

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

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# ภาคผนวก ง-1

## เอกสารเครื่องมือตรวจวัด

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## List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
1	Office Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Thermo Scientific	G25A 158M	Jirunatee Associates Co., Ltd.	COF-025-68	21 Jul 25	20 Jul 26	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	25P3507	9 Sep 25	8 Sep 26	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1382	17 Apr 25	16 Apr 26	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25H811	10 Apr 25	9 Apr 26	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920006	UAE Consultant Co.,Ltd.	02052025	2 May 25	1 May 26	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920009	UAE Consultant Co.,Ltd.	07052025	7 May 25	6 May 26	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jul 23	6 Jul 31	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920014	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	42i 1182920016	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920017	UAE Consultant Co.,Ltd.	07052025	6 May 25	5 May 26	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co.,Ltd.	12052025	12 May 25	11 May 26	-
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jul 23	6 Jul 31	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497733	UAE Consultant Co.,Ltd.	17072025	17 Jul 25	16 Jul 26	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	11072025	11 Jul 25	10 Jul 26	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778118	UAE Consultant Co.,Ltd.	29072025	29 Jul 25	28 Jul 26	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778119	UAE Consultant Co.,Ltd.	24072025	24 Jul 25	23 Jul 26	-
19	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jul 23	6 Jul 31	-
20	Wind Speed/Wind Direction	WS/WD	LSI Lastem	E-LOG 305 / DNA 821 20080021/ 20040197	Thai Meteorological Department	346/25	28 May 25	27 May 26	-
21	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 84065	Innovative Instrument Co.,Ltd.	25-ACT-081	29 May 25	28 May 26	-
22	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A95}$	Larson Davis	LxT2 0006695	Electrical And Electronics Institute Foundation For Industrial Development	CP20240337EA	20 Sep 24	19 Sep 26	-
23	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A95}$	Larson Davis	LxT2 0006696	Innovative Instrument Co.,Ltd.	25-SLM-243	29 Jul 25	28 Jul 27	-
24	Sound Level Meter	$L_{Aeq\ 24\ hrs}$ , $L_{Aeq\ 1\ hr}$ , $L_{Amax}$ , $L_{A90}$ , $L_{A95}$	Larson Davis	LxT2 0006754	Innovative Instrument Co.,Ltd.	25-SLM-130	4 Apr 25	3 Apr 27	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Hydrogen Chloride	Apex Instruments, USA.	XC-572-V 0803018	Envi Equipment Service Co., Ltd.	E25-010007	16 Jan 25	15 Jan 26	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 02376344/208	Entech Industrial Sultution Co., Ltd.	G 680034	20 Jan 25	19 Jan 26	-



List of Opacity Training Certification for Opacity Mesurement

No.	Name	Training Couse	Train	Date	Remark
1	Mr.Ronnapob Putragulpattana	Opacity	Pollution Control Department	22-23 March 2018	-
2	Mr.Watcharin San-Ngam	Opacity	Pollution Control Department	22-23 December 2022	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Ecosence	pH100A JC04740	Technology Promotion Association (Thailand-Japan)	25CH264	26 Feb 25	25 Feb 26	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE9M0004	Technology Promotion Association (Thailand-Japan)	25TW24	5 Feb 25	4 Feb 26	-
3	Conductivity Meter	Conductivity	Horiba	LAQUA-PH210 HC9L0014	Technology Promotion Association (Thailand-Japan)	25CH165	5 Feb 25	4 Feb 26	-
4	Turbidity Meter	Turbidity	Thermo Scientific	EUTECH TN-100 3065434	Technology Promotion Association (Thailand-Japan)	25CH400	2 Apr 25	1 Apr 26	-





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
123/117 TONGKALAKU RD. BANGKOK 11, HONGKONG, THAILAND, BANGKOK 10256  
TEL: 0-2713-10604 FAX: 0-2714-4484

## Certificate of Calibration

Certificate No.: 25P2307  
Page: 1 of 2

Equipment: U Tuzi Manometer  
Manufacturer: Dewey  
Model: 1221-SB-WIN  
Serial No.:  
ID No.: UNE-95M179-0511  
Condition As-Received: Used Item  
Received Date: 09 September 2025  
Calibration Date: 09 September 2025

Reference: 2008-C14AWSC  
Ambient Temperature:  $(23 \pm 2) ^\circ\text{C}$   
Relative Humidity:  $(60 \pm 10) \%$   
Atmospheric Pressure: 1007 mbar  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udonwadi 41, Sukhumvit Road, Bangkok, Phrakhanong,  
Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CIP-PA, using "DKG-E6-11: Calibration of Pressure Gauges" as a guideline.

### Condition of this result of calibration

1. Reference standards instruments
2. Instrument
3. Pressure Calibrator
4. This instrument was used clean air as pressure media.
5. The result of calibration was made on required at the point specified by customer.
6. This instrument was calibrated by applied pressure to high port (+) side and low port (-) side open to atmospheric pressure.
7. This instrument was supplied in vertical operation and top of the pressure port was used as the reference level.
8. This certificate is valid only to the item calibrated on date and place of calibration.
9. This measurement result is traceable to the International System of Unit maintained through:  
National Institute of Metrology (Thailand), NIM-QAQC Accreditation No. Calibration 0144

Calibrated by: Suran Whangnue  
Name Date: 11 September 2025

Approved Signatory: Attapol P  
1. ) Prathit Pongphet  
1. ) Surin Sawanman  
1. ) Attapol Pongphet

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Cert.No.: 25P2307  
Page: 2 of 2

Result of calibration: Without adjustment  
Extension: Pressure Measurement  
Increasing Pressure

Range: 0 mbar to 30 mbar  
Scale Interval: 0.1 mbar, The Second Estimate

Applied Pressure	High-port side	MTC Estimation Low-port side	$\Delta P$	Error
0.00	0.00	0.00	0.00	0.00
2.00	0.95	-1.00	1.95	-0.05
4.00	1.90	-2.00	3.90	-0.05
6.00	2.85	-3.00	5.85	-0.05
8.00	3.80	-4.00	7.80	0.00
10.00	4.75	-5.00	9.75	0.00
12.00	5.70	-6.00	11.70	0.00
14.00	6.65	-7.00	13.65	0.00
16.00	7.60	-8.00	15.60	0.00
18.00	8.55	-9.00	17.55	0.00
20.00	9.50	-10.00	19.50	-0.05
22.00	10.45	-11.00	21.45	0.00
24.00	11.40	-12.00	23.40	0.00
26.00	12.35	-13.00	25.35	0.00
28.00	13.30	-14.00	27.30	0.00
30.00	14.25	-15.00	29.25	0.00
32.00	15.20	-16.00	31.20	0.00
34.00	16.15	-17.00	33.15	0.00
36.00	17.10	-18.00	35.10	0.00
38.00	18.05	-19.00	37.05	0.00

The uncertainty of measurement was  $\pm 0.11$  mbar

\*  $\Delta P$  = High-port side - Low-port side

\* UDC = 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. : 25-0011  
Page : 1 of 2

Equipment : Dual Thermo-Hygrometer  
Manufacturer : Beijing  
Model :  
Serial No. :  
ID No. : UAE-ANV-133/2500  
Condition As-Received : Used Item  
Received Date : 04 April 2023  
Calibration Date : 10 April 2023  
to 17 April 2023  
Reference : 2024.0110/002  
Ambient Temperature : ( 21 ± 2 ) °C  
Relative Humidity : ( 50 ± 25 ) %  
Submitted by : United Analyst and Engineering Consultants Co., Ltd.  
81 Soi Udonruek 41, Sukhumvit Road, Bangkok,  
Phrasarong, Bangkok 10260

### Procedure used

Calibration were conducted using on-line calibration procedure CP-002 according to comparison with selected 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

1) Dual Thermo-Hygrometer  
Model : Optima 421  
Serial No. : 194766  
Calibration No. : TH-2023-72  
Due Date : 05 Feb 2025

2) Handheld Thermo-hygrometer with Sensor  
Model : 1323  
Serial No. : E71206  
Calibration No. : 2410A1  
Due Date : 18 Nov 2025

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

3. This Certificate is acceptable to the International System of Unit maintained through:-

-National Institute of Metrology (France), BIPM-CHM/C Accredited No. Calibration 0144

-Technology Promotion Association (Thailand-Japan), NIST-CHM/C Accredited No. Calibration 0001

Calibrated by : Sanchai Dumvor  
Issue Date : 05 April 2023

Approved Signatory :

Viporn

[ / ] Chaitan Wongsamrart

[ / ] Pongtong Tanwattana

[ / ] Viporn Tanthawatt

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Cert. No.: 25-0011  
Page: 2 of 2

Result of Calibration:  
Publication: Without Adjustment  
Humidity Measurement:

Reference Temperature (°C)	Standard Humidity (%RH)	UUC <sup>*</sup> Reading (%RH)	Correction (%RH)	Uncertainty of Measurement (%RH)
25.0	40.1	40	0.1	1.7
25.0	60.0	60	0.0	1.8
25.0	80.0	78	-2.0	1.3

Result of Calibration:  
Publication: Without Adjustment  
Temperature Measurement:

Standard Temperature (°C)	UUC <sup>*</sup> Reading (°C)	Correction (°C)	Uncertainty of Measurement (K-°C)
20.001	20.0	0.001	0.72
24.967	25.0	-0.013	0.72
30.021	30.0	0.021	0.72
34.964	34.0	0.964	0.72
40.032	38.0	1.032	0.72

UUC<sup>\*</sup> : Unit Under Calibration

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

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MULTI-POINT GAS TEST REPORT

Test Date : May 7, 2025

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : 1182920009

Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model :	1461
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071

Dilutor Detail

Carbon Monoxide (CO)	965.9	PPM
Cylinder No. :	EB0159156	
Expiration Date :	Nov 6, 2026	

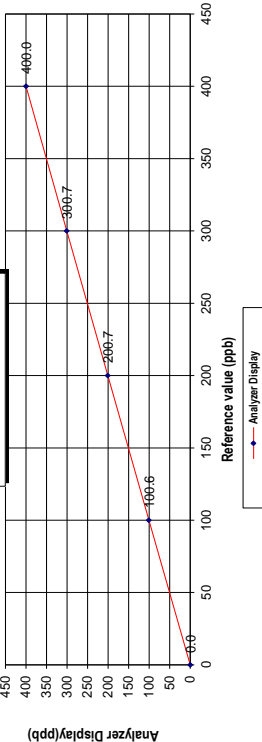
Multi-point gas test data

Level	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	100.6	0.60	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit  $\pm$  5%

Multi-Point Gas Test Chart



Calculate by

7 / 05 / 2025

Approve by

7 / May / 2025



MULTI-POINT GAS TEST REPORT

Test Date : May 2, 2025

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 421  
Manufacturer : Thermo Scientific Serial Number : 1182920006

Standard Gas Concentration

Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model :	1461
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071

Dilutor Detail

Carbon Monoxide (CO)	965.9	PPM
Cylinder No. :	EB0159156	
Expiration Date :	Nov 06, 2026	

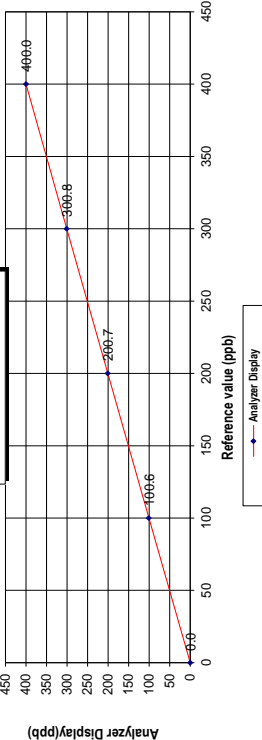
Multi-point gas test data

Level	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	100.6	0.60	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit  $\pm$  5%

Multi-Point Gas Test Chart



Calculate by

2 / 05 / 2025

Approve by

2 / May / 2025



### MULTI-POINT GAS TEST REPORT

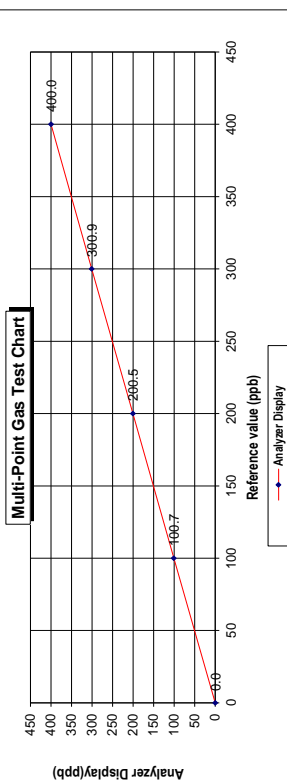
Test Date : Sep 20, 2024

Equipment :	Gas Analyzer (NO <sub>2</sub> )	Model :	42i
Manufacturer :	Thermo Scientific	Serial Number :	1200636463

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	965.9	PPM	
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 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	100.7	0.70	0.70
Level 3 40.00%	200.0	200.5	0.25	0.25
Level 4 60.00%	300.9	300.9	0.30	0.30
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)
				:Acceptable Limit $\pm$ 5%



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[Signature]  
20 Sep 2024



### MULTI-POINT GAS TEST REPORT

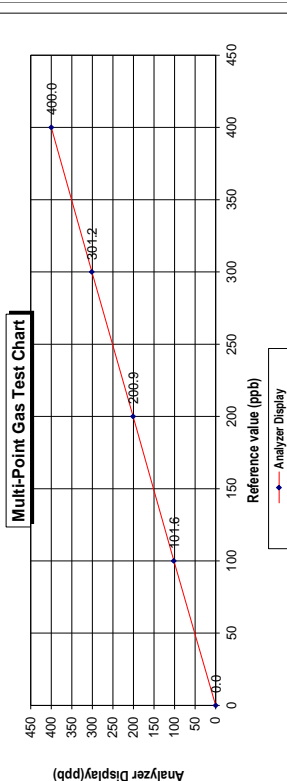
Test Date : Sep 20, 2024

Equipment :	Gas Analyzer (NO <sub>2</sub> )	Model :	42i
Manufacturer :	Thermo Scientific	Serial Number :	1201778106

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	146i
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	965.9	PPM	
Cylinder No. :	EB0159156		
Expiration Date :	Nov 6, 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	101.6	1.60	1.57
Level 3 40.00%	200.0	200.9	0.90	0.45
Level 4 60.00%	301.2	301.2	1.20	0.40
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb		Average Difference (%)
				:Acceptable Limit $\pm$ 5%



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Approve by  
[Signature]  
20 Sep 2024







MULTI-POINT GAS TEST REPORT

Test Date : May 6, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920017

Standard Gas Concentration

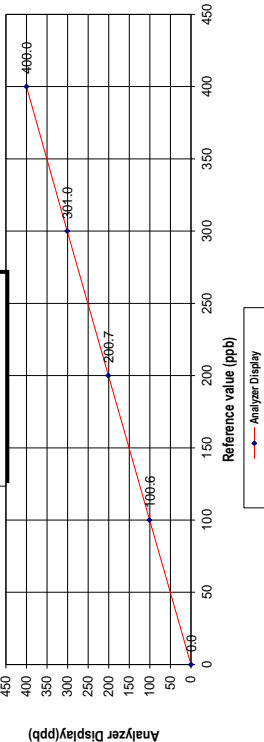
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071

Carbon Monoxide (CO)  
Cylinder No. : E801159156  
Expiration Date : Nov 06, 2026

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.00	0.00	0.00
Level 1	100.0	100.6	0.60	0.60
Level 2	200.0	200.7	0.35	0.35
Level 3	300.0	301.0	0.33	0.33
Level 4	400.0	400.0	0.00	0.00
Level 5	500.0	500.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)		0.26
:Acceptable Limit $\pm$ 5%				

Multi-Point Gas Test Chart



Calculate by

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6 ...../...../.....  
05 ...../...../.....  
2025

Approve by

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6 ...../...../.....  
05 ...../...../.....  
2025



MULTI-POINT GAS TEST REPORT

Test Date : May 12, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

Standard Gas Concentration

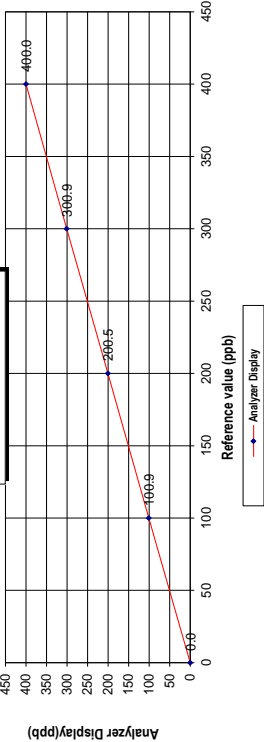
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77	PPM	Model :	146i
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071

Carbon Monoxide (CO)  
Cylinder No. : E801159156  
Expiration Date : Nov 06, 2026

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.00	0.00	0.00
Level 1	100.0	100.9	0.89	0.89
Level 2	200.0	200.5	0.25	0.25
Level 3	300.0	300.9	0.30	0.30
Level 4	400.0	400.0	0.00	0.00
Level 5	500.0	500.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)		0.29
:Acceptable Limit $\pm$ 5%				

Multi-Point Gas Test Chart



Calculate by

.....  
12 ...../...../.....  
05 ...../...../.....  
2025

Approve by

.....  
.....12 ...../...../.....  
05 ...../...../.....  
2025



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.uaiconsultant.com E-mail: uae@uaiconsultant.com

MULTI-POINT GAS TEST REPORT

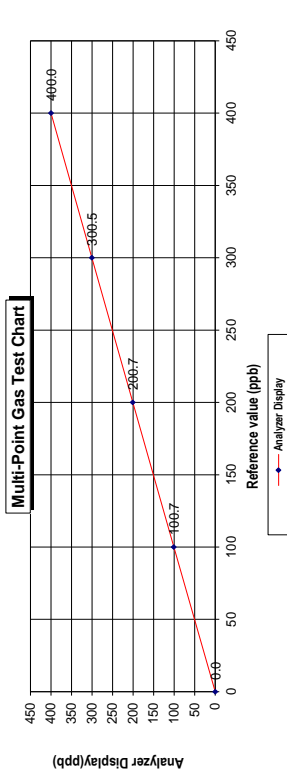
Test Date : May 12, 2025

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 431  
Manufacturer : Thermo Scientific Serial Number : 1180540065

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	1461	
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 ]
Zero	0.0	0.00	0.00	0.00
Level 1	100.0	100.7	0.70	0.70
Level 2	200.0	200.7	0.35	0.35
Level 3	300.0	300.5	0.17	0.17
Level 4	400.0	400.0	0.00	0.00
Level 5	500.0	500.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			0.24
:Acceptable Limit $\pm$ 5%				



Calculate by  
Srinchai C.

Approve by  
Srinchai C.

12...../.....05...../.....2025.

.....12...../.....May...../.....2025

MULTI-POINT GAS TEST REPORT

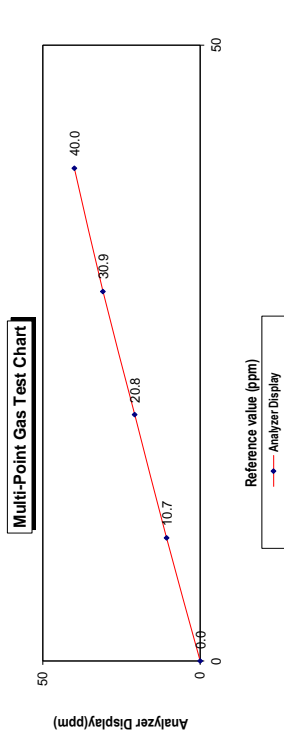
Test Date : July 17, 2025

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1201497733

Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	46.77	PPM	Model :	1461	
Methane (CH <sub>4</sub> )	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	965.9	PPM			
Cylinder No. :	EB0159156				
Expiration Date :	Nov 06, 2026				

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Zero	0.0	0.0	0.0	0.0
Level 1	10.0	10.7	0.7	6.5
Level 2	20.0	20.8	0.8	3.8
Level 3	30.0	30.9	0.9	2.9
Level 4	40.0	40.0	0.0	0.0
Level 5	50.0	50.0	0.0	0.0
Remark : Measuring Range	50.0 ppm			2.66
:Acceptable Limit $\pm$ 5%				



Calculate by  
Srinchai C.

Approve by  
Srinchai C.

17...../.....07...../.....2568

.....17...../.....July...../.....2025



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaiconsultant.com E-mail: uae@uaiconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : July 11, 2025

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1201778117

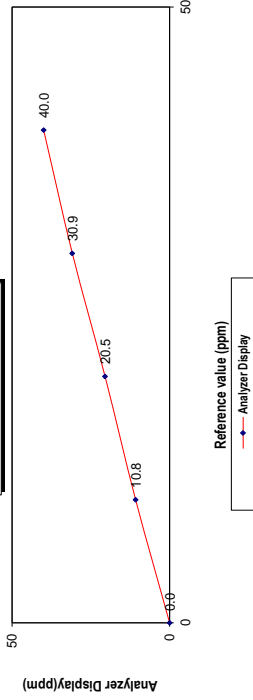
Standard Gas Concentration

	PPM	Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	Model :	1461
Methane (CH <sub>4</sub> )	-	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	10.8	0.8	7.4
Level 3 40.00%	20.0	20.5	0.5	2.4
Level 4 60.00%	30.0	30.9	0.9	2.9
Level 5 80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)		2.55
:Acceptable Limit $\pm$ 5%				

Multi-Point Gas Test Chart



Calculate by

.....  
.....11.... / .....07..... / .....2568.....  
.....11.... / .....07..... / .....2568.....

Approve by

.....  
.....11.... / .....07..... / .....2568.....  
.....11.... / .....07..... / .....2568.....



United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaiconsultant.com E-mail: uae@uaiconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : July 29, 2025

Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1201778118

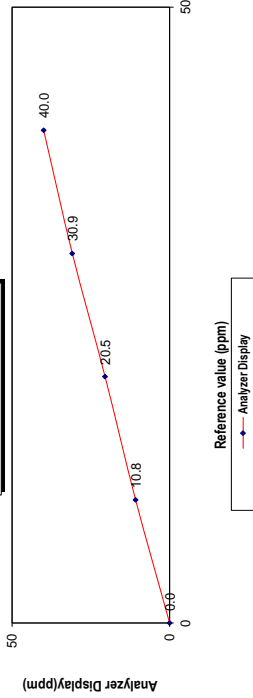
Standard Gas Concentration

	PPM	Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77	Model :	1461
Methane (CH <sub>4</sub> )	-	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	10.8	0.8	7.4
Level 3 40.00%	20.0	20.5	0.5	2.4
Level 4 60.00%	30.0	30.9	0.9	2.9
Level 5 80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm	Average Difference (%)		2.55
:Acceptable Limit $\pm$ 5%				

Multi-Point Gas Test Chart



Calculate by

.....  
.....29.... / .....07..... / .....2568.....  
.....29.... / .....07..... / .....2568.....

Approve by

.....  
.....29.... / .....07..... / .....2568.....  
.....29.... / .....07..... / .....2568.....

## MULTI-POINT GAS TEST REPORT

Test Date : July 24, 2025

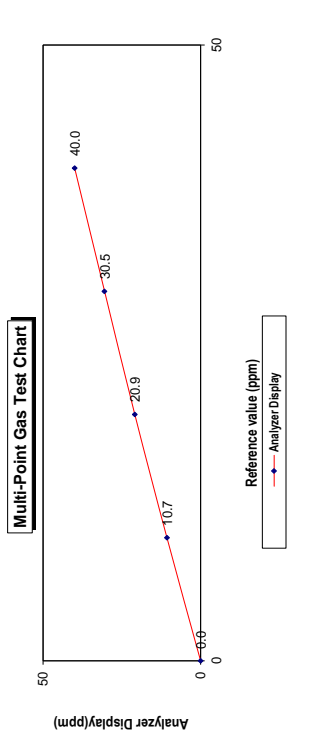
Equipment : Gas Analyzer (CO) Model : 481  
Manufacturer : Thermo Scientific Serial Number : 1201778119

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89	PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO)	46.77	PPM	Model : 1461
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	10.7	6.5	6.5
Level 3 40.00%	20.0	20.9	4.3	4.3
Level 4 60.00%	30.0	30.5	1.6	1.6
Level 5 80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.50

:Acceptable Limit  $\pm 5\%$



Calculate by

Approve by

24 07 2568

24 July 2025

## Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT  
Name : CO., LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prathumthani, Bangkok 10260

Certificate No : 25-ACT-081  
Request No : Req-2025-1161

Unit Under Calibration Details : Class : 1  
Manufacturer Item : Acoustic Calibrator  
Model : 010B  
Serial Number : 118063  
ID : UAE EPM 16772567  
Range : 94 dB / 1000 Hz  
Instrument Name : T100

## Calibration Environment and Details

Temperature : (23  $\pm$  2 °C)  
Humidity : (50  $\pm$  20 %RH)  
Barometric Pressure : (1013  $\pm$  10.0 hPa)  
Received Date : 26 May 2025  
Calibration Date : 29 May 2025  
Location of Calibration : LAD 1 Acoustic

Calibration Procedure : In-house method CP-ACCT-02 based on IEC 60642:2017 Electroacoustics - Sound calibration

Reference Standard	Model	Serial Number	Traceability	Due Calibration
Sound Calibrator	SV 35A	54079	IEC	12 June 2025
THD Multitester	2015	1047765	NIST	4 February 2026

Traceability : This certificate provides traceability of measurement to recognized national standard and to the realization of the International System of Units (SI).

## Note

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

Calibrated by :

Mr. Nipponat Kongsakul

Approved By :

Mr. Pail Malaisri

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date :

29 May 2025

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ISO 17025:2017 Rev 24 Issue Date 11/27/20

Certificate No : 25-ACT-081  
Request No : Rsp-2025-164

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)	Uncertainty (±%)
	Measured	Declared value		
94 dB / 1000 Hz	93.83	-0.17	-	0.11

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment	Uncertainty (±%)
	Measured (Hz)	Declared value		
94 dB / 1000 Hz	1000.0	1000	-	0.01

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment	Uncertainty (±%)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	2.31	-	-	0.17

Note:

- The calibration results are from the reference pressure instrument
- The calibration results include the measurement volume correction

End of Calibration

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Rev. 2018-ACT-02 Rev. 2018 Issue 01/01/2018



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT  
975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,  
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280  
Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20240337EA  
Operation No.: CP2024070257

## Certificate of Calibration

Equipment: Sound Level Meter  
Manufacturer: Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
Model/Type: LXT2 (Meter), 375A04 (Microphone), PRMLxT2C (Preamplifier)  
Serial No.: 0006695 (Meter), 394464 (Microphone), 071564 (Preamplifier)  
ID No.: UAE.EFM.135/2565  
Customer: United Analyst and Engineering Consultant Co.,Ltd.  
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak  
Phrakhanong, Bangkok 10260  
Received Date: 3 September 2024  
Calibrated Date: 20 - 24 September 2024  
Issued Date: 26 September 2024  
Calibrated by: Ms. Juntaporn Kunhakom

Approved by:   
( Mr. Sittichai Swaksuriyawong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.  
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k)  
providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except  
with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



Certificate No.: CP20240337EA

### Calibration Report

**Equipment:** Sound Level Meter  
**Manufacturer:** Larson Davis (Meter), PCB (Microphone), PCB (Preamplifier)  
**Model/Type:** LXT2 (Meter), 375A04 (Microphone), PRMLXT2C (Preamplifier)  
**Serial No.:** 0006695 (Meter), 394464 (Microphone), 071564 (Preamplifier)  
**ID No.:** UAE EFM.135/2565  
**Ambient Temperature:** (23 ± 2 ) °C  
**Relative Humidity:** (50 ± 15 ) %  
**Pressure:** (101.3 ± 1.5) kPa  
**Method of Calibration :-**

IEC 61672-3:2013.

**Condition of this result of calibration**

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1012-23	12 November 2024
2) Arbitrary Function Generator	AFG2021	C010063	CK20240048EA	23 June 2025
3) Programmable Attenuator	PA5	2755	EF-0040-23	1 October 2024
4) 6.5 Digit precision multimeter	8846A	9610014	CB20230200EA	15 November 2024
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P240022 CD20240180EA	20 March 2025 7 August 2025
6) Performance Audio Analyzer	U8903B	MY56510003	CB20240035EB CK20240069EA	13 February 2025 19 September 2025

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

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

- Reference standards instrument for Acoustic function
  - National Institute of Metrology (Thailand)
- Reference standards instrument for Electrical function
  - Electrical and Electronics Institute, NSC Accredited Calibration No.0119
  - National Institute of Metrology (Thailand)
  - Electrical and Electronics Institute, NSC Accredited Calibration No.0119

**Result of Calibration:-**

**Function : 1. Indication at the calibration check frequency**

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
-	-	-	-

เอกสารไม่ควบคุม

Certificate No.: CP20240337EA

### Calibration Report

**Function : 2. Self-generated Noise**

**2.1 Microphone Installed**

Measured value (dB)
28.5

**2.2 Microphone replaced by the electrical input signal device**

Frequency Weighting	Measured value (dB)
A-weighting	28.4
C-weighting	28.4
Z-weighting	34.1

**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)
125	0.2	0.1	0.1
1000	-0.1	-0.1	-0.1
8000	-1.1	-1.1	-1.0
			Acceptance limits (dB)
			±1.5
			±1.0
			±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)
63	0.0	0.0	0.0
125	0.0	0.0	0.0
250	-0.1	0.0	-0.1
500	0.0	-0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	0.0	0.0
			Acceptance limits (dB)
			±2.0
			±1.5
			±1.5
			±1.0
			±2.0
			±3.0
			±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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Certificate No.: CP20240337EA

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)	SPL Reference (dB)	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

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Certificate No.: CP20240337EA

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	43.1	0.1	±1.1
42.0	42.1	0.1	±1.1
41.0	41.2	0.2	±1.1
40.0	40.3	0.3	±1.1
39.0	39.3	0.3	±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	136.0	0.0	±1.0
	2	118.9	-0.1	+1.0 ; -2.5
	0.25	109.8	-0.2	+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	100.9	-0.1	+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	134.0	-0.4	±2.0
Negative half cycle	134.4	134.0	-0.4	±2.0

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
142.2	142.3	0.1	เอกสารไม่ควบคุม



ELECTRICAL AND ELECTRONICS INSTITUTE  
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Certificate No.: CP20240337EA

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	0.24	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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F-CAL-005 Ed.1

INNOVATIVE INDUSTRIAL CREATION LAB  
INNOVATIVE INSTITUTE (CO., LTD.) HEAD OFFICE  
111/101/111, MIT SATHAPAN (COMM. 1) TAMBON BANGKHAM  
AMPHUR MUANG PHUENSAWAT PROVINCE 40000 THAILAND  
TEL : 043-875-0000 FAX : 043-875-0001



Certificate of Calibration

Customer : UNITED ANALYTICAL AND ENGINEERING CONSULTANT CO., LTD.  
Name : Certificate No. : 25-0241-041  
Address : 81/301 Udonnuek Rd., Sukkumvit Road, Bangsue, Pathumthani, Bangkok 10260  
Request No. : Req-2024-1011

Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Manufacturer : LAUREN DAVY  
Model : Lx72  
Serial Number : 0006996  
ID : NAEI-DTM-L20-2308

Resolution : 0.1 dB  
Reference : 23 °C ± 2 °C

Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 % RH ± 20 % RH  
Measurement Point : 1011 kPa ± 0.1 kPa  
Received Date : 16 July 2025  
Calibrated Date : 28 July 2025

Calibration Procedure : Acoustic method (CP-01.01.01) based on IEC 61672-3 : 2013 Electromagnetic - Sound level meter - Part 3: Periodic tests

Location of Calibration

Lab Address :

Item	Brand	Model	PK	Date calibration	Traceability
Measurement Standard	Brüel & Kjær	4226	5472041	8 May 2025	NIMT
Audio Generator	Frontek	9-04011	(1)	17 October 2023	NK Electric

Note :

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

Calibrated By :

Mr. Supaporn Uanagun

Service Calibration Engineer

Approved By :

Mr. Pichat Mathayon

Calibration Engineer Supervisor

Issue Date :

20 July 2025

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Rev 001 (11/24/24) Rev 002 Issue Date 11/22/24



## 1. Indication of the calibration check frequency.

UNC Setting	Nominal		Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ min)
	Level		RSD		RSD		
	( $\mu$ g/L)	( $\sigma$ g/L)	( $\mu$ g/L)	( $\sigma$ g/L)	( $\mu$ g/L)	( $\sigma$ g/L)	
Calibration Setting							
Mean for 100.00	100.00	0.02	100.00	0.02	100.00	0.02	0.030

## 2. Self-generated noise, Microphone installed

UNCERTAINTY	
Measured	
1157.25(10)	(10)
1157.25(10)	(10)
1157.25(10)	(10)

3. Self-generated noise. Microphone replaced by the electrical input signal device

UVC Setting	Measured	Uncertainty
FA5777-19		
Q1C Wavelength	600	$\pm 5$ nm
A	28.8	$\pm 0.10$
C	26.4	$\pm 0.10$
$\Sigma$	30.7	$\pm 0.10$

## 4. Acoustic signal test of frequency weights (1)

FUC Setting	Deviation from various frequency Weighting Response curves				UNCERTAINTY (± 60%)
	A	C	Z		
FAST (27.1 Hz)	(0.0)	(0.0)	(0.0)		(± 60%)
STD Setting					
125 Hz	0.1	0.2	0.2		(± 60%)
1000 Hz	0.0	0.0	0.1		(± 60%)
4000 Hz	0.4	0.5	0.2		(± 60%)
8000 Hz	0.4	0.5	0.2		(± 60%)

5. Electrical signal test of frequency weightings. Weighting network response with relative to I lftt

AVC Setting		Deviation from various frequency Weighting Response curve				UNCERTAINTY (± dB)
F=57.17-130	STD Setting	A (dB)	C (dB)	Z (dB)		
	63 Hz	-0.1	0.0	0.0	0.26	
	125 Hz	-0.1	0.0	0.0		
	250 Hz	-0.1	0.0	0.0		
	500 Hz	0.0	0.1	0.0		
	1000 Hz	0.0	0.0	0.0		
	2000 Hz	0.1	0.1	0.0		
	4000 Hz	0.0	0.0	0.1	0.3	
	8000 Hz	0.0	0.0	0.1		
	16000 Hz	0.0	-0.1	-0.1		

### 3. Frequency and time weightings of Jitter

TTC testing	STD	Measured		UNCERTAINTY
		LUC	ERM	
FAST / 25.130	REF			
TTC Sampling	REF			$\pm 200$
	A	114.00	0.0	
	F	114.00	0.0	0.20
Z	114.20	118.0	0.0	

TCC Rating	STD	Measured		UNCERTAINTY ( $\pm 40$ )
		AUC (0.8)	ERR (42%)	
25-30 V/A	118.06	114.0	0.1	0.20
VCC Time Response	116.00	114.0	0.1	
	114.26	114.6	0.6	
1-0V				

7. Long Term Stability

VUC Setting	Measured	UNCERTAINTY
FASST / A / 37-130	UUC	(1.00)
STD Setting		
Initial	114.0	
Final	114.0	
Deviation	0.0	0.10

8. Level Linearity on the reference level range

VUC Setting	Antiquated	Deviation	UNCERTAINTY
FASST / A / 37-130	REF	UUC	ERR
STD 0.0	(0.0)	(0.0)	(0.0)
130.00	119	139.0	0.0
134.00	124	134.0	0.0
138.00	128	138.0	0.0
142.00	134	142.0	0.0
146.00	139	146.0	0.0
150.00	144	150.0	0.0
154.00	149	154.0	0.0
158.00	154	158.0	0.0
162.00	159	162.0	0.0
166.00	164	166.0	0.0
170.00	169	170.0	0.0
174.00	174	174.0	0.0
178.00	179	178.0	0.0
182.00	184	182.0	0.0
186.00	189	186.0	0.0
190.00	194	190.0	0.0
194.00	199	194.0	0.0
198.00	204	198.0	0.0
202.00	209	202.0	0.0
206.00	214	206.0	0.0
210.00	219	210.0	0.0

9. Level linearity including the level range control

VUC Setting	STD	Measured	UNCERTAINTY
FASST / A	REF	UUC	ERR
UUC Range	(0.0)	(0.0)	(0.0)
37-130	42.20	42.1	0.10
	114	114.0	0.10

10. Tone burst response

VUC Setting	STD	Antiquated	Measured	UNCERTAINTY
A / 37-130	Test (0.0)	Ref	UUC	ERR
UUC Tone Response	(0.0)	(0.0)	(0.0)	(0.0)
Final	200	131.0	134.9	-4.1
	2	118.0	117.7	-0.3
	0.25	100.0	100.8	+0.2
Flow	200	126.6	128.5	+0.1
	2	100.0	100.8	+0.2
	200	129.0	129.0	0.0
	2	100.0	100.0	0.0
REF	127	100.0	99.8	-0.1

11. Peak C Sound level

VUC Setting	Antiquated	Measured	UNCERTAINTY
FASST / C / 65-142	REF	UUC	ERR
STD Setting	(0.0)	(0.0)	(0.0)
Compliance cycle	137.4	136.8	-0.60
Positive half cycle	136.4	136.2	-0.20
Negative half cycle	136.4	136.2	-0.20

Certificate No : 25-5246543  
Request No : Req-2023-003

12. Overhaul Indication

UVC Setting	Measured	UNCERTAINTY
0.637 / A / 75.118	VLC	± 0.01
STD Setting	0.01	
Positive over-halt cycle	141.0	± 0.20
Negative over-halt cycle	140.0	
Decrement	0.1	

13. High Level Stability

UVC Setting	Measured	UNCERTAINTY
0.637 / A / 75.118	VLC	± 0.01
STD Setting	0.01	
Initial	130.0	± 0.10
Final	130.0	
Decrement	0.0	

End of Certificate

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The results related only to the item calibrated. The certificate shall not be reproduced except by JIL, without written approval of the Instrument Co., Ltd.  
File: 090-516-5005-Rev-06 Issue date: 07/2/23

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Name : 41 San Chulalongkorn Rd., Sukhumvit Road, Bangkok, Thailand, Bangkok  
Address : 10250  
Certificate No : 25-5016130  
Request No : Req-2023-0718

Unit Under Calibration Details  
Measurement Item : Sound Level Meter  
Manufacturer : LAUREN DAVY  
Model : L412  
Serial Number : 000754  
ID : (USC)EIMJ002548  
Resolution : 0.1 dB

Microphone Class : 2  
Microphone Model : 377A10  
Microphone SN : 346281  
Pre-amplifier Model : PM540-42C  
Pre-amplifier SN : 073382  
Instrument Status : Valid

Calibration Environment and Details  
Temperature : 23 °C ± 2 °C  
Humidity : 40 %RH ± 20 %RH  
Barometric Pressure : 1013.0 hPa ± 10 hPa  
Reference Date : 24 March 2023  
Calibrated Date : 4 April 2023

Calibration Facility : In-house method CP-S1-M-01 based on IEC 61072-3 : 2013 Electromagnetic Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab 3-Aurville  
Reference Standard :  
Instrument : Brand : Model : SN : Due calibration : Traceability  
Standard Microphone : Brüel & Kjær : 4102 : 2294004 : 29 June 2025 : NMIC  
Audio Generator : Brüel & Kjær : 131 : 15 October 2024 : NIE Electric

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

Calibrated By :  Mr. Nopadol Lamsan  
Service Calibration Engineer

Approved By :  Mr. Pich Matharun  
Calibration Engineer Supervisor  
Issue Date : 8 April 2023

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The results related only to the item calibrated. The certificate shall not be reproduced except by JIL, without written approval of the Instrument Co., Ltd.  
File: 090-516-5005-Rev-06 Issue date: 07/2/23

## 1. Indication at the calibration check frequency

UVC Setting	Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)
		UVC (dB)	ERR (dB)	UVC (dB)	ERR (dB)	
$\beta = 52^\circ / A / 27.631$						
Calibration Setting						
1001 Hz (1.0 cm)	-115.7%	-114.6	-1.4	-113.9	-0.94	0.20

Name: \_\_\_\_\_

## 2. Self-generated noise; Microphone Installed

UNCERTAINTY	
Measured	
UAC Setting	
PAS1/P2-10	
UAC Weighting	(dB)
A	-20.0
	(5.10)

### 3. Self-generated noise, Microphone replaced by the electrical input signal device

UCC Setting	Measured	Uncertainty
PART 1 22-28		
UCC Weighting	(dB)	( $\pm$ dB)
A	28.1	0.10
C	27.4	0.10
Z	31.8	0.10

## 4. Acoustic signal test of frequency weightings (Without W11screen)

LTC Setting	Deviation from various frequency				UNCERTAINTY ( $\pm 40$ )
	Weighting Response curve				
	A	C	Z		
FAST 25.110	(m)	(m)	(m)		
STD Setting	0.4	0.0	0.0	0.0	
225 Hz					
1000 Hz	0.0	0.0	0.0	0.0	
0000 Hz	0.1	0.2	0.2	0.0	
0000 Hz	-1.0	-1.2	-1.3	0.0	

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5. Electrical signal test of frequency weighting. Weighting network response with relative to 1 kHz

UUC Aiding		Resolution from various Frequencies			Uncertainty 1 $\pm$ dB
		Weighting Response curve			
		A (dB)	C (dB)	Z (dB)	
F375 175-130		-0.2	0.0	0.0	0.20
STD Aiding					
63 Hz		-0.1	0.0	0.0	
125 Hz		-0.1	0.0	0.0	
250 Hz		-0.1	0.0	0.0	
500 Hz		-0.1	0.0	0.0	
1000 Hz		0.0	0.0	0.0	
2000 Hz		0.0	0.0	0.0	
4000 Hz		0.0	0.0	0.0	
8000 Hz		0.0	0.0	0.0	
16000 Hz		-0.1	-0.1	-0.1	

- *E. frequency and time weightings at 1 kHz*

UNCERTAINTY	Measured			STD	UVC Soling	
	UVC	ERR	UVC		ERR	
0.20	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	0.00	0.00	0.00	
	0.00	0.00	0.00	0.00	0.00	

UVC Setting	STD	Measured		UNCERTAINTY ( $\pm 0.05$ )
		UVC	ERR	
37.19 V.A.	0.05	0.05	0.05	
UVC Time Response				
Fast	114.00	114.00	0.00	
Slow	114.00	114.00	0.00	0.20
Lat	110.00	110.00	0.00	

The results showed only a slight increase in the number of correct responses. The results are still to be replicated using a different stimulus material.



### 7. Long Term Stability

U/C Setting	Measured	UNCERTAINTY
FAST / A / 37-138	U/C	± 4.00
STD Setting	100	
Initial	114.6	
Final	114.6	
Deviation	0.0	0.0

### 8. Level linearity on the reference level range

U/C Setting	Anticipated	Measured	UNCERTAINTY
FAST / A / 37-138	REF	U/C	± 4.00
STD 40	40	40.0	
114.00	114	114.0	
129.00	129	129.0	
124.00	124	124.0	
119.00	119	119.0	
114.00	114	114.0	
109.00	109	109.0	
104.00	104	104.0	
99.00	99	99.0	
94.00	94	94.0	
89.00	89	89.0	
84.00	84	84.0	
79.00	79	79.0	
74.00	74	74.0	
69.00	69	69.0	
64.00	64	64.0	
59.00	59	59.0	
54.00	54	54.0	
49.00	49	49.0	
44.00	44	44.0	
39.00	39	39.0	
34.00	34	34.0	

### 9. Level linearity including the level range control

U/C Setting	STD	Measured	UNCERTAINTY
FAST / A	REF	U/C	± 4.00
U/C Range	100	100	
	42.00	43.0	
	114	114.0	

### 10. Tone burst response

U/C Setting	STD	Anticipated	Measured	UNCERTAINTY
FAST / A / 37-138	Touchtone	Ref	U/C	± 4.00
U/C Tone Response	100	100	100	
	20	21.0	21.0	
	2	21.0	17.3	
	0.25	100.0	100.0	
	200	120.0	120.3	
	2	100.0	100.9	
	200	120.0	120.1	
	2	100.0	100.0	
	0.25	100.0	100.0	
	200	120.0	120.3	
	2	100.0	100.9	
	200	120.0	120.1	
	2	100.0	100.0	
	0.25	100.0	100.0	

### 11. Peak C Sound level

U/C Setting	Anticipated	Measured	UNCERTAINTY
FAST / C / 05-142	REF	U/C	± 0.00
STD Setting	100	100	
Complete cycle	37.6	38.7	
Positive half cycle	37.6	38.1	
Negative half cycle	37.6	38.7	0.00



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

Master Console Information		Calibration Certificate		Test Parameters	
Console Model Number	XC-572-V	Date	16/01/2025	Std Temp	25.0 K
Console Serial Number	0003018	Calibration Reference No.	SEK25-010004	Std Press	760 mm Hg
DCM Model Number	SK25EX	Barometric Pressure	762.74	K <sub>a</sub>	0.386
DCM Serial Number	00009766	Calibration Meter Gamma	1.001	Capable Leak Check	PASS

Calibration Data Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate		Variation	
(V <sub>gas</sub> )	(Q <sub>gas</sub> )	(V <sub>std</sub> )	(Q <sub>std</sub> )	Value	Variation	Std & Curr	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )	(ΔH <sub>g</sub> )
m³	m³/min	m³	m³/min	(%)	(Δ%)	m³/min	mm H <sub>2</sub> O		
0.327	0.011	0.124	0.011	0.977	0.003	0.011	46.452		0.573
0.370	0.011	0.134	0.011	0.975	0.004	0.011	46.808		0.528
0.130	0.016	0.134	0.016	0.970	-0.004	0.016	46.340		0.463
0.130	0.016	0.134	0.016	0.972	-0.002	0.016	46.123		0.246
0.262	0.029	0.258	0.029	0.974	0.000	0.029	45.180		-0.009
0.277	0.029	0.272	0.029	0.980	0.000	0.029	45.975		0.098
0.278	0.025	0.221	0.026	0.975	0.003	0.025	45.421		-0.456
0.278	0.027	0.272	0.027	0.975	0.001	0.027	45.056		0.321
0.240	0.031	0.271	0.030	0.970	-0.004	0.030	45.906		-0.071
0.240	0.031	0.271	0.030	0.971	-0.003	0.030	45.604		-0.273
				0.974	Y Average	45.577			
				ΔH <sub>g</sub> Average					

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH<sub>g</sub>, orifice pressure differential that equates to 0.75 atm (0.0212 m/mm) in standard atmosphere Std. pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm).



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

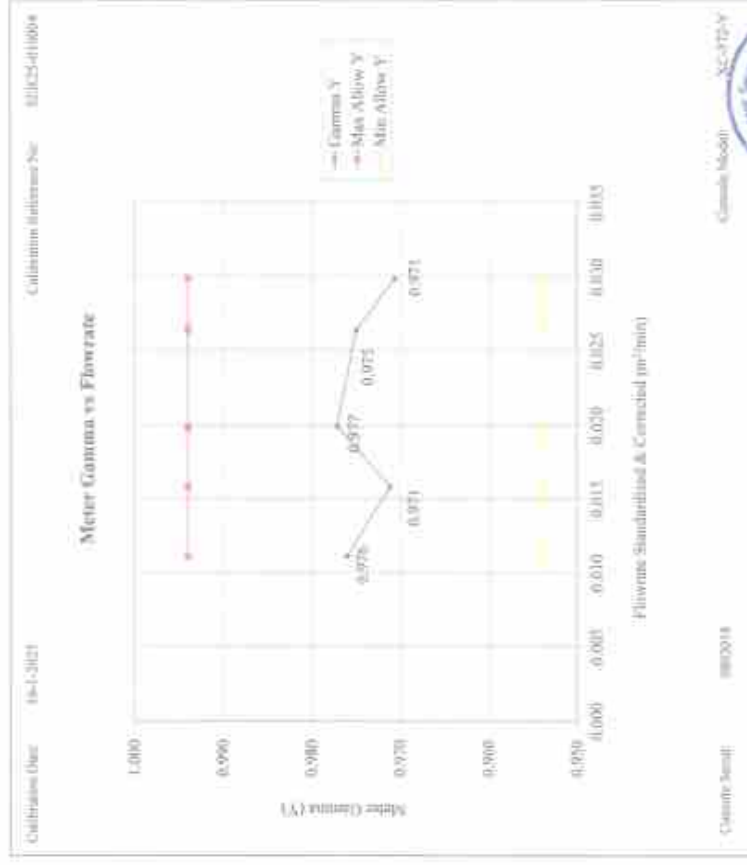
Master Console Information		Calibration Certificate		Test Parameters	
Console Model Number	XC-572-V	Date	16/01/2025	Std Temp	25.0 K
Console Serial Number	0003018	Calibration Reference No.	SEK25-010004	Std Press	760 mm Hg
DCM Model Number	SK25EX	Barometric Pressure	762.74	K <sub>a</sub>	0.386
DCM Serial Number	00009766	Calibration Meter Gamma	1.001	Capable Leak Check	PASS

Run Time	Mastering Cunnels										Calibration Meter			
	DCM Orifice DH	(P <sub>gas</sub> ) mm H <sub>2</sub> O	Volume Initial	Volume Fluid	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Fluid	Outlet Temp Initial	Outlet Temp Final				
Filled	(Q)		m <sup>3</sup>	(V <sub>ref</sub> )	(V <sub>ref</sub> )	(T <sub>ref</sub> )	(V <sub>ref</sub> )	(V <sub>ref</sub> )	(T <sub>ref</sub> )	(T <sub>ref</sub> )				
9.01	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
12.05	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
12.16	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
8.47	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
8.47	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
13.80	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
13.77	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
10.28	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
10.27	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
9.08	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				
9.07	13.0	13.0	m <sup>3</sup>	46.5	46.5	28	28	28	28	28				

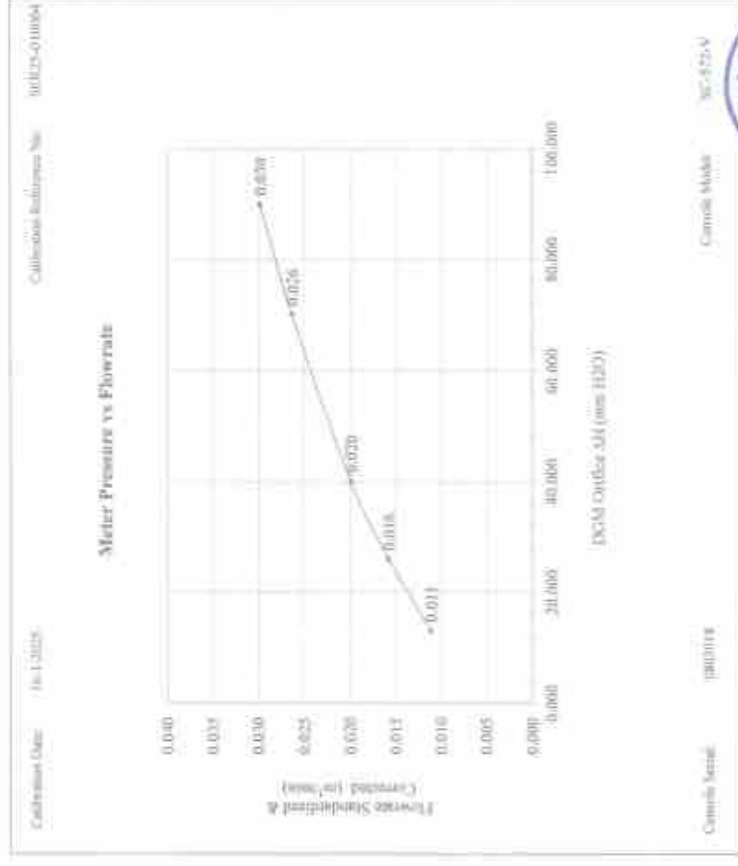


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Meter Details Information		Calibration Certificate		Twelve's Compliance	
Console Model Number	XC-872-V	Date	16/01/2025	Std Temp	23.3 K
Console Serial Number	08030118	Calibration Reference No.	62025-010004	Std Press	760 mm Hg
DCM Model Number	SS25EX	Barometric Pressure	762.74	K <sub>1</sub>	0.286
DCM Serial Number	00009766	Calibration Meter Gamma	1.003	Console Leak Check	PASS



Meter Details Information		Calibration Certificate		Twelve's Compliance	
Console Model Number	XC-872-V	Date	16/01/2025	Std Temp	23.3 K
Console Serial Number	08030118	Calibration Reference No.	62025-010004	Std Press	760 mm Hg
DCM Model Number	SS25EX	Barometric Pressure	762.74	K <sub>1</sub>	0.286
DCM Serial Number	00009766	Calibration Meter Gamma	1.003	Console Leak Check	PASS





# THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information	
Console Model Number	XC-572-V
Console Serial Number	8003018
DGM Model Number	SA-248-X
DGM Serial Number	00000766
Meter Box Model Number	JENCO 745 RF
Meter Box Serial Number	JC 16005

Calibration Conditions	
Date	16/01/2025
Time	05:20 PM
Calibration Reference No.	SR25-01000
Reference Thermometer	DIGICON
Serial Number	183109105

Channel and test point		Sample									
		Copper Thermocouple Simulator									
		Meter Box Channel Temperature Reading ( °C )									
Stack		-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Probe		-17.0	24.0	37.0	92.0	148.0	258.0	371.0	481.0	592.0	814.0
Filter		-17.0	24.0	37.0	93.0	149.0	258.0	371.0	481.0	592.0	814.0
Exit		-17.0	24.0	37.0	93.0	149.0	258.0	371.0	481.0	592.0	814.0

Tolerance Range		Meter	
Stack	± 1.50%	Absolute	± 3.0 °C
Probe	± 3.0 °C	Exit	± 2.0 °C
Filter	± 3.0 °C		



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Instrument description	Flux Gas Analyser
Instrument model	Tello 350 New
Instrument serial no.	02325144208
Control unit serial no.	02308595726
10 ml. air control no.	UAG-DMA2-113/2555
Manufacturer	Telco EE & Co. KGaA
Probe description	
Probe model	
Probe serial no.	
Customer name	UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address	111 521 UDDOMRANG, SUKUMVIT ROAD, BANGCHAK PRAMONGK BANGKOK 10260

Total pages of certificate	2 Pages
Receiving no.	E-253114
Receiving date	16-Jan-25

Parameter of calibration	Gas Calibration(Oxygen 2.00,0.004,21.02 %vol, Carbon Monoxide 00.45,102,1007 ppm) Nitrogen Dioxide 30.66,31.8,302.9 ppm, Nitric Oxide 31.0,151.5,322.5 ppm, Sulphur Dioxide 30.36,110.7,600.0 ppm)
--------------------------	--

Condition of UUC	Good
Ambient condition	All of the Measurement were carried out the standard laboratory Temperature : 23 ± 0.5 °C Humidity : 55 ± 15 %RH

Calibration place	171/21 Sri Ngunnongrue 47 Yuen 40, Thungmahachul, Lakso, Bangkok 10210
Calibration procedure no.	This instrument was calibrated by comparison with standard gas mixture according to calibration item instruction No. W1-Q-05-C

The calibration certificate represents accuracy of measurement as stated in the attached certificate of measurement multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to data under the environmental condition.

This Calibration Certificate may not be reissued other than in full except with the permission of the issuing laboratory.

Calibration applications without signature and seal are void and the results shall only be the ones listed on this certificate.

This calibration certificate documents are traceable to national standards, which require measurement according to the International System of Units (SI).

Date of calibration	25 Jan-23
---------------------	-----------

*Kumchay*  
Mr. Kwanchoi Kumchay  
Calibration Technician

*D. Wuttu*  
Mrs. Nungphat Wuttu  
Technical Manager



**Cert.No.:** 25CH264  
**Page.:** 1 of 3

28 February 2025

The authors may not be representative of the whole group of people who have been involved in the kind of activities described in the present study and further research is needed.

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นายวัชรินทร์ แสงงาม

ระหว่างวันที่ ๒๒ - ๒๓ ธันวาคม ๒๕๖๕

ให้ไว้ ณ วันที่ ๒๒ ธันวาคม ๒๕๖๕

(นายปิ่นสักก์ สุรัสวดี)

อธิบดีกรมควบคุมมลพิษ



Cert.No.: 25CH264  
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-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 4.007	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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC04740	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

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Cert.No.: 25CH264  
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 (±)	Coverage factor k
pH Electrode S/N.: 240710SIA605377	4.007	4.01	173	0.0079	2.00
	6.999	7.01	-2	0.0085	2.00
	6.999	7.01	-2	0.0085	2.00
	10.010	10.01	-177	0.0092	2.00

##### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -  
- Serial No. : 240710SIA605377

Dimension of probe

- Length : 112 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.004	14.7	-0.304	0.13	2.00
30.0	30.002	29.8	-0.202	0.13	2.00
45.0	45.003	44.8	-0.203	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 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000 FAX. 0-2719-9484

## Certificate of Testing

Cert.No.: 25TW24  
Page.: 1 of 2

**Equipment :** DO Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-DO210  
**Serial No. :** HE9M0004  
**ID No. :** UAE.EFM.012/2563 (EFM.DO.01/63)  
**Received Date :** 04 February 2025  
**Test Date :** 05 February 2025  
**Reference :** 2502-0108WSC-2  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phra Khanong, Bangkok 10260

**Laboratory Condition :**

Temperature (  $25 \pm 5$  ) °C

Humidity (  $50 \pm 20$  ) %

In - house method : GP-CH9

by Comparison Technique with Azide Modification Method

**Test Procedure :**

**Tested by :**

Walalak Sirthean

**Approved by :** Approved Signatory

( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

**Issue Date :**

5 February 2025

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Cert.No.: 25TW24  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instruments :

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	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.: 9K2B0019

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.20	0.0084

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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## Certificate of Calibration

Cert. No.: 25LM17  
Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : Horiba

Model : LAQUA-DO210

Serial No. : HE9M0004

ID No. : UAE.EFM.012/2563(EFM.DO.01/63)

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

Location : TPA On Site Calibration Laboratory

Received Order : 04 February 2025

Calibrated Date : 05 February 2025

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

AC Line Voltage : ( 220 ± 22 ) V

Calibrated by : Warakorn Lergagtrakul

Approved by :

( ) Chakrit Waewwanjua  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Approved Signatory

Issue Date : 07 February 2025

The Uncertainties are for a confidence probability of approximately 95%

This certificate and meter represented only when in full comply with the meter  
Approved by the Head of Composite Services & Equipment Calibration and Testing Services.

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Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2502-0108WSC-1

Cert. No.: 25LM17  
Page.: 2 of 2

### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.  
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) Digital Thermometer	A52847	2411189	TPA	25 Oct 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 : Temperature measurement.

This instrument was connected with temperature sensor, S/N : 9K2B0019

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
15.0	80	15.003	15.0	-0.003	0.16	2.00
30.0	80	30.003	30.0	-0.003	0.16	2.00
45.0	80	45.003	45.0	-0.003	0.16	2.00

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 & EQUIPMENT CALIBRATION AND TESTING SERVICES  
304/1 PATTANANONG ROAD 101/10, SUKHUMVIT, BANGKOK 10110  
TEL: 02-2717-2006-38 FAX: 02-2719-9406



## Certificate of Calibration

Cert.No.: 25CH165  
Page.: 1 of 3

**Equipment :** Conductivity Meter  
**Manufacturer :** Horiba  
**Model :** LAQUA-EC210  
**Serial No. :** HC9L0014  
**ID No. :** UAE.EFM.007/2563(EFM.SCT.01/63)  
**Condition As-Received:** Used Item  
**Received Date :** 04 February 2025  
**Calibration Date :** 05 February 2025  
**Reference :** 2502-0107WSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

**Ambient Temperature :**

**Relative Humidity :**

**Calibration Procedure:**

In -house method :

- CP-CH6 by direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

**Calibrated by :** Warakorn Lengagrakul

**Approved by :**

( ) Chakrit Waewwanjua  
( ) Ponpan Papim  
(✓) Saithip Meangmai

Approved Signatory

**Issue Date :**

06 February 2025

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

This certificate may not be reproduced other than for copies with the prior written  
Approval of JEA Head of Calibration Services & Equipment Calibration and Testing Services

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Cert.No.: 25CH165  
Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	241995	09 Sep 2025
2) Ref. Std. Thermometer	4982054	110RC044	241757	14 July 2025

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board. Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1412.9 $\mu$ S/cm	CPA Chem	1005307	15 June 2025
12.881 mS/cm	CPA Chem	1005308	15 June 2025

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ ) °C  
3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration results

Function : Conductivity Measurement

( \* ) After Adjustment at 1412.9  $\mu$ S/cm

Conductivity Electrode Serial No.: 9B9F0064

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
1412.9 $\mu$ S/cm	1430 $\mu$ S/cm	1413 $\mu$ S/cm	9.2 $\mu$ S/cm	2.00
12.881 mS/cm	12.69 mS/cm	12.58 mS/cm	0.086 mS/cm	2.00

Remark : - UUC\* = Unit Under Calibration

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Cert.No.: 25CH165  
Page.: 3 of 3

#### Calibration Results

##### Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : 9383

- Serial No. : 9B9F0064

Dimension of probe;

- Length : 110 mm

- Diameter : 16 mm

- Immersion Depth : 100 mm

##### Calibration Result : Without adjustment

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.003	45.0	-0.003	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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## Certificate of Calibration

Cert.No.: 25CH400  
Page.: 1 of 2

Equipment :

Turbidity Meter

Manufacturer :

Thermo Scientific

Model :

EUTECH TN-100

Serial No. :

3065434

ID. No. :

UAE.EFM.021/2565(TM.02/65)

Condition As-Received:

Used Item

Received Date :

01 April 2025

Calibration Date :

02 April 2025

Reference :

2504-0030WSC-1

Submitted by :

United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
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

( ) Chakrit Waewwanjua

( ) Ponpan Paipim

(✓) Sathip Meangmai

Issue Date :

3 April 2025

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

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Cert.No. : 25CH400  
Page. : 2 of 2

#### 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 four - Formazin suspension standard curve by using 0,20,100,800 NTU

Turbidity Meter Serial Number : 3065434

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( $\pm$ NTU )	Coverage Factor <i>k</i>
0.1	0.16	0.022	2.00
20	19.9	0.38	2.00
100	100	0.74	2.00
800	802	2.1	2.11

**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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## ภาคผนวก ง-2

### เอกสารเครื่องมือวิเคราะห์

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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	CADMIUM CHROMIUM COPPER IRON LEAD MANGANESE MERCURY NICKEL ZINC	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
2	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	250422 1 BL002 25	23/4/2025	22/4/2026
3	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
4	Analytical Balance	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
5	Auto Clave	TOTAL COLIFORM BACTERIA	ALP Co.,Ltd. (Japan)	CL-40L / 810010	National Food Institute Ministry of Industry (Thailand)	2503287-001-01	5/6/2025	4/6/2026
6	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1002	7/7/2025	6/7/2026
7	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	25TM578	19/3/2025	18/3/2026
8	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	17/2/2025	16/2/2026
9	Digestion Units	TOTAL KJELDAHL NITROGEN	Foss Tecator	2520 Auto / 91794469	National Food Institute Ministry of Industry, Thailand	2501440-001-01	27/1/2025	26/1/2026
10	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC1L0026	Technology Promotion Association (Thailand-Japan)	25CH246	26/2/2025	25/2/2026
11	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7/3/2025	6/3/2026

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
12	Mercury Analyzer	MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	2/7/2025	1/7/2026
13	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	25TM579	19/3/2025	18/3/2026
14	Incubator	TOTAL COLIFORM BACTERIA	Binder	K8400 / 20220000022479	National food institute ministry of Industry	2503682 004 01	1/7/2025	30/6/2026
15	Incubator	FECAL COLIFORM BACTERIA	Memmert	IPP260 / V615.0187	National Food Institute, Ministry of Industry, Thailand	2502229-001-01	19/3/2025	18/3/2026
16	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	13319	27/1/2025	26/1/2026
17	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	13854	24/2/2025	23/2/2026
18	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0048	technology promotion association (thailand-japan)	25CH586	21/5/2025	19/5/2026
19	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan)	25CH354	20/3/2025	18/3/2026
20	pH Meter	pH	Horiba	LAQUA-PH210 / HA1L0035	technology promotion association (thailand-japan)	25CH262	28/2/2025	27/2/2026
21	pH Meter	pH	Horiba	LAQUA-PH210 / HA0D0082	technology promotion association (thailand-japan)	25CH588	21/5/2025	20/5/2026
22	pH Meter	pH	Horiba	LAQUA-PH210 / HA0C0025	technology promotion association (thailand-japan)	25CH261	26/2/2025	25/3/2026
23	pH Meter	pH	YSI Environmental	pH 100A / JC03354	Technology Promotion Association (Thailand-Japan)	24CH1379	6/11/2024	5/11/2025
24	Spectrophotometer	CHROMIUM HEXAVALENT COLOUR (pH 7.0) COLOUR (pH Sample)	Agilent	Cary 60 66860A / MY15410009	DQE Services Co.,Ltd.	SP25-019	26/5/2025	25/5/2026
25	UV-VIS Spectrophotometer	NITRATE NITRATE NITROGEN SULPHATE TOTAL PHOSPHORUS	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-001	3/1/2025	2/1/2026
26	UV/VIS Spectrophotometer	AMMONIA-NITROGEN CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP25-024	17/6/2025	16/6/2026

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
27	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6/9/2024	5/9/2025
			Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	25CH1053	9/9/2025	7/9/2026
28	Water Bath	FECAL COLIFORM BACTERIA	Memmert	WNE 14 / L416.0612	National Food Institute Ministry of Industry, Thailand	2501624-002-01	10/2/2025	9/2/2026

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

## Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

### Preventive Maintenance Checklist

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

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

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

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

### Introduction

#### Customer Information

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

#### Important Customer Web Links

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

#### Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "x" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.



## Instrument Maintenance

### System Information

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

Instrument System Name and ID	240 FS RRS
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 9432 R	M1 13150001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

### Preparation, Safe operation and Initial performance checks

Revision: 10.00, Issued: November 2021

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

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

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *W19*
- ☒ 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 Notices.
- ☒ 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 - "Aa found test 1"
- ☒ Perform a Basic Cu XBS test - "Aa found test 2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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## Preventive Maintenance Procedures

### FLAME SYSTEM section

☐ Section not applicable

#### Electronic components

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

#### Mechanical components

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

#### Optics components

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

## Sample Introduction and Atomization

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

## Gas handling components and safety interlocks

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

## Analytical performance for Flame systems

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

## FURNACE SYSTEM section



Section not applicable

### Electronic components

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

### Mechanical components

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

### Optics components

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

### Gas handling, water system and 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 nuts, 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.

### Vapor generation accessory VQA (hydride generator)

#### ☒ Section NOT Applicable

- ☐ Inspect VQA gas supply hose.
- ☐ Inspect/replace VQA 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 14 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

### 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.



## Signature Page

### Service Review

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

### Test Results

Test Description	Expected Test Result	Actual Test Result
Flame optics PMAT Gain Test		
For copper at 324.8 nm, 4 nA, 0.5 nm slit width	± 5%	4.97
Flame (performance test with 5 ppm copper sample)		
Air / acetylene, mixing gas/leak removed	Abs value < 0.5	0.559%
Air / acetylene, mixing gas/leak installed, 10 replicates	%RSD < 1.0	0.27
Deuterium furnace optics PMAT Gain test		
For copper at 324.8 nm, 4 nA, 0.5 nm slit width	± 5%	-
Deuterium furnace performance test with 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.1%	-
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.10	-
MBR%	≥ 70%	-

### AA consumable and parts list table

Part Description	Part Number	Product Model # where used	PM supplied or Consumable	Instrument Type
Test Solution - Cu type solution	6610030100	50 85-140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-2001	50 85-140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-10279	50 85-140 240 280	*	Common
K1, M1, 2 Drying aqueous complete set	4910093400	50 85-140 240 280	PM supplied	Flame
Organic kit	4910093500	50 85-140 240 280	PM supplied	Flame
Wine Reducer Cleaning	49100234720	50 85-140 240 280	consumable	Flame
Tubing/Capillary Std Rebo	4910024600	50 85-140 240 280	consumable	Flame
Capillary Tube Hiss: Nub (2) (argonics only)	4910044000	50 85-140 240 280	consumable	Flame
Glass impact beads (5/μm)	4910025700	50 85-140 240 280	consumable	Flame
Teflon impact beads (5/μm) (argonics only)	4910043300	50 85-140 240 280	consumable	Flame
Burner cleaning strip (100/μm)	4910023000	50 85-140 240 280	consumable	Flame
Window UV silica - round (right end)	20100802600	50 85-140 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	20100802000	50 85-140 240 280	PM supplied	Common
Flat adhesive window (mm)	4910012700	50 85-140 240 280	PM supplied	Common
Flat adhesive window (rectangular)	4910012800	50 85-140 240 280	PM supplied	Common
Electrode kit (1 μm) (D2)	6310003400	GTAA120	PM supplied	Furnace
Furnace (D2)	6310003100	GTAA120	PM supplied	Furnace
Zeeman electrode kit (1 μm)	6310003500	GTAA120	PM supplied	Furnace
Zeeman anode	6310003600	GTAA120	PM supplied	Furnace
O-ring: PSD metal bottle	6910025000	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.

```

D2 Run Hours: 53550.500
D2 Serial Number: not set
D2 Install Date: 197-870
D2 Original Inventory: 1500
D2 Last Inventory: 245000

Instruction: Run from 11:00 to 11:40
Zero Way Length: 0.00000000
Name Correction: 0.000
Name Hours: 3601.634

```



Frequency:

Averaging Period: 30.0  
Datapoint Count: 10

Upper Limit:  
51.00  
Lower Limit:  
49.00

Highest Measured Frequency:  
51.00  
Lowest Measured Frequency:  
50.00

Result: **Passed**

Power Supply:

Averaging Period: 30.0  
Datapoint Count: 20

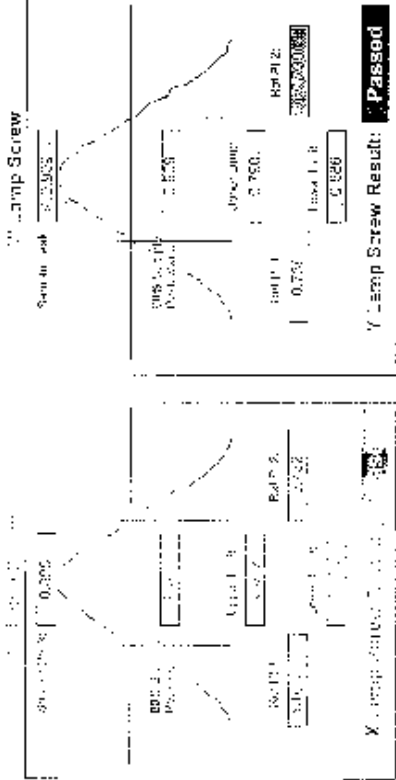
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V (5.0%)	11.92	12.12	12.08	<b>Passed</b>
42.00 V (12.0%)	41.90	41.93	41.80	<b>Passed</b>
5.00 V (1.0%)	4.99	5.04	5.00	<b>Passed</b>
34.00 V (1.0%)	33.90	33.90	34.00	<b>Passed</b>

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Beam Balance:

Lamp Type: Power  
Lamp Socket Used: 7

Peak Selected: 324.82  
Lamp Alignment: **Not Aligned**



General:

Power Element(s): Output  
Lamp Type: 22 Pin Pin 5  
Lamp Type: 22 Pin Pin 5  
Lamp Type: 22 Pin Pin 5  
Lamp Type: 22 Pin Pin 5  
Lamp Type: 22 Pin Pin 5

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Color	0.00	0.00	0.00	<b>Passed</b>
First Color	0.00	0.00	0.00	<b>Passed</b>
Second Color	0.00	0.00	0.00	<b>Passed</b>

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Auto Lamp Test Log

- Lamp 1: Headlight (Left/Right)
- Lamp 2: Tail - Stop/Brake (Left/Right)
- Lamp 3: Tail - Backup
- Lamp 4: Horn/Chime/Alarm
- Lamp 5: Fog/Daytime Running
- Lamp 6: Not Connected
- Lamp 7: Dual Bulb/Sealed
- Lamp 8: Dual Bulb/Sealed

Result: **Passed**

GTN Test Results Report

Notes:

Signature: Kanyakorn S. Date: 30 Jan 2025

Inspector: \_\_\_\_\_

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Analyst: 1/30/2025 10:53 AM (Sat) 15:00:25.33 AM  
Worksheet: Security Test 1  
Comment:  
Methods: C1  
Computer name: R771-T02-79J11S  
Serial Number: 1811032201

Method: C1 (10.5m)

Sample ID: C0179970	Core Vol:	3.87E	Max Value:	
	Height:	3.87E	3.87E	
STANDARD: 1	0.002	0.002	0.0001	15000225
	0.001	0.1	3.87E	1500146 AM

Methods:  
211.13 3 Step C100  
File: Linear Calibration Set 1

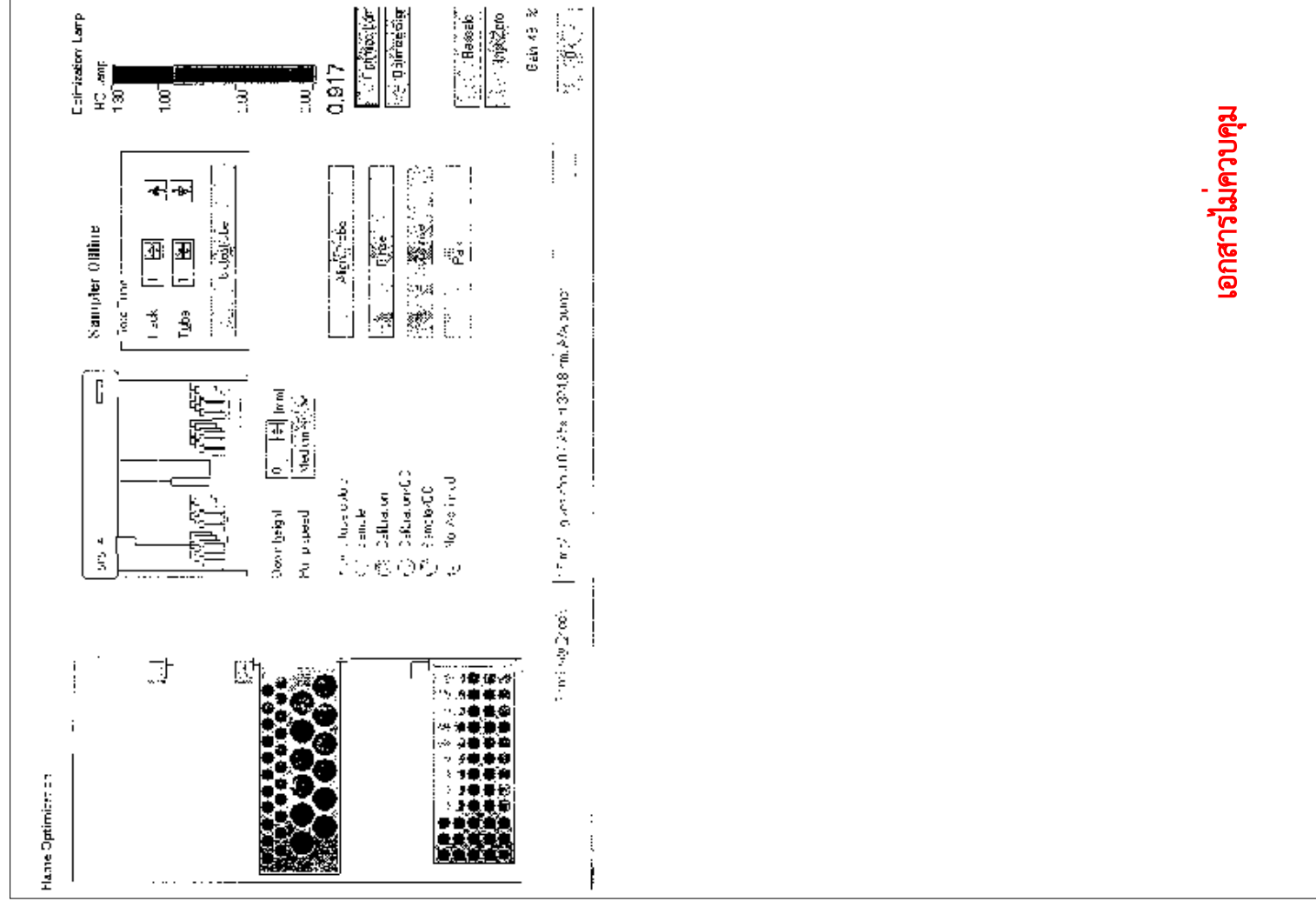
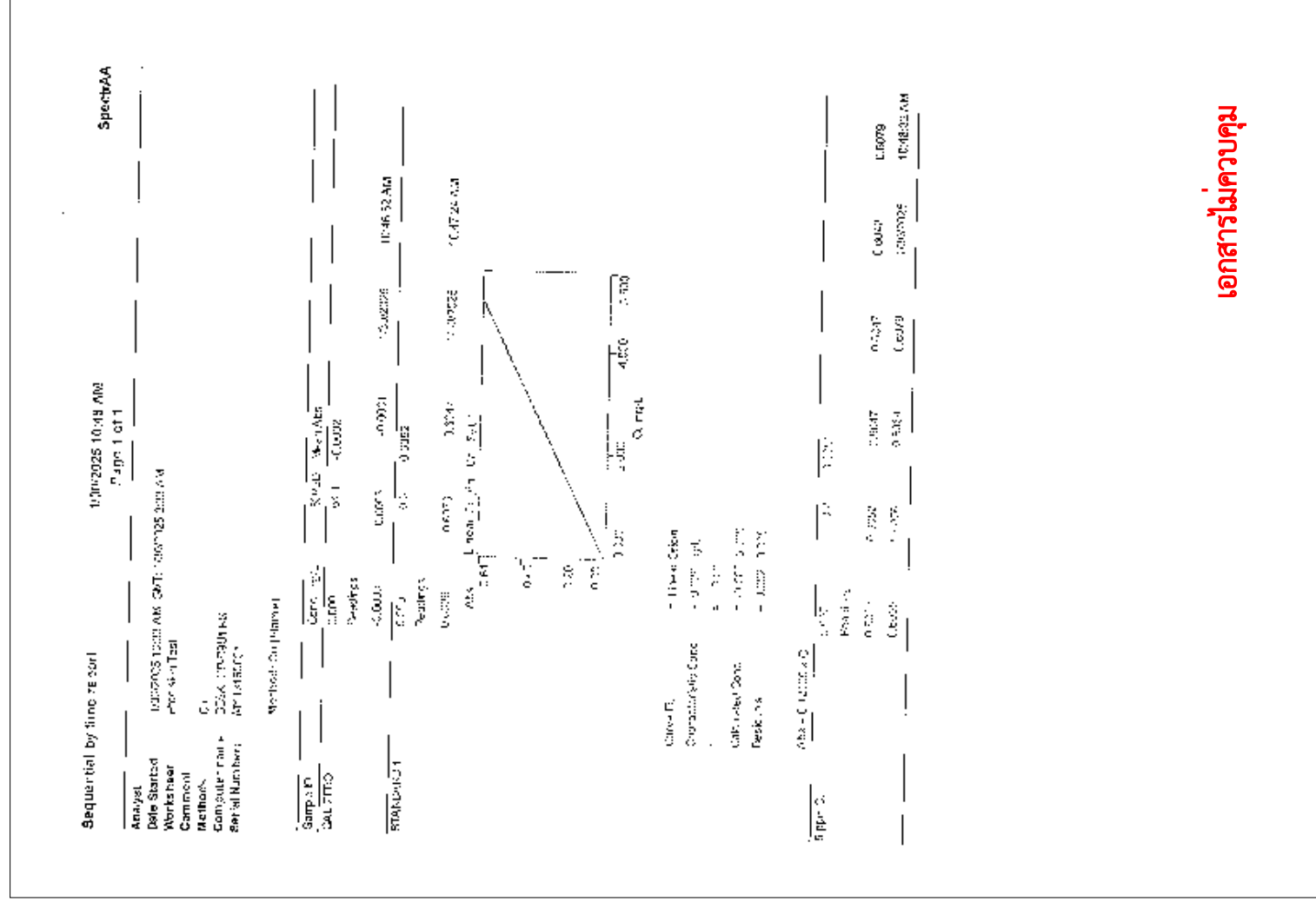


Curve Fit: - Linear Fit  
Characteristic Curve: - 2.00E+01  
1 - 5.100E+00  
Calculated Conc: - 0.0002  
Residuals: - 0.00E+00

ALS: J1147 x 2

Spectrum	0.002	0.002	0.0001	15000225
	0.001	0.1	3.87E	1500146 AM

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United Analyst and Engineering Consultant Co., Ltd.

Automatic Mercury Analyzer

Model : RA-4500

Preventive Maintenance Report

SERIAL No. RA-4500 : 11780278

Soft version : Ver 2.0.5

ROM version : Ver 2.0.2

DATE : 02 JULY 2025

DUE DATE : 02 JULY 2026

INSPECTED BY : *Natthaphong P.*  
( Natthaphong P. )

APPROVED BY : *Kitichai S.*  
( Kitichai S. )



Kinetic Solutions Company Limited.

2, Soi Lat Krabang 1, Lat Krabang Subdistrict,

Lat Krabang District, Bangkok 10520

Tel. (+66) 062-789-5221

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Inspection

ITEMS	SPECIFICATIONS	RESULT	JUDGE
1. Quantity	Accessories are completed.	GOOD	OK
2. Appearance	No visible damage.	GOOD	OK
2.2 Parts / Cables	Correctly placed and connected.	GOOD	
3. Indication	Plate and Label are indicated.	GOOD	OK
4. Self Check			
4.1 GLP Counter	Mercury Lamp	5000 hours	110 hr
	Membrane Filter	2000 hours or 1 year after replace	< 1 hr
	Main Pump Tube	750 hours or 1 year after replace	< 1 hr
	Absorbed Hg	1500 mg	< 1 hr
	P1 Tube	2000 hours or 1 year after replace	< 1 hr
	P2 Tube	2000 hours or 1 year after replace	< 1 hr
	P3 Tube	2000 hours or 1 year after replace	< 1 hr
	P4 Tube	2000 hours or 1 year after replace	< 1 hr
	P5 Tube	2000 hours or 1 year after replace	< 1 hr
	P6 Tube	2000 hours or 1 year after replace	< 1 hr
	P7 Tube	2000 hours or 1 year after replace	< 1 hr
	Heater	2000 hours	42 hr
4.2 Check/Test	Flow rate Adjustment	Flow rate 0.14 - 0.20 L/min	0.18 L/min
	Signals Detector	V.SIG is 3.5 - 4.5 V.	4.03 V.
		V.REF is 3.5 - 4.5 V.	4.03 V.
	Cooling Fan	Check the operation of cooling fan	PASS
	Color Sensor	signals (P.S.B) at least one nonzero	PASS
	Radiation Thermometer	a positive valve form thermometer	PASS
	Heater	heater temp rises 4 °C within 5 min.	PASS
5. Heater	Temperature	At 95 °C ± 2 °C with 30 min.	94.7 °C
6. Calibration Curve	no pre-treatment	0-10ug ; Max Dev. 5.0%	0.90%
7. Reproducibility	100 µg/L (n=5)	Average: 100 ± 5 µg/L	101.4 µg/L
		C.V. ≤ 5.0%	0.71%
8. Blank	no pre-treatment	Less than 0.5 (AREA)	0.103 AREA

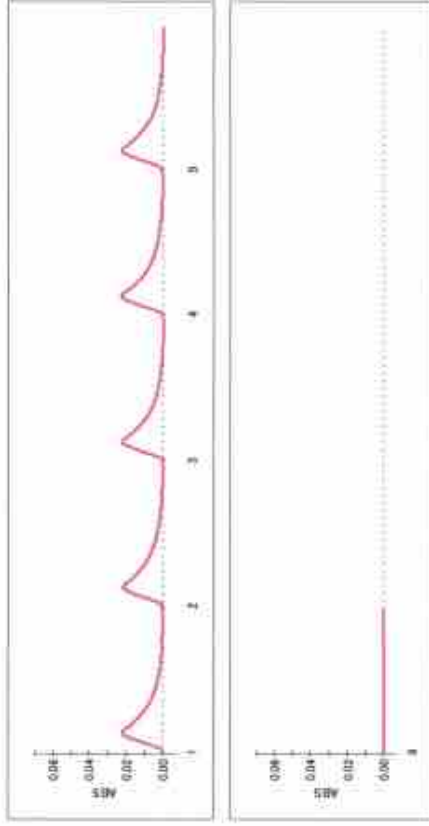
Apparatus

NAME	Date Certified	Expiration
Mercury (CP Standard 1000 µg/mL) AccuStandard, Inc. Lot 223035027	March 10, 2023	March 10, 2028

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Self Check  
 Heat check: PASS!! ( 25.7deg(05:00) -> 28.7deg(02:28)  
 Sensor check: PASS!! ( 263- [5- 128]  
 Leak check: PASS!! (0.1BL/min)  
 S/E/Ref check: PASS!! (31.6 & 0.3V, Ref: 4.01V)  
 Drift check: PASS!! ( 0.0000037 -> -0.0000026 = 0.0000063)

120 Standard Stock  
 Item Name: C7 2015  
 Date: 2023-06-10

**AccuStandard, Inc.**

**CERTIFICATE OF ANALYSIS**

For 2023-06-10  
 For 2023-06-10  
 www.AccuStandard.com

**AccuTrace™ Reference Standard**

Catalog No: ICP-JUN-1  
 Description: Mercury ICP Standard  
 Element: Mercury (Hg)  
 BRM: 3133  
 Lot: 220355027  
 Matrix: 10% Nitric Acid  
 Hazards: Refer to SDS for complete safety information

Date Certified: Mar 10, 2023  
 Expiration: Mar 10, 2025  
 Density: 1.052 g/mL  
 Sample Size: 100 mL  
 Components: 1  
 Storage Condition: Ambient (p>5 °C)

**Certified Reference Material**

Signal Word: Danger

**Certified Concentration: 1000 µg/mL**

Trace Elements in µg/mL	
Ag	nd+0.02
Al	nd+0.02
As	nd+0.2
Au	nd+0.02
B	nd+0.2
Ba	nd+0.02
Be	nd+0.02
Bi	nd+0.2
Cd	nd+0.02
Ca	nd+0.2
Ce	nd+0.02
Co	nd+0.2
Cu	nd+0.02
Dy	nd+0.02
Er	nd+0.02
Eu	nd+0.2
Fe	nd+0.02
Ga	nd+0.02
Ge	nd+0.02
Hf	nd+0.02
Hg	1000.00
Ir	nd+0.2
K	nd+0.02
La	nd+0.02
Li	nd+0.02
Mn	nd+0.02
Mo	nd+0.02
Nb	nd+0.02
Ni	nd+0.2
Nd	nd+0.02
Os	N/A
P	nd+0.02
Pb	nd+0.02
Pr	nd+0.02
Rb	N/A
Rh	nd+0.2
Ru	nd+0.02
S	N/A
Sb	nd+0.02
Se	nd+0.02
Si	N/A
Sm	nd+0.2
Sr	nd+0.02
Ta	nd+0.02
Tb	nd+0.02
Ti	nd+0.2
Tl	nd+0.02
U	nd+0.2
V	nd+0.02
W	nd+0.2
Y	nd+0.02
Yb	nd+0.02
Zn	nd+0.2
Zr	nd+0.02

The Certified Reference Material was verified in accordance with ISO/IEC 17025 (AT-7338) and ISO 17034 (AT-1463). The solution was analyzed gravimetrically using a balance calibrated against weight sets (D 886771), traceable to NIST. A product with a purity of 99.999% was used for the gravimetric analysis. The gravimetric analysis was performed in accordance with ISO 9001:2015. The product contains mercury and must be disposed of in accordance with all federal, state and local regulations. The gravimetric uncertainty for this product is ±0.2%. The CRM uncertainty is ±0.2%.

In order to verify the concentration, the test solution was checked by plasma emission spectrometry (ICP) against materials traceable to the above listed NIST SRMs.

We use the highest purity raw materials available to minimize impurity levels in the final solution. Typically, 99.999% pure starting materials are used as well as high purity acids and ASTM Type 1.8 Phosphate distilled water.

All trace level element impurities were determined via plasma emission spectrometry on the concentrate.

All weights are traceable through NIST. Test No. 184279134.16.5 (184252605.18).

All glassware used in preparation is Class A.

All bottles are acid washed and kept closed with deionized water prior to use.

Shake gently prior to use and do not pipette directly out of the bottle. Use only certified Class A volumetric glassware. Keep bottles tightly sealed.

Certified By:

AccuStandard is accredited to ISO 17034, ISO/IEC 17025 and certified to ISO 9001:2015

For use as a reference laboratory analysis

Page 1 of 1

**1. Quality Standards:**

- ISO 17024:2018 – General Requirements for the Competence of Reference Material Producers
- ISO/IEC 17025:2017 – General Requirements for the Competence of Testing And Calibration Laboratories
- ISO 9001:2015 – Quality Management System – Requirements
- Eagle Registrations

**2. Intended Use:** The product covered by this certificate is designed for calibration or for use in quality control procedures for the specified chemical compounds listed on the reverse side. This product can be used for quantification and/or identification. This product can also be used as a reference material to validate analytical procedures, subject to the conditions under Section 7.

**3. Manufacturing:** All balances are calibrated daily using an in-house procedure with weights that are compared annually to master weights and traceable to NIST. The balances are also calibrated annually by an ISO/IEC 17025 accredited calibration laboratory. Please refer to the NIST test number listed on the front of this certificate. Class A glassware is used in the manufacture and quality control of all standards. Good Laboratory Practices have been used throughout the preparation of this Standard.

**4. Homogeneity:** This product is sufficiently homogeneous and any sample size would be within the uncertainty budget.

**5. Stability:** The manufacturer guarantees the stability of this solution through the expiration date stated on the label when handled and stored according to the conditions stated on the label.

**6. Uncertainty:** The uncertainty values as stated on the face of this certificate have been determined using the EURACHEM/CITAC Guide. We report a combined expanded uncertainty equal to the positive square root of the total variance of the uncertainty of the components using the following formula:  $u_c = \sqrt{(u_{\text{NIST}})^2 + (u_{\text{volume}})^2 + (u_{\text{stability}})^2}$ . This formula represents uncertainty components from the mass, volume, short-term stability, long-term stability and homogeneity factors associated with the production of this product. The expanded uncertainty assumes a normal distribution and a coverage factor of k=2 is chosen using approximately a 95% confidence level.

**7. Legal Notice and Limit of Liability:** This product is for routine laboratory analysis and research purposes only. The company's liability will be limited to replacement of product or refund of purchase price. Notice of claims must be made within thirty (30) days from date of delivery.

**CERTIFICATE OF CALIBRATION**

Certificate No. : SP25-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhunong, 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 :

ปณณ

(Mr. Tanawat Eritdach)

Technical Manager

Approved by :

ชุตติยา

(Ms. Chonthicha Saengjien)

Quality Manager

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

This instrument's 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 prior written approval of DQE Services Co., Ltd.

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REPORT OF CALIBRATION

Certificate No. : SP25-001

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Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-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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REPORT OF CALIBRATION

Certificate No. : SP25-001

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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
	1.0230	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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PM-006-03 Rev. 01/11/2023

## REPORT OF CALIBRATION

Certificate No. : SP25-001

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Photometric Accuracy :

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

## REPORT OF CALIBRATION

Certificate No. : SP25-001

Page 5 of 5

Wavelength Accuracy :

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

Remark : - UVC = Ultraviolet Calibration

- N/A = Not Available

- The result reported 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



CERTIFICATE OF CALIBRATION

Certificate No. : SP25-019

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomrith 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 26 May 2025

Calibration Date : 26 May 2025

Issue Date : 29 May 2025

Condition Instrument : Good

Calibrated by : 

Approved by : 

( Mr. Tanawat Rittidach )

( Ms. Chonticha Saenguen )

Technical Manager

Quality Manager

The calibration result is issued only in the above calibration form and will remain in force as long as the date and place of calibration only.

The measurement capability of the laboratory and its responsibility to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced unless that is full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

FSM-700-02-001 (01/2021)

REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5^{\circ}\text{C}$

Relative humidity  $55 \pm 20\% \text{RH}$

Calibration method : In-house method CP-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 Siama Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FSM-700-02-001 (01/2021)

## REPORT OF CALIBRATION

Certificate No. : SP25-019

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	0.0000	0.0000	0.0028	2.00
	0.5780	0.5739	0.0041	0.0031	2.00
	1.0484	1.0430	0.0054	0.0029	2.00
440	2.1876	2.1876	0.0000	0.0084	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
465	1.0239	1.0219	0.0020	0.0035	2.00
	2.1230	2.1207	0.0023	0.0085	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
546.1	0.5230	0.5190	0.0040	0.0029	2.00
	0.9633	0.9609	0.0024	0.0029	2.00
	1.9753	1.9719	0.0034	0.0079	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5161	0.0020	0.0031	2.00
	1.0002	0.9979	0.0023	0.0033	2.00
635	1.9973	2.0021	-0.0048	0.0102	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5503	0.0014	0.0030	2.00
	1.0803	1.0808	-0.0005	0.0031	2.00
	2.0373	2.0324	0.0049	0.0105	2.00
	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5583	0.0008	0.0031	2.00
	1.0518	1.0513	0.0005	0.0030	2.00
	1.9274	1.9281	-0.0007	0.0102	2.00

เอกสารไม่ควบคุม

PM-708-02 Rev 1.0/2021

## REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7488	-0.0019	0.0063	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8663	0.0011	0.0067	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2902	0.0017	0.0052	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6428	0.0002	0.0063	2.00

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PM-708-02 Rev 1.0/2021



REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UTC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage Factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.6	0.21	0.18	2.00
334.06	333.8	0.26	0.18	2.00
369.93	369.5	0.43	0.18	2.00
418.59	417.9	0.69	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.6	0.42	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.5	-0.52	0.18	2.00
431.38	430.7	0.68	0.18	2.00
472.50	472.3	0.20	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.8	-0.63	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.1	-0.38	0.20	2.00
748.55	748.9	-0.35	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.1	0.18	0.18	2.00

Remark : - UTC = 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 -

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PM-709-02 R01 1/11/2023

CERTIFICATE OF CALIBRATION

Page 1 of 5

Certificate No. : SP25-024

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udonnuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 17 June 2025

Calibration Date : 17 June 2025

Issue Date : 20 June 2025

Condition Instrument : Good

Calibrated by : เบญญ์ Approved by : จุลธิ์ชา  
( Mr.Tanawat Rattitach ) ( Ms.Chonitcha Sanggarn )  
Technical Manager Quality Manager

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

The measurement capability of the laboratory and its traceability is recognized against standards and by the unit of measurement indicated at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

เอกสารไม่ควบคุม

PM-709-02 R01 1/11/2023

## REPORT OF CALIBRATION

Certificate No. : SP25-024 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-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 Surma Scientific Limited

Spectral Band Width of UUC : 5.0 nm.

Scan Speed of UUC : 40

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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EE4-206-02 Rev. 3/1/2023

## REPORT OF CALIBRATION

Certificate No. : SP25-024 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	0.574	0.0040	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.185	0.0026	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0035	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.122	0.0010	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0071	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.996	0.0042	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0030	2.00
	2.0373	2.031	0.0063	0.0082	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0030	2.00
	1.9274	1.924	0.0034	0.0081	2.00


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EE4-206-02 Rev. 3/1/2023



DQE Services

DQE Services Co., Ltd.  
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Phone : +66 (0)2 538 2054, Email : dqservicethai@gmail.com

# REPORT OF CALIBRATION

Certificate No. : SP25-024


Page 4 of 5

## Photometric Accuracy :


Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7469	0.000 0.747	0.0000 -0.0001	0.0050 0.0057	2.00 2.00
257	0.0000 0.8674	0.000 0.864	0.0000 0.0034	0.0050 0.0059	2.00 2.00
313	0.0000 0.2919	0.000 0.293	0.0000 -0.0011	0.0050 0.0051	2.00 2.00
350	0.0000 0.6430	0.000 0.639	0.0000 0.0040	0.0050 0.0055	2.00 2.00

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PM-200-02 R01 13/1/2021



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PHONE : +66 (0)2 538 2054, EMAIL : dqservicethai@gmail.com

# REPORT OF CALIBRATION

Certificate No. : SP25-024

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.4	0.60	0.18	2.00
279.30	278.8	0.50	0.18	2.00
288.90	288.3	0.60	0.18	2.00
334.50	333.9	0.60	0.18	2.00
361.40	360.8	0.60	0.18	2.00
418.40	417.9	0.50	0.18	2.00
447.20	446.6	0.60	0.18	2.00
459.30	459.1	0.20	0.18	2.00
537.00	536.4	0.60	0.18	2.00
638.00	637.5	0.50	0.18	2.00
441.29	440.7	0.59	0.18	2.00
479.88	479.4	0.48	0.18	2.00
513.75	513.3	0.45	0.18	2.00
528.59	528.2	0.39	0.18	2.00
575.10	574.5	0.60	0.18	2.00
585.56	585.4	0.16	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.2	0.31	0.20	2.00
747.61	747.0	0.61	0.18	2.00
807.04	806.4	0.64	0.18	2.00
879.68	879.1	0.58	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 is a normal distribution corresponds to a coverage probability of approximately 95%.

- End of Certificate -

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PM-200-02 R01 13/1/2021



## Certificate of Calibration

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

Equipment: Turbidity Meter  
Manufacturer: Oakton  
Model: T100IR  
Serial No.: 1120501017  
ID. No.: UAE.WAT.058/2583  
Condition As-Received:  
Received Date: 05 September 2024  
Calibration Date: 06 September 2024  
Reference: 2409-0177DSC-1  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsak 41, Sukhumvit Road,  
Bangchak, Phraekhanong, Bangkok 10260

Ambient Temperature:  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity:  $(50 \pm 20) \%$   
Calibration Procedure: In-house method: CP-CH11  
Direct measurement by  
using Formazin standard solution

Calibrated by: Walailak Srithean

Approved by:   
Approved Signatory

( ) Unichaphol Harachai  
( ) Pongpan Pajitni  
(✓) Sathip Meangmai

Issue Date: 9 September 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 Calibration and Testing Equipment Services.

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

### Condition of this calibration result

#### 1. Reference Standard Instruments:

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrogaph	1103328	130EC010	24H1372	12 July 2025
2) Electronic Balance	1126143764	140RC004	22MM22	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	0000493847	99.65%
2) Hydrozinium 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 ( $\pm$ NTU )	Coverage Factor K
0	0.00	0.0081	2.08
20	20.2	0.39	2.00
100	100	0.75	2.00
400	401	1.5	2.08
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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## Certificate of Calibration

Cert.No.: 24CH1379  
Page.: 1 of 3

**Equipment:** pH Meter  
**Manufacturer:** EcoSense  
**Model:** pH100A  
**Serial No.:** JC03354  
**ID No.:** UAE.EFM.063/2562(ENV.pH03/62)  
**Condition As-Received:** Used Item  
**Received Date:** 05 November 2024  
**Calibration Date:** 06 November 2024  
**Reference:** 2411-0122WSC-1  
**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 Lemgagrakul

**Approved by:** \_\_\_\_\_  
Approved Signatory

( ) Unnophol Harachai  
(✓) Ponpan Paipim  
( ) Saithip Meangmai

**Issue Date:** 8 November 2024

The Uncertainties are for a confidence probability of approximately 95%  
This certificate may not be reproduced other than in conjunction with the print version  
Approval of this kind of document is subject to 3. Management Certification and Testing Services

เอกสารไม่ควบคุม



Cert.No.: 24CH1379  
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-15184-01-00

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00

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Cert.No.: 24CH1379  
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.:240710SIA605377	4.008	4.01	173	0.0079	2.00
	6.999	7.00	-2	0.0092	2.00
	6.999	7.00	-2	0.0095	2.00
	10.010	10.01	-178	0.0092	2.00

##### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 240710SIA605377
- Dimension of probe
  - Length : 110 mm.
  - Diameter : 12 mm.
  - Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ( $\pm$ °C)	Coverage factor $k$
15.0	15.003	14.9	-0.103	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.003	44.8	-0.203	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 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



## Certificate of Calibration

Cert. No.: 25TM1002  
Page : 1 of 3

Equipment : BOD Incubator  
Manufacturer : AIRCO  
Model : UC4-1320  
Serial No. :  
ID No. : UAE.WAD.002/2550  
Submitted by : United Analyst and Engineering Consultant Co.Ltd.  
3 Soi Udomrui 41, Sukhumvit Road,  
Bangchak, Phraekhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 07 July 2025  
Calibration Date : 07 July 2025  
Ambient Temperature : (26  $\pm$  10 ) °C  
Relative Humidity : ( 50  $\pm$  30 ) %  
AC Line Voltage : ( 220  $\pm$  22 ) V  
Calibrated by : Man Pattanasongpaboon  
Approved by : Kunchit  
Approved Signatory  
( ) Chakrit Waeewangua  
( ) Suwit Injai  
(✓) Kunchit Promprat  
Issue Date : 17 July 2025

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 : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2507-01460C-3

Cert. No.: 25TM1002  
Page : 2 of 3

#### Procedure Used :-

Calibration was conducted using calibration procedure CP-QT02 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 : MY59003411  
Serial No. : 24LM192  
Traceable : TPA  
Due Date : 24 Dec 2025

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

3. This measurement result is traceable to the International System of Unit maintained through :

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

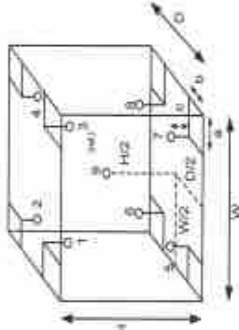
#### Result of Calibration :-

Function of UUC\* : ( \* ) Without Adjustment

Fresh air setting : Temperature Source

Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL.Humid. ( % )	57	58
AC Supply ( Volt )	225	225



#### 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>

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2507-01460C-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 25TM1002  
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	19.9	0.48	0.46	1.2	2

Measured Temperature ( °C )								
Position								
1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.225	20.265	20.121	19.607	19.971	20.055	19.872	18.925
								0.72

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.: 25CH246  
Page.: 1 of 3

Equipment : Conductivity Meter  
Manufacturer : Horiba  
Model : LAQUA-EC210  
Serial No. : HC1L0026  
ID No. : UAE.EFM.015/2565(EFM.SCT.02/65)  
Condition As-Received:  
Received Date : 25 February 2025  
Calibration Date : 26 February 2025  
Reference : 2502-0787WSC-3  
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-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard  
Calibrated by : Warakorn Lengagrakul  
Approved by :   
( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
Issue Date : 27 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH246  
Page.: 2 of 3

**Condition of this result of calibration**

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	241995	09 Sep 2025
2) Ref. Std. Thermometer	4982054	110RC044	241757	14 July 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)
2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1412.9 $\mu\text{S/cm}$	CPA Chem	1005307	15 June 2025
12.881 $\text{mS/cm}$	CPA Chem	1005308	15 June 2025

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ )  $^{\circ}\text{C}$
3. This certificate is valid only to the item calibrated on date and place of calibration.

**Calibration results**

**Function : Conductivity Measurement**

( \* ) After Adjustment at 1412.9  $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 9B1J0077

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor <i>k</i>
1412.9 $\mu\text{S/cm}$	1471 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.881 $\text{mS/cm}$	13.33 $\text{mS/cm}$	12.90 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00

**Remark :** - UUC\* = Unit Under Calibration



Cert.No.: 25CH246  
Page.: 3 of 3

**Calibration Results**

**Function : Temperature Measurement**

This equipment was connected with Temperature Probe;

- Model : 9383  
- Serial No. : 9B1J0077  
Dimension of probe;  
- Length : 110 mm  
- Diameter : 16 mm  
- Immersion Depth : 90 mm

**Calibration Result : Without adjustment**

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of Measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor <i>k</i>
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.002	45.1	0.098	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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## Certificate of Calibration

Cert.No.: 25CH261  
Page.: 1 of 3

Equipment: pH Meter  
Manufacturer: Horiba  
Model: LAQUA-PH210  
Serial No.: HA0C0025  
ID No.: UAE EFM:1172563(EFM.pH.07/63)  
Condition As-Received:  
Received Date: 25 February 2025  
Calibration Date: 26 to 28 February 2025  
Reference: 2502-0783WSC-1  
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 Lemgagrakul

Approved by :  
Approved Signatory

( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 28 February 2025

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

### 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-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 4.007	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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA0C0025	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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Cert.No.: 25CH261  
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.: Q9AG0214	4.007	4.01	178.4	0.0071	2.00
	6.999	7.00	4.1	0.0092	2.00
	6.999	7.00	3.0	0.0095	2.00
	10.010	10.01	-169.8	0.0092	2.00

##### Function : Temperature Measurement

###### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AG0214

Dimension of probe

- Length : 110 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
45.0	45.002	44.9	-0.102	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)  
COMPARATIVE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
500/4 PATTANANATHI ROAD JOM TR. UYANA LAMU, BANGKALANG BANGKOK 10260  
TEL. 0-2511-2000-30 FAX 0-2511-4400



## 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)  $^{\circ}\text{C}$

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 Lemgagtrakul

Approved by :

Approved Signatory

( ) Chakrit Waewwanjua

( ) Ponpan Palpim

(✓) Sathip Meangmai

Issue Date :

28 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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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-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

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 (±mV)	Coverage factor k
			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

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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 (±)	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

##### (\*) 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 (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PETCHABURI ROAD JOO IN SUKUMVIT ROAD, SUKHUMVIT BANGKOK 10260  
TEL: 02-2711-2225-2226-22 FAX: 02-2711-1600



## Certificate of Calibration

Cert.No.: 25CH354  
Page.: 1 of 3

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Condition As-Received:

Received Date :

Calibration Date :

Reference :

Submitted by :

pH Meter

Horiba

LAQUA-PH210

HA9M0047

UAE.EFM.005/2563 (EFM.pH.05/63)

Used Item

18 March 2025

20 March 2025

2503-0612WSC-2

United Analyst and Engineering Consultant Co.,Ltd.

3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,

Phrakhanong, Bangkok 10260

Ambient Temperature :

Relative Humidity :

Calibration Procedure :

(25 ± 2.5) °C

(50 ± 15) %

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 :

Approved by :

Uthen Kankawi

Approved Signatory

( ) Chakrit Waewwanjua

( ) Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

20 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of this record of Calibration Services is: Accredited Calibration and Testing Services

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### Condition of this calibration result

1. Reference Standard Instrument

Instrument

1) Document Process Calibrator 43160066 130RC092 24E1320 22 Apr 2025

2) Ref. Standard Thermometer 4982054 110RC044 24I757 14 Jul 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-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 4.007

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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA9M0047	pH	mV				
	4.00	177.48	177.7	4.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	7.00	0.00	0.3	7.01	0.058	2.00
	10.00	-177.48	-176.8	10.01	0.058	2.00

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### 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 (±)	Coverage factor <i>k</i>
pH Electrode	4.007	4.01	168.5	0.011	2.13
S/N.: -	6.999	7.00	-5.9	0.012	2.09
	6.999	7.00	-6.1	0.011	2.07
	10.010	10.02	-176.7	0.010	2.00

#### Function : Temperature Measurement

##### (\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : -
- Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
15.0	15.005	15.0	-0.005	0.13	2.00
30.0	30.007	30.0	-0.007	0.13	2.00
45.0	44.995	44.9	-0.095	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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## Certificate of Calibration

Equipment :

pH Meter

Manufacturer :

Horiba

Model :

LAQUA-PH210

Serial No. :

HA9M0048

ID No. :

UAE.EFM.003/2563(EFM.pH.03/63)

Condition As-Received:

Used Item

Received Date :

20 May 2025

Calibration Date :

21 May 2025

Reference :

2505-0602WSC-1

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-CH6 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by :

Walalak Sirithean

Approved by :

Saithip

Approved Signatory

( ) Chakrit Waewwanjua

( ) Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

23 May 2025

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Cert.No.: 25CH586  
Page.: 2 of 3

#### Condition of this calibration result

##### 1. Reference Standard Instrument

###### Instrument

- | Serial No. | ID No.   | Cert. No. | Due Date     |
|------------|----------|-----------|--------------|
| 54030049   | 130RC116 | 24E2759   | 25 Aug 2025  |
| 4982054    | 110RC044 | 24I757    | 14 July 2025 |
- This measurement result 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-ASO National Accreditation Board, Accredited No. AR-1835

###### Buffer Solution

Manufacturer	Lot No.	Exp. date
CPA chem	1066665	18 Jan 2027
Hach Lange GmbH	C03232	02 Dec 2026
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 (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: HA910048	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	0.00	0.0	7.00	0.058	2.00
		-177.48	-177.5	10.01	0.058	2.00

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Cert.No.: 25CH586  
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 (±)	Coverage factor k
pH Electrode S/N.: Q9AD0211	4.007	4.01	189.9	0.0071	2.00
	7.000	7.00	-3.5	0.0096	2.00
	7.000	7.00	-3.0	0.0092	2.00
	10.010	10.01	-175.3	0.0096	2.00

##### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q9AD0211

Dimension of probe

- Length : 103 mm.

- Diameter : 16 mm.

- Immersion Depth : 80 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.002	15.0	-0.002	0.13	2.00
30.0	29.998	30.0	0.001	0.13	2.00
45.0	45.001	45.0	-0.001	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 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



NSC-TSI-TIS 7025  
CALIBRATION 0038

## Certificate of Calibration

Cert.No.: 25CH588  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HA0D0082  
ID No. : UAE.EFM.072/2664(EFM.pH.05/64)  
Condition As-Received :  
Received Date : 20 May 2025  
Calibration Date : 21 May 2025  
Reference : 2505-0602WSC-3  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Calibration Procedure : In - house method  
- CP-CHS by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
- CP-CHS by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by :   
Approved Signatory

( ) Chakrit Waewwanjua  
( ) Ponpan Paipim  
(✓) Sathip Meangmai

Issue Date : 23 May 2025

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Cert.No.: 25CH588  
Page.: 2 of 3

### Condition of this calibration result

#### 1. Reference Standard Instrument

##### Instrument

Serial No.	ID No.	Cert. No.	Due Date
54030049	130RC116	24E2759	25 Aug 2025
4982054	110RC044	24I757	14 July 2025

1) Document Process Calibrator

2) Ref. Standard Thermometer

- This measurement result 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 Akkreditierungsgesellschaft, 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

Lot No.	Exp. date
1066665	18 Jan 2027
C03232	02 Dec 2026
1066669	18 Jan 2026

##### Manufacture

CPA chem

Hach Lange GmbH

CPA chem

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 ( $\pm\text{mV}$ )	Coverage factor $k$
		pH	mV	mV	pH		
pH Meter S/N.: HA0D0082	4.00		177.48	177.3	4.01	0.058	2.00
	7.00		0.00	0.0	7.00	0.058	2.00
	7.00		0.00	0.0	7.00	0.058	2.00
	10.00		-177.48	-177.3	10.01	0.058	2.00

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Cert.No.: 25CH588  
Page: 3 of 3

#### Calibration Results

Function : pH Measurement

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

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.L: Q9AA0036	4.007	4.01	160.4	0.0086	2.05
	7.000	7.00	-13.5	0.0095	2.00
	7.000	7.01	-12.6	0.0096	2.00
	10.010	10.00	-186.0	0.0092	2.00

Function : Temperature Measurement

( $^{\circ}$ ) Without adjustment

This equipment was connected with Temperature Probe:

- Model : 9652-10D

- Serial No. : Q9AA0036

Dimension of probe

- Length : 103 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	15.002	15.0	-0.002	0.13	2.00
30.0	29.999	30.0	0.001	0.13	2.00
45.0	45.001	45.0	-0.001	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 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARIN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484

## Certificate of Calibration

Cert.No.: 25CH1053  
Page: 1 of 2

Equipment : Turbidity Meter  
Manufacturer : Oakton  
Model : T100IR  
Serial No. : 1120501017  
ID. No. : UAE-WAT 056/2503  
Condition As-Received : Used Item  
Received Date : 05 September 2025  
Calibration Date : 08 September 2025  
Reference : 2509-0212DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsak 41, Sukhumvit Road, Bangkok,  
Phrakhamong, Bangkok 10250  
Ambient Temperature : (23  $\pm$  3.0)  $^{\circ}$ C  
Relative Humidity : (50  $\pm$  20) %  
In-house method : CP-CH11  
Dried measurement by using Formazin standard solution  
Calibrated by : Walalak Siritraan  
Approved by : *Sutthip*  
Approved Signatory  
( ) Chakrit Waiwongwut  
( ) Poranan Pajipim  
(☒) Sathip Meangmual  
Issue Date : 8 September 2025

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

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Approval of the Head of Calibration and Testing Equipment Services.

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Cert. No. : 25C-11063  
Page. : 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instruments :

Instruments	ID No.	Certificate No.	Due date
1) Data Logger	130EC012	24H2043	23 Sep 2025
2) Liquid-In Glass Thermometer	130RC003	25440	16 Apr 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand + Japan)

##### 2. Certified Reference Materials :

Turbidity Standard solution (Formazin)  
- The measurement results are traceable to SI through CPA chem Ltd.,

Turbidity Solution	Manufacturer	Lot No.	Exp. date
20.0 NTU	CPA Chem	1088008	18 Mar 2026
100.0 NTU	CPA Chem	1088007	18 Mar 2026
400 NTU	CPA Chem	1088018	18 Mar 2026
800 NTU	CPA Chem	1088017	18 Mar 2026

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 : 1170501017

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
0	0.00	0.026	2.00
20.0	20.2	0.20	2.00
100.0	100	1.2	2.00
400	403	2.4	2.00
800	799	4.3	2.00

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

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534-4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-28 FAX.0-2719-9484



## Certificate of Calibration

Cert. No.: 25TMA578  
Page : 1 of 3

Equipment : BOD Incubator  
Manufacturer : ARCO  
Model : UR-1120  
Serial No. : \*  
ID No. : UAE WAO.006/2553  
Submitted by : United Analyst and Engineering Consultant Co. Ltd.  
3 Sol Udomak 41, Sukhumvit Road,  
Bangkok, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 19 March 2025  
Calibration Date : 19 March 2025  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
AC Line Voltage : ( 220 ± 22 ) V  
Calibrated by : Man Pattanasongpaiboon  
Approved by : Kunchit  
Approved Signatory

( ) Chairit Waewwanjua  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 27 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2503-04370C-2

Cert. No.: 25TM578  
Page : 2 of 3

Procedure Used :-  
Calibration were conducted using calibration procedure CP-QT02 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 MY44073381  
Serial No. 24LM73  
Traceable TPA  
Due Date 18 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.

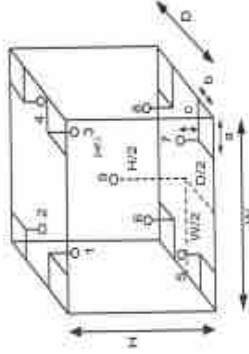
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL Humid. ( % )	56	55
AC Supply ( Volt )	224	224



#### Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm
D =	0.82	m
W =	1.2	m
H =	1.2	m
Capacity =	0.89	m <sup>3</sup>

#### Dimension of Chamber :

D =	0.82	m
W =	1.2	m
H =	1.2	m
Capacity =	0.89	m <sup>3</sup>



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2503-04370C-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 25TM578  
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	19.8	0.49	0.69	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (±°C)
	Position								
20.0	1	2	3	4	5	6	7	8	
	20.025	19.753	20.063	19.839	20.103	20.066	20.152	20.211	
								0.69	

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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3, EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARNI ROAD SOI 18, SUANLUANG, SUKHLIANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-5484



## Certificate of Calibration

Cert. No.: 25TM579  
Page : 1 of 3

Equipment : Hot Air Oven  
Manufacturer : Memmert  
Model : UF 55  
Serial No. : B212.04.11  
ID No. : UAE.WAO.0052556  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Sa Udomrauk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10250  
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 Paltanapongpaiboon

Kunchit

Approved Signatory

( ) Chakrit Wiewwarjua  
( ) Suwit Imjai  
(✓) Kunchit Prompror

Issue Date : 27 March 2025

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

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

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Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2503-0437OC-3

Cert. No.: 25TM579  
Page : 2 of 3

### Procedure Used :-

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

The Temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument : Serial No. : Cert. No. : Due Date :  
1) Data Acquisition : MY44073381 : 24UM73 : 18 May 2025

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certificate is traceable to the International System of Unit.

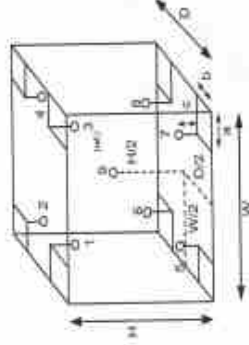
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- ( ° ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	28
REL Humid ( % )	49	55
AC Supply ( Volt )	221	224



Ref. Std. ID No.: 06 Calibration Point		
Position : ( 120, 180 ) °C	( 104 ) °C	
1	23-01TC-01	1RTD-2/1
2	23-01TC-02	1RTD-2/2
3	23-01TC-03	22-01RTD-03
4	23-01TC-04	1RTD-2/4
5	23-01TC-05	1RTD-2/5
6	23-01TC-06	1RTD-2/6
7	23-01TC-07	23-01RTD-07
8	23-01TC-08	1RTD-2/8
9 (ref.)	23-01TC-09	23-01RTD-09

### Probe Installation Details :

Probe Installation Details : Dimension of Chamber :  
a = 5.0 cm D = 0.50 m  
b = 5.0 cm W = 0.80 m  
c = 5.0 cm H = 0.75 m  
Capacity = 0.30 m<sup>3</sup>

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**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2503-0437QC-3  
**Result of Calibration :** (\*) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

Cert. No.: 25TM539  
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
104.0	104.0	104.0	0.040	0.43	0.78	2
120.0	120.0	120.0	0.04	1.3	1.6	2
180.0	180.0	180.0	0.49	1.5	1.8	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.395	104.125	104.363	104.317	103.849	103.738	104.178	104.229	104.025	0.42
120.0	119.575	119.366	119.907	119.905	118.905	119.954	119.194	119.888	119.994	1.1
180.0	180.286	179.510	180.401	180.551	179.281	179.453	180.196	180.451	180.374	1.2

**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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**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
**CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES**  
314/4 PATTANAKARN ROAD 901 18, SUKHLIANG, SUKHLIANG BANGKOK 10250  
TEL: 0-2317-5000 FAX: 0-2319-9484

## Certificate of Testing

Cert.No.: 25TW29  
Page: 1 of 2

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5100  
**Serial No. :** 11B 101863  
**ID No. :** UAE.WAO.004/2554  
**Received Date :** 14 February 2025  
**Test Date :** 17 February 2025  
**Reference :** 2502-0473DSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomrak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
**Laboratory Condition :** Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
In - house method : CP-CHP  
**Test Procedure :** by Comparison Technique with Acide Modification Method

Wataak Sirithuan

Sirithuan

Approved Signatory

( ) Chakrit Waerwanjua  
( ) Ponpan Paipom  
(✓) Siritap Meangmai

Issue Date :

18 February 2025

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Signature \_\_\_\_\_

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Report No.:	13319
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Date:	24 February 2025
Job No.:	11735
Instruments:	KT8100

Start	Travel To Customer (Hrs)		09:00
Finish	07:30	2 hrs	18:00
	08:00		

Application	Special
Distributor	Courtesy Visit
Digital Service	PMA Onboarding
Internal	Warranty
Investigate	Sales Support

PMA Type	Signature
	Signature Advance

[illegible][illegible]

Signed POSS		I confirm this report is
Name		

E-mail:	
*Paraphrase:	



Please scan QR code



## Certificate of Calibration

Certificate No.: 250422-1-BL002-25  
 Code No.: BL002-25

Page: 1 of 3

**Customer Name:** United Analyst and Engineering Consultant Co., Ltd.  
**Address:** 3 Soi Udomsak 41, Sukhumvit Rd., Bang Chak, Prachinburi, Bangkok 10260

**Equipment:** Electronic Balance  
**Manufacturer:** Mettler Toledo  
**Model:** AS204-S/FACT  
**Serial No.:** 1129351010  
**Asset No.:** UAE-WAS.002/2552  
**Building:** N/A  
**Floor:** 1  
**Room:** 107

**Received Date:** April 22, 2025  
**Date of Calibration:** April 23, 2025  
**Calibration Conditions:**  
 Temperature: 22.8 °C to 23.6 °C  
 Humidity: 54.8 % to 68.9 %  
 Pressure: 756.6 mmHg to 758.2 mmHg

**Calibrated by:** Sakarin Srikrang  
**Approved by:** Suwit Chotmrok  
**Signature:**   
**Issued Date:** April 25, 2025

**Note:** 1) The uncertainties are for a confidence probability of approximately 95%  
 2) This Certificate is valid only to the item calibrated on date and scope of calibration.  
 3) 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 United Analyst and Engineering Consultant Co., Ltd. (UAE)

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Certificate No.: 250422-1-BL002-25  
 Code No.: BL002-25  
 Page: 2 of 3

**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** 1129351010  
**Max. Capacity:** 220 g  
**Calibration Date:** April 23, 2025  
**Condition As Received:** In Condition

**Manufacturer:** Mettler Toledo  
**Readability:** 0.0001 g  
**ID No.:** UAE-WAS.002/2552

### Condition of Equipment:

#### Condition of This Result of Calibration:

1. Calibration Method: This instrument was calibrated by method UAE-CP-001-005 In-house Method based on NIST Lab 10 - 2022

#### Reference Standard:

Standard Weight Class F2 (OIML)

Standard Weight Class F2 (OIML)

Standard Weight Class F2 (OIML)

Standard Weight Class F2 (OIML)

Standard Weight Class F2 (OIML)

Standard Weight Class F2 (OIML)

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Standard Weight Class F2 (OIML)

**Traceability:** NIST  
**Certificate No.:** 250422-1-BL002-25  
**Due Date:** 25-Feb-26

**Traceability:** NIST  
**Certificate No.:** 250422-1-BL002-25  
**Due Date:** 25-Feb-26

**Traceability:** NIST  
**Certificate No.:** 250422-1-BL002-25  
**Due Date:** 25-Feb-26

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**Traceability:** NIST  
**Certificate No.:** 250422-1-BL002-25  
**Due Date:** 25-Feb-26

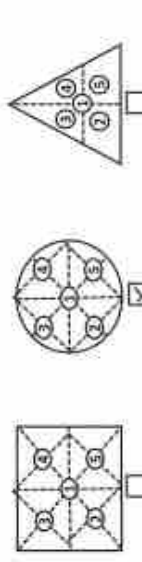
3. This certification is traceable to SI Unit  
 4. This certification was certified only for the instrument we calibrated.  
 5. This result of calibration was found accurate as show on data and place of calibration only.  
 6. Through the reference standard laboratory of AMMC 25-009359 Calibration 01B2

#### Calibration Result:

Repeatability of Reading	Nominal Value (g)	Standard Deviation of Reading (g)
	200*	0.00045

#### 2. Eccentric or off-center loading

A mass of 100 g was placed and removed in various position on pan  
 The Balance reading obtained is given in the table.



1	2	3	4	5	Maximum Difference (g)
100.0000	99.9998	99.9997	100.0003	100.0005	0.0005

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Verification Certificate

Certificate No.: 2501440-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260

Equipment: Digestion Unit (Heating Block)  
Manufacturer: FOSS  
Model: Tecator Digester 2520  
Serial No.: 91905060  
ID No.: UAE.WAS.030/2566  
Order No.: 2501440  
Operation No.: 2501440-001  
Date of Receipt: 27 January 2025  
Date of Calibration: 27 January 2025

Calibrated by: Mr. Worapong Soukthong  
Approved by: (Mr. Phraphut Tuoajit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team  
Date of Issue: 29 January 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.



Certificate No.: 250422-1-BL002-25  
Code No.: BL002-25  
Page: 3 of 3

Equipment: Electronic Balance  
Model: AB204-S/FACT  
Serial No.: 1129361010  
Max Capacity: 220 g  
Calibration Date: April 23, 2025  
Manufacturer: Mettler Toledo  
Residuality: 0.0001 g  
ID No.: UAE.WAS.002/2552

Calibration Results: (Continued)  
Calibration Range: 0 - 200 g  
Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (± mg)	Coverage Factor k
Unload	0.000000	0.0000	0.0000	0.10	2.05
0.01	0.0100003	0.0099	0.0001	0.10	2.05
0.05	0.05000058	0.0500	0.0000	0.10	2.05
0.1	0.10000012	0.0999	0.0001	0.10	2.05
0.5	0.50000133	0.5000	0.0000	0.10	2.05
1	1.00000105	1.0000	0.0000	0.10	2.05
10	10.0000010	10.0000	0.0000	0.11	2.04
40	40.0000016	40.0000	0.0000	0.14	2.00
50	50.0000056	50.0000	0.0001	0.13	2.00
80	80.000007	80.0000	0.0001	0.15	2.00
100	100.000009	99.9999	0.0001	0.17	2.00
120	120.000011	119.9999	0.0001	0.21	2.00
150	150.0000165	149.9998	0.0001	0.24	2.00
160	160.0000175	159.9997	0.0001	0.26	2.00
200	200.000029	199.9998	0.0001	0.30	2.00

4. Effect of Tare

Tare Load (g)	Tare Load (g)	Indication (g)	Correction (g)
100	20.000094	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000056	59.9997	0.0003
	80.000037	79.9999	0.0001
	100.000018	100.0000	-0.0003

Remarks:

The repeatability of measurement was based on standard uncertainty multiplied by coverage factor k, providing

เอกสารไม่ควบคุม (Uncontrolled Document)



## Verification Report

**Certificate No.:** 2501440-001-01  
**Equipment:** Digestion Unit (Heating Block)  
 Model: Tessor Digester 2030 Serial No.: 91905060  
 Resolution: 1 °C ID No.: UAE WMS-030/2566  
 Manufacturer: FOSS  
**Date of Calibration:** 27 January 2025

Page 2 of 4

**Location:** Dry Laboratory (112), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Environment Condition:** Ambient Temperature ( 20 ± 1 ) °C  
 Relative Humidity ( 58 ± 2 ) %  
 Line Voltage ( 224 ± 1 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by Jert standard thermocouples type R into its Digestion blocks and Calibration according to IEC Method WTE-026 based on BS 4309 : 1968.
  - 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.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	00000550/WV1510403	TC24/0003	5-Jun-2025	N.M. Technical Center Laboratory
	Type R	SJCH1, RCH2, RCH3			

- 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 data and piece of calibration only.
- Condition of Calibrated Item : Good

UUC\* Description  
 Time of Record 1 Hour 6 Minute At 360 °C

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

## Verification Report

**Certificate No.:** 2501440-001-01  
**Equipment:** Digestion Unit (Heating Block)  
 Model: Tessor Digester 2030 Serial No.: 91905060  
 Resolution: 1 °C ID No.: UAE WMS-030/2566  
 Manufacturer: FOSS  
**Date of Calibration:** 27 January 2025

Page 3 of 4

**Calibration point:** 360 °C

**Calibration result:**

Table 1 : Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (± °C)	Standard Thermometer (°C)	Uncertainty (± °C)
1	360	360	0.22	377.84	2.0
2	360	360	0.19	378.68	2.0
3	360	360	0.13	378.70	2.0
4	360	360	0.12	379.82	2.0
5	360	360	0.20	381.01	2.0
6	360	360	0.16	380.48	2.0
7	360	360	0.15	378.22	2.0
8	360	360	0.19	377.99	2.0
9	360	360	0.09	378.48	2.0
10	360	360	0.15	378.17	2.0
11	360	360	0.18	377.64	2.0
12	360	360	0.11	379.27	2.0
13	360	360	0.13	378.14	2.0
14	360	360	0.25	379.11	2.0
15	360	360	0.15	379.63	2.0
16	360	360	0.18	378.05	2.0
17	360	360	0.31	378.44	2.0
18	360	360	0.18	378.79	2.0
19	360	360	0.17	378.41	2.0
20	360	360	0.13	379.24	2.0

Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors for at least half an hour after reaching steady state.

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







## Calibration Certificate

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

Page 1 of 4

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**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**   
 (Mr. Phraphat Tuanyit)  
 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 measurements 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-001 Rev001, 01.01.2016, 26.04.05

## Calibration Report

**Certificate No.:** 2502226-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**ID No.:** UAE.WAO.012/2563  
**Capacity:** 102 g / 220 g

Page 2 of 4

**Environment Condition:** Ambient Temperature: 21.2 °C, 0.6 °C Relative Humidity: 46 ± 3.5 %  
**Place of Calibration:** 208 Science House, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Condition of Equipment:** Good Condition  
**Condition of This Results of Calibrations:**  
 1. Calibration Method: VFI Method W-MAO1 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 E6 100g to 200g BR5567572 TCS MC401605 19 April 2025  
**Instrument** **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**  
 Thermo-Hygro Meter K23-H1 MFLTH 012728 Quality Room 0925-0542 11 February 2016

3. This contribution is traceable to SI UNIT  
 4. This certificate was certified only for the instrument was calibration  
 5. The result of calibration was found accurate as shown on item and place of calibration only

### Calibration Results:

#### 1. Repeatability of Reading:

Normal Value	Standard Deviation of Reading	UCL	LCL
40	0.0000002		
80	0.0000042		
120	0.0000040		
200	0.0000000		

#### 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	2	3	4	5	(Maximum Difference)
100.0003	100.0001	100.0001	100.0001	100.0001	0.0001

for N. Nigubant

FC-001 Rev001, 01.01.2016, 26.04.05

## Calibration Report

**Certificate No.:** 2502226-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g / 0.0001 g  
**ID No.:** (AE-WW2 0127563)  
**Capacity:** 82 g / 220 g

Page 3 of 4

Date of Calibration: 30 March 2025

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Values (Range: 0 - 82 g ; Resolution: 0.0001 g.)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.00000g	2.00
0.001	0.001003	0.001001	0.00000	0.00000g	2.00
0.005	0.005000	0.005000	0.00000	0.00000g	2.00
0.01	0.010003	0.010000	0.00000	0.00000g	2.00
0.05	0.050000	0.050000	0.00000	0.00000g	2.00
0.1	0.100003	0.100000	0.00000	0.00000g	2.00
0.5	0.500000	0.500000	0.00000	0.00000g	2.00
1	1.000003	1.000000	0.00000	0.00000g	2.00
2	2.000000	2.000000	0.00000	0.00000g	2.00
5	5.000003	5.000000	0.00000	0.00000g	2.00
10	10.000000	10.000000	0.00000	0.00000g	2.00
20	20.000000	20.000000	0.00000	0.00000g	2.00
30	30.000000	30.000000	0.00000	0.00000g	2.00
50	50.000000	50.000000	0.00000	0.00000g	2.00
80	80.000000	80.000000	0.00000	0.00000g	2.00

for N. Niyadot

## Calibration Report

**Certificate No.:** 2502226-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g / 0.0001 g  
**ID No.:** (AE-WW2 0127563)  
**Capacity:** 82 g / 220 g

Date of Calibration: 30 March 2025

Calibration Results: (Continued)

Calibration Range: >80-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Values (Range: >80 - 200 g ; Resolution: 0.0001 g.)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
90	89.999910	89.99992	-0.00001	0.00011	2.00
100	100.000000	100.00000	0.00000	0.00010	2.00
110	110.000000	110.00001	0.00000	0.00017	2.00
120	120.000000	120.00002	-0.00001	0.00018	2.00
130	130.000010	130.00003	-0.00001	0.00019	2.00
140	140.000113	140.00012	-0.00001	0.00019	2.00
150	150.000000	150.00002	-0.00001	0.00021	2.00
160	160.000010	160.00003	-0.00001	0.00022	2.00
170	170.000113	170.00012	-0.00001	0.00023	2.00
200	200.000113	200.00012	-0.00001	0.00028	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 %.

for N. Niyadot



## Calibration Certificate

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

Page 3 of 4

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**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 Charonsuk  
 Scientist  
**Approved by**   
 (Mr. Phraphut 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 capability to recognize national standards and as the basis 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.

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2502226-002-01  
**Equipment:** Electronic Balance  
**Model:** XSR205DU  
**Serial No.:** C210685394  
**Capacity:** 82 g / 220 g

Page 2 of 4

**Date of Calibration:** 20 March 2025  
**Environment Condition:** Ambient Temperature: 21.2 °C, Relative Humidity: 48 %  
**Place of Calibration:** 204 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration

1. Calibration Method: 1st Method W-M-011 In House Method based on UKAS Lab 14 : 2019
2. Reference Standards
3. The certificate is traceable to SI UNIT
4. This certificate is certified only for the instrument to be calibrated
5. This result of calibration was found acceptable as shown on trace and place of calibration only.

### Calibration Results

#### 1. Repeatability of Reading:

Normal Value (g)	Standard Deviation of Reading (g)
40	0.000010
80	0.000012
100	0.000010
200	0.000010

#### 2. Off-Center Error:

A mass of 100 g was placed and moved to various positions on pan.  
 The balance reading obtained is given in the table.

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

P-CE-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



เอกสารแนบ



## Calibration Certificate

Certificate No.: 2502229-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchuck, Prakhunong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Incubator)

Manufacturer: MEMMERT

Model: IPP 260

Serial No.: V615.0187

ID No.: UAE-MIC.003/2559

Order No.: 2502229

Operation No.: 2502229-001

Date of Receipt: 19 March 2025

Date of Calibration: 19 March 2025

Calibrated by Mr. Jarawut Pripaswattanasri Approved by

Scientist

(Mr. Paraphat Tuntit) (for)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

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 in 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.

Page 1 of 3

## Calibration Report

Certificate No.: 2502229-001-01  
Equipment: CHAMBER (Incubator)  
Model: IPP 260 Serial No.: V615.0187  
Resolution: 0.1 °C ID No.: UAE-MIC.003/2559  
Manufacturer: MEMMERT  
Date of Calibration: 19 March 2025

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Environment Condition:  
Ambient Temperature: ( 16.2 ± 1 ) °C  
Relative Humidity: ( 32 ± 4 ) %  
Line Voltage: ( 223 ± 3 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by using 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (F): 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.

### 2. Reference Standard Instrument:

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34973A	MY49018851	TE 670477-01	4 May 2025	NATIONAL FOOD INSTITUTE
	RTD	CH101109187001108			

3. This certificate is traceable to International System of Units (SI Units).

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

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

6. Condition of Calibrated item: Good

UUC Description:

Time of Record	Hour	Minute	At	55.0 °C
Fresh air Damper	Open	Close	Position	Fun
	X			

Not Available

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

Page 2 of 3

## Calibration Report

Certificate No.: 2502229-001-01  
Equipment: CHAMBER (Incubator)  
Model: JPP 260 Serial No.: VB13-0107  
Resolution: 0.1 °C ID No.: UAE-MTC-00372559  
Manufacturer: JENDEXERT

Date of Calibration: 19 March 2025 Page 3 of 3

Calibration point: 35.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	15.5	38	220.0
MAX	17.1	35	225.0

Table 1 : 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	
35.0	34.94	34.95	34.91	34.97	35.15	35.01	34.98	35.05	35.12	0.29

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
35.0	35.0	35.0	35.0	0.10	0.21	0.35

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 sensor, for at least half an hour after reaching steady state.  
Uniformity = The minimum 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 %.

## Calibration Certificate

Certificate No.: 2503287-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomauk 41, Sukhumvit Road,  
Bangchack, Prakhomong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave  
Manufacturer: ALP  
Model: CL-40L  
Serial No.: 810610  
ID No.: UAE-MTC-032/2565  
Order No.: 2503287  
Operation No.: 2503287-001  
Date of Receipt: 5 June 2025  
Date of Calibration: 5 June 2025

Calibrated by: Mr. Phuraphat Tuanjit  
Scientist  
Approved by: (Miss Preeyaporn Jaengkarntit)  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team  
Date of Issue: 11 June 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 capability to recognize 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-002 Revision: 01 Date: 20-04-25

## Calibration Report

**Certificate No.:** 2503387-001-01  
**Equipment:** Autoclave  
**Model:** CL-40L  
**Serial No.:** H10010  
**Resolution:** 1 °C  
**ID No.:** UAE-MIC-032/2565  
**Manufacturer:** ALP  
**Date of Calibration:** 5 June 2025  
**Page 2 of 3**

**Location:** Room 301 Media Frequency, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Environment Condition:**  
Ambient Temperature (  $25 \pm 1$  ) °C  
Relative Humidity (  $55 \pm 5$  ) %  
Line Voltage (  $230 \pm 5$  ) Volt

### Condition of this results of Calibration:

1. This instrument was calibrated by insert 3 standard Data loggers with RTD into its autoclave and calibration according to WTE-018 based on BS 2646:1-2021, Autoclaves for sterilization in laboratories

Part 1: Design, construction, safety and performance - Specification.

- The temperature scale used was based on ITS - 90.

- All data show below write final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	RTTemp140-PT	T20527	MC-25-07-18-101	31-Mar-26	MANCHESTER, INC.
	CPH-CH-HITEMP-140	K59708	2503081-002-01	31-Mar-26	WATSON/ALC FOOD
	RTTemp140	F35596	2501835-001-01	22-Feb-26	WATSON/ALC FOOD

3. This certificate is traceable to International System of Units (SI Units)

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

6. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical

7. Condition of Calibrated Item: Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 20 Minute At 115 and 121 °C

8. Result of Calibration :

☒ Without adjustment  
☐ After adjustment

*P. Pongphat*  
11 June 2025

FCS-012 Revision: 01 Date: 20-04-25

## Calibration Report

**Certificate No.:** 2503387-001-01  
**Equipment:** Autoclave  
**Model:** CL-40L  
**Serial No.:** H10010  
**Resolution:** 1 °C  
**ID No.:** UAE-MIC-032/2585  
**Manufacturer:** ALP  
**Date of Calibration:** 5 June 2025  
**Calibration point:** 115 and 121 °C  
**Calibration result:**  

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	25.8	50	223
Max	26.8	59	225

  
**Page 3 of 3**

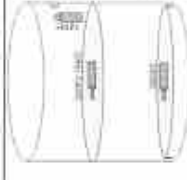


Table 1 : Reporting of Temperature

Measured Temperatures (°C) @ Sensor No. (Sensor No. 2 is REF)				Uncertainty ± (°C)
Calibration Point (°C)	Std. # 1	Std. # 2 (Ref)	Std. # 3	
115	115.46	115.43	115.42	0.70
121	121.59	121.54	121.51	0.70

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)		UUC* Reading		Stability ± (°C)		Overall Variation (°C)	
Min (°C)	Max (°C)	Average (°C)	MPa	Min (°C)	Max (°C)	Min (°C)	Max (°C)
115	115	115	0.08	0.24	0.17	0.50	0.50
121	121	121	0.12	0.24	0.19	0.52	0.52

### Note:

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

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensor.

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 Validation = 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 -----

*P. Pongphat*  
11 June 2025

FCS-012 Revision: 01 Date: 20-04-25



## Calibration Certificate

**Certificate No.:** 2503682-004-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakhong, Bangkok 10260

Page 1 of 3

**Equipment:** CHAMBER (Incubator)  
**Manufacturer:** BINDER  
**Model:** KB 400  
**Serial No.:** 20220000023479  
**ID No.:** UAE.MIC.028/2566  
**Order No.:** 2503682  
**Operation No.:** 2503682-004  
**Date of Receipt:** 1 July 2025  
**Date of Calibration:** 1 July 2025

**Calibrated by** Mr. Phuraphat Tuanje  
**Approved by** P. Pongphatit  
(Miss Prueyaporn Jaengkanit)  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team  
**Date of Issue:** 3 July 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.

F-25-008 Revision: 01 Date: 20/04/83



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## Calibration Report

**Certificate No.:** 2503682-004-01  
**Equipment:** CHAMBER (Incubator)  
**Model:** KB 400  
**Serial No.:** 20220000023479  
**Manufacturer:** BINDER  
**Date of Calibration:** 1 July 2025

**Location:** Microbiology Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Environment Condition:**  
Ambient Temperature ( )  $21 \pm 1$  ) °C  
Relative Humidity ( )  $55 \pm 10$  ) %  
Line Voltage ( )  $230 \pm 5$  ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by input 13 standard thermometer into its chamber and calibration according to WTE-014 based on TIAS G-20-1 (01-08 (E)) Guidelines for Calibration and Checks of Temperature Controlled Enclosures. The temperature scale limit 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 Thermometers with sensor	34072A RTD	HY9003357 CH100-002/RTD-001-001	2503168-001-01	13 January 2026	NATIONAL FOOD INSTITUTE

### 3. This certificate is traceable to International System of Units (SI Units).

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.

### 6. Condition of Calibrated item:

Good

### UUC Description:

Time of Record 1 Hour 9 Minute Alt. 35.0 °C

Fresh air Denial

Open Position

Close

Not Available

### 7. Result of Calibration:

☒ Without adjustment

☐ After adjustment

F-25-008 Revision: 01 Date: 20/04/83



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Condition of this calibration result:

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

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MV44065265	WR2407-141-1	W.R. Electric Co., Ltd.
Digital Thermus-Hygrometer	HT-771SD	AL07155	25H171	Technology Promotion Association (Thailand-Japan)

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	150.4	0.47

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
150.407	150.377	150.369	150.402	150.422
(1B)	(2B)	(3B)	(4B)	(5B)
150.426	150.394	150.644	150.690	150.542
(1C)	(2C)	(3C)	(4C)	(5C)
150.477	150.303	150.627	150.257	150.176
(1D)	(2D)	(3D)	(4D)	(5D)
150.462	150.456	150.199	150.406	150.102
(1E)	(2E)	(3E)	(4E)	(5E)
150.185	150.513	150.235	150.460	150.442

Figure: Shows the location of the temperature source.

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

\*\* End of certificate \*\*

เอกสารไม่ควบคุม

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	PARTICULATE MATTER (PM10)	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19/3/2025	18/3/2026
2	Analytical Balance	PARTICULATE MATTER (PM10)	Mettler Toledo	MX204 / CS11670418	METTLER TOLEDO	TH2068-032-050825-ACC-TH	8/5/2025	7/5/2026
3	Dionex Aquion Ion Chromatography	HYDROGEN CHLORIDE	Thermo Scientific	Dionex Aquion / 220340349	ARCHÉMICA LAB., LTD	ID1048	23/4/2025	22/4/2026


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

## Calibration Certificate

**Certificate No.:** 2502228-003-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**ID No.:** UAE.AIR.023/2566  
**Order No.:** 2502228  
**Operation No.:** 2502228-003  
**Date of Receipt:** 19 March 2025  
**Date of Calibration:** 19 March 2025

**Calibrated by** Mr.Yothin Charoensuk  
 Scientist  
**Date of Issue:** 25 March 2025  
**Approved by**   
 ( Mr.Phraphat Tungsit )  
 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 measurements 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.

Form 001 Revision: 01 Date: 20.01.65

## Calibration Report

**Certificate No.:** 2502228-003-01  
**Equipment:** Electronic Balance  
**Model:** MS204TS/00  
**Serial No.:** C252436235  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.023/2566

Page 2 of 3

**Environment Condition:** Ambient Temperature: 21.3 ± 0.6 °C Relative Humidity: 55 ± 0.25 %

**Place of Calibration:** 208-Buacha Road 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NIST Method W-94-001 In-House Method based on OIML Lait 14: 2019

2. Reference Standards:

**Reference Standard** **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**  
 Standard Weight Class E2 (mg to 200g) M203SE372 TCS K01041006 10 April 2025  
**Instrument** **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**  
 Metro-Highs Meter 828 H4 MFLB11-SE2723 Quality Reform Q02-6542 10 February 2026

3. The certification is traceable to SI UNIT.

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

5. The 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)
100	0.00023
200	0.00029

**2. Off-Center Error:**

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

The balance reading obtained is given in the table.

	1	2	3	4	5	6	Maximum Difference (g)
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
100.0000	99.9995	99.9995	99.9995	99.9995	99.9998	99.9998	0.0003

Form 001 Revision: 01 Date: 20.01.65

## Calibration Report

**Certificate No.:** 2502228-003-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE-AN/07/2566  
**Model:** ME204TN001  
**Serial No.:** C13249235  
**Capacity:** 220 g

**Date of Calibration:** 13 March 2025 Page 3 of 3

### Calibration Results: (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor (k)
Unfired	0.0000	0.0000	0.0000	0.0000H	2.00
5.1	0.1000	0.1001	-0.0001	0.0000H	2.00
1	1.0000	1.0000	0.0000	0.0000H	2.00
2	3.0003	3.0005	-0.0002	0.0000H	2.00
5	3.0003	3.0005	-0.0002	0.0000H	2.00
10	10.0001	9.9999	0.0002	0.0000H	2.00
20	20.0003	20.0000	0.0003	0.0000H	2.00
50	50.0003	49.9998	0.0005	0.0001H	2.00
70	70.0006	69.9998	0.0008	0.0001H	2.00
100	100.0006	99.9998	0.0008	0.0001H	2.00
150	150.0000	149.9990	0.0010	0.0001H	2.00
200	200.0003	199.9990	0.0013	0.0001H	2.00

This 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 -----

*for N. myobots*

F:\CS-012 Project\01 Date: 20.03.25



## Certificate of Calibration

**Aquion: (Anion System ID#1048)**

This certificate is to verify that instrument below are calibrated

By Archemica Lab Co., Ltd.

**Aquion**

**S/N: 220340349**

**For**

**UAE Consultant Co., Ltd.**



**Operator Signature:** Thitipong P. **Date:** Apr 23-24, 2025

(Mr. Thitipong Piromkripuk)

**Test Engineer**

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# Qualification Report

PM\_Checklist: CM\_OQ and PQ  
Aquion: Anion (ID#1048)

For  
UAE Consultant Co., Ltd.  
(1<sup>st</sup> Contract)

เอกสารไม่ควบคุม

# PM

## Preventive Maintenance Check List

เอกสารไม่ควบคุม





### Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization:		Name/ Department
United Analyst and Engineering Consultant Co. Ltd.		K. Suwanra
Engineer:		Date
Mr. Thirapong Promkrijsuk		23-24/Apr/2015

#### Instrument Detail

Instrument Model	Application
Aquion (ID#1048, 1st Contract)	Anion
Instrument Components	Serial Number
Aquion	220380031

#### Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS32	AG22	ASRS300	-	-
Remarks: -				



Perform By Archemica

Archemica  
Date 24 / Apr / 2015  
Customer Siriman  
Date April, 2015

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### General ICS Maintenance Checklist

No.	Description	Result
1	Instrument power on	<input checked="" type="checkbox"/>
2	Instrument connection	<input checked="" type="checkbox"/>
3	Rebuild injection valve 6 port	<input checked="" type="checkbox"/>
4	Rebuild seal	<input checked="" type="checkbox"/>
5	Rebuild seal	<input checked="" type="checkbox"/>
6	Rebuild auxiliary valve - port	<input checked="" type="checkbox"/>
7	Rebuild seal	<input checked="" type="checkbox"/>
8	Rebuild seal	<input checked="" type="checkbox"/>
9	Inlet check valve assembly	<input checked="" type="checkbox"/>
10	Verified current flow indication	<input checked="" type="checkbox"/>
11	Rebuild seal in primary pump head	<input checked="" type="checkbox"/>
12	Rebuild seal in secondary pump head	<input checked="" type="checkbox"/>
13	Rebuild seal in primary pump head	<input checked="" type="checkbox"/>
14	Rebuild seal in secondary pump head	<input checked="" type="checkbox"/>
15	Rebuild seal in primary pump head	<input checked="" type="checkbox"/>
16	Rebuild seal in secondary pump head	<input checked="" type="checkbox"/>
17	Rebuild seal in primary pump head	<input checked="" type="checkbox"/>
18	Rebuild seal in secondary pump head	<input checked="" type="checkbox"/>
19	Rebuild seal in primary pump head	<input checked="" type="checkbox"/>
20	Rebuild seal in secondary pump head	<input checked="" type="checkbox"/>
21	Check conductivity cell	<input checked="" type="checkbox"/>
22	Check electrochemical cell	<input checked="" type="checkbox"/>
23	Working electrode	<input checked="" type="checkbox"/>
24	Reference electrode	<input checked="" type="checkbox"/>
25	Gasket	<input checked="" type="checkbox"/>
26	Gasket	<input checked="" type="checkbox"/>
27	End-line filter	<input checked="" type="checkbox"/>
28	Leak sensor	<input checked="" type="checkbox"/>
29	Leak sensor	<input checked="" type="checkbox"/>
30	Leak sensor	<input checked="" type="checkbox"/>
31	Leak sensor	<input checked="" type="checkbox"/>
32	Leak sensor	<input checked="" type="checkbox"/>
33	Leak sensor	<input checked="" type="checkbox"/>
34	Leak sensor	<input checked="" type="checkbox"/>

เอกสารไม่ควบคุม



# CM OQ

## Chromeleon Operation Qualification

เอกสารไม่ควบคุม

### ThermoFisher SCIENTIFIC Chromeleon Operational Qualification

#### General Information

Instrument Controller: DESKTOP-C4FS3L7  
Client: DESKTOP-C4FS3L7  
Operator: Thitsong Promkritpuk  
Computer Name: DESKTOP-C4FS3L7  
Version Number: 7.3.1 Build 6535  
7.3.1.6535  
Overall Test Result: Passed

#### Comparison Format:

All Parameters	Significant Digits	10
----------------	--------------------	----



*Sunon Asadyasat*  
Retestern's Signature (V) Date

*Thitsong 24-Apr-2025*  
Operator's Signature (V) Date

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**ThermoFisher**  
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**Chromleon Operational Qualification, Part 1**  
Verification of Selected Results

Report Variable	Peak Name	Status
Detection Agent Calibration Type Evolution Type Standard Method Calibration Mode	Cobra	
	Acetaminide	OK
	Acetaminide	OK
Slope (d)	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Correlation Coeff.	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Variance	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Std. Deviation	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Rel. Std. Dev.	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Variance Coeff.	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK

**ThermoFisher**  
S C I E N T I F I C

**Chromleon Operational Qualification, Part 1**  
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Calibration Point Y	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Amount [mg]	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Resolution (EP)	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Resolution (USP)	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Peak Asymmetry (EP/USP)	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK
Peak Asymmetry (AIA)	Acetaminide	OK
	Acetaminide	OK
	Acetaminide	OK

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Chromleon Operational Qualification, Part 1

Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetaminophen	ok
	Acetaminophen	ok
	Propofolone	ok
Theoretical Plates (USP)	Acetaminophen	ok
	Propofolone	ok
	Propofolone	ok
Theoretical Plates (JP)	Acetaminophen	ok
	Acetaminophen	ok
	Propofolone	ok

Test Result: Passed

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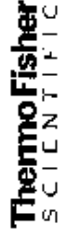
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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Injection	Variable Category	Report Variable		Peak Name	Status
		No.	Name		ok
		Type	Type		ok
		Position	Position		ok
		Status	Status		ok
Chromatogram		Volume	Volume		ok
		Dilution Factor	Dilution Factor		ok
		Weight	Weight		ok
		IntStd	IntStd		ok
		Instrument Method	Instrument Method		ok
		Processing Method	Processing Method		ok
		Channel	Channel		ok
		No. of Peaks	No. of Peaks		ok
		Chromatogram Start Time	Chromatogram Start Time		ok
		Signal Min.	Signal Min.		ok
Peak Results		Signal Max.	Signal Max.		ok
		Unit	Unit		ok
		Notes	Notes		ok
		No.	No.	Acetaminophen	ok
		No.	No.	Acetaminophen	ok
		Peak Name	Peak Name	Acetaminophen	ok
		Peak Name	Peak Name	Acetaminophen	ok
		Ret. Time	Ret. Time	Acetaminophen	ok
		Ret. Time	Ret. Time	Acetaminophen	ok
		Ret. Time	Ret. Time	Propofolone	ok

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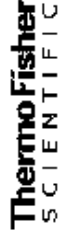


## Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Area, Ret, Dev.	Acetanilide	ok
	Ret, Dev, (abs)	Acetophenone	ok
	Ret, Dev, (abs)	Propiophenone	ok
	Ret, Ret, Dev.	Acetanilide	ok
	Ret, Dev, (rel)	Acetophenone	ok
	Ret, Dev, (rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel, Area	Acetanilide	ok
	Rel, Area, (Total)	Acetophenone	ok
	Rel, Area, (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Ret, Height (Total)	Acetanilide	ok
	Ret, Height (Total)	Acetophenone	ok
	Ret, Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Ret, Amount	Acetanilide	ok
	Ret, Amount	Acetophenone	ok
	Ret, Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok

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## Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Left Width (5%)	Acetanilide	ok
	Left Width (5%)	Acetophenone	ok
	Left Width (5%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
Type	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution (EP)	Acetophenone	ok
	Resolution (USP)	Acetanilide	ok
	Resolution (USP)	Acetophenone	ok
	Resolution (USP)	Propiophenone	ok
	Asymmetry (EP)	Acetanilide	ok
Asymmetry (EP)	Asymmetry (EP)	Acetophenone	ok
	Asymmetry (EP)	Propiophenone	ok

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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Acetanilide	OK
	Asymmetry(AIA)	Acetophenone	OK
	Asymmetry(AIA)	Propiophenone	OK
	Asymmetry(AIA)	Acedanilide	OK
	Theor. Plates(EP)	Acetophenone	OK
	Theor. Plates(EP)	Propiophenone	OK
	Theor. Plates(EP)	Acetanilide	OK
	Theor. Plates(USP)	Acetanilide	OK
	Theor. Plates(USP)	Propiophenone	OK
	Theor. Plates(USP)	Acetanilide	OK
	Theor. Plates(JP)	Acetanilide	OK
	Theor. Plates(JP)	Propiophenone	OK
	Cal.Mode	Acetanilide	OK
	Cal.Mode	Propiophenone	OK
Peak Calibration	Cal.Type	Acetanilide	OK
	Cal.Type	Propiophenone	OK
	Cal.Type	Acetanilide	OK
	Weights	Propiophenone	OK
	Weights	Acetanilide	OK
	Calibr. Coefficient C0	Acetanilide	OK
	Calibr. Coefficient C0	Propiophenone	OK
	Calibr. Coefficient C0	Acetanilide	OK
	Calibr. Coefficient C1	Acetanilide	OK
	Calibr. Coefficient C1	Propiophenone	OK
	Calibr. Coefficient C1	Acetanilide	OK
	RF-Value	Acetanilide	OK
	RF-Value	Propiophenone	OK
	RF-Value	Acetanilide	OK
	No. of Points	Acetanilide	OK

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Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	OK
	No. of Points(disabled)	Acetanilide	OK
	No. of Points(disabled)	Propiophenone	OK
	No. of Points(disabled)	Acetanilide	OK
	Variance	Acetanilide	OK
	Variance	Propiophenone	OK
	Variance	Acetanilide	OK
	Var.Coeff	Propiophenone	OK
	Var.Coeff	Acetanilide	OK
	Var.Coeff	Propiophenone	OK
	Std.Dev.	Acetanilide	OK
	Std.Dev.	Propiophenone	OK
	Std.Dev.	Acetanilide	OK
	Rel.Std.Dev.	Propiophenone	OK
	Rel.Std.Dev.	Acetanilide	OK
	Rel.Std.Dev.	Propiophenone	OK
	Corr.Coeff.	Acetanilide	OK
	Corr.Coeff.	Propiophenone	OK
	Corr.Coeff.	Acetanilide	OK
	R-Square	Propiophenone	OK
	R-Square	Acetanilide	OK
	R-Square	Propiophenone	OK
	Adj. R-Square	Acetanilide	OK
	Adj. R-Square	Propiophenone	OK
	Adj. R-Square	Acetanilide	OK
Peak Results	X	Acetanilide	OK
	X	Propiophenone	OK
	X	Acetanilide	OK
	Y	Propiophenone	OK
	Y	Acetanilide	OK
	W	Propiophenone	OK
	W	Acetanilide	OK
	F(X)	Propiophenone	OK
	F(X)	Acetanilide	OK
	F(X)	Propiophenone	OK

เอกสารไม่ควบคุม



ThermoFisher  
S C I E N T I F I C

Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal Point X	Acetanilide	OK
	Residual for Cal Point X	Acetophenone	OK
	Residual for Cal Point X	Propiophenone	OK
	Calibration Point Status	Acetanilide	OK
	Calibration Point Status	Acetophenone	OK
	Calibration Point Status	Propiophenone	OK
	Amount	Acetanilide	OK
	Amount	Acetophenone	OK
	Amount	Propiophenone	OK
	Cal Type	Acetanilide	OK
Component	Peak Type	Acetanilide	OK
	Left Limit	Acetophenone	OK
	Right Limit	Acetanilide	OK
	Group	Acetanilide	OK
	Factor	Acetophenone	OK
	Amount	Acetanilide	OK
	Cont. Limit	Acetanilide	OK
		Acetophenone	OK
		Propiophenone	OK
		Acetanilide	OK

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ThermoFisher  
S C I E N T I F I C

Chromleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	OK
	PPI	Acetophenone	OK
	PPI	Propiophenone	OK
	RSD PPI	Acetanilide	OK
	RSD PPI	Acetophenone	OK
	RSD PPI	Propiophenone	OK
	Match	Acetanilide	OK
	Match	Acetophenone	OK
	Match	Propiophenone	OK
	RSD Match	Acetanilide	OK
	RSD Match	Acetanilide	OK
	RSD Match	Acetophenone	OK
	RSD Match	Propiophenone	OK
	Rel. Max at	Acetanilide	OK
	Rel. Max at	Acetophenone	OK
	Rel. Max at	Propiophenone	OK
		Acetanilide	OK
		Acetophenone	OK
		Propiophenone	OK
		Acetanilide	OK

Test Result: Passed

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ThermoFisher  
S C I E N T I F I C

Chromleon Operational Qualification, Part 3  
System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Inj Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
	Inj. Eval. Result	ok
System Suitability Test Case Result	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok

Test Result: Passed

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PQ

Performance Qualification

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IC PUMP FLOW RATE ACCURACY

ThermoFisher  
SCIENTIFIC

IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4872	0.500	$\pm 2.0$	PASS
1.0	0.9960	0.40	$\pm 2.0$	PASS

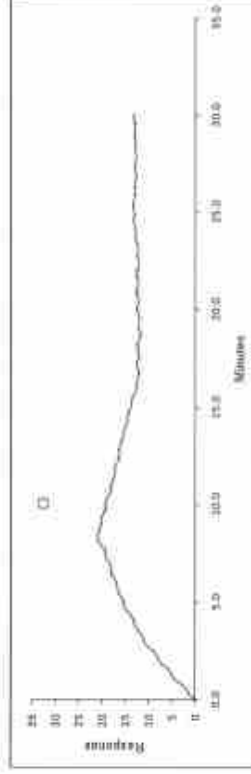
OVERALL TEST RESULT: PASS  
APPROXIMATELY 100%  
APPROXIMATELY 100%

Field Service Representative Signature	Customer Signature
<i>Thirapong P.</i>	<i>Sudon</i>
Date: 14 Apr 2025	Date: 06 Apr 2025

เอกสารไม่ควบคุม

NOISE AND DRIFT (CD)

ThermoFisher  
SCIENTIFIC



Information

System Name	AquionPFC
Detector	Z20360059
Data Path	d:\rom-1\data\pfc-01\317\Chromatolocal\Archeolocal\Service Contract\2025\1st Con 21-Apr-2025\Aquion %33194NIC OQ.aeq\926.smp\ECD_1.dtm

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	0.7 nS	$\pm 2.0$ nS	PASS	1000
Drift	12.7 nS/hr	$\pm 20.0$ nS/hr	PASS	1000



OVERALL TEST RESULT: PASS

Field Service Representative Signature	Customer Signature
<i>Thirapong P.</i>	<i>Sudon</i>
Date: 14 Apr 2025	Date: 06 Apr 2025

เอกสารไม่ควบคุม

## TEST EQUIPMENT AND STANDARDS

ThermoFisher  
S C I E N T I F I C

## Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fuke	289	59270015	N/A	N/A
Thermocouple	Fuke	K-Type	59270015	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129561010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	24159332	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

## Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	241021	Oct-2026
Nitrate	Thermo Scientific	10 ppm	060254	241021	Oct-2026
Nitrate	Thermo Scientific	25 ppm	060254	241021	Oct-2026
Nitrate	Thermo Scientific	50 ppm	060254	241021	Oct-2026
Nitrate	Thermo Scientific	100 ppm	060254	241021	Oct-2026
Nitrate	Thermo Scientific	1000 ppm	060254	241021	Oct-2026
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Field Service Representative Signature:	Customer Signature:
<i>Thanyaporn P.</i>	<i>Sunadit</i>
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

## REPEATABILITY (CD)

ThermoFisher  
S C I E N T I F I C

## Information

System Name	AquionP4IC
Detector SN	220360559
Data Path	ChromelonLocal\Analytical\Service_Contract\2025\Fat Con 23-Apr-2025\Aquion #10461C CQ

## Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.4783	3.742
Repeatability 02	25	0.4783	3.748
Repeatability 03	25	0.4787	3.745
Repeatability 04	25	0.4787	3.756
Repeatability 05	25	0.4783	3.747
Repeatability 06	25	0.4783	3.688

## Repeatability

Test	Measured (% RSD)	OO Limit (% RSD)	Result
Retention Time	0.2	± 5.0	PASS
Area	0.7	± 1.0	PASS

OVERALL TEST RESULT: PASS  
ANALYTICAL LABS CO., LTD.

Field Service Representative Signature:	Customer Signature:
<i>Thanyaporn P.</i>	<i>Sunadit</i>
Date: 24 Apr 2025	Date: 24 Apr 2025

เอกสารไม่ควบคุม

CARRYOVER (CD)

Information

System Name	Aquion
Detector SN	220360059
Data Path	Chromesent\Local\Ar\chemicals\Service Contract\2025\1st Con 23-Apr-2025\Aquion #1048\IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.4783	0.035
High Standard	25	0.4767	48.725
Carryover	25	0.4733	0.042

Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.01	≤ 0.10	PASS

OVERALL TEST RESULT: PASS

Thermo Scientific  
ARQUIONICALAS CO., LTD.

Field Service Representative Signature:	Customer Signature:
Date: 24/ Apr /2025	Date:

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DETECTOR LINEARITY (CD)



Information

System Name	Aquion
Detector SN	220360059
Data Path	Chromesent\Local\Ar\chemicals\Service Contract\2025\1st Con 23-Apr-2025\Aquion #1048\IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	3.247	5.03
Detector Linearity 02	10	0.187	10.06
Detector Linearity 03	25	14.967	25.12
Detector Linearity 04	50	26.261	49.63
Detector Linearity 05	100	58.743	100.15

Linearity

Test	Observed	OQ Limit	Result
r²	1.000	≥ 0.999	PASS

OVERALL TEST RESULT: PASS

Thermo Scientific  
ARQUIONICALAS CO., LTD.

Field Service Representative Signature:	Customer Signature:
Date: 24/ Apr /2025	Date: 24/ Apr /2025

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TEMPERATURE ACCURACY

ThermoFisher  
SCIENTIFIC

Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.5	0.5	± 2.0	PASS



OVERALL TEST RESULT: PASS

ThermoFisher Scientific

Field Service Representative Signature:	Customer Signature:
<i>[Signature]</i>	<i>[Signature]</i>
Date: 21/10/2025	Date: 21/10/2025


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# Certificate

## Certificate of Standards and Instruments for Qualification

เอกสารไม่ควบคุม






**SYSTRONICS INSLAB COMPANY LIMITED**  
18/11-12, Sukhumvit Rd., Bangkok, Muang Bangkok, Bangkok 10110, Thailand  
Tel: +66(0)20 694 146-5, Email: cal@systronics.com

Certificate No. **EL341707**  
Page **3 of 5**


## CERTIFICATE OF CALIBRATION

Range	Standard Value	UUC* Reading	Error	(±) Uncertainty
<b>Function : AC Voltage Measurement LoZ (Without Adjustment)</b>				
1000 V	100.000 V	100.4 V	0.4 V	0.000 V
1000 V	999.00 V	999.7 V	0.7 V	0.000 V
<b>Function : DC Current Measurement (Without Adjustment)</b>				
500 uA	0.000 uA	0.00 uA	0.00 uA	0.000 uA
500 uA	50.000 uA	49.99 uA	-0.01 uA	0.000 uA
500 uA	499.00 uA	498.95 uA	-0.05 uA	0.000 uA
5000 uA	500.0 uA	500.0 uA	0.0 uA	0.000 uA
5000 uA	4999.0 uA	4999.4 uA	-0.6 uA	0.000 uA
50 mA	0.000 mA	0.001 mA	0.001 mA	0.000 mA
50 mA	49.000 mA	48.996 mA	-0.004 mA	0.000 mA
500 mA	490.00 mA	489.96 mA	-0.04 mA	0.000 mA
500 mA	4900.0 mA	4899.6 mA	-0.4 mA	0.000 mA
5 A	0.000 A	0.000 A	0.000 A	0.000 A
5 A	4.9000 A	4.8996 A	-0.0004 A	0.000 A
10 A	1.0000 A	1.000 A	0.000 A	0.000 A
10 A	9.9000 A	9.899 A	-0.001 A	0.000 A
<b>Function : AC Current Measurement (Without Adjustment)</b>				
500 uA	50.00 uA	49.92 uA	-0.08 uA	0.000 uA
500 uA	499.00 uA	498.85 uA	-0.15 uA	0.000 uA
5000 uA	500.00 uA	499.8 uA	-0.2 uA	0.000 uA
5000 uA	4990.0 uA	4989.0 uA	-1.0 uA	0.000 uA
50 mA	5.0000 mA	4.998 mA	-0.002 mA	0.000 mA
50 mA	49.000 mA	48.981 mA	-0.019 mA	0.000 mA
500 mA	490.00 mA	489.8 mA	-0.20 mA	0.000 mA
500 mA	4900.0 mA	4899.0 mA	-1.0 mA	0.000 mA
5 A	0.0000 A	0.0000 A	0.0000 A	0.0000 A
5 A	4.9000 A	4.8972 A	-0.0028 A	0.000 A
10 A	1.0000 A	1.000 A	0.000 A	0.000 A
10 A	9.9000 A	9.899 A	-0.001 A	0.000 A

Remark : (\*) UUC : Unit Under Calibration

  
 The Hong P.  
 24 Apr 2025

เอกสารไม่ควบคุม




**SYSTRONICS INSLAB COMPANY LIMITED**  
18/11-12, Sukhumvit Rd., Bangkok, Muang Bangkok, Bangkok 10110, Thailand  
Tel: +66(0)20 694 146-5, Email: cal@systronics.com

Certificate No. **E 241757**  
Page **4 of 5**

## CERTIFICATE OF CALIBRATION

Range	Standard Value	UUC* Reading	Error	(±) Uncertainty
<b>Function : Resistance Measurement (Without Adjustment)</b>				
100 Ω	0.000 Ω	0.00 Ω	0.00 Ω	0.000 Ω
100 Ω	50.000 Ω	49.99 Ω	-0.01 Ω	0.000 Ω
100 Ω	499.00 Ω	498.99 Ω	-0.01 Ω	0.000 Ω
1 kΩ	0.000 kΩ	0.000 kΩ	0.000 kΩ	0.000 kΩ
1 kΩ	4.9000 kΩ	4.8999 kΩ	-0.0001 kΩ	0.000 kΩ
10 kΩ	49.000 kΩ	48.999 kΩ	-0.001 kΩ	0.000 kΩ
100 kΩ	490.00 kΩ	489.99 kΩ	-0.01 kΩ	0.000 kΩ
1 MΩ	0.000 MΩ	0.000 MΩ	0.000 MΩ	0.000 MΩ
1 MΩ	4.9000 MΩ	4.8999 MΩ	-0.0001 MΩ	0.000 MΩ
10 MΩ	49.000 MΩ	48.999 MΩ	-0.001 MΩ	0.000 MΩ
100 MΩ	490.00 MΩ	489.99 MΩ	-0.01 MΩ	0.000 MΩ
1 GΩ	0.000 GΩ	0.000 GΩ	0.000 GΩ	0.000 GΩ
1 GΩ	4.9000 GΩ	4.8999 GΩ	-0.0001 GΩ	0.000 GΩ
10 GΩ	49.000 GΩ	48.999 GΩ	-0.001 GΩ	0.000 GΩ
100 GΩ	490.00 GΩ	489.99 GΩ	-0.01 GΩ	0.000 GΩ
<b>Function : Capacitance Measurement (Without Adjustment)</b>				
1 pF	0.000 pF	0.00 pF	0.00 pF	0.000 pF
1 pF	0.0001 pF	0.0001 pF	0.0001 pF	0.0001 pF
1 pF	0.001 pF	0.001 pF	0.000 pF	0.000 pF
10 pF	0.000 pF	0.000 pF	0.000 pF	0.000 pF
10 pF	0.0001 pF	0.0001 pF	0.0001 pF	0.0001 pF
10 pF	0.001 pF	0.001 pF	0.000 pF	0.000 pF
100 pF	0.000 pF	0.000 pF	0.000 pF	0.000 pF
100 pF	0.0001 pF	0.0001 pF	0.0001 pF	0.0001 pF
1 nF	0.000 nF	0.000 nF	0.000 nF	0.000 nF
1 nF	0.0001 nF	0.0001 nF	0.0001 nF	0.0001 nF
1 nF	0.001 nF	0.001 nF	0.000 nF	0.000 nF
10 nF	0.000 nF	0.000 nF	0.000 nF	0.000 nF
10 nF	0.0001 nF	0.0001 nF	0.0001 nF	0.0001 nF
10 nF	0.001 nF	0.001 nF	0.000 nF	0.000 nF
100 nF	0.000 nF	0.000 nF	0.000 nF	0.000 nF
100 nF	0.0001 nF	0.0001 nF	0.0001 nF	0.0001 nF
1 μF	0.000 μF	0.000 μF	0.000 μF	0.000 μF
1 μF	0.0001 μF	0.0001 μF	0.0001 μF	0.0001 μF
1 μF	0.001 μF	0.001 μF	0.000 μF	0.000 μF
10 μF	0.000 μF	0.000 μF	0.000 μF	0.000 μF
10 μF	0.0001 μF	0.0001 μF	0.0001 μF	0.0001 μF
10 μF	0.001 μF	0.001 μF	0.000 μF	0.000 μF
100 μF	0.000 μF	0.000 μF	0.000 μF	0.000 μF
100 μF	0.0001 μF	0.0001 μF	0.0001 μF	0.0001 μF
1 mF	0.000 mF	0.000 mF	0.000 mF	0.000 mF
1 mF	0.0001 mF	0.0001 mF	0.0001 mF	0.0001 mF
1 mF	0.001 mF	0.001 mF	0.000 mF	0.000 mF
10 mF	0.000 mF	0.000 mF	0.000 mF	0.000 mF
10 mF	0.0001 mF	0.0001 mF	0.0001 mF	0.0001 mF
10 mF	0.001 mF	0.001 mF	0.000 mF	0.000 mF
100 mF	0.000 mF	0.000 mF	0.000 mF	0.000 mF
100 mF	0.0001 mF	0.0001 mF	0.0001 mF	0.0001 mF
1 F	0.000 F	0.000 F	0.000 F	0.000 F
1 F	0.0001 F	0.0001 F	0.0001 F	0.0001 F
1 F	0.001 F	0.001 F	0.000 F	0.000 F

Remark : (\*) UUC : Unit Under Calibration

  
 The Hong P.  
 24 Apr 2025

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ไม่พบใบประกอบ

# Thermo SCIENTIFIC CERTIFICATE OF CONFORMITY

## IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number: 24157332  
Instrument Part Number: 22000-60001

### TEST BOX LOADS AND FUNCTIONS

[v] AHS	100Ω	+/- 5%	[x] CR-TC 3-pin ANA INT	1.3KΩ	+/- 5%
[x] EGC CAP KOI	100Ω	+/- 5%	[x] CR-TC 3-pin CAP INT	13.05kΩ	+/- 1%
[v] EGC CAP MSA	100Ω	+/- 5%	[x] CR-TC 4-pin ANA INT	1.3KΩ	+/- 5%
[v] EGC ANA KOI	100Ω	+/- 5%	[x] CR-TC 4-pin CAP INT	13.05kΩ	+/- 1%
[x] EGC ANA MSA	100Ω	+/- 5%	[x] EGC - Memory Test		
[x] HRS (CC)	12Ω	+/- 5%	[x] HRS - Memory Test		
[x] BRC (CV)	250Ω	+/- 5%	[x] CR-TC - Memory Test		

Tester: Alicia Pelaez

Date: 11 April 2024

P/N 22000-97001-C



SYSTRONICS INS LAB COMPANY LIMITED

100/112, Subpracha Rd., Haepracha, Muang Phayung, Phayung 21150, Thailand  
Tel: 081881 888 145-6 Email: calibration@systronics.com

## CERTIFICATE OF CALIBRATION

Certificate No.: SL-241782  
Page: 3 of 5

Range	Standard Value	UUC Reading	Error	(±) Uncertainty
Function: Frequency Measurement (Without Adjustment)				
100 Hz	10.00 Hz	10.000 Hz	0.000 Hz	0.00059 Hz
100 Hz	90.00 Hz	90.000 Hz	0.000 Hz	0.00064 Hz
1000 Hz	100.00 Hz	100.00 Hz	0.00 Hz	0.000 Hz
1000 Hz	900.00 Hz	900.00 Hz	0.00 Hz	0.000 Hz
10 kHz	1.0000 kHz	1.0000 kHz	0.0000 kHz	0.00000 kHz
10 kHz	9.0000 kHz	9.0000 kHz	0.0000 kHz	0.00007 kHz
100 kHz	10.000 kHz	10.000 kHz	0.000 kHz	0.00058 kHz
100 kHz	90.000 kHz	90.000 kHz	0.000 kHz	0.00061 kHz
1000 kHz	100.00 kHz	100.00 kHz	0.00 kHz	0.00058 kHz
3000 kHz	300.0 kHz	300.00 kHz	0.00 kHz	0.00059 kHz

Range	Standard Value	Required UUC Reading	Error	(±) Uncertainty
Function: Thermocouple Measurement K Type (Without Adjustment)				
-200 to 1350 °C	-5.550 mV	-180.0 °C	1.4 °C	0.37 °C
-200 to 1350 °C	0.000 mV	0.0 °C	0.6 °C	0.24 °C
-200 to 1350 °C	4.996 mV	100.0 °C	0.6 °C	0.22 °C
-200 to 1350 °C	24.905 mV	600.0 °C	0.6 °C	0.22 °C
-200 to 1350 °C	37.326 mV	900.0 °C	0.6 °C	0.22 °C
-200 to 1350 °C	40.038 mV	1200.0 °C	0.7 °C	0.29 °C

Benchmark: (\*) 1AUC: Unit Under Calibration

END OF CALIBRATION

SYSTRONICS INS LAB  
AND-EMILIA LAB CALIB  
Thitiporn P.  
11/4/2024

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แผ่นมาตรฐาน

## Certificate of Completion

This certifies that

Thitipong Piromkripuk

Has successfully completed

eLearn: RPG IC-Specific Qualification Service Training

Valid for 3 years from:

Aug/1/2024

Thitipong P.  
212 / Apr / 2025

Issued electronically and  
approved by:

Thermo Fisher University LMS  
Certification Management and  
Compliance Group  
tmc.training@thermofisher.com

The world leader in serving science

Important note: The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors.

Better Separations Through  
Better Chemistry

## Certificate of Analysis

### Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254  
Certificate of Analysis

Lot Number 241021

Expiration of Certification  
October 2025

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in  $\geq 18.2$  megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

#### Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	4.95 $\pm$ 0.09
2	9.97 $\pm$ 0.02
3	25.33 $\pm$ 0.12
4	50.46 $\pm$ 0.28
5	101.4 $\pm$ 1
6	1004 $\pm$ 4

The concentration value is based a proven reliable method of analysis. The estimated uncertainty are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 070605-01 2nd-Edition

thermoscientific.com/dionex

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1007146 EN 03/25 0107146-11

Thermo Fisher Scientific  
17201 New Way  
Folsom, CA 95630  
USA

thermo  
scientific

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Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lankai Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10390  
+662 723 0382  
MET-TH-SERVICE@mt.com



## Accuracy Calibration Certificate

### Customer

Company: United Analyt and Engineering Consultant Co., Ltd.  
Address: 3 Sri Udon Suk 41, Sukhumvit Rd., Bang Chak  
City: Phra Prathum  
Zip / Postal: 10261  
State / Province: Bangkok  
Order Number:   
Contact: Burabakorn Lertprattum

### Weighing Device

Manufacturer: Mettler Toledo  
Model: MX204  
Serial No.: C2516170410  
Building: N/A  
Floor: 2  
Room: Balance Room 204  
Instrument Type: Weighing Instrument  
Asset Number: UAE-ATR-01-02508  
Terminal Model: N/A  
Terminal Serial No.: N/A  
Terminal Asset No.: N/A  
Range: 1  
Max. Capacity: 220 g  
Readability (d): 0.001 g

### Procedure

Calibration Guideline: EURAMET cp 18 v.4.0 (11/2015)  
CPW00120  
METTLER TOLEDO Work Instruction:  
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity of the weighing instrument was adjusted before calibration with a built-in weight.  
In accordance with EURAMET cp 18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

As Found	Temperature	Humidity
0.0000 g	Start: 20.0 °C End: 21.2 °C	Start: 53.8 % End: 50.3 %

As Found Calibration Date: 08-May-2025  
As Left Calibration Date: N/A  
Issue Date: 10-May-2025  
Calibrator: N/A  
Approved Signature:   
Technical Manager / Head of Calibration Center

### Error of Indication

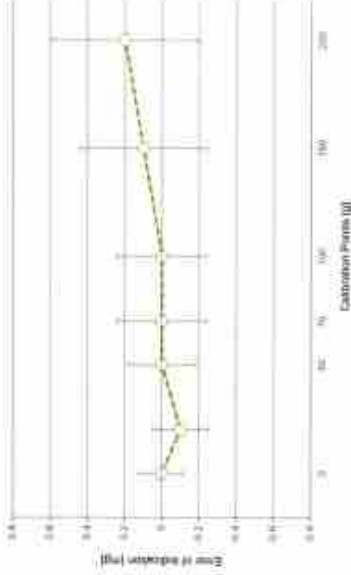
#### As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	x
1	0.0000 g	0.0000 g	0.0000 g	0.12 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.13 mg	3
4	3.0000 g	3.0000 g	0.0000 g	0.13 mg	2
5	5.0000 g	5.0000 g	0.0000 g	0.14 mg	2
6	10.0000 g	10.0000 g	0.0000 g	0.14 mg	2
7	20.0000 g	19.9999 g	-0.0001 g	0.18 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.18 mg	2
9	60.9699 g	60.9699 g	0.0000 g	0.24 mg	2
10	98.9999 g	98.9999 g	0.0000 g	0.24 mg	2
11	148.9999 g	148.0000 g	-0.0001 g	0.34 mg	2
12	199.9999 g	200.0001 g	0.0002 g	0.39 mg	2

As Found

As Left

For improved legibility of the graphics, only weighing measurement points are shown and measurement points close to zero are not displayed.



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k=2, but the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

### Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

#### Weight Set 1: OIML R2

Weight Set No.: 91522  
Certificate Number: 194591  
Date of Issue: 23-Jan-2024  
Calibration Due Date: 17-Mar-2026

#### Thema Hygrometer

Equipment No.: 14214  
Certificate Number: 902-14-0010008  
Date of Issue: 23-Jan-2025  
Calibration Due Date: 30-Jun-2026

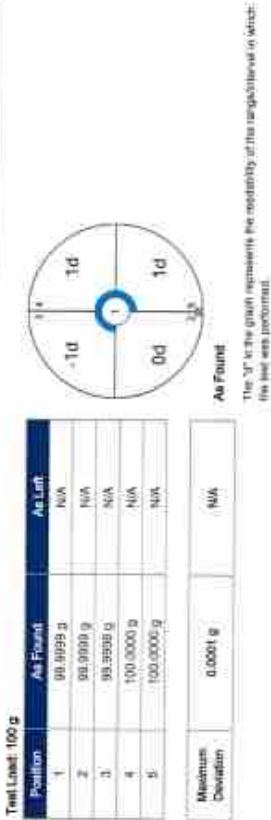
Measurement Results

Repeatability



This "R" in the graph represents the repeatability of the measurements in which the test was performed.  
The results of this graph are used to set the standard value of the differences from the master value.

Eccentricity



This "V" in the graph represents the repeatability of the measurements in which the test was performed.

Remarks

- FACT equipment functionality activated
- Equipment condition: Good
- Calibration after installation
- New calibration according to customer's prototype
- Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with  $k=2$  in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:  $3.0 \cdot 10^{-6} / K$   
Temperature range on site for the evaluation of the measurement uncertainty in use:  $3 K$

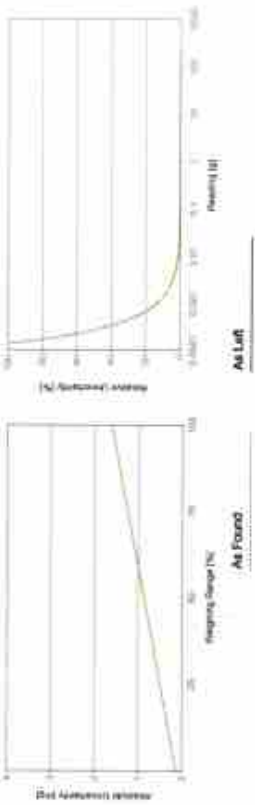
Uncertainty of Uncertainty Equates

Range		As Found	As Left
d	Max		
Y	0.0001 g	220 g	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a just load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Example)

Net Indication	As Found	As Left
0.0229 g	0.13 mg	0.68%
0.2250 g	0.13 mg	N/A
2.2000 g	0.14 mg	0.006%
22.0000 g	0.28 mg	0.0012%
220.0000 g	1.0 mg	0.0004%



GWP®  
Certificate

As Found ✓ As Left ✓

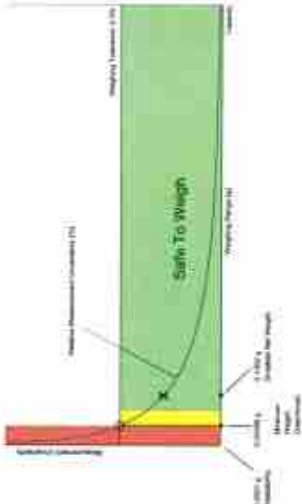
The weighing device meets the given process requirements.

Fields Performed: ☒ As Found ☐ As Left ☒ No adjustment/modifications made. As Left requires compliance to As Found.

Process Requirements

Weighing Tolerance: 0.20% | Smallest Net Weight: 0.1000 g | Safety Factor: 2

Safe Weighing Range



While the value in the graph reflects the actual calibration results, the values shown are only a visual representation. This graph reflects As Left finding, unless only As Found was performed.

## Minimum Weight As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13205 g	0.26662 g	0.40315 g	0.66132 g	1.41207 g
0.2%	0.066025 g	0.13331 g	0.19951 g	0.33066 g	0.70603 g
0.3%	0.04335 g	0.08817 g	0.13255 g	0.22183 g	0.44898 g
0.5%	0.02637 g	0.05381 g	0.07932 g	0.13255 g	0.26662 g
1%	0.01317 g	0.02692 g	0.03966 g	0.06626 g	0.13331 g
2%	0.00658 g	0.01317 g	0.01987 g	0.03313 g	0.06665 g
5%	0.00329 g	0.00657 g	0.00994 g	0.01657 g	0.03333 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

## As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.13205 g	0.26662 g	0.40315 g	0.66132 g	1.41207 g
0.2%	0.066025 g	0.13331 g	0.19951 g	0.33066 g	0.70603 g
0.3%	0.04335 g	0.08817 g	0.13255 g	0.22183 g	0.44898 g
0.5%	0.02637 g	0.05381 g	0.07932 g	0.13255 g	0.26662 g
1%	0.01317 g	0.02692 g	0.03966 g	0.06626 g	0.13331 g
2%	0.00658 g	0.01317 g	0.01987 g	0.03313 g	0.06665 g
5%	0.00329 g	0.00657 g	0.00994 g	0.01657 g	0.03333 g

Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 5% (for safety factor, 1/2, 1/3, 1/5, or 1/10 of the required value). The values are calculated with  $k = 2$  and based on the lower formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing loads at the bottom of the instrument from the past until last occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

- If "N/A" is shown above, no appropriate value could be calculated.
- METTLER TOLEDO is not responsible for the definition of the process requirements.

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## Measurement Results Results Summary

Repeatability			
As Found	As Left	Essentially	Error of Indication
✓	✓	✓	✓
✗	✗	✗	✗
✗	✗	✗	✗

✗ = Passed

✗ = Failed

✗ = Safety Factor not met

## Repeatability

Test Load: 100 g

As Found			
Tolerance	Control Limit	Result	As Left
0.1%	0.00005 g	✓	0.00015 g
0.2%	0.00010 g	✓	0.00015 g
0.3%	0.00015 g	✓	0.00015 g
0.5%	0.00025 g	✓	0.00015 g
1%	0.00050 g	✓	0.00015 g
2%	0.00100 g	✓	0.00015 g
5%	0.00250 g	✓	0.00015 g

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

## Eccentricity

Test Load: 100 g

As Found			
Tolerance	Control Limit	Result	As Left
0.1%	0.0001 g	✓	0.0001 g
0.2%	0.0002 g	✓	0.0001 g
0.3%	0.0003 g	✓	0.0001 g
0.5%	0.0005 g	✓	0.0001 g
1%	0.0010 g	✓	0.0001 g
2%	0.0020 g	✓	0.0001 g
5%	0.0050 g	✓	0.0001 g

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

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Error of Indication

All Found

Conformity limits for various weighing tolerances									
Reference Value	Error	0.1%	0.2%	0.3%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
00.0000 g	-0.0001 g	0.0100 g	0.0200 g	0.0300 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g	
00.0000 g	0.0000 g	0.0250 g	0.0500 g	0.0750 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
00.9999 g	0.0000 g	0.0500 g	0.1000 g	0.1500 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
00.9999 g	0.0000 g	0.0500 g	0.1000 g	0.1500 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g	
100.9999 g	0.0001 g	0.0100 g	0.0200 g	0.0300 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g	
100.9999 g	0.0002 g	0.0200 g	0.0400 g	0.0600 g	0.1000 g	0.2000 g	0.4000 g	1.0000 g	
Result		✓	✓	✓	✓	✓	✓	✓	

All Left

Conformity limits for various weighing tolerances									
Reference Value	Error	0.1%	0.2%	0.3%	0.5%	1%	2%	5%	
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
20.0000 g	-0.0001 g	0.0100 g	0.0200 g	0.0300 g	0.0500 g	0.1000 g	0.2000 g	0.5000 g	
50.0000 g	0.0000 g	0.0250 g	0.0500 g	0.0750 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g	
99.9999 g	0.0000 g	0.0300 g	0.0600 g	0.0900 g	0.1500 g	0.3000 g	0.6000 g	1.5000 g	
99.9999 g	0.0000 g	0.0300 g	0.0600 g	0.0900 g	0.1500 g	0.3000 g	0.6000 g	1.5000 g	
149.9999 g	0.0001 g	0.0150 g	0.0300 g	0.0450 g	0.0750 g	0.1500 g	0.3000 g	0.7500 g	
149.9999 g	0.0002 g	0.0300 g	0.0600 g	0.0900 g	0.1500 g	0.3000 g	0.6000 g	1.5000 g	
Result		✓	✓	✓	✓	✓	✓	✓	

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding corner limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.