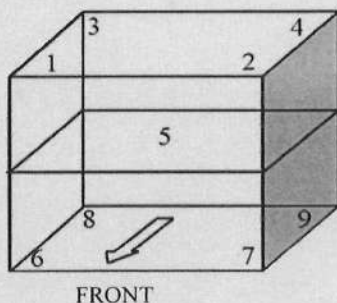
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



GENERAL INFORMATION

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

CHAMBER PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

NOTE 2: LOCATION 5 WAS REFERENCE LOCATION.

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

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

END OF CALIBRATION REPORT

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

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 Chanpu

Calibration Method : CAL-M4004, TLAS G-20
The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	66-400227-1	24 Oct 2023	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. : 66-400422-3

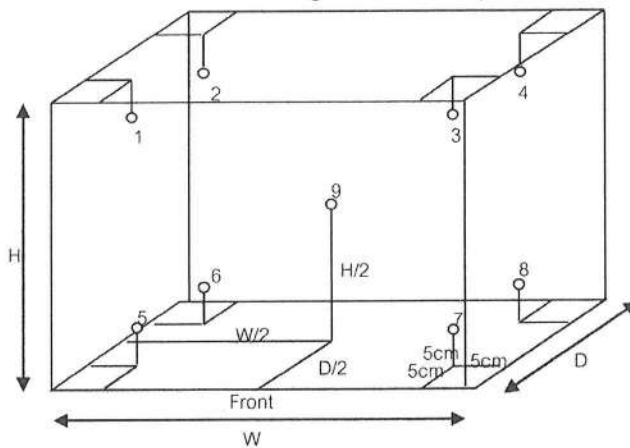
Page : 2 of 2

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	8	9	
104.0	107.0	107.0	104.9	104.7	104.2	104.7	103.1	103.2	102.9	104.2	103.5	0.83
180.0	184.0	184.0	180.5	180.3	179.7	180.3	176.9	176.8	177.0	180.3	179.4	1.1

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	107.0	107.0	1.5	0.3	2.3
180.0	184.0	184.0	2.8	0.4	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 -



**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 22T8896

REFERENCE No : 66224-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WNB22

SERIAL No : L514.0184

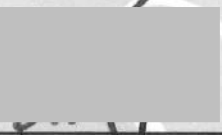
ID No : LAB-WB-001

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : PACIFIC LABORATORY CO., LTD.
14/5358 MOO. 14 TAMBOL BANGBUA THONG
AMPHOE BANG NUA THONG, NONTABURI 11110

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 01-Aug-22

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 02-Aug-22

RECEIVED DATE : 01-Aug-22

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

F-G010 REV : 02



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www.qcalibration.com

CERTIFICATE No : 22T8896

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

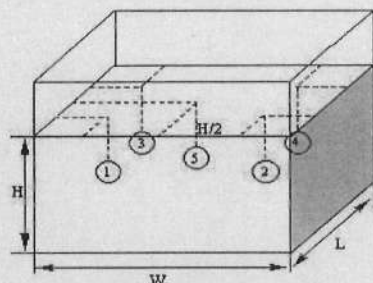
INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	22T7514	05-Jul-23

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 1.5

Overall Variation of Line Voltage (V) : 11

Instrument Condition : Normal

BATH PERFORMANCE

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

TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

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

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

END OF CALIBRATION REPORT

CAL

Calibratech Co.,Ltd.

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

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



NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400422-4

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 : 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 : Permpon Chanpu

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

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



Certificate of Calibration

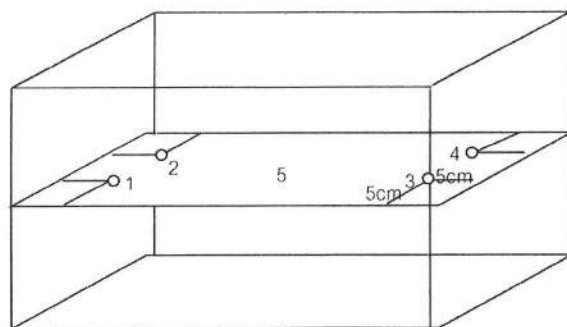
Certificate No. : 66-400422-4

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					Uncertainty (± ° C)	Measured Uniformity (° C)	Measured Stability (° C)
			No.							
			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%

- o0o -





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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert. No.: 23LM28

Page.: 1 of 3

Certificate of Calibration

Equipment : COD Tester

Manufacturer : Hanna

Model : HI839800-02

Serial No. : 04500100101

ID No. : LAB-CD-002

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

Location : TPA Calibration Lab.

Received Order : 16 February 2023

Calibration Date : 2 March 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :

Malee

Approved Signatory

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

Issue Date : 9 March 2023

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

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

A 0010656



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

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

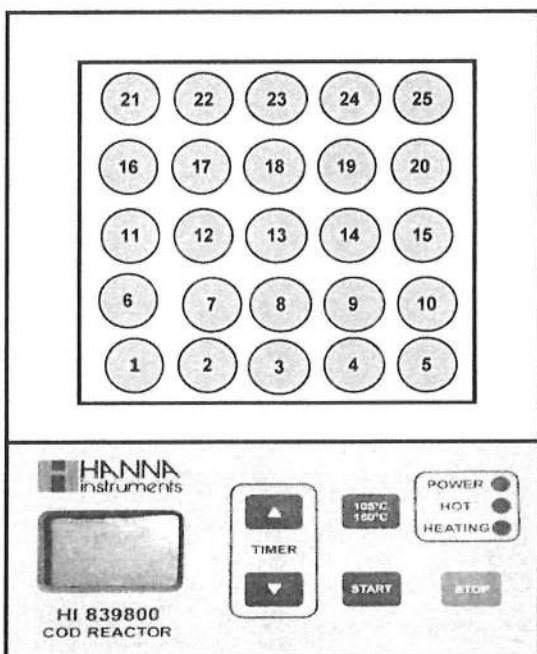
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Alumina (Aluminium Hydroxide)



Top View

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

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

Malu.



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

Cert. No.: 23LM28

Page.: 3 of 3

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

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

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

UUC* : Unit Under Calibration

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

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

-oOo-

Malu.



CERTIFICATE No : 23E7527

REFERENCE No : 70098-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : CONDUCTIVITY METER

MANUFACTURER : EUTECH

MODEL : PCSTESTR 35

SERIAL No : 2949339

ID No : LAB-PH-015

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : PACIFIC LABORATORY CO., LTD.
14/5358 MOO. 14 TAMBOL BANGBUA THONG
AMPHOE BANGBUA THONG, NONTHABURI 11110

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 22-Aug-23

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 22-Aug-23

RECEIVED DATE : 03-Aug-23

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



CERTIFICATE No : 23E7527

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : CONDUCTIVITY METER
MANUFACTURER : EUTECH
SERIAL NUMBER : 2949339
RECEIVED DATE : 03-Aug-23
AMBIENT TEMPERATURE : 23 °C ± 3 °C
MODEL : PCSTESTR 35
ID No : LAB-PH-015
CALIBRATION DATE : 22-Aug-23
RELATIVE HUMIDITY : 50 % RH ± 15% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD CONDUCTIVITY BUFFER SOLUTION IN CONTROLLED TEMPERATURE BATH.
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) REFERENCE MATERIAL	00652-26	CC23583	4066-13834656	29-Dec-23
2) REFERENCE MATERIAL	00652-30	CC23645	4173-13874428	17-Jan-24
3) REFERENCE MATERIAL	00652-32	CC23572	4068-13828617	21-Dec-23
4) REFERENCE MATERIAL	00652-34	CC23312	4069-13693312	21-Oct-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) STANDARD THERMOMETER	421504	55000379	22T9904	13-Sep-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO :-
- NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), USA.
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH ELECTROD

CONDUCTIVITY BUFFER SOLUTION	UUC READING	CORRECTION	VALUE BEFORE ADJUSTMENT	UNIT	UNCERTAINTY OF MEASUREMENT (±)	COVERAGE FACTOR k
99.2	99.6	-0.40	N/A	μS/cm	3.0	2.0
1411.0	1411	0.00	N/A	μS/cm	30	2.0
9.999	9.82	0.18	N/A	mS/cm	0.21	2.0

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR SHOWN IN THE TABLE, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

ภาคผนวกที่ 5-6
เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์
ปริมาณฝุ่นละออง

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

Request No.23-66/0141

MTC.No.23-66/0141

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : DRYCAL DC-LITE FLOWMETER

Manufacturer : BIOS International Corporation, USA.

Serial No.: 104699

Model : DCL-M, Rev 1.09

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

Subdivision : (0.0001, 0.001) l/min

Submitted by : PACIFIC LABORATORY CO.,LTD.

14/5358 Moo14, T.Bang Bua Thong, A.Bang Bua Thong,
Nonthaburi 11110, Thailand.

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

Calibration date : 5 January 2023

Standard :

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

Calibrated by

(Mr.Terasak Panna)

Approved by :

(Ms.Kirana Luanghirun)

Director

Mechanical Engineering Standards Laboratory

Ref. 2013265122305450001

Issued Date 5 January 2023

The results relate only to the items tested/calibrated or value assigned.

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FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

Request No.23-66/0141

2/2

MTC.No.23-66/0141

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

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

Atmospheric pressure (1010 ± 13) hPa

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

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

Measurement data :

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

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

The end of calibration certificate.

T_{1/2}

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.4

Head Office

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Tel. (66) 0 2577 9000
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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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 Thippichai

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

Edition 5, July 2015

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

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by

(Surachai Promthong)

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 \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
 Stdev. : 0.000048 g

- o0o -



ภาคผนวกที่ 5-7
เอกสารสอบเทียบเครื่องมือตรวจวัดสภาพความร้อน



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 31 January, 2023

Certification No. 037/23

Page : 1 of 2

Object : Thermal Environment Monitor

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTemp°32

Serial No. : TPD080015

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1014.8 hPa

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.6169 , No.6178

: TT-3 Serial 43BE04

Japan Meteorological Agency

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Signed :

Mr. Risood Promsut





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 037/23

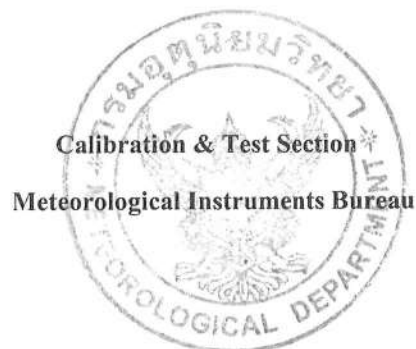
31 January, 2023

Page : 2 of 2

Standard Temp. °C	Temperature Sensor Reading					
	Dry Bulb °C	Correction °C	Globe °C	Correction °C	Wet Bulb °C	Correction °C
50.08	50.1	-0.02	50.0	0.08	50.1	-0.02
41.02	41.1	-0.08	41.0	0.02	41.1	-0.08
30.45	30.4	0.05	30.5	-0.05	30.4	0.05

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer





THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 January, 2023

Certification No. 014/23

Page : 1 of 2

Object : Thermal Environment Monitor

Manufacturer : QUEST TECHNOLOGIES

Type : QUESTEMP*36

Serial No. : TKJ090016 ID No. : N/A

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 hPa

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

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.6169 , No.6178

: TT-3 Serial 43BE04

Japan Meteorological Agency

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Si

M

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 014/23

13 January, 2023

Page : 2 of 2

Standard Temp. °C	Temperature Sensor Reading					
	Dry Bulb °C	Correction °C	Globe °C	Correction °C	Wet Bulb °C	Correction °C
50.14	50.1	0.04	50.2	-0.06	50.1	0.04
40.22	40.2	0.02	40.3	-0.08	40.2	0.02
30.25	30.2	0.05	30.3	-0.05	30.2	0.05

Calibrated by :



Mr. Watcharapol Subwat

Mechanical Engineer



ภาคผนวกที่ 5-8
เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพดิน

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

- 1 Customer's should provide all necessary operating supplies upon request of the engineer.
- 2 A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- 3 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.
- 4 If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about Agilent Technologies services, 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	240 FS AA / MV 1310001 / UAE_HEM_1558
Instrument System Site and Location	Heavy metal Analysis Unit / UNITED ANALYST AND ENGINEERING

List System Component Product Numbers	List the Serial Numbers of each Component
1. 05433A	MV1310001
2. 05444A	MV1315001
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

Revision: 10.00, Issued: November 2021

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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.

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 barbs.
- ☒ 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.

FURNACE 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**.

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 Squaresness 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 workload component checks

- ☐ Inspect the GTA workload 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 workload 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 workload.

- ☐ 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.

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.

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	0.5916
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	-
MSR%	≥ 70 %	-

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, Mk 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 Neb	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3)	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)	5310003400	GTA120	PM supplied	Furnace
Shroud (D2)	5310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	5310003500	GTA120	PM supplied	Furnace
Zeeman shroud	5310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	5910025900	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.

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 write in this box.

Service Completion

Service request number 600564733
Agilent signature Nukon L.
Total number of pages in this document 13

Date service completed Jan 30, 2023
Customer signature Chowthanan

SVD Results Report



Report ID: 7 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 Luangsangwan
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(900nm)
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
Lower Limit: 49.00
Average Frequency: 50.00
Highest Measured Frequency: 50.00
Lowest Measured Frequency: 50.00

Result: **Passed**

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

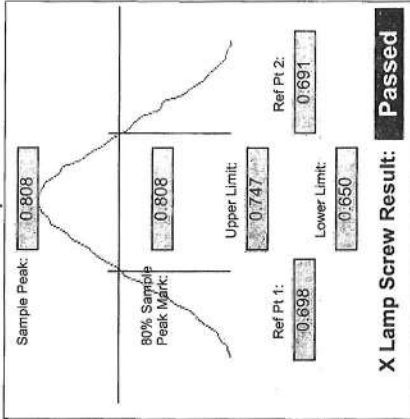
Optics

Beam Balance:

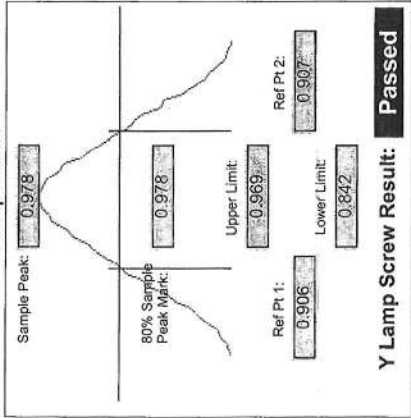
Lamp Type:
Lamp Socket Used:

Peak Selected:
Lamp Alignment: Performed

'X' Lamp Screw



'Y' Lamp Screw



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

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
Upper Limit(nm) 324.888
(Approach from Zero Order)
Sample 1: 324.828
Sample 2: 324.828
(Approach from end)
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

Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected
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 5: Not Supported
Lamp 8: Not Supported

Result: Passed

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

UNITED ANALYSIS AND ENGINEERING CONSULTANTS Lueangsangwan

Date

Sequential by time report

30/01/2023 10:58 AM

SpectRAA

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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

