

**เอกสารแนบ 4-1**

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศ



**Calibration Report**  
Non-Dispersive Infrared CO Analyzer

DATE: 11 March 2023 BRAND: API MODEL: 3002  
NO: CO-010 SERIAL NO: 199-1

Calibrator (Dilution System)  
Brand: API Model: 700  
Last Cal. Date: 05 August 2023 Serial No: 911

Reference Standard Gas  
Standard Gas: Carbon Monoxide (CO) Cylinder No: DT11838  
Certified Date: 14 March 2023 Expiry Date: 14 March 2025 Cylinder Conc.: 4.560 ppm

Calibrating Condition  
Pressure: 1011 mmHg Temp: 24.6 °C % RH: 30

Calibration Setting  
Span: Initial Reading (Before Adj.) PPM Final Reading (After Adj.) PPM  
Set Point: Expected Concentration Analyzer Response NDIR Analyzer Response  
Zero: 0 -0.10 - 0  
CO Span: 400 39.94 -0.100 40.00

API Model 3002 CO Analyzer Check List

Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm/100 Zero Air
CO Measure	402.1	ppm	250-4000 ppm
CO Reference	394.6	ppm	250-4000 ppm
Measure/Reference Ratio	1.186	-	1.1-1.3, 100% Zero Air
Sample Pressure	28.2	mmHg-A	< 7.5 Ambient Absolute Pressure
Sample Flow	805	cc/min	800 ± 10%
Sample Temperature	48.2	°C	48 ± 1
Reactor Temperature	48.0	°C	48 ± 1
Reactor Temperature	48.3	°C	48 ± 1
Box Temperature	30.4	°C	Ambient Temp ± 1 ± 10
Photo-Diode	9026.8	mV	250 mV to 6750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.1

Calibrated by: Abul Dajani  
(Mr. Abul Dajani)

Approved by: [Signature]  
(Mr. Piers Denison)

**CALIBRATION REPORT**  
CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE: 11 March 2023 BRAND: API MODEL: 200A  
NO: NCK-017 SERIAL NO: 1977

Calibrator (Dilution System)  
Brand: API Model: 700  
Last Cal. Date: 05 August 2023 Serial No: 911

Reference Standard Gas  
Standard Gas: Nitric Oxide (NO) Cylinder No: N011839  
Certified Date: 03 January 2023 Expiry Date: 03 January 2025 Cylinder Conc.: 40.0 ppm

Calibrating Condition  
Pressure: 1011 mmHg Temp: 24.6 °C % RH: 30

Calibration Setting  
Span: Initial Reading (Before Adj.) PPM Final Reading (After Adj.) PPM  
Set Point: Expected Concentration Analyzer Response NDIR Analyzer Response  
Zero: 0 -0.10 - 0  
NO Span: 400 39.7 -0.075 40.00  
NO<sub>2</sub> Span: 400 40.0 -0.001 40.00

API Model 200A NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPM	0-1000
STABILITY (Zero Gas)	0.1	PPM	< 2 ppm/100 Zero Air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMI	109.3	mV	20-150
AZERO	94.2	mV	20-150
HWPS	875	°C	420-900 constant
REACT. TEMP	50.3	°C	50 ± 1
BOX TEMP	29.4	°C	8 ± 0.5
PMI TEMP	7.1	°C	7 ± 0.2
MOLY TEMP	375.2	°C	315 ± 5
REACT. PRESS	8.3	mmHg-A	2-10 constant
SAMPLE PRESS	29.5	mmHg-A	25-50 constant
NO Span Conc.	400	PPM	20-20,000
NO <sub>2</sub> Span Conc.	400	PPM	20-20,000
NO Slope	1.009	-	1.0 ± 0.3
NO <sub>2</sub> Slope	1.008	-	1.0 ± 0.3
NO Offset	1.2	mV	20 to +150
NO <sub>2</sub> Offset	0.8	mV	20 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by: Abul Dajani  
(Mr. Abul Dajani)

Approved by: [Signature]  
(Mr. Piers Denison)

**CALIBRATION REPORT**  
CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE: 11 March 2023 BRAND: API MODEL: 200A  
NO: NCK-017 SERIAL NO: 1977

Calibrator (Dilution System)  
Brand: API Model: 700  
Last Cal. Date: 05 August 2023 Serial No: 911

Reference Standard Gas  
Standard Gas: Nitric Oxide (NO) Cylinder No: N011839  
Certified Date: 03 January 2023 Expiry Date: 03 January 2025 Cylinder Conc.: 40.0 ppm

Calibrating Condition  
Pressure: 1011 mmHg Temp: 24.6 °C % RH: 30

Calibration Setting  
Span: Initial Reading (Before Adj.) PPM Final Reading (After Adj.) PPM  
Set Point: Expected Concentration Analyzer Response NDIR Analyzer Response  
Zero: 0 -0.10 - 0  
NO Span: 400 39.7 -0.075 40.00  
NO<sub>2</sub> Span: 400 40.0 -0.001 40.00

API Model 200A NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPM	0-1000
STABILITY (Zero Gas)	0.1	PPM	< 2 ppm/100 Zero Air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMI	109.3	mV	20-150
AZERO	94.2	mV	20-150
HWPS	875	°C	420-900 constant
REACT. TEMP	50.3	°C	50 ± 1
BOX TEMP	29.4	°C	8 ± 0.5
PMI TEMP	7.1	°C	7 ± 0.2
MOLY TEMP	375.2	°C	315 ± 5
REACT. PRESS	8.3	mmHg-A	2-10 constant
SAMPLE PRESS	29.5	mmHg-A	25-50 constant
NO Span Conc.	400	PPM	20-20,000
NO <sub>2</sub> Span Conc.	400	PPM	20-20,000
NO Slope	1.009	-	1.0 ± 0.3
NO <sub>2</sub> Slope	1.008	-	1.0 ± 0.3
NO Offset	1.2	mV	20 to +150
NO <sub>2</sub> Offset	0.8	mV	20 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by: Abul Dajani  
(Mr. Abul Dajani)

Approved by: [Signature]  
(Mr. Piers Denison)

**Non-Dispersive Infrared Calibration Report**

Calibrator (Dilution System)  
Brand: API Model: 700  
Last Cal. Date: 05 August 2023 Serial No: 911

Reference Standard Gas  
Standard Gas: Nitric Oxide (NO) Cylinder No: N011839  
Certified Date: 03 January 2023 Expiry Date: 03 January 2025 Cylinder Conc.: 40.0 ppm

Calibrating Condition  
Pressure: 1011 mmHg Temp: 24.6 °C % RH: 30

Calibration Setting  
Span: Initial Reading (Before Adj.) PPM Final Reading (After Adj.) PPM  
Set Point: Expected Concentration Analyzer Response NDIR Analyzer Response  
Zero: 0 -0.10 - 0  
NO Span: 400 39.7 -0.075 40.00  
NO<sub>2</sub> Span: 400 40.0 -0.001 40.00

API Model 200A NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPM	0-1000
STABILITY (Zero Gas)	0.1	PPM	< 2 ppm/100 Zero Air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMI	109.3	mV	20-150
AZERO	94.2	mV	20-150
HWPS	875	°C	420-900 constant
REACT. TEMP	50.3	°C	50 ± 1
BOX TEMP	29.4	°C	8 ± 0.5
PMI TEMP	7.1	°C	7 ± 0.2
MOLY TEMP	375.2	°C	315 ± 5
REACT. PRESS	8.3	mmHg-A	2-10 constant
SAMPLE PRESS	29.5	mmHg-A	25-50 constant
NO Span Conc.	400	PPM	20-20,000
NO <sub>2</sub> Span Conc.	400	PPM	20-20,000
NO Slope	1.009	-	1.0 ± 0.3
NO <sub>2</sub> Slope	1.008	-	1.0 ± 0.3
NO Offset	1.2	mV	20 to +150
NO <sub>2</sub> Offset	0.8	mV	20 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by: Abul Dajani  
(Mr. Abul Dajani)

Approved by: [Signature]  
(Mr. Piers Denison)





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T 06-25544111 F 06-25544112 E-mail: info@sps.co.th, www.sps.co.th

Calibration Report Non-Dispersive Infrared CO Analyzer			
Date :	20 March 2025	Brand :	API
No. :	CO-810	Model :	720
		Serial No. :	911
Calibrator (Dilution System)			
Brand :	API	Model :	720
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	071839
Certified Date :	14 March 2024	Expiry Date :	14 March 2026
Cylinder Conc. :	4.180 ppm		
Calibrating Condition			
Pressure :	1011 mmbar	Temp. :	24.5 °C
% RH :	50		
Calibration Setting			
Span	Initial Reading (Before AGL PPM)		Final Reading (After AGL PPM)
Set Point	Expected Concentration	Analyzer Response	%OF
Zero	0	0.11	0
NO Span	400	399.8	1.007
CO Span	400	400.0	1.010
API Model 810 CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
RANGE	500	PPM	0-500 ppm
STABILITY	0.1	PPM	< 2 ppm With Zero Air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.0	mV	30 - 150
AZERO	99.8	mV	30 - 150
HVPS	473	V	430 - 900 constant
CELL TEMP	50.1	°C	50 ± 1
BOX TEMP	28.9	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOXY TEMP	314.7	°C	315 ± 5
CELL PRESS	8.5	inHg-A	2 - 10 constant
SAMPLE PRESS	28.7	inHg-A	25 - 30 constant
NO Span Conc	400	PPM	20 - 20,000
NO Span Conc	400	PPM	20 - 20,000
NO Span	1.009	-	1.0 ± 0.3
NO Slope	1.012	-	1.0 ± 0.3
NO Offset	1.6	mV	30 to +150
NO Offset	1.0	mV	30 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by : Adul Dangkam  
(Mr. Adul Dangkam)

Approved by : Mr. Peera Detum  
(Mr. Peera Detum)



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Calibration Report Non-Dispersive Infrared CO Analyzer			
Date :	20 March 2025	Brand :	API
No. :	CO-810	Model :	300E
		Serial No. :	999 E
Calibrator (Dilution System)			
Brand :	API	Model :	720
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	071839
Certified Date :	14 March 2024	Expiry Date :	14 March 2026
Cylinder Conc. :	4.180 ppm		
Calibrating Condition			
Pressure :	1011 mmbar	Temp. :	24.5 °C
% RH :	50		
Calibration Setting			
Span	Initial Reading (Before AGL PPM)		Final Reading (After AGL PPM)
Set Point	Expected Concentration	Analyzer Response	%OF
Zero	0	0.10	0
CO Span	400	399.8	1.007
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
RANGE	50	PPM	0-500 ppm
STABILITY	0.10	PPM	< 1 ppm With Zero Air
CD VOLUME	408.1	mV	250-4500 mV
CD REFERENCE	3998.7	mV	250-4500 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W-Zero Air
Sample Pressure	28.5	inHg-A	< 2" Ambient Absolute Pressure
Sample Flow	806	cc/min	800 ± 10%
Sample Temperature	48.3	°C	48 ± 4
Box Temperature	48.1	°C	48 ± 2
Wheat Temperature	48.3	°C	48 ± 2
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10
Photo Drive	3007.2	mV	250 mV to 4150 mV
Slope	1.013	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by : Adul Dangkam  
(Mr. Adul Dangkam)

Approved by : Mr. Peera Detum  
(Mr. Peera Detum)



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CALIBRATION REPORT CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER			
DATE :	20 March 2025	BRAND :	API
NO. :	NOX-817	MODEL :	200A
		SERIAL NO. :	1977
Calibrator (Dilution System)			
Brand :	API	Model :	720
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A00726V
Certified Date :	05 January 2023	Expiry Date :	05 January 2026
Cylinder Conc. :	48.8 ppm		
CALIBRATING CONDITION			
Pressure :	1011 mmbar	Temp. :	24.5 °C
% RH :	50		
CALIBRATION SETTING			
Span	Initial Reading (Before AGL PPM)		Final Reading (After AGL PPM)
Set Point	Expected Concentration	Analyzer Response	%OF
Zero	0	0.11	0
NO Span	400	399.8	1.007
NO <sub>2</sub> Span	400	400.0	1.010
API Model 200A NO <sub>x</sub> Analyzer Check List			
Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPM	500 standard
STABILITY (Zero Gas)	0.1	PPM	< 2 with zero air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.0	mV	30 - 150
AZERO	99.8	mV	30 - 150
HVPS	473	V	430 - 900 constant
CELL TEMP	50.1	°C	50 ± 1
BOX TEMP	28.9	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOXY TEMP	314.7	°C	315 ± 5
CELL PRESS	8.5	inHg-A	2 - 10 constant
SAMPLE PRESS	28.7	inHg-A	25 - 30 constant
NO Span Conc	400	PPM	20 - 20,000
NO <sub>2</sub> Span Conc	400	PPM	20 - 20,000
NO Span	1.009	-	1.0 ± 0.3
NO <sub>2</sub> Slope	1.012	-	1.0 ± 0.3
NO Offset	1.6	mV	30 to +150
NO <sub>2</sub> Offset	1.0	mV	30 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by : Adul Dangkam  
(Mr. Adul Dangkam)

Approved by : Mr. Peera Detum  
(Mr. Peera Detum)



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CALIBRATION REPORT CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER			
DATE :	20 March 2025	BRAND :	API
NO. :	NOX-817	MODEL :	200A
		SERIAL NO. :	1977
Calibrator (Dilution System)			
Brand :	API	Model :	720
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A00726V
Certified Date :	05 January 2023	Expiry Date :	05 January 2026
Cylinder Conc. :	48.8 ppm		
CALIBRATING CONDITION			
Pressure :	1011 mmbar	Temp. :	24.5 °C
% RH :	50		
CALIBRATION SETTING			
Span	Initial Reading (Before AGL PPM)		Final Reading (After AGL PPM)
Set Point	Expected Concentration	Analyzer Response	%OF
Zero	0	0.11	0
NO Span	400	399.8	1.007
NO <sub>2</sub> Span	400	400.0	1.010
API Model 200A NO <sub>x</sub> Analyzer Check List			
Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPM	500 standard
STABILITY (Zero Gas)	0.1	PPM	< 2 with zero air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	30 - 150
AZERO	99.8	mV	30 - 150
HVPS	473	V	430 - 900 constant
CELL TEMP	50.1	°C	50 ± 1
BOX TEMP	28.9	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOXY TEMP	315.1	°C	315 ± 5
CELL PRESS	8.5	inHg-A	2 - 10 constant
SAMPLE PRESS	28.6	inHg-A	25 - 30 constant
NO Span Conc	400	PPM	20 - 20,000
NO <sub>2</sub> Span Conc	400	PPM	20 - 20,000
NO Slope	1.007	-	1.0 ± 0.3
NO <sub>2</sub> Slope	1.010	-	1.0 ± 0.3
NO Offset	1.6	mV	30 to +150
NO <sub>2</sub> Offset	0.9	mV	30 to +150
Stability at Zero	0.1	PPM	< 0.2
Stability at Span	0.2	PPM	< 2 ppm @ 400 ppm span gas

Calibrated by : Adul Dangkam  
(Mr. Adul Dangkam)

Approved by : Mr. Peera Detum  
(Mr. Peera Detum)





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Tel : (662) 634-4370 Fax : (662) 573-4332 E-mail : spps@spsservice.com, spps@spsservice.co.th

Calibration Report			
Total Hydrocarbon Analyzer			
Date : 01 March 2025	Brand : HOFBA	Model : APHA-560CE	
No. : 010	Serial No. : 4211054001		
Calibrator (Dilution System)			
Brand : Tescodyne	Model : 750		
Last Cal. Date : 29 October 2024	Serial No. : 421		
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )	Cylinder No. : D112195		
Calibrated Date : 25 February 2023	Expired Date : 25 February 2025	Cylinder Conc. : 993 ppm	
Calibrating Condition			
Pressure : 1011 mbar	Temp. : 24.5 °C	% RH : 50	
Start Time : 9:05 AM			
Pre-Calibration Checks			
Change Particulate Filter : Yes	Station Temp. : 25.0 °C		
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)	Final Reading (After Adj)	
Zero	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Span	25	10.05	10
Calibration Setting (Final)			
Span Instrument Gain : 0.993	Finish Time : 10:05 AM		
APHA-560 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (FID)	910.4	mV	800-1,350
Signal (TIC)	916.2	mV	800-1,350
Detection	78.0	µPa	(Pressure 4m/201.5m/200.20 µPa)
Flame	19.2	µPa	8 - 25
Flow	259.1	°C	240 ± 10
Flow	0.9	L/min	0.9 ± 0.5
Over Flow	0.8	L/min	0.8

Calibrated by :

Adul Dangkhun  
(Mr. Adul Dangkhun)

Approved by :

Phero Detakorn  
(Mr. Phero Detakorn)





## Certificate of Calibration

Certificate No. : 24P1369  
Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No. : -

ID No. : UAE ANV.013/2547

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 22 April 2024

Reference: 2404-0243WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1007 mbar

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

**Procedure used:** The calibration was conducted by direct comparison method against Pressure Measuring Instruments  
Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as  
a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3.This result of calibration was made on requested at the point specified by customer.

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

5.This result of calibration instrument was in absolute pressure.

6.This instrument was used clean air as pressure media.

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

8.This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew

Issue Date : 23 April 2024

Approved Signatory :

[ ] Phalinee Prabpaipal  
[ ] Sura Suwannasri  
[✓] Attapol Panurach

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Cert.No.: 24P1369

Page: 2 of 2



**Result of calibration:- Without adjustment**

Range: 720 mmHg to 780 mmHg

**Function:- Absolute Pressure Measurement**

Scale Interval: 1 mmHg ( The Fifth Estimate )

**Increasing Pressure**

Applied Pressure (mmHg)	718.40	729.71	740.61	751.07	761.97	773.05	786.91
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.60	0.29	-0.61	-1.07	-1.97	-3.05	-6.91

**Decreasing Pressure**

Applied Pressure (mmHg)	786.91	772.99	761.71	750.69	740.13	729.35	718.44
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.91	-2.99	-1.71	-0.69	-0.13	0.65	1.56

The uncertainty of measurement was ± 0.24 mmHg

\* UUC = Unit Under Calibration

The 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. : 24H752  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model : -

Serial No. : -

ID No. : UAE ANV.004/2548

Condition As-Received: Used Item

Received Date: 05 April 2024

Calibration Date: 10 April 2024  
to 18 April 2024

Reference: 2404-0247WSC

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-H02 according to comparison  
with standard chilled mirror sensor for humidity measurement function and comparison with standard  
temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	231238	16 Oct 2024

2.The 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 maintained through:-

-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Chakrit Waewwanjua

Issue Date : 18 April 2024

Approved Signatory :

[ ] Chakrit Waewwanjua  
[✓] Vipom Tantiyawutti  
[ ] Unnopphol Harachai

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**Result of Calibration:-** Without Adjustment

**Function:** Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	41	0.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

**Result of Calibration:-** Without Adjustment

**Function:** Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.5	0.486	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	0.72

UUC\* : Unit Under Calibration

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

-000-

Cert. No.: 24H752

Page: 2 of 2

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**MULTI-POINT GAS TEST REPORT**

Test Date : Sep 6, 2026

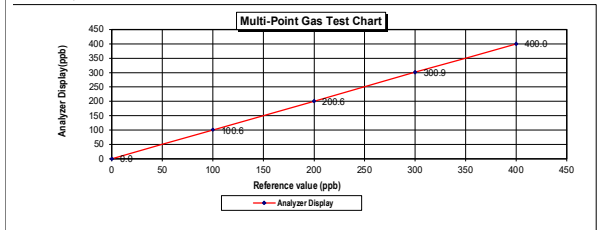
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

**Multi-point gas test data**

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.60	0.60	0.60
Level 3	40.00%	200.0	0.60	0.30	0.30
Level 4	60.00%	300.0	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb  
: Acceptable Limit  $\pm 5\%$   
Average Difference (%) 0.24



Calculate by : *[Signature]*  
6 / 9 / 2567

Approve by : *[Signature]*  
6 / Sep / 2024

**MULTI-POINT GAS TEST REPORT**

Test Date : Sep 6, 2024

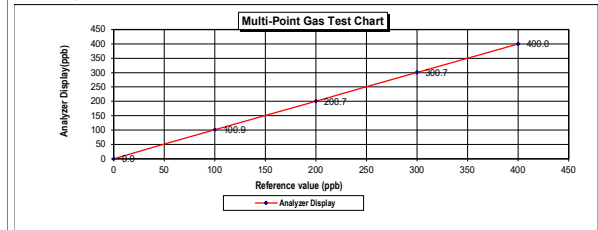
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387066

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

**Multi-point gas test data**

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.90	0.89	0.89
Level 3	40.00%	200.0	0.70	0.35	0.35
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb  
: Acceptable Limit  $\pm 5\%$   
Average Difference (%) 0.29



Calculate by : *[Signature]*  
6 / 9 / 2567

Approve by : *[Signature]*  
6 / Sep / 2024



**CERTIFICATE OF ANALYSIS**  
Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
LTD.  
Part Number: E04N515A0071A  
Cylinder Number: 880159156  
Labeling: 125 - 67Nml/500ml - (70)  
Purity Number: K12023  
Gas Code: CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, SO<sub>2</sub>, N<sub>2</sub>O  
Expiration Date: Jul 26, 2031

Calibration performed in accordance with EPA Method 10.1. The calibration was performed by the following personnel: [Name], [Signature], [Date]. The calibration was performed using the following standards: [List of standards]. The calibration was performed using the following equipment: [List of equipment]. The calibration was performed using the following method: [List of method]. The calibration was performed using the following procedure: [List of procedure]. The calibration was performed using the following results: [List of results].

**ANALYTICAL RESULTS**

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
CO <sub>2</sub>	100.0 PPM	100.0 PPM	10	$\pm 0.05\%$	10/09/2023
NITROGEN DIOXIDE	100.0 PPM	100.0 PPM	10	$\pm 0.05\%$	10/09/2023
NITROGEN MONOXIDE	100.0 PPM	100.0 PPM	10	$\pm 0.05\%$	10/09/2023
CARBON MONOXIDE	100.0 PPM	100.0 PPM	10	$\pm 0.05\%$	10/09/2023
ETHYLENE	100.0 PPM	100.0 PPM	10	$\pm 0.05\%$	10/09/2023

**CALIBRATION STANDARDS**

Type	Lot No	Cylinder No	Concentration	Uncertainty	Expiration Date
GAIS	104202308	CC754364	98.36 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jan 04, 2031
PRM	C2116101	AP1514048	100.15 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Feb 28, 2025
GAIS	202204255	CC754361	98.52 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Apr 25, 2021
PRM	12405	CC13680	15.01 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.5\%$	Feb 17, 2023
GAIS	1234002002	EB010037	9.693 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.6\%$	Sep 25, 2025
NTRM	160102-22	KAL003025	97.68 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Nov 01, 2027
CO	220601	CC743902	246.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$	Dec 02, 2028
NTRM	150608-02	CC411730	13.389 PPM CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$	May 14, 2025

**ANALYTICAL EQUIPMENT**

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nicolet iS50 FTIR AUP2010245 CO <sub>2</sub>	FTIR	Jun 15, 2023
SIEMENS ULTRAM 18E N1-CA-180	NDIR	Jun 14, 2023
Nicolet iS50 FTIR AUP2010245 NO	FTIR	Jun 09, 2023
Nicolet iS50 FTIR AUP2010245 NO <sub>2</sub>	FTIR	Jun 15, 2023
Nicolet iS50 FTIR AUP2010245 SO <sub>2</sub>	FTIR	Jun 08, 2023

Approved for Release : *[Signature]*  
9 / 9 / 2567

Page 1 of 1



**MULTI-POINT GAS TEST REPORT**

Test Date : Sep 9, 2024

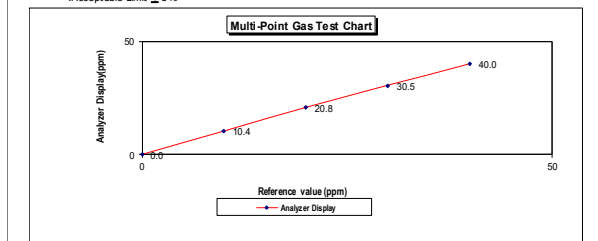
Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1180540074

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

**Multi-point gas test data**

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	0.4	3.8	3.8
Level 3	40.00%	20.0	0.8	3.8	3.8
Level 4	60.00%	30.0	0.5	1.6	1.6
Level 5	80.00%	40.0	0.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
: Acceptable Limit  $\pm 5\%$   
Average Difference (%) 1.87



Calculate by : *[Signature]*  
9 / 9 / 2567

Approve by : *[Signature]*  
9 / Sep / 2024

**MULTI-POINT GAS TEST REPORT**

**Test Date :** June 14, 2024

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**Equipment :** Gas Analyzer (CO)      **Model :** APMA-370  
**Manufacturer :** HORIBA      **Serial Number :** YN43AG7T

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**Standard Gas Concentration**

Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM
Nitric Oxide (NO)	46.77	PPM
Methane (CH <sub>4</sub> )	-	PPM
Carbon Monoxide (CO)	965.9	PPM
Cylinder No. :	EB0159156	
Expiration Date :	Nov 06, 2026	

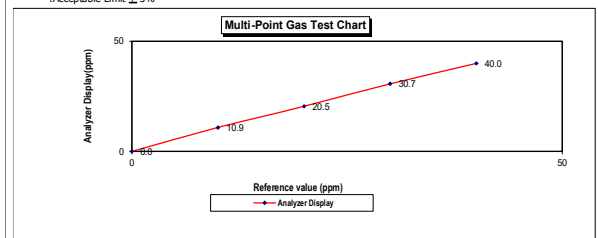
**Diluter Detail**

Manufacturer :	Thermo Scientific
Model :	1461
Serial Number :	1180540071

**Multi-point gas test data**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark :	Measuring Range	50.0 ppm	Average Difference (%)	2.60	

Acceptable Limit  $\pm 5\%$



**Calculate by** *[Signature]* **Approve by** *[Signature]*

14 / 06 / 2567 14 / June / 2024

**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA PROTOCOL STANDARD**

**Customer:** AIR LIQUIDE (THAILAND)  
**LTG:** 8004161548914  
**Cylinder Number:** 8004161548914  
**Lab/ID:** 124 - Phrakhanong - (P)  
**Product Number:** A712023  
**Gas Code:** CO, CO2, NO, NO2, SO2, SALT

**Reference Number:** 8004161548914  
**Cylinder Volume:** 144.0 CF  
**Cylinder Pressure:** 2015 PSIG  
**Inlet Orifice:** 480  
**Calibration Date:** 04/06/2024

**Expiration Date:** Jul 05, 2031

Our product is certified to contain at least 99.9% pure gas. The purity of the gas is determined by the use of a gas chromatograph. The gas is analyzed for purity and the results are reported as a percentage of the total gas. The gas is analyzed for purity and the results are reported as a percentage of the total gas. The gas is analyzed for purity and the results are reported as a percentage of the total gas.

**ANALYTICAL RESULTS**

Component	Reference Concentration	Actual Concentration	Procedural Method	Total Relative Uncertainty	Assay Dates
CO	100.0 PPM	100.0 PPM	21	$\pm 0.000001$ (1 ppm)	04/06/2024, 05/06/2024
NO	100.0 PPM	100.0 PPM	21	$\pm 0.000001$ (1 ppm)	04/06/2024, 05/06/2024
NO2	100.0 PPM	100.0 PPM	21	$\pm 0.000001$ (1 ppm)	04/06/2024, 05/06/2024
CO2	100.0 PPM	100.0 PPM	21	$\pm 0.000001$ (1 ppm)	04/06/2024, 05/06/2024
SO2	100.0 PPM	100.0 PPM	21	$\pm 0.000001$ (1 ppm)	04/06/2024, 05/06/2024

**CALIBRATION STANDARDS**

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
CO	104020208	CC784954	98.36 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jan 04, 2031
NO	0211101	AP1514048	100.15 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Feb 28, 2025
NO2	022254525	CC784381	98.62 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Apr 25, 2031
CO2	02409	0913680	15.01 PPM NITRIC OXIDE/NITROGEN	$\pm 1.5\%$	Feb 17, 2023
SO2	15340020202	EB0130037	9.69 PPM NITRIC OXIDE/NITROGEN	$\pm 1.5\%$	Mar 29, 2025
NO	1501102-22	KAL003026	97.68 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.5\%$	Nov 01, 2027
CO	220001	CC784952	249.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$	Dec 02, 2028
NO2	120606-02	CC411130	13.359 PPM CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$	May 14, 2025

The CO, NO, NO2, CO2, or SO2 listed above is only a reference to the GAS used in the assay and not part of the analysis.

**ANALYTICAL EQUIPMENT**

Instrument/Make/Model	Analytical Principle	Last Multi-point Calibration
Nicolet 850 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMATE N1-CA-180	NDIR	Jun 14, 2023
Nicolet 850 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet 850 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet 850 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

*[Signature]*  
Approved for Release

**CERTIFICATE OF CALIBRATION**

**Page 1 of 2 Pages**

**MEASUREMENT TYPE:** Temperature, Humidity, Atmospheric Pressure

**SYNOPSIS:** The purpose of this calibration is to ensure the accuracy of the measurement equipment used in the laboratory.

**TO:** United Analyst and Engineering Consultant Co., Ltd.  
31 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

**RECEIVED DATE:** 10 Aug 2024  
**MEASUREMENT DATE:** 07 Aug 2024  
**Issue Date:** 08 Aug 2024

**ENVIRONMENTAL CONDITIONS:** Ambient conditions: 25.0°C, 50% RH, 1013.25 hPa

**PLACE OF CALIBRATION:** Effluent type wind tunnel of Jirapong Associates Co., Ltd.

**UNITS:** Temperature: °C, Humidity: %RH, Atmospheric Pressure: hPa

**Preconditioning:** 24 hours at ambient conditions  
**Measurement Condition:** The average values during measurements are (23.45 °C, 51.31 %RH and 1009.02 hPa).

**Method:** The method used for this calibration is the standard method for the measurement of temperature, humidity, and atmospheric pressure.

**Approved by:** *[Signature]*  
**Calibrated by:** *[Signature]*

**Remarks:**  
1. The calibration is valid for the period of 12 months.  
2. The calibration is valid for the period of 12 months.  
3. The calibration is valid for the period of 12 months.

**CERTIFICATE OF CALIBRATION**

**Page 2 of 2 Pages**

**MEASUREMENT TYPE:** Temperature, Humidity, Atmospheric Pressure

**SYNOPSIS:** The purpose of this calibration is to ensure the accuracy of the measurement equipment used in the laboratory.

**TO:** United Analyst and Engineering Consultant Co., Ltd.  
31 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

**RECEIVED DATE:** 10 Aug 2024  
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**Method:** The method used for this calibration is the standard method for the measurement of temperature, humidity, and atmospheric pressure.

**Approved by:** *[Signature]*  
**Calibrated by:** *[Signature]*

**Remarks:**  
1. The calibration is valid for the period of 12 months.  
2. The calibration is valid for the period of 12 months.  
3. The calibration is valid for the period of 12 months.












**Calibration Certificate**  
 Certificate of Calibration  
 Certificate of Calibration  
 Certificate of Calibration

**CERTIFICATE OF CALIBRATION**  
 Page 1 of 1 Page

**Calibration No.** : CPT-180-67

**REGULATORY STATE**  
**MANUFACTURER**  
**SERIAL NUMBER**  
**IS NUMBER**  
**CERTIFICATION AUTHORITY**  
**CUSTOMER**

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**VALID DATE**

**ENVIRONMENTAL CONDITIONS**  
 Ambient condition in the laboratory is shown:  
 Temperature : 23.0 ± 0.5 °C  
 Relative humidity : 55.0 ± 15.0 %RH

**NOTES:** The certificate is valid only for the item calibrated on date and place of calibration

**CALIBRATION OF RESULTS:**  
 The results are shown in the table below

**Calibrated by:**  
 1. Mr. Pongrat Thachud  
 2. Mr. Pongrat Thachud  
 3. Mr. Pongrat Thachud

**Calibration Department Manager**

THIS CERTIFICATE MAY BE USED AS EVIDENCE OF CALIBRATION OF THE INSTRUMENT FOR WHICH IT WAS ISSUED.  
 THIS CERTIFICATE IS VALID FOR 12 MONTHS.

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**Calibration Certificate**  
 Certificate of Calibration  
 Certificate of Calibration  
 Certificate of Calibration

**CERTIFICATE OF CALIBRATION**  
 Page 1 of 1 Page

**Calibration No.** : CPT-180-67

**REGULATORY STATE**  
**MANUFACTURER**  
**SERIAL NUMBER**  
**IS NUMBER**  
**CERTIFICATION AUTHORITY**  
**CUSTOMER**

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**VALID DATE**

**ENVIRONMENTAL CONDITIONS**  
 Ambient condition in the laboratory is shown:  
 Temperature : 23.0 ± 0.5 °C  
 Relative humidity : 55.0 ± 15.0 %RH

**NOTES:** The certificate is valid only for the item calibrated on date and place of calibration.

**CALIBRATION OF RESULTS:**  
 The results are shown in the table below

**Calibrated by:**  
 1. Mr. Pongrat Thachud  
 2. Mr. Pongrat Thachud  
 3. Mr. Pongrat Thachud

**Calibration Department Manager**

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เอกสารไม่ควบคุม



**Calibration Certificate**  
 Certificate of Calibration  
 Certificate of Calibration  
 Certificate of Calibration

**CERTIFICATE OF CALIBRATION**  
 Page 1 of 1 Page

**Calibration No.** : CPT-180-67

**REGULATORY STATE**  
**MANUFACTURER**  
**SERIAL NUMBER**  
**IS NUMBER**  
**CERTIFICATION AUTHORITY**  
**CUSTOMER**

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**VALID DATE**

**ENVIRONMENTAL CONDITIONS**  
 Ambient condition in the laboratory is shown:  
 Temperature : 23.0 ± 0.5 °C  
 Relative humidity : 55.0 ± 15.0 %RH

**NOTES:** The certificate is valid only for the item calibrated on date and place of calibration

**CALIBRATION OF RESULTS:**  
 The results are shown in the table below

**Calibrated by:**  
 1. Mr. Pongrat Thachud  
 2. Mr. Pongrat Thachud  
 3. Mr. Pongrat Thachud

**Calibration Department Manager**

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เอกสารไม่ควบคุม



**Calibration Certificate**  
 Certificate of Calibration  
 Certificate of Calibration  
 Certificate of Calibration

**CERTIFICATE OF CALIBRATION**  
 Page 1 of 1 Page

**Calibration No.** : CPT-180-67

**REGULATORY STATE**  
**MANUFACTURER**  
**SERIAL NUMBER**  
**IS NUMBER**  
**CERTIFICATION AUTHORITY**  
**CUSTOMER**

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**VALID DATE**

**ENVIRONMENTAL CONDITIONS**  
 Ambient condition in the laboratory is shown:  
 Temperature : 23.0 ± 0.5 °C  
 Relative humidity : 55.0 ± 15.0 %RH

**NOTES:** The certificate is valid only for the item calibrated on date and place of calibration

**CALIBRATION OF RESULTS:**  
 The results are shown in the table below

**Calibrated by:**  
 1. Mr. Pongrat Thachud  
 2. Mr. Pongrat Thachud  
 3. Mr. Pongrat Thachud

**Calibration Department Manager**

THIS CERTIFICATE MAY BE USED AS EVIDENCE OF CALIBRATION OF THE INSTRUMENT FOR WHICH IT WAS ISSUED.  
 THIS CERTIFICATE IS VALID FOR 12 MONTHS.

เอกสารไม่ควบคุม

## CERTIFICATE OF CALIBRATION

Certificate No.: JNAC-001-01 Page: 1 of 2 Pages

**MEASUREMENT ITEM:** Pressure transducer  
**MANUFACTURER:** OTC  
**MODEL TYPE:** OTC-001-01  
**SERIAL NUMBER:** 00100101  
**ID NUMBER:** 00100101  
**CONDITION AS RECEIVED:** Good  
**CUSTOMER:** United Analyst and Engineering Consultant Co., Ltd.  
 81 Sri Udomsuk 41, Sukhumvit Road, Bangkok, Thailand  
 10110, Thailand  
**RECEIVED DATE:** 01 Aug 2023  
**RECALIBRATION DATE:** 01 Aug 2024  
**VALID DATE:** 01 Aug 2024

**Calibration procedure:** The measurement results were compared to the international system of units (SI) through the NMI (National Metrology Institute of Thailand) via Certificate number: MF-0009-24.

**Uncertainty of Measurement:** The uncertainty of measurement is expressed as a standard deviation (SD) of the measurement results. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement).

**Calibration results:**

Pressure (mbar)	Calibration Result (mbar)	Uncertainty (mbar)
100.00	100.00	0.01
200.00	200.00	0.01
300.00	300.00	0.01
400.00	400.00	0.01
500.00	500.00	0.01
600.00	600.00	0.01
700.00	700.00	0.01
800.00	800.00	0.01
900.00	900.00	0.01
1000.00	1000.00	0.01

**Calibration conditions:**

- Condition: ☒ Normal ☐ Abnormal
- Pressure transducer medium: Air
- Pressure transducer range: 0 to 1000 mbar
- Pressure transducer accuracy: ±0.01 mbar
- Pressure transducer resolution: 0.01 mbar

Issued by:   
 Mr. Parinya Booncharoen  
 Calibration Department Manager

## CERTIFICATE OF CALIBRATION

Certificate No.: JNAC-001-02 Page: 1 of 2 Pages

**MEASUREMENT ITEM:** Pressure transducer  
**MANUFACTURER:** OTC  
**MODEL TYPE:** OTC-001-01  
**SERIAL NUMBER:** 00100102  
**ID NUMBER:** 00100102  
**CONDITION AS RECEIVED:** Good  
**CUSTOMER:** United Analyst and Engineering Consultant Co., Ltd.  
 81 Sri Udomsuk 41, Sukhumvit Road, Bangkok, Thailand  
 10110, Thailand  
**RECEIVED DATE:** 01 Aug 2023  
**RECALIBRATION DATE:** 01 Aug 2024  
**VALID DATE:** 01 Aug 2024

**Calibration procedure:** The measurement results were compared to the international system of units (SI) through the NMI (National Metrology Institute of Thailand) via Certificate number: MF-0009-24.

**Uncertainty of Measurement:** The uncertainty of measurement is expressed as a standard deviation (SD) of the measurement results. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement).

**Calibration results:**

Pressure (mbar)	Calibration Result (mbar)	Uncertainty (mbar)
100.00	100.00	0.01
200.00	200.00	0.01
300.00	300.00	0.01
400.00	400.00	0.01
500.00	500.00	0.01
600.00	600.00	0.01
700.00	700.00	0.01
800.00	800.00	0.01
900.00	900.00	0.01
1000.00	1000.00	0.01

**Calibration conditions:**

- Condition: ☒ Normal ☐ Abnormal
- Pressure transducer medium: Air
- Pressure transducer range: 0 to 1000 mbar
- Pressure transducer accuracy: ±0.01 mbar
- Pressure transducer resolution: 0.01 mbar

Issued by:   
 Mr. Parinya Booncharoen  
 Calibration Department Manager

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เอกสารไม่ควบคุม

## CERTIFICATE OF CALIBRATION

Certificate No.: JNAC-001-03 Page: 1 of 2 Pages

**MEASUREMENT ITEM:** Pressure transducer  
**MANUFACTURER:** OTC  
**MODEL TYPE:** OTC-001-01  
**SERIAL NUMBER:** 00100103  
**ID NUMBER:** 00100103  
**CONDITION AS RECEIVED:** Good  
**CUSTOMER:** United Analyst and Engineering Consultant Co., Ltd.  
 81 Sri Udomsuk 41, Sukhumvit Road, Bangkok, Thailand  
 10110, Thailand  
**RECEIVED DATE:** 01 Aug 2023  
**RECALIBRATION DATE:** 01 Aug 2024  
**VALID DATE:** 01 Aug 2024

**Calibration procedure:** The measurement results were compared to the international system of units (SI) through the NMI (National Metrology Institute of Thailand) via Certificate number: MF-0009-24.

**Uncertainty of Measurement:** The uncertainty of measurement is expressed as a standard deviation (SD) of the measurement results. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement).

**Calibration results:**

Pressure (mbar)	Calibration Result (mbar)	Uncertainty (mbar)
100.00	100.00	0.01
200.00	200.00	0.01
300.00	300.00	0.01
400.00	400.00	0.01
500.00	500.00	0.01
600.00	600.00	0.01
700.00	700.00	0.01
800.00	800.00	0.01
900.00	900.00	0.01
1000.00	1000.00	0.01

**Calibration conditions:**

- Condition: ☒ Normal ☐ Abnormal
- Pressure transducer medium: Air
- Pressure transducer range: 0 to 1000 mbar
- Pressure transducer accuracy: ±0.01 mbar
- Pressure transducer resolution: 0.01 mbar

Issued by:   
 Mr. Parinya Booncharoen  
 Calibration Department Manager

## CERTIFICATE OF CALIBRATION

Certificate No.: JNAC-001-04 Page: 1 of 2 Pages

**MEASUREMENT ITEM:** Pressure transducer  
**MANUFACTURER:** OTC  
**MODEL TYPE:** OTC-001-01  
**SERIAL NUMBER:** 00100104  
**ID NUMBER:** 00100104  
**CONDITION AS RECEIVED:** Good  
**CUSTOMER:** United Analyst and Engineering Consultant Co., Ltd.  
 81 Sri Udomsuk 41, Sukhumvit Road, Bangkok, Thailand  
 10110, Thailand  
**RECEIVED DATE:** 01 Aug 2023  
**RECALIBRATION DATE:** 01 Aug 2024  
**VALID DATE:** 01 Aug 2024

**Calibration procedure:** The measurement results were compared to the international system of units (SI) through the NMI (National Metrology Institute of Thailand) via Certificate number: MF-0009-24.

**Uncertainty of Measurement:** The uncertainty of measurement is expressed as a standard deviation (SD) of the measurement results. The standard uncertainty has been determined in accordance with the GUM (Evaluation of measurement data - Guide to the expression of uncertainty in measurement).

**Calibration results:**

Pressure (mbar)	Calibration Result (mbar)	Uncertainty (mbar)
100.00	100.00	0.01
200.00	200.00	0.01
300.00	300.00	0.01
400.00	400.00	0.01
500.00	500.00	0.01
600.00	600.00	0.01
700.00	700.00	0.01
800.00	800.00	0.01
900.00	900.00	0.01
1000.00	1000.00	0.01

**Calibration conditions:**

- Condition: ☒ Normal ☐ Abnormal
- Pressure transducer medium: Air
- Pressure transducer range: 0 to 1000 mbar
- Pressure transducer accuracy: ±0.01 mbar
- Pressure transducer resolution: 0.01 mbar

Issued by:   
 Mr. Parinya Booncharoen  
 Calibration Department Manager

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เอกสารไม่ควบคุม

**UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.**  
 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
 Tel. 0 2763 2828 Fax 0 2763 2800 www.uaconsultant.com E-mail: ua@uaconsultant.com

## CALIBRATION REPORT

Report Form: UA-01 (Rev. 1.0)  
 Date: 17/09/2024

**Client:** Thai Gas Co., Ltd.  
**Location:** Thai Gas Co., Ltd.  
**Item:** Gas Analyzer  
**Model:** PHA-370  
**Serial Number:** GAL13KSE

**Calibration Date:** 17/09/2024  
**Calibration By:** [Signature]

**Calibration Result:** The gas analyzer is in good condition and meets the required accuracy.

**Calibration Details:**  
 The gas analyzer was calibrated using a standard gas cylinder with the following composition:  
 Sulphur Dioxide (SO<sub>2</sub>) : 0.00%  
 Nitric Oxide (NO) : 0.00%  
 Methane (CH<sub>4</sub>) : 39.8%  
 Carbon Monoxide (CO) : 0.00%  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Calibration Results:**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.51	0.51	0.51	0.51
Level 2	80.00%	40.00	-1.12	-2.88	2.88
Remark : Measuring Range		50.00 ppm	Average Difference (%)		1.70
: Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

**Calculate by:** [Signature]  
 19/09/2024

**Approve by:** [Signature]  
 19/09/2024

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**UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.**  
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## CALIBRATION REPORT

Report Form: UA-01 (Rev. 1.0)  
 Date: 01/10/2024

**Client:** Thai Gas Co., Ltd.  
**Location:** Thai Gas Co., Ltd.  
**Item:** Gas Analyzer  
**Model:** PHA-370  
**Serial Number:** GAL13KSE

**Calibration Date:** 01/10/2024  
**Calibration By:** [Signature]

**Calibration Result:** The gas analyzer is in good condition and meets the required accuracy.

**Calibration Details:**  
 The gas analyzer was calibrated using a standard gas cylinder with the following composition:  
 Sulphur Dioxide (SO<sub>2</sub>) : 0.00%  
 Nitric Oxide (NO) : 0.00%  
 Methane (CH<sub>4</sub>) : 39.8%  
 Carbon Monoxide (CO) : 0.00%  
 Cylinder No. : D824432  
 Expiration Date : Aug 4, 2028

**Calibration Results:**

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.46	0.46	0.46	0.46
Level 2	80.00%	40.00	-0.46	-1.16	1.16
Remark : Measuring Range		50.00 ppm	Average Difference (%)		0.81
: Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

**Calculate by:** [Signature]  
 1/10/2024

**Approve by:** [Signature]  
 1/10/2024

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

**Test Date :** Sep 19, 2024

**Equipment :** Hydrocarbon Analyzer **Model :** PHA-370  
**Manufacturer :** HORIBA **Serial Number :** GAL13KSE

**Standard Gas Concentration**

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO <sub>2</sub> ) : 0.00% PPM	Manufacturer : [Blank]
Nitric Oxide (NO) : 0.00% PPM	Model : [Blank]
Methane (CH <sub>4</sub> ) : 39.8% PPM	Serial Number : [Blank]
Carbon Monoxide (CO) : 0.00% PPM	
Cylinder No. : D824432	
Expiration Date : Aug 4, 2028	

**Multi-point gas test data**

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error	
Level 1 Zero	0.51	0.51	0.51	0.51	
Level 2 80.00%	40.00	-1.12	-2.88	2.88	
Remark : Measuring Range		50.00 ppm	Average Difference (%)		1.70
: Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

**Calculate by:** [Signature]  
 19/09/2024

**Approve by:** [Signature]  
 19/09/2024

เอกสารไม่ควบคุม

**MULTI-POINT GAS TEST REPORT**

**Test Date :** Oct 1, 2024

**Equipment :** Hydrocarbon Analyzer **Model :** 55i  
**Manufacturer :** Thermo SCIENTIFIC **Serial Number :** 1182920025

**Standard Gas Concentration**

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO <sub>2</sub> ) : 0.00% PPM	Manufacturer : [Blank]
Nitric Oxide (NO) : 0.00% PPM	Model : [Blank]
Methane (CH <sub>4</sub> ) : 39.8% PPM	Serial Number : [Blank]
Carbon Monoxide (CO) : 0.00% PPM	
Cylinder No. : D824432	
Expiration Date : Aug 4, 2028	

**Multi-point gas test data**

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error	
Level 1 Zero	0.46	0.46	0.46	0.46	
Level 2 80.00%	40.00	-0.46	-1.16	1.16	
Remark : Measuring Range		50.00 ppm	Average Difference (%)		0.81
: Acceptable Limit $\pm 5\%$					

**Multi-Point Gas Test Chart**

**Calculate by:** [Signature]  
 1/10/2024

**Approve by:** [Signature]  
 1/10/2024

เอกสารไม่ควบคุม

Certificate of Analysis  
Special Gases Division

## Customer Details

Customer: **Thailand Gas Corporation Ltd.**

Address:

Thailand Gas Corporation Ltd., Bangkok  
Charo Road, Bangkok, Thailand 10110

## Product Details

Product Name	Argon Gas	Grade	99.999%	Lot No.	10110-10110
Manufacturer	Thailand Gas Corporation Ltd.	Country of Origin	Thailand	Expiry Date	10110-10110
Quantity	100 kg	Unit	kg	Weight	100 kg

## Laboratory Report

Analysis Method	Gas Chromatography	Analysis Date	10110-10110	Analysis Time	10110-10110
Analysis Result	99.999%	Analysis Location	Thailand Gas Corporation Ltd.	Analysis Operator	10110-10110

## Certificate of Analysis

Certificate No.	10110-10110	Certificate Date	10110-10110	Certificate Time	10110-10110
Certificate Location	Thailand Gas Corporation Ltd.	Certificate Operator	10110-10110	Certificate Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

## Declaration of Compliance

Declaration No.	10110-10110	Declaration Date	10110-10110	Declaration Time	10110-10110
Declaration Location	Thailand Gas Corporation Ltd.	Declaration Operator	10110-10110	Declaration Signature	10110-10110

เอกสารไม่ควบคุม

**เอกสารแนบ 4-2**

เอกสารสอบเทียบเครื่องมือตรวจวัดเสียง

Request No. 21-67/0304 MTC No. EEL. BP. 109/0267

### CALIBRATION CERTIFICATE

**Submitted by** : S.P.S. Consulting Service Co., Ltd.  
**Address** : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

**Instrument Calibrated :**  
 Description : Sound Calibrator  
 Manufacturer : ACO  
 Model : 2127  
 Serial No. : 130006  
**Standards used :**  
 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.  
 2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.  
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.  
 4. Digital Multimeter Agilent 34401A S/N MY44005560.  
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.  
 6. Audio Analyzer Keithley 2015-P S/N4106495.  
 7. Condenser Microphone B&K 4180 S/N 2889871.

**Ambient Environment**  
 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325 ± 1.500) kPa

**Calibration Procedure:** CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

**Date of Receipt** : 22 Feb. 2024  
**Date of Calibration** : 4 Mar. 2024

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.

FMBL/MTC.002 Rev.4

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 Thailand  
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 Fax. (66) 0 2579 8592  
 E-mail : suran@tistr.or.th

Request No. 21-67/0304 MTC No. EEL. BP. 109/0267

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

**Nominal Output of Unit Under Test** = 94 dB re 20µPa at 1000 Hz

**Acoustic Output in dB re 20µPa, Corrected to Reference Conditions:** 101.325 kPa, 23.0 °C and 50 %RH.

#### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

#### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

#### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	1.65	± 0.50	±4.0%

**Note :** 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

**Calibrated by :**  
 (Mr. Weerachai Deechaiyae)

**Approved by :**  
 (Mr. Prasanna Klunpa)  
 Director

Electrical and Electronic Standards Laboratory  
 Industrial Metrology and Testing Service Centre

**Date of Calibration** : 4 Mar. 2024  
**Date of Issue** : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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 Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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 Fax. (66) 0 2579 8592  
 E-mail : suran@tistr.or.th

Request No. 21-68/0220 MTC No. EEL. BP. 44/0268

### CALIBRATION CERTIFICATE

**Submitted by** : S.P.S. Consulting Service Co., Ltd.  
**Address** : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

**Instrument Calibrated :**  
 Description : Sound Calibrator  
 Manufacturer : ACO  
 Model : 2127  
 Serial No. : 130006  
**Standards used :**  
 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.  
 2. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.  
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.  
 4. Digital Multimeter Agilent 34401A S/N MY44005560.  
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.  
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.  
 7. Condenser Microphone B&K 4180 S/N 2889871.

**Ambient Environment**  
 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325 ± 1.500) kPa

**Calibration Procedure:** CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

**Date of Receipt** : 19 Feb. 2025  
**Date of Calibration** : 21 Feb. 2025

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.

FMBL/MTC.002 Rev.5

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 Fax. (66) 0 2325 9165  
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 Bangkok 10900, Thailand  
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
 Fax. (66) 0 2579 8592

Request No. 21-68/0220 MTC No. EEL. BP. 44/0268

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

**Nominal Output of Unit Under Test** = 94 dB re 20µPa at 1000 Hz

**Acoustic Output in dB re 20µPa, Corrected to Reference Conditions:** 101.325 kPa, 23.0 °C and 50 %RH.

#### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	93.81	-0.19	± 0.10	±0.40 dB

#### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	999.9	-0.1	± 1.5	±1.0%

#### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	0.95	± 0.50	±3.0%

**Note :** 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

**Calibrated by :**  
 (Mr. Weerachai Deechaiyae)

**Approved by :**  
 (Mr. Prasanna Klunpa)  
 Director

Electrical and Electronic Standards Laboratory  
 Industrial Metrology and Testing Service Centre

**Date of Calibration** : 21 Feb. 2025  
**Date of Issue** : 24 Feb. 2025

Ref : 2011268021900739001

End of Certificate

2 / 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.

FMBL/MTC.002 Rev.5

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 Fax. (66) 0 2325 9165  
 E-mail : mt@tistr.or.th Website : www.tistr.or.th

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 Bangkok 10900, Thailand  
 Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
 Fax. (66) 0 2579 8592

Note B\_083/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data					
Brand	ACO	Number	AC 03/56		
Model	2127	Serial No.	130906		
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025		
		Due Date	21 February 2026		

Sound Level Meter Data					Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading (dB)	
					Before Adjustment	After Adjustment
ACO-B24	ACO	6236	00182005	11 March 2025	93.9	93.9
ACO-B29	ACO	6236	00222301	11 March 2025	93.1	93.8

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)  $93.81 \pm 0.10$  dB

Calibrated by :

(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudorn)

Note B\_083/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data					
Brand	ACO	Number	AC 03/56		
Model	2127	Serial No.	130906		
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025		
		Due Date	21 February 2026		

Sound Level Meter Data					Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading (dB)	
					Before Adjustment	After Adjustment
ACO-B24	ACO	6236	00182005	20 March 2025	93.9	93.9
ACO-B29	ACO	6236	00222301	20 March 2025	93.9	93.9

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)  $93.81 \pm 0.10$  dB

Calibrated by :

(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudorn)

Note B\_086/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data					
Brand	ACO	Number	AC 03/56		
Model	2127	Serial No.	130906		
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025		
		Due Date	21 February 2026		

Sound Level Meter Data					Calibration Data	
SLM No.	Brand	Model	Serial No.	Date	Actual Reading (dB)	
					Before Adjustment	After Adjustment
ACO-B24	ACO	6236	00182005	20 March 2025	93.8	93.8

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)  $93.81 \pm 0.10$  dB

Calibrated by :

(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudorn)







Certificate No.: CP20240293EA

## Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
30.6

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	29.5
C-weighting	28.9
Z-weighting	34.4

Function : 3. Acoustical signal tests of frequency weightings (Without Windscreen)

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.1	0.0	0.1	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	1.9	1.9	1.9	±5.0

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.1	0.0	0.0	±2.0
125	0.0	0.0	0.1	±1.5
250	-0.1	0.0	0.0	±1.5
500	0.0	-0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	-0.1	0.0	0.0	±5.0

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
C-weighting	94.0	0.0	±0.2
A-weighting	94.0	0.0	±0.2
Z-weighting	94.0	0.0	±0.2

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เอกสารไม่ควบคุม

Certificate No.: CP20240293EA

## Calibration Report

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
LAeq	94.0	0.0	±0.1

Function : 6. Long-Term Stability

Long-term stability over 30 minutes, with steady 1 kHz signal at reference level.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
30	94.0	94.0	0.0	±0.3

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
134.0	134.1	0.1	±1.1
139.0	139.1	0.1	±1.1
140.0	140.1	0.1	±1.1
141.0	141.1	0.1	±1.1

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F-CAL-005 Ed.1

เอกสารไม่ควบคุม

Certificate No.: CP20240293EA

## Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.1	0.1	±1.1
43.0	43.2	0.2	±1.1
42.0	42.2	0.2	±1.1
41.0	41.3	0.3	±1.1
40.0	40.4	0.4	±1.1

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	135.9	-0.1	±1.0
	2	118.8	-0.2	+1.0 ; -2.5
	0.25	109.6	-0.4	+1.5 ; -5.0
Slow	200	129.5	-0.1	±1.0
	2	109.9	-0.1	+1.0 ; -5.0
	200	130.0	0.0	±1.0
LAE	2	110.0	0.0	+1.0 ; -2.5
	0.25	100.8	-0.2	+1.5 ; -5.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	135.4	134.7	-0.7	±3.0
Positive half cycle	134.4	134.1	-0.3	±2.0
Negative half cycle	134.4	134.1	-0.3	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
143.6	143.5	-0.1	±4.5

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เอกสารไม่ควบคุม

Certificate No.: CP20240293EA

## Calibration Report

Function : 11. High-Level Stability

High-level stability over 5 minutes, with steady 1 kHz signal, 1 dB below upper boundary.

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	139.0	139.0	0.0	±0.3

Uncertainty of measurement

Function	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1) Indication at the calibration check frequency	0.30	Not applicable
2) Self-generated Noise	0.10	Not applicable
3) Acoustical signal tests of frequency weightings - Free-field sound pressure response level	0.30	0.60 (10Hz to 4kHz) 0.70 (>4kHz to 10kHz)
4) Electrical signal tests of frequency weightings	0.20	0.20
5) Frequency and time weighting at 1 kHz	0.20	0.20
6) Long-Term Stability	0.10	0.10
7) Level Linearity on the reference level range	0.30	0.30
8) Tone burst response	0.20	0.30
9) Peak C sound level	0.20	0.35
10) Overload indication	0.20	0.25
11) High-Level Stability	0.10	0.10

Remarks:

1. Indication at the calibration check frequency can not measured because customer does not provide a sound calibrator.
2. The acceptance limit is for the deviated value.
3. Acceptance limits was IEC61672-3:2013 Class 2.
4. The coverage factor  $k = 2.00$

-- End of Report --

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เอกสารไม่ควบคุม

**เอกสารแนบ 4-3**

เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำ

**QUALITY CALIBRATION CO.,LTD.**  
235 Petchkasem 63/2 Road, Lakson, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4384  
www.qcalibration.com

**CERTIFICATE No : 25M2256**  
**REFERENCE No : 76365-3**

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE  
**MANUFACTURER** : SARTORIUS  
**MODEL** : BSA224S-CW  
**SERIAL No** : 36591843  
**ID No** : BA09/61  
**CONDITION AS RECEIVED** : USED ITEM  
**SUBMITTED BY** : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

**CALIBRATED BY** : ATSAWIN Y.  
**CALIBRATION DATE** : 07-Mar-25

**APPROVED BY** : PONGSAW J.  
**ISSUED DATE** : 13-Mar-25  
**RECEIVED DATE** : 07-Mar-25

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**  
235 Petchkasem 63/2 Road, Lakson, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4384  
www.qcalibration.com

**CERTIFICATE No : 25M2256**  
**PAGE : 2 OF 2**

**Calibration Report**

**EQUIPMENT** : DIGITAL BALANCE  
**MANUFACTURER** : SARTORIUS  
**ID No** : BA09/61  
**AIR PRESSURE** : 1009mbar ± 1mbar  
**AMBIENT TEMPERATURE** : 24°C ± 1°C  
**MODEL** : BSA224S-CW  
**S/N** : 36591843  
**RECEIVED DATE** : 07-Mar-25  
**CALIBRATION DATE** : 07-Mar-25  
**RELATIVE HUMIDITY** : 52%RH ± 10%RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	OK-151	C02250116	28-Jun-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jun-27

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 THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION** : WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL  
2. TARE FUNCTION : NORMAL  
3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g  
4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (±g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR

POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000

OFF-CENTER LOADING : 0.0000

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

END OF CALIBRATION REPORT

F-G010 REV 03

**CAL**  
Calibratex Co., Ltd.  
7/106-7 Moo 2, Sukaprasoon 3 Rd., Bangpoo, Pakkard, Nonthaburi 11120  
Tel (02) 964-6211 Fax (02) 964-5155, e-mail : calibratex.co@yahoo.com, calibratex.co@hotmail.com

**Certificate of Calibration**

**Certificate No. :** 68-400046-2 **Page : 1 of 2**

**Submitted by :** S. P. S Consulting Service Co., Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

**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. :** TM21/59

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

**Date of Received :** 21 January 2025  
**Date of Calibration :** 24 January 2025  
**Date of Issue :** 24 January 2025  
**Calibrated by :** Chonrip Sanchusri

**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-0023-24 10 Feb 2026 National Institute of Metrology (Thailand) (NIMT)

2. Standard Digital Thermometer  
ID No. Cert. No. Due Date Traceability  
400003 23E1866 01 Jun 2025 National Institute of Metrology (Thailand) (NIMT)  
400004 23E1866 01 Jun 2025 National Institute of Metrology (Thailand) (NIMT)

**Approved by :** (Permon Champa)  
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 Calibratex Co., Ltd.

CAL-F0031-03

**CAL**  
Calibratex Co., Ltd.  
7/106-7 Moo 2, Sukaprasoon 3 Rd., Bangpoo, Pakkard, Nonthaburi 11120  
Tel (02) 964-6211 Fax (02) 964-5155, e-mail : calibratex.co@yahoo.com, calibratex.co@hotmail.com

**Certificate of Calibration**

**Certificate No. :** 68-400046-2 **Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As Received :** Closed

**Function :** Temperature Measurement  
(ice point check, UUC reading 0 °C (liquid cooling) : 0.002 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
20.4001	20	0.5	0.31

**Remark :**  
UUC : 1.00 Linear Calibration

This result of calibration was found accurate as shown on date and place of calibration only.  
This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.

-o/o-

CAL-F0031-03



# CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukul 29 Yrak 4, Prasert Manukul Rd., Ladphrae, Bangkok 10230  
Tel. 02-578-0354-4 Fax. 02-578-2872 www.ccl-lab.com E-mail: info@ccl-lab.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : CONDUCTIVITY METER  
MANUFACTURER : METTLER TOLEDO  
MODEL / TYPE : SEVEN COMPACT S230  
SERIAL NO. : C141708983/5821320179[CD 05/65]  
CLID. NO. : 272300452  
JOB CONTROL NO. : 250204013412  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24 ROAD, JOMPOL,  
CHIATUCHAR, BANGKOK 10906

DATE OF RECEIVED : 04 February 2025

DATE OF ISSUED : 06 February 2025

The report of calibration shall not be reproduced except in full without approval of the calibration Laboratory Co., Ltd.

Calibrated By : Sukgasm Sechanart  
Wenick Inchaistri  
Calibration Engineer

*[Signature]*

Approved By : Mongkol Yotsontorn  
Authorized Signatory  
06 February 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25013412  
F3-011-05/12-23

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# CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukul 29 Yrak 4, Prasert Manukul Rd., Ladphrae, Bangkok 10230  
Tel. 02-578-0354-4 Fax. 02-578-2872 www.ccl-lab.com E-mail: info@ccl-lab.com



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : CONDUCTIVITY METER  
MANUFACTURER : METTLER TOLEDO  
MODEL / TYPE : SEVEN COMPACT S230  
SERIAL NO. : C141708983/5821320179[CD 05/65]  
DATE OF CALIBRATION : 05 February 2025

#### ENVIRONMENT CONDITIONS :

Temperature :  $(25 \pm 1.5) ^\circ\text{C}$  Relative Humidity :  $(50 \pm 15) \% \text{ RH}$

#### PROCEDURE USED :

This instrument [ Conductivity Meter ] was calibrated under procedure No. WI-505-130.

The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM).

[This instrument [Temperature] was calibrated by comparison with Calibration Bath, Precision Thermometer and IPTT which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Conductivity Solution, Hanna Product Code HI 70333, Lot number /830.
2. Potassium Chloride Solution ( nominal 1.41 mS/cm )
3. Potassium Chloride Solution ( nominal 12.8 mS/cm )
4. Calibration Bath, Kambic Model OH-22/2 U/LT S/N. 17115653.
5. Precision Thermometer, ASL Model F201 S/N. 01616809.
6. IPTT, ASL Model T190-250-10-5%, PO-08440-3-13.

Certificate No. Q25013412  
F3-011-05/12-23

page 2 of 4



# CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukul 29 Yrak 4, Prasert Manukul Rd., Ladphrae, Bangkok 10230  
Tel. 02-578-0354-4 Fax. 02-578-2872 www.ccl-lab.com E-mail: info@ccl-lab.com



#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Hanna instruments.  
Certificate No. 20F21, Due Date June 2025.
2. The measurements are traceable to International System of Units (SI), through Sigma-Aldrich Canada Co.  
Certificate No. IHC3095403, Due Date 31 January 2026.
3. The measurements are traceable to International System of Units (SI), through Sigma-Aldrich Canada Co.  
Certificate No. IHC2011554, Due Date 30 September 2025.
4. The measurements are traceable to International System of Units (SI) through Calibration Laboratory Co., Ltd.  
Certificate No. Q24120999, Due Date 26 November 2025.
5. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0424/67, Due Date 21 February 2025.
6. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. IT-0035-24, Due Date 01 March 2023.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"



# CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukul 29 Yrak 4, Prasert Manukul Rd., Ladphrae, Bangkok 10230  
Tel. 02-578-0354-4 Fax. 02-578-2872 www.ccl-lab.com E-mail: info@ccl-lab.com



#### CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

#### MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

The table in the following gives the calibration results and associated measurement uncertainties of Conductivity Meter.

#### CALIBRATION DATA

##### 1. Conductivity Solution Test @ $25 ^\circ\text{C}$

Standard Conductivity Solutions	DUC Reading	Uncertainty of Measurement	k Factor
984.89 $\mu\text{S/cm}$	984.89 $\mu\text{S/cm}$ [Cell Constant 0.548589]	$\pm 1.00 \mu\text{S/cm}$	2.00
1414.0 $\mu\text{S/cm}$	1414 $\mu\text{S/cm}$ [Cell Constant 0.548589]	$\pm 21.0 \mu\text{S/cm}$	2.00
12.85 mS/cm	12.84 mS/cm [Cell Constant 0.548589]	$\pm 0.19 \text{ mS/cm}$	2.00

Note, The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

\* means Calibrations marked "Not TISI Accredited" in this Certificate have been included for completeness.

##### \*2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature ( $^\circ\text{C}$ )	DUC Reading ( $^\circ\text{C}$ )	Correction ( $^\circ\text{C}$ )	Uncertainty $\pm$ ( $^\circ\text{C}$ )
100	25.01	24.9	+0.11	0.07

Technical Note, Type of sensor : Conductivity Probe

Probe  $\varnothing$  12 mm

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2.00$ .

Note, \* means Calibrations marked "Not TISI Accredited" in this Certificate have been included for completeness.

This report is valid for the above stated instrument's only.

### End of Certificate ###

Certificate No. Q25013412  
F3-011-05/12-23

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CERTIFICATE No : 24E6416  
REFERENCE No : 73694-1

PAGE : 1 OF 3

### Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
MODEL : HI 3512  
SERIAL No : TH118035  
ID No : pH 04/56  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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

F-G010 REV 03



CERTIFICATE No : 24E6416

PAGE : 2 OF 3

### Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
MODEL : HI 3512  
ID No : pH 04/56  
RECEIVED DATE : 24-Jun-24  
AMBIENT TEMPERATURE : 23 °C ± 1 °C  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 27-Jun-24  
RELATIVE HUMIDITY : 50 % RH ± 10 % RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READING THE VALUE COMPARED WITH THE CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER.

#### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC784945	4880-14413915	24-Aug-25
2) pH STANDARD SOLUTION	00651-08	CC785578	4881-14430613	31-Aug-25
3) pH STANDARD SOLUTION	00651-10	CC787086	4882-14443317	21-Sep-25
4) PROCESS CALIBRATOR	CA150	9156079	24C1251	09-Apr-25
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421594	5506079	23T9023	13-Sep-24

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 SI UNIT MAINTAINED AT :-

- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA,  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

#### RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/S = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.115	0.15	2.00
354.95	355.5	-0.55	0.884	0.15	2.00
295.80	296.4	-0.60	1.885	0.15	2.00
236.64	237.1	-0.46	2.886	0.15	2.00
177.48	178.0	-0.52	3.887	0.15	2.00
118.32	118.8	-0.48	4.887	0.15	2.00
59.16	59.6	-0.44	5.887	0.15	2.00
0.00	0.4	-0.40	6.888	0.15	2.00
-59.16	-58.7	-0.46	8.101	0.15	2.00
-118.32	-117.9	-0.42	9.345	0.15	2.00
-177.48	-177.4	-0.08	10.589	0.15	2.00
-236.64	-236.4	-0.24	11.834	0.15	2.00
-295.80	-294.5	-1.30	13.077	0.15	2.00
-354.95	-354.7	-0.25	14.322	0.15	2.00
-414.11	-413.9	-0.21	15.565	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03



CERTIFICATE No : 24E6416

PAGE : 3 OF 3

### Calibration Report

#### RESULT OF CALIBRATION (CONTINUED) :-

2. DISPLAY UNIT WITH pH ELECTRODE SN-09081004

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT (pH)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.015	4.011	0.004	3.905	0.012	2.00
7.003	7.003	0.000	6.972	0.012	2.00
10.009	10.014	-0.005	9.570	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT (°C)	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 99%.

END OF CALIBRATION REPORT

F-G010 REV 03



CERT. No.: HS-W015C

Certificate of Calibration

Calibration Date : 18 Mar 25  
Submitted by : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL,  
CHATUCHAK, BANGKOK THAILAND 10900

Model : YSI 5000  
SN : 15B100751  
Probe : YSI 5010  
SN : 22D100007  
ID NO :  
Air Temp ref : SN, RM65C20  
Bathwater ref : SN, RM65C20  
Water Temp ref :  
ID NO : HS201  
Technician : Katsong KL

Avg Process Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.0 mmHg

Salinity : 0 ppt

#### Calibration Details

Calibration Point	100% air sat. (92) °C, DO = 9.09 mg/L	(actual)	(target)
Measurement 1 (mg/L)	9.08	(PASS)	---
Measurement 2 (mg/L)	9.08	(PASS)	---
Measurement 3 (mg/L)	9.08	(PASS)	---
Measurement 4 (mg/L)	9.07	(PASS)	---
Measurement 5 (mg/L)	9.07	(PASS)	---
Measurement 6 (mg/L)	9.07	(PASS)	---
Measurement 7 (mg/L)	9.07	(PASS)	---
Measurement 8 (mg/L)	9.07	(PASS)	---
Measurement 9 (mg/L)	9.07	(PASS)	---
Measurement 10 (mg/L)	9.06	(PASS)	---

Mean Measurement

Accuracy

Control Status

Manufacturer Specification

Accuracy : ± 0.02 mg/L

1) This certificate is issued based on the result that are found as given in date and place of test only.

2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.

3) This result shall not be used for advertising purpose.

Technician Signature  
(Katsong Katsong)

Laboratory Manager  
(Nateapha Pitsakunon)



## Certificate of Calibration

Cert.No.: 25CH217  
Page.: 1 of 3

Equipment : Turbidity Meter  
Manufacturer : Eutech  
Model : CyberScan WLTB1000  
Serial No. : 201802206  
ID. No. : TB 02/50  
Condition As-Received: Used Item  
Received Date : 17 February 2025  
Calibration Date : 18 February 2025  
Reference : 2502-0500WN-1  
Submitted by : S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road,  
Jompol, Chatuchak, Bangkok 10900  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 20) %  
Calibration Procedure : In - house method : CP-CH11  
Direct measurement by  
using Formazin standard solution  
Calibrated by : Walalak Sirithean  
Approved by :   
Approved Signatory  
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Salthip Meangmai  
Issue Date : 21 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No. : 25CH217  
Page. : 2 of 3

### Condition of this calibration result

#### 1. Reference Standard Instruments :

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	14233821	110RC001	24MM131	04 July 2025
- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)				

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

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

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

### Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU  
Turbidity Meter Serial Number : 201802206

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Error ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k	Tolerance Limit ( ± NTU )	Judgement
20	19.4	-0.6	0.38	2.00	2.0	Pass
40	39.9	-0.1	0.40	2.00	2.0	Pass
100	98.9	-1.1	0.70	2.00	2.0	Pass
400	391	-9	1.5	2.05	20.0	Pass

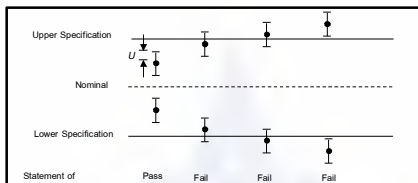
**Remark** - UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

Cert.No. : 25CH217  
Page. : 3 of 3

### Decision Rule : The decision rule is prescribed by customer (Error ± Uncertainty < Specification)

Statement of conformity are reported as :

- o Pass - the measured value included the measurement uncertainty is below the acceptance limit.
- o Fail - the measured value included the measurement uncertainty is above the acceptance limit.



U=95% expanded measurement uncertainty

Tolerance Limit (Specification Limit) provided by customer

Tolerance Limit (TL) (Specification Limit) : specified upper or lower bound of permissible values of property.

Acceptance Limit (AL) : specified upper or lower bound of permissible measured quantity values.

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

-o0o-

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	January 6, 2025
Address :	7 Soi Phaholyothin 24	Recommendation Recertification	
	Paholyothin Road	Period	6 Months
	Jompol Chatuchak, Bangkok 10900	Recertification Due:	July 6, 2025
User Name:	K.Phenpha Vipphasthawatt	Date Last Certified:	July 4, 2024
Phone:	083-9269252	Visit Number:	1 OF 2
Email:		PerkinElmer Phone:	02-719-6420 ext 204
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

Page 1 of 6

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			<input type="checkbox"/>
B. Grating Condition			<input type="checkbox"/>
C. Replace or Clean Dust Filter			<input type="checkbox"/>
D. Cleaning the Contact Cylinders			<input type="checkbox"/>
E. Cleaning the Furnace Windows			<input type="checkbox"/>
F. Cleaning the Burner Head			<input type="checkbox"/>
G. Cleaning the Nebulizer			<input type="checkbox"/>
H. Cleaning the Drain System			<input type="checkbox"/>
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			<input type="checkbox"/>
B. Sampling & Rinse Pump			<input type="checkbox"/>
C. Sample Position & Clean			<input type="checkbox"/>
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			<input type="checkbox"/>
B. Thermosensor			<input type="checkbox"/>
4. FIAS CHECKS			
A. Pump and 5 Port Valve			<input type="checkbox"/>
B. Chemifold and Tubing			<input type="checkbox"/>
C. Power Supply			<input type="checkbox"/>
D. Flow meter and Gas system			<input type="checkbox"/>

Page 2 of 6

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
PARAMETER	SPECIFICATION	ACTUAL VAULE	
A. Flame Mode Tests			
1. Detector-Linearity with Barium (553.55 nm)			
Neutral Density Filter 0.2 :	0.2042 Abs. + 5%	0.2029 Abs.	
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.	
2. Baseline Noise at 1 Abs with Barium (553.55 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.	
3. AA Baseline with Copper (Cu 324.75 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.	
4. D <sub>2</sub> Background Compensation (Copper 324.75 nm)			
with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.	
5. AA-BG Baseline Noise with Copper (324.75 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.	
6. AA-BG Baseline Noise with Arsenic (193.70 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.	

Page 3 of 6

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
PARAMETER	SPECIFICATION	ACTUAL VAULE	
7. Flame Interlock Shutdown			
	Shutdown correct?		<input type="checkbox"/>
8. Flame Sensitivity with Copper (324.75 nm)			
(5 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.	
(2 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.	

Page 4 of 6

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
PARAMETER	SPECIFICATION	ACTUAL VALUE	
<b>B. THGA Tests</b>			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm) (measure 5 furnace dry firings without any sample)			
Baseline	≤ 0.005 Int.Abs	0.0012	
SD	≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass (m <sub>0</sub> ) and Precision (357.87 nm) (measure 5 furnace firing using 20 µl sample injections of 10 µg/L Cr standard)			
m0 Results	≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
Precision	≤ 2.0%	1.15	%
4. Copper Characteristic Mass (m <sub>0</sub> ) and Zeeman Ratio (324.75 nm) (measure 5 furnace firing using 20 µl sample injections of 25 µg/L Cu standard)			
m0 Results	≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
Zeeman Ratio	0.52 ± 0.04	0.542	

Page 5 of 6

PerkinElmer Scientific (Thailand) Co., Ltd.  
290 Soi Soorvijai 4, Bangkok, Huay Kwang, Bangkok 10310 Head Office

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	January 6, 2025
Remarks :			
- Neutral Density Filter refer to data sheet			
- Zeeman Ratio = $\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)} + \text{Background Signal(peak area)}}$			
= 0.1635/0.1635+0.1378			
0.542			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet			
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
<b>Service Department PerkinElmer Ltd.</b>			
Customer Service Engineer: <i>Wiphon Promlunda</i>			
( Wiphon Promlunda ) Service Engineer			

Page 6 of 6

PerkinElmer Scientific (Thailand) Co., Ltd.  
290 Soi Soorvijai 4, Bangkok, Huay Kwang, Bangkok 10310 Head Office

## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

45/1-45/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : SP24020  
Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501514123060  
**ID No.:** SP0358  
**Calibration Mode :** WAVELENGTH ACCURACY  
 PHOTOMETRIC ACCURACY

**Condition As Found :** GOOD

**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHI 24, PHAHOLYOTHI ROAD,  
CHOMPON, CHATUCHAK,  
BANGKOK 10900, THAILAND.

**Location :** WET CHEMISTRY LABORATORY IV

**Ambient Temperature :** ( 28.1 ± 5 ) °C  
**Relative Humidity :** ( 47.2 ± 25 ) %

**Received Date :** 27 AUGUST 2024  
**Calibration Date :** 27 AUGUST 2024  
**Date of Issue :** 27 AUGUST 2024

Calibrated by: *Nathakorn Pongpattana*

Approved by: *T. Petchurani*  
( Thanaikul Petchurani )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

45/1-45/1 Sirinthorn Road, Bangbunru, Bangkok, 10700 Thailand  
Tel : +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : SP24020  
Job No. : VC67SP0013  
Pages : 2 of 3

### Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01  
 The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution  
 The calibration procedure used was based on ASTM E275-01, ASTM E925-02

### Condition of this result of calibration :

#### 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

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

#### 3. This certificate is traceable to the international system of unit maintained at :

- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.7	-0.12	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	739.9	-0.19	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC\* = Unit Under Calibration

*T. Petchurani*



## CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003  
Date Issued : 23-Sep-24

## Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0029	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
Neutral Density glass filter	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5161	0.5161	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
BS-4244444444	20	20	0.2422	0.2418	-0.0004	0.0101	2.00	
		40	0.4866	0.4852	-0.0014	0.0115	2.00	
		60	0.7414	0.7389	-0.0025	0.0067	2.00	
	235.0	80	0.9858	0.9842	-0.0016	0.0093	2.00	
		100	1.2442	1.2414	-0.0028	0.0086	2.00	
		120	1.5026	1.5000	-0.0026	0.0086	2.00	

UUC\* = Unit Under Calibration

## Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 5015412300

Resolution of Wavelength Mode: 0.1 nm  
Resolution of Photometric Mode: 0.0001 A  
Parameter Setting: Wavelength, Absorbance  
Measurement Mode: 1100 nm-190 nm  
Wavelength Scan: 7.5 nm/min  
Scanning Speed: 0.1 nm  
Data Pitch: 1.0 nm  
Band width (Wavelength): 1.0 nm  
Band width (Vis): 1.0 nm  
Band width (UV): 1.0 nm

Stray Light** UUC* Reading at 220 nm
Transmission T (%)
0.0117
Absorbance (A)
3.8659

\*\*Specific Absorbance:

Transmission  $\leq 1.0$  T (%), Absorbance  $\geq 2.0$  A

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate

T. Petchu

Customer : S.P.S. CONSULTING SERVICE CO., LTD.  
7 Soi Phaholyothin 24 Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 16-Sep-24

Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

## Result of Calibration

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

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

Approved by: Sarayuth T.  
(Sarayuth Tochua)

Page 1 of 2

Certificate No. : S2024090374-0003

Environment : Ambient Temperature : Start record 23.7 °C, Stop record 23.5 °C  
Relative Humidity : Start record 54.6 %RH, Stop record 54.4 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability (°C)	Measured Uniformity (°C)	Overall Variation (°C)
35	35.0	35.0	0.04	0.21	0.28
41.5	41.5	41.5	0.07	0.19	0.30

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty* (°C)
35	34.81	35.12	34.90	34.92	35.02	34.82	34.92	35.13	34.99	0.23
41.5	41.31	41.49	41.33	41.34	41.41	41.31	41.52	41.32	41.48	0.23

Decision Rule: With Guard Band

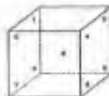
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

Pass = (error) + (uncertainty) &lt; (MPE) MPE = Maximum Permissible Error

Fail = (error) + (uncertainty) &gt; (MPE)

Note: Probe No. 9 is Reference Probe

Setting Air Fresh No. : 0



Condition Air-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used &amp; Traceability :

The International System of Units (SI) through

MIT Certificate No. L202407573-0005 for Temperature Indicator with Sensor Serial No. 1307020117, Due To Jan-25

Note: 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

Page 2 of 2



QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qualitycalibration.comCERTIFICATE No : 25T2261  
REFERENCE No : 76365-8

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNB29  
SERIAL No : L614.0123  
ID No : WB 05/58  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900CALIBRATED BY : SUCHART S.  
CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSUK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



F-G010 REV : 03



CERTIFICATE No : 25T2261

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : WB 05/58  
RECEIVED DATE : 07-Mar-25  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
MODEL : WNB29  
SERIAL NUMBER : L614.0123  
CALIBRATION DATE : 07-Mar-25  
RELATIVE HUMIDITY : 51 %RH ± 10 % RH

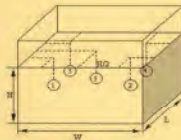
### CONDITION OF THIS RESULTS OF CALIBRATION

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 6690614 24T6473 01-Jul-25  
3. THIS 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 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) : 0.6  
Overall Variation of Line Voltage (V) : 12  
Instrument Condition : Normal  
Bath Inner Size (W\*L\*H) : 60\*40\*10 cm

### BATH PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Temperature Stability (°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.0	50.2	0.06	0.05	0.03	0.16
60.0	60.2	0.06	0.08	0.04	0.17

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (4 °C)
		#1	#2	#3	#4	Ref. 5	
50.2	50.2	49.84	49.88	49.86	49.88	49.89	0.15
60.2	60.2	59.83	59.84	59.85	59.86	59.91	0.16

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



F-0010 REV 03

## Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

### Preventive Maintenance Checklist

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

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

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

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

#### Introduction

#### Customer Information

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

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#### 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/support/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.

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#### 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 AAS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8432 A	M1 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

#### Preparation, Safe operation and Initial performance checks

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

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

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test\_1"
- ☒ Perform a Basic Cu ABS test - "As found test\_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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## Preventive Maintenance Procedures

### FLAME SYSTEM section

☐ Section not applicable

#### Electronic components

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

#### Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote R21 or mineral-based molybdenum disulfide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
  - ☒ Monochromator drive
  - ☒ Slit drive
  - ☒ Lamp selector
  - ☐ ABA

#### Optics components

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

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### Sample Introduction and Atomization

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

### Gas handling components and safety interlocks

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

### Analytical performance for Flame systems

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

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### FURNACE SYSTEM section

☒ Section not 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 Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

### Gas handling, water system and workhead component checks

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

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

### Analytical performance for Furnace systems

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

### PSD autosampler accessory for Furnace systems

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

### Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.

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

#### Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

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

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

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

**NOTE: The autosampler requires no extra lubrication throughout its lifetime.**  
For further details refer to the SPS 4 service manual G8410-90050.

#### Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 ml of Dow Corning 200 10 Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

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#### Vapor generation accessory VGA (hydride generator)

☐ Section NOT Applicable

- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (320 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.

#### UltrAA lamp accessory (external)

☒ Section NOT Applicable

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

#### Restore System

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

#### Guidance

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

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### Signature Page

#### Service Review

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

#### Test Results

Test Description	Expected Test Result	Actual Test Result
<b>Flame optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	49 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.559%
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.2 %
<b>Deuterium furnace optics PMT Gain test</b>		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	—
<b>Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)</b>		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.15	—
<b>Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)</b>		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSR%	≥ 70 %	—

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#### AA consumable and parts list table

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

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

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

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Service Engineer Comments (optional)

If there are any specific points you wish to have as part of performing the maintenance or other items of interest for the customer, please enter this box.

Service Completion

Service request number: 6007549143 Date service completed: 30 Jan 2025  
 Agilent signature: Kanyakorn S. Customer signature: Sawan Y  
 Total number of pages in this document: 13

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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	12.12	13.20	<b>Passed</b>
-12.00 V Rail	-13.20	-11.90	-10.80	<b>Passed</b>
5.00 V Rail	4.50	5.04	5.50	<b>Passed</b>
310.00 V Rail	279.00	326.00	341.00	<b>Passed</b>

SVD Results Report



Report ID: Diagnostic Start Time: 1/30/2025 9:14:28 AM Diagnostic End Time: 1/30/2025 9:26:00 AM  
 Customer: UAE Service Engineer: Kanyakorn S.  
 Address: Soi Udomsuk 41, Sukhumvit Rd. Bangkok Contact Details: 026376363#1  
 Instrument: 507101101

Configuration:

Serial Number: MY3100001 Turrot Type: Automatic  
 Instrument Model: Varian AA10245230 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 UHAA: False Firmware Version: 2.11  
 Optics Type: Quartz Beam Photomultiplier Type: Normal(90nm)  
 D2 D3 ChromScan Filter: True PWD Version: 48  
 Backup Lock Version: 1.08

EEPROM Data:

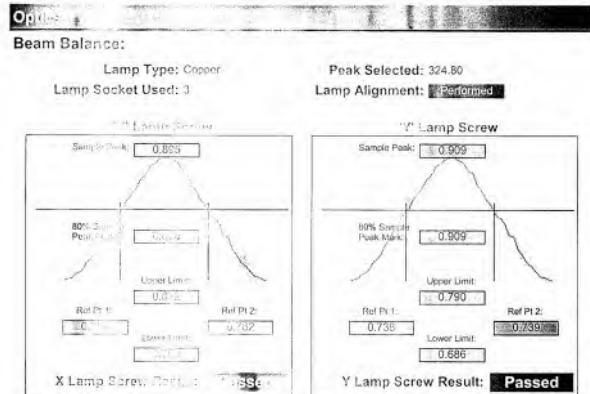
Instrument: True 1/1/1970 1000000000 D2 Run Hours: 83908.900  
 Zero Wavelength Offset: 20.133 D2 Serial Number: not set!  
 Mono Correction: 0.770 D2 Install Date: 1/1/1970  
 Flame Hours: 32411.834 D2 Original Intensity: 1.000  
 D2 Last Intensity: 475.000

Report Generated At: 1/30/2025 9:47:25 AM

1

SVD Results Report SVD

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Grating S

Lamp Element(s): Copper  
 Lamp Socket Position: 3  
 Lamp Current(mA): 4.00  
 Slit Width (mm): 0.5  
 1st Order Wavelength(nm): 324.80  
 Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	324.80	0.10	<b>Passed</b>
First Order	324.45	324.72	325.15	<b>Passed</b>
Second Order	648.90	649.44	649.97	<b>Passed</b>

Report Generated At: 1/30/2025 9:47:25 AM

2

SVD Results Report SVD

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Report Generated At: 1/30/2025 9:47:25 AM

3

SVD Results Report SVD

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Lamp Used: Cheper	Lamp Current(mA): 0.2
Peak Used(nm): 324.759	SL1 Width(nm): 0.2
Connection to Socket: 3	SL1 Height: Normal
Lamp Alignment: 	
Lower Limit(nm) 324.778	324.868 Upper Limit(nm)
(Distance from Zero Dot)	
Sample 1: 324.823	(Distance from end)
Sample 3: 324.823	Sample 4: 324.823
Sample 5: 324.819	Sample 6: 324.819
Sample 7: 324.819	Sample 8: 324.819
Sample 9: 324.819	Sample 10: 324.819
Count: 259	Standard Deviation: 0.003



SVD Results Report SVD

**Wavelength Drive:**

**Slit Drive:**

**Turret Drive:**

**Stat** | **Display Descriptive Statistics** | **Display Normality Test Results**

**Wavelength**

**Display Descriptive Statistics**

Sample	Wavelength	Upper Limit	Result
01	297	297	Passed
02	298	298	Passed
03	299	299	Passed
04	304	304	Passed
05	305	305	Passed
06	306	306	Passed
07	308	308	Passed
08	317	317	Passed

Burner Flame:	Flame Detect:	Working
HOB Burner Flame:	SCU Active:	Working
Flame Safety Circuit:	Oxidant Pressure:	Working
Oxidant Flow:	Exhaust Changeover:	Working
Pressure Release during Flame:	Ignition:	Working
Liquid Trap:		

1

SVD Results Report SVD

5

SVD Results Report 

Sequential by time report

1/30/2025 10:53 AM Page 1 of 1

SpectraAA

---

Analyst  
 Date Started 1/30/2025 10:53 AM GMT: 1/30/2025 3:33 AM  
 Worksheet Sensitivity Test 01  
 Comment  
 Methods Cu  
 Computer name DESKTOP-RSUFPS  
 Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL 27910	0.000	38.6	0.0602
Readings			
0.0002	0.0003	0.0001	1/30/2025 10:51:46 AM

---

STANDARD 1

Conc. mg/L	%RSD	Mean Abs
0.0002	0.1	0.5571
Readings		
0.5574	0.5563	0.5575
1/30/2025 10:52:22 AM		

Abs

Linear Origin - Cal. Set 1

Cu mg/L

Curve Fit = Linear Origin  
 Characteristic Conc. = 0.026 mg/L  
 r = 1.0000  
 Calculated Conc. = 0.002 %RSD  
 Residuals = -0.007 0.005

Abs = 0.11141 x C

5 ppm Cu	0.002	0.3	0.5568
Readings			
0.5562	0.5596	0.5615	1/30/2025 10:52:54 AM

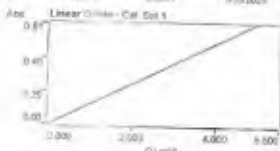
## เอกสารไม่ควบคุม

Analyst  
Date Started 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM  
Worksheet Precision Test  
Comment  
Methods Cu  
Computer name DESKTOP-RSUFRS  
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZIRCO	0.000	64.1	-0.0002
	Readings		
	-0.0002	-0.0002	-0.0001

STANDARD 1	Conc. mg/L	%RSD	Mean Abs
	0.000	0.0	0.0002
	Readings		
	0.0002	0.0002	0.0001



Curve Fit = Linear Origin  
Characteristic Conc. = 0.000 mg/L  
r = 1.0000  
Calculated Conc. = -0.002 5.510  
Residuals = 0.002 0.000

Abs = 0.12105 x C

5 ppm Cu	Conc. mg/L	%RSD	Mean Abs
	0.000	0.0	0.0001
	Readings		
	0.0001	0.0001	0.0001
	0.0002	0.0002	0.0001
	0.0003	0.0003	0.0001

SPS 4

Sampler Offline

Goto Tube

Back 1

Tube 1

Goto Tube

Down height 0.00 (mm)

Pump speed Medium

View to tube holes

Sample

Calibration

Calibration/QC

Sample/QC

Not Assumed

Optimization Lamp

HC Lamp

0.917

Optimized Lamp

Optimized Lamp

Repeat

Print/Zero

Gain 45 %

OK

Security Check: 1.5 mg/L given about 0.2 Abs at 300.8 nm, A/A Burns

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เอกสารไม่ควบคุม



## PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,

Phra Khanong, Bangkok 10260

Instrument Serial No.: PFB520031902

Date: 14-May-2024

### PinAAcle 900F Preventive Maintenance (PM)

Company Name:	United Analyst and Engineering Consultant Co., LTD.		
Address (Instrument Location):	41 Sukumvit Rd., Phra Khanong, Bangkok 10260		
Serial Number:	PFB520031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yalinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanan	Service Order Number:	WO-02787590
Date PM Performed: (DD-MMM-YYYY)	14-May-2024	Next PM Due Date: (DD-MMM-YYYY)	14-Nov-2024
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	PerkinElmer®
09370145 Rev.9	A	January 2018	

#### Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

#### General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFB520031902	Syngistix V.4.0.1.1935
Fias100(New Install)	100524040501	

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
MS001096	Fan Filters	N/A
MS160256	O-Ring Kits for Sampling Introduction ( Stainless Steel Nebulizer)	N/A
MS160257	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	N/A
MS901754	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	Apr 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 mL	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 mL	AR	AR

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## Procedure Checklist

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

### 1. General:

- ✓ Review the instrument performance with the customer and document any recent problems.
- ✓ Inspect the customer log book and make any appropriate PM entries.
- ✓ Perform general inspection of system for cleanliness.

### 2. PC Instrument Software:

- ✓ Instrument Software user files/databases archived, packed, and/or deleted as needed.

### 3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary.
- ✓ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ✓ Clean exterior of the instrument.
- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification.
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

### 4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ Carefully check all internal and external cable connections.
- ✓ Check instrument firmware revisions upgrade to current levels (if necessary)
- ✓ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

### 5. Optics:

- ✓ Inspect and clean the sample compartment windows, if needed.
- ✓ Inspect optics. Clean or replace if necessary.

### 6. Gasses:

- ✓ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-Installation Checklist SDB.
- ✓ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

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## Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	R Lumina HCL	1	030819-010130
N3050152	Mi Lumina HCL	1	052719-020020

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### 7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

### 8. After PM Performance tests:

#### 8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	Passed

#### 8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.002	Passed

#### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

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#### 8.4 D<sub>2</sub> Background Compensation with Copper

Description: Verifies the instrument's ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	Passed

#### 8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.002	Passed

#### 8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0022	Passed

#### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.8005	Passed

#### 10. Review:

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

#### Additional Comments

Additional Comments Regarding the PM

#### Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.	
This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 14-May-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 14-May-2024 (DD-MMM-YYYY)

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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



## Certificate of Calibration

Cert.No.: 24MM292  
Page.: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AB204-S/FACT  
Serial No. : 1129361010  
ID No. : UAE.WAS.002/2552  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Balance Room (108)  
Received order : 11 May 2024  
Calibration Date : 11 May 2024  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %  
Calibrated by : Khit Rutanaprapachai  
Approved by : Kunchit  
( ) Ponpan Palpim  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-0166OC-1  
Procedure used :-

Cert.No.: 24MM292  
Page: 2 of 3

Calibration were conducted using In-house calibration procedure CP-0801 based on UKAS LAB 14 according to direct measurement method against standard weight.

#### Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0013-24	25 Jan 2026

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

3. This result of calibration was made on requested at the point specified by customer.

4. This certificate is not certified for any commercial transaction.

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

Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
100	100.0000	0.0000	0.19	2.03
200	200.0006	-0.0006	0.30	2

After Adjustment :

1. Determination of the standard deviation of weighing machine ( n = 10 )

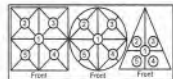
Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2405-01660C-1  
Result of calibration

Cert.No.: 24MM292  
Page: 3 of 3



2. Effect of off center loading  
A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (K)
Unloaded	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.08
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

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-

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



## Calibration Certificate

Certificate No.: 2502226-002-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsak 41, Sukhumvit Road,  
Bangchack, Prakhong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2502226

Operation No.: 2502226-002

Date of Receipt: 19 March 2025

Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk  
Scientist

Approved by *Mr. N. Nigrapat*  
(Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

FC-012 Revision: 01 Date: 20.04.65

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



## Calibration Report

Certificate No.: 2502226-002-01

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR2050U  
Resolution: 0.00001 g / 0.0001 g  
Serial No.: C210685394  
ID No.: UAE.WAO.010/2565  
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 2 of 4

Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %

Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 34 : 2019

2. Reference Standards:

Reference Standard Model Serial No. Calibrated By Certificate No. Due Date  
Standard Weight Class E2 1mg to 200g BS0567572 TCS M2401005 19 April 2025

Instrument Model Serial No. Calibrated By Certificate No. Due Date  
Thermo-Hygro Meter 608-H1 NFI.01H 017/23 Quality Reborn QR25-0642 10 February 2026

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000042
100	0.000000
200	0.000000

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table:



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

FC-012 Revision: 01 Date: 20.04.65

เอกสารไม่ควบคุม

for N. Nigrapat



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



## Calibration Report

Certificate No.: 2502226-002-01

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: XSR2050U  
Resolution: 0.00001 g / 0.0001 g  
Serial No.: C210685394  
ID No.: UAE.WAO.010/2565  
Capacity: 82 g / 220 g

Date of Calibration: 20 March 2025

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor K
Unloaded	0.000000	0.000000	0.000000	0.0000067	2.082
0.001	0.001003	0.001000	0.000000	0.0000098	2.09
0.005	0.005002	0.005001	-0.000001	0.0000092	2.06
0.01	0.010003	0.010002	-0.000002	0.0000089	2.00
0.05	0.049996	0.050001	-0.000001	0.0000096	2.00
0.1	0.100011	0.100002	-0.000001	0.000011	2.00
0.5	0.500016	0.500004	-0.000002	0.000014	2.00
1	1.000003	1.000005	-0.000005	0.000016	2.00
2	2.000023	2.000006	-0.000004	0.000017	2.00
5	5.000015	5.000009	-0.000005	0.000020	2.00
10	10.000009	10.000005	-0.000004	0.000026	2.00
20	20.000030	20.000007	-0.000004	0.000037	2.00
30	30.000039	30.000009	-0.000005	0.000050	2.00
50	50.000028	50.000008	-0.000005	0.000068	2.00
80	80.000067	80.000013	-0.000006	0.00011	2.00

FC-012 Revision: 01 Date: 20.04.65

เอกสารไม่ควบคุม

for N. Nigrapat



## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Resolution:** 0.0001 g / 0.0001 g  
**Serial No.:** C09071872  
**ID No.:** UAE.WAO.012/2563  
**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025 Page 2 of 4

**Calibration Results:** (Continued)

**Calibration Range:** >40-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: >40 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor (x)
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0001	-0.0001	0.00016	2.00
110	110.00007	110.0002	-0.0001	0.00017	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
130	130.00010	130.0002	-0.0001	0.00019	2.00
140	140.00013	140.0002	-0.0001	0.00019	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
160	160.00010	160.0002	-0.0001	0.00022	2.00
170	170.00012	170.0002	-0.0001	0.00023	2.00
200	200.00013	200.0002	-0.0001	0.00026	2.00

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 %.

----- End -----

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2502226-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Resolution:** 0.00001 g / 0.0001 g  
**Serial No.:** C09071872  
**ID No.:** UAE.WAO.012/2563  
**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025 Page 2 of 4

**Environment Condition:** Ambient Temperature:  $21.2 \pm 0.6$  °C, Relative Humidity:  $48 \pm 3.5$  %

**Place of Calibration:** 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

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

2. Reference Standards:

**Reference Standard** **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**

Standard Weight Class E2 1mg to 200g 8505367572 TCS M24941005 19 April 2025

**Instrument** **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**

Thermo-Hygro Meter 608-H1 NFI.BTH 017/23 Quality Return QR25-0542 10 February 2026

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

**1. Repeatability of Reading:**

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000042
100	0.0000006
200	0.0000008

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0002	0.0001

FCS-012 Revision: 01 Date: 20-04-65

## Calibration Certificate

**Certificate No.:** 2502226-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsak 41, Sukhumvit Road,  
Bangchack, Prakhong, Bangkok 10260

**Equipment:** Electronic Balance

**Manufacturer:** HETTLER TOLEDO

**Model:** XSR205DU

**Serial No.:** C09071872

**ID No.:** UAE.WAO.012/2563

**Order No.:** 2502226

**Operation No.:** 2502226-001

**Date of Receipt:** 19 March 2025

**Date of Calibration:** 20 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
Scientist

**Approved by** *for N. Nijphat*  
( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

**Date of Issue:** 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

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

FCS-009 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2502226-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Resolution:** 0.00001 g / 0.0001 g  
**Serial No.:** C09071872  
**ID No.:** UAE.WAO.012/2563  
**Capacity:** 82 g / 220 g

**Date of Calibration:** 20 March 2025 Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0-80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor (x)
Unlabeled	0.000000	0.00000	0.00000	0.0000089	2.00
0.001	0.001003	0.00100	-0.00000	0.0000092	2.00
0.005	0.005002	0.00500	-0.00000	0.0000094	2.00
0.01	0.010003	0.01000	-0.00000	0.0000095	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	-0.00001	0.000011	2.00
0.5	0.500016	0.50000	-0.00002	0.000014	2.00
1	1.000003	1.00001	-0.00001	0.000016	2.00
2	2.000023	2.00005	-0.00003	0.000017	2.00
5	5.000015	5.00005	-0.00003	0.000021	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00012	-0.00009	0.000037	2.00
30	30.000039	30.00012	-0.00008	0.000038	2.00
50	50.000028	50.00014	-0.00011	0.000068	2.00
80	80.000067	80.00020	-0.00013	0.00011	2.00

FCS-012 Revision: 01 Date: 20-04-65





## Certificate of Calibration

Cert. No.: 25TM577  
Page: 1 of 3

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1320  
Serial No. :  
ID No. : UAE WAO.018/2551  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 19 March 2025  
Calibration Date : 19 March 2025  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
AC Line Voltage :  $(220 \pm 22) \text{ V}$   
Calibrated by : Man Pattanapongpaiboon  
Approved by : Kunchit  
( ) Chakrit Waewwanjua  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 27 March 2025

The Uncertainties are for a confidence probability of approximately 95%  
This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2503-0437OC-1  
Procedure Used :-

Cert. No.: 25TM577  
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013M23	24LM71	TPA	12 May 2025

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

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

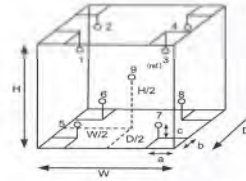
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	26
REL Humid. (%)	56	55
AC Supply ( Volt )	224	224



#### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm

#### Dimension of Chamber :

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	24-17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	23-17RTD-08
9 (ref.)	23-17RTD-09

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2503-0437OC-1  
Result of Calibration :- ( ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 25TM577  
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.24	0.54	0.99	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.215	20.192	19.852	19.710	19.710	20.006	19.720	19.810	19.733	0.41

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-000-

เอกสารไม่ควบคุม



## Certificate of Calibration

Equipment : CONDUCTIVITY METER  
Model : SevenDirect SD30  
Serial No. (or ID) : C41872132 (UAE WAO.017/2567)  
Manufacturer : METTLER TOLEDO  
Electrode Serial No. : 5824370998  
Condition : In Condition  
Certificate No. : C24250010  
Issued Date : 15 January 2025  
Job No. : WO-06057642  
Page : 1 of 2  
Model : InLab 731-ISM  
Brand : METTLER TOLEDO

Customer : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

Environment Condition : Temperature 21.7 °C ± 0.2 °C  
Humidity 48.8 %RH ± 2.1 %RH

Calibration Place : United Analyst and Engineering Consultant Co., Ltd. ( Calibration Laboratory )  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

Calibration By : Mr. Atchai Ngamchanat  
Calibration Date : 15 January 2025

The Method used : In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability : This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 1066606, 1066608, 1066610

(Mr. Atchai Ngamchanat)  
Person in charge

(Miss Kaewkan Suradech)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor  $k=2$  to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated as described. The result shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
3030 Sukhumvit Road, Bangkok, Phrakhanong District, Bangkok 10260  
Phone: +66 2709 1000 Fax: +66 2709 1001 Email: info@dksh.com

Delivering Growth - in Asia and Beyond.

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#### Calibration Results:

##### Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 $\mu\text{S/cm}$	24.8 $\mu\text{S/cm}$	0.200 $\mu\text{S/cm}$	2.00	0.28 $\mu\text{S/cm}$
1413.1 $\mu\text{S/cm}$	1386.4 $\mu\text{S/cm}$	14.7 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
111.3 $\text{mS/cm}$	109.5 $\text{mS/cm}$	1.8 $\text{mS/cm}$	2.00	0.81 $\text{mS/cm}$

##### After Adjustment : at 1413.1 $\mu\text{S/cm}$

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor (k)	Uncertainty (±)
25.000 $\mu\text{S/cm}$	25.1 $\mu\text{S/cm}$	-0.100 $\mu\text{S/cm}$	2.00	0.28 $\mu\text{S/cm}$
1413.1 $\mu\text{S/cm}$	1413.1 $\mu\text{S/cm}$	0.0 $\mu\text{S/cm}$	2.00	11 $\mu\text{S/cm}$
111.3 $\text{mS/cm}$	110.2 $\text{mS/cm}$	1.1 $\text{mS/cm}$	2.00	0.81 $\text{mS/cm}$

The End of Certificate



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

## Certificate of Testing

Cert.No.: 24TW222  
Page.: 1 of 2

Equipment : DO Meter  
Manufacturer : YSI  
Model : 4010-D-2W  
Serial No. : 20260326  
ID No. : UAE.WAO.0602563  
Received Date : 16 October 2024  
Test Date : 17 October 2024  
Reference : 2410-053205C-1  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Liddesauk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
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  
( ) Unnopphol Harachai  
( ) Ponpan Palpin  
(✓) Sathip Meangmai  
Issue Date : 17 October 2024



Cert.No.: 24TW222  
Page.: 2 of 2

#### Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM1131	04 July 2025

#### 2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 22M102385

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.24	0.0071

This report was certified only for the instrument we tested. It is allowable to use for study  
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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## UNITED ANALYST AND ENGINEERING CONSULTANT COMPANY Ltd.

Automatic Mercury Analyzer

Model RA-4500

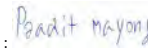
Preventive Maintenance Report


Serial No. : 17780278

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : 09 July 2024

PM by :   
( Pradit M. )

Approved by :   
( Kitichai S. )



Coax Group Corporation Ltd.  
1131/62,64,325-331 Nakornchaisri road,  
Kwang Thanon Nakornchaisri, Dusit, Bangkok 10300 Thailand  
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

Inspection result

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

Counter

Maintenance

MAIN

GC

Counter

Parameter

Measurement Count

20277(22-09-08)

Clear

P1 tube(12/2000h)

04/09/24-07-08

Clear

Mercury Exhaust Filter Amount(mg/1500mg)

1/22-09-08

Clear

P2 tube(12/2000h)

04/11/24-07-08

Clear

Lamp Active time(5000h)

18/12/24-07-08

Clear

P3 tube(12/2000h)

04/09/24-07-08

Clear

Membrane Filter Usage Time(2000h)

04/08/24-07-08

Clear

P4 tube(12/2000h)

04/09/24-07-08

Clear

Main Pump tube(750h)

04/08/24-07-08

Clear

P5 tube(12/2000h)

04/09/24-07-08

Clear

Heating Lamp Time

500h(23/22-09-08)

Clear

P6 tube(12/2000h)

04/09/24-07-08

Clear

P7 tube(12/2000h)

04/09/24-07-08

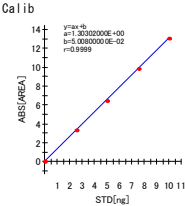
Clear

Exit

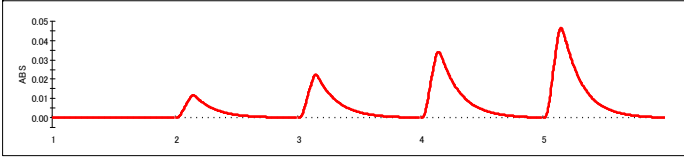
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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

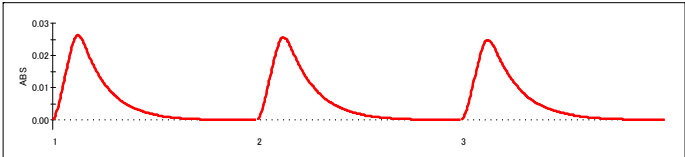


No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000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



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

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



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

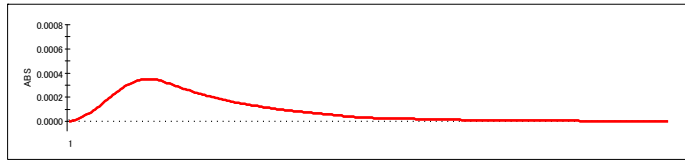
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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

SMP

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



-3-

เอกสารไม่ควบคุม

NIC NIPPON INSTRUMENTS CORPORATION

## Calibration Report

Certificate No.: 2500116-001-01  
Equipment: CHAMBER (Hot Air Oven)  
Model: UF55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT

Date of Calibration: 8 October 2024 Page 2 of 3

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Environment Condition:  
Ambient Temperature ( 30.3 ± 1 ) °C  
Relative Humidity ( 55 ± 1 ) %  
Line Voltage ( 230 ± 3 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.  
- The temperature scale used was based on ITS - 90.  
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MYS7003188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH4201-009/RTD4201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

UUC Description :  
Time of Record : 1 Hour 9 Minute At: 104.0,140.0 and 180.0 °C  
Fresh air Damper : - Open Position -  
X Close Fan 40%  
- Not Available

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

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

## Calibration Certificate

Certificate No.: 2500116-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 7 Soi Udomsak 41, Sukhumvit Road,  
Bangchack, Prakhong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)  
Manufacturer: MEMMERT  
Model: UF55  
Serial No.: B216.1666  
ID No.: UAE.WAO.027/2559  
Order No.: 2500116  
Operation No.: 2500116-001  
Date of Receipt: 8 October 2024  
Date of Calibration: 8 October 2024

Calibrated by: Mr.Yothin Charoensuk Scientist  
Approved by: ( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 15 October 2024

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

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

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

## Calibration Report

Certificate No.: 2500116-001-01  
Equipment: CHAMBER (Hot Air Oven)  
Model: UF55 Serial No.: B216.1666  
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559  
Manufacturer: MEMMERT

Date of Calibration: 8 October 2024 Page 3 of 3

Calibration point: 104.0,140.0 and 180.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.10	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.88
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

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

UUC\* = Unit Under Calibration

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

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

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

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

----- End -----

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



## Certificate of Calibration

Cert. No.: 24TM938  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 402 E6  
Serial No. : 20220300322479  
ID No. : LAE.MC.25B/2566  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 09 July 2024  
Calibration Date : 09 July 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Khit Ruttanaprapachai  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 19 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2407-0153OC-4  
Procedure Used :-

Cert. No.: 24TM938  
Page : 2 of 3

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

### Condition of this result of calibration

#### 1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1.) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

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

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

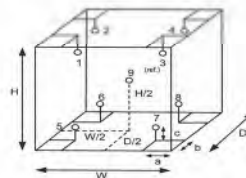
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration : ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	23	24
REL.Humid. ( % )	52	54
AC Supply ( Volt )	221	222



#### Probe Installation Details :

a = 10 cm  
b = 10 cm  
c = 10 cm

#### Dimension of Chamber :

D = 0.47 m  
W = 0.65 m  
H = 1.2 m  
Capacity = 0.37 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2407-0153OC-4  
Result of Calibration :- ( ° ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM938  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
35.0	35.0	35.0	0.030	0.31	0.33	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.093	35.011	35.081	35.118	34.840	35.054	34.924	34.978	34.824	0.30

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



## Certificate of Calibration

Cert.No.: 24CH1597  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HAA0A0005  
ID No. : UAE.EFM.004/2563(EFM.pH.04/63)  
Condition As-Received: Used Item  
Received Date : 24 December 2024  
Calibration Date : 26 December 2024  
Reference : 2412-0601WSC-2  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard  
Calibrated by : Warakorn Lernagatrakul  
Approved by :   
( ) Pornthippa Tameyakul  
( ) Ponpan Paipim  
(✓) Salthip Meangmai  
Issue Date : 27 December 2024

The Uncertainties are for a confidence probability of approximately 95%

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

☒ PASS  
☐ NOT PASS  
 Remarks: END 10.5 (std. solution)  
 mV: 0.0 (std. voltage mV)  
 pH: 0.05 (std. solution)  
 (pH) (mV)  
 Verify Approve  
 2/11/25



Cert.No.: 24CH1597  
 Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

##### 2. Certified Reference Materials

: The measurement results are traceable to SI through Hach Lange GmbH Ltd.,  
 Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
 : The measurement results are traceable to SI through CPA chem Ltd.,  
 ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 7.000	Hach Lange GmbH	C03185	09 July 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

#### Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter S/N.: HAOA0005	4.00	177.48	177.4	4.01		0.058	2.00
	7.00	0.00	0.1	7.00		0.058	2.00
	7.00	0.00	0.1	7.00		0.058	2.00
	10.00	-177.48	-177.2	10.01		0.058	2.00



Cert.No.: 24CH1597  
 Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	177.2	0.0079	2.00
	7.000	7.00	2.2	0.0092	2.00
	7.000	7.00	2.2	0.0085	2.00
	10.010	10.01	-170.9	0.0095	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : -  
 - Serial No. : -  
 Dimension of probe:  
 - Length : 112 mm.  
 - Diameter : 16 mm.  
 - Immersion Depth : 100 mm.

Calibration Point ( $^{\circ}$ C)	Standard Temperature ( $^{\circ}$ C)	UUC* Reading ( $^{\circ}$ C)	Error ( $^{\circ}$ C)	Uncertainty of measurement ( $\pm$ $^{\circ}$ C)	Coverage factor k
15.0	15.003	15.0	-0.003	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
45.0	45.002	45.0	-0.002	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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 2: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 634/4 RATTANAKARIN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10550  
 TEL: 0-2717-3000-20 FAX: 0-2719-9486



## Certificate of Calibration

Cert.No.: 25CH262  
 Page.: 1 of 3

**Equipment :** pH Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-PH210  
**Serial No. :** HA1L0035  
**ID No. :** UAE.EFM.011/2565(EFM.pH.01/65)  
**Condition As-Received:** Used Item  
**Received Date :** 25 February 2025  
**Calibration Date :** 26 to 28 February 2025  
**Reference :** 2502-0783WSC-2  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Phrakhanong, Bangkok 10260  
**Ambient Temperature :** (25  $\pm$  2.5)  $^{\circ}$ C  
**Relative Humidity :** (50  $\pm$  15) %  
**Calibration Procedure :** In - house method :  
 - CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
 - CP-CH8 by comparison with temperature standard

**Calibrated by :** Warakorn Lemgagrakul

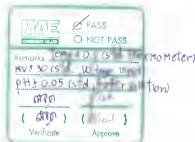
**Approved by :**   
 Approved Signatory

( ) Chakrit Waewwanjua  
 ( ) Porpan Paipim  
 (✓) Saitip Meangmai

**Issue Date :** 28 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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 Approval of the head of Corporate Services 2: Equipment Calibration and Testing Services.



Cert.No.: 25CH262  
Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15164-01-00  
: The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

#### Calibration Results

##### Function : mV Measurement

##### Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor $k$
	pH	mV	mV	pH		
pH Meter S/N.: HA1L0035	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.1	7.02	0.058	2.00
	7.00	0.00	0.1	7.02	0.058	2.00
	10.00	-177.48	-177.4	10.01	0.329	4.53

Cert.No.: 25CH262  
Page.: 3 of 3

#### Calibration Results

##### Function : pH Measurement

##### Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: -	4.007	4.01	178.3	0.0085	2.05
	6.999	7.00	2.3	0.0092	2.00
	6.999	7.00	2.4	0.0092	2.00
	10.010	10.01	-172.2	0.0092	2.00

#### Function : Temperature Measurement

##### ( $^{\circ}$ ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -  
- Serial No. : -  
Dimension of probe  
- Length : 110 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 80 mm.

Calibration Point ( $^{\circ}$ C)	Standard Temperature ( $^{\circ}$ C)	UUC* Reading ( $^{\circ}$ C)	Error ( $^{\circ}$ C)	Uncertainty of measurement ( $\pm$ $^{\circ}$ C)	Coverage factor $k$
15.0	15.003	15.0	-0.003	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
45.0	45.002	45.0	-0.002	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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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DQE Services Co.,Ltd.  
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230  
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP25-001  
Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)  
Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Location of calibration : Laboratory 213  
Equipment : UV-Vis Spectrophotometer  
Manufacturer : Hitachi  
Model : U-2900  
Serial No. : 21E22-009  
ID No. : UAE.WAT.051/2564  
Received Date : 3 January 2025  
Calibration Date : 3 January 2025  
Issue Date : 8 January 2025  
Condition Instrument : Good

Calibrated by :   
( Mr.Tanawut Rittidach )  
Technical Manager

Approved by :   
( Ms.Chonthicha Sangern )  
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the price written on the certificate.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 15189:2013

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CIP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.


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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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ISO 15189:2013

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.578	0.0000	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.560	-0.0005	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.521	0.0020	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.977	-0.0017	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.518	0.0001	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.552	-0.0003	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.559	0.0001	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00


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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 15189:2013

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.744	0.0029	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.863	0.0044	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.290	0.0019	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00


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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.1	0.62	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.3	0.51	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	637.7	0.28	0.18	2.00
431.38	431.1	0.28	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.3	-0.13	0.18	2.00
585.35	585.1	0.25	0.20	2.00
684.40	684.5	-0.10	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k.

which for a normal distribution corresponds to a coverage probability of approximately 95%

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## Certificate of Calibration

Cert.No.: 24CH1115  
Page.: 1 of 2

Equipment: Turbidity Meter  
Manufacturer: Oxiton  
Model: T100R  
Serial No.: 1120501017  
ID No.: UAE.WAT.256/2563  
Condition As-Received: Used Item  
Received Date: 06 September 2024  
Calibration Date: 06 September 2024  
Reference: 2409-0177DSC-1  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
3 Sri Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature: (25 ± 2.5) °C  
Relative Humidity: (50 ± 20) %  
Calibration Procedure: In-house method: CP-CH11  
Direct measurement by  
using Formazin standard solution  
Calibrated by: Walalak Sirthean  
Approved by:   
Approved Signatory  
( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date: 9 September 2024

### Condition of this calibration result

#### 1. Reference Standard Instruments:

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrometer	1103228	130EG010	24H1372	12 July 2025
2) Electronic Balance	1126143764	140RC004	23MM22	20 Feb 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

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

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.85%
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 five - Formazin suspension standard curve by using 0.20,100,400,800 NTU  
Turbidity Meter - Serial Number : 1120501017

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
0	0.00	0.0081	2.06
20	20.2	0.39	2.00
100	100	0.75	2.00
400	401	1.5	2.06
800	801	2.1	2.17

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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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.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



สถาบันอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Certificate

Certificate No.: 2501624-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Phrakhanong, Bangkok 10260

Page 1 of 3

Equipment: Water Bath  
Manufacturer: MEMMERT  
Model: WNE14  
Serial No.: L416.0606  
ID No.: UAE.MIC.002/2560  
Order No.: 2501624  
Operation No.: 2501624-001  
Date of Receipt: 10 February 2025  
Date of Calibration: 10 February 2025

Calibrated by: Mr.Worapob Soeklong  
Scientist  
Date of Issue: 19 February 2025  
Approved by:   
( Mr.Pheraphat Tuanjit )  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

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

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

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

เอกสารไม่ควบคุม



สถาบันอาหาร  
Foundation for Industrial Development National Food Institute  
Food Industrial Laboratory Service Center



## Calibration Report

Certificate No.: 2501624-001-01  
Equipment: Water Bath  
Model: WNE14  
Resolution: 0.1 °C  
Manufacturer: MEMMERT  
Serial No.: L416.0606  
ID No.: UAE.MIC.002/2560

Date of Calibration: 10 February 2025 Page 3 of 3

Calibration point: 44.5 °C

### Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.7	52	223.0
Max	26.3	65	225.0

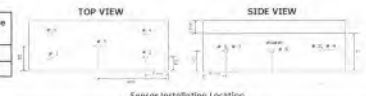


Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. ( Sensor No.5 is REF )					Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	
44.5	44.55	44.46	44.48	44.47	44.48	0.18

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	MIN	UUC* Reading (°C)	MAX	Average	Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
44.5	44.5	44.5	44.5	44.5	0.082	0.070	0.29

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

UUC\* = Unit Under Calibration

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

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

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

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

----- End -----

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## Calibration Report

**Certificate No.:** 250162-001-01  
**Equipment:** Water Bath  
 Model: WWT-14      Serial No.: L416-0606  
 Resolution: 0.1 °C      ID No.: LWE-MBC-002/2500  
 Manufacturer: MCPHMET  
**Date of Calibration:** 19 February 2025 Page 2 of 3

**Location:** 101 Phrasarangkarn Laboratory UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Environment Condition:** Ambient Temperature ( 25 ± 1 ) °C  
 Relative Humidity ( 59 ± 7 ) %  
 Line Voltage ( 224 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 5 standard thermometer into its liquid bath and calibration according to W-TE-011 based on ASTM E715-80 (2022); Standard Specification for Gravity-Convection and Forced-Circulation Water Baths.  
 - The temperature scale used is ITS - 90.  
 - All data show below were final values and the initial data may be obtained upon request.

### 2. Reference Standard Instrument :

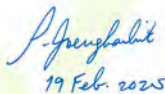
Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	349724	MY59002902	TE 670478-01	4-May-25	NATIONAL FOOD INSTITUTE
	RTD	RTD4301-305 / CH4301-305			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

### UUC Description:

Time of Record 1 Hour 9 Minute At 44.5 °C

7. Result of Calibration :
- |                                     |                    |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/>            | After adjustment   |

  
 19 Feb. 2025

F-C5-012 Revision: 01 Date: 20-04-65

