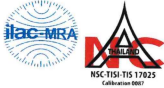


ภาคผนวก จ

หนังสือรับรองการสอบเทียบเครื่องมือ

ภาคผนวก จ-1

บริษัท อินทิเกรตเต็ด รีเซิร์ช เซ็นเตอร์ จำกัด



Certificate of Calibration

Certificate No.: C01253246

Page: 2 of 2

Equipment: Electronic Balance
Manufacturer: Sartorius
Model: ME36S
Serial No.: 27206085
ID No.: -
Condition of the item: Normal

Certificate No.: C01253246
Job No.: WO-00091493
Issued Date: 03 November 2025
Page: 1 of 2

Customer: Integrated Research Center Co., Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 25 °C ± 0.8 °C
Relative Humidity 68 % ± 2.4 %

Calibration Place: Double A (1991) Public Company Limited.
(Water Laboratory IP1 (Balance Room))
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piyapat Saidoung

Calibration Date: 29 October 2025

The Method Used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02250448

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C01-15: 30 Jun 2025

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	10000	(mg)
Reference Points (mg)					
A	B	C	D	E	
-	-0.002	-0.001	0.002	0.001	

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (mg)

Nominal test value (mg)	Standard Deviation
2000	0.0007
20000	0.0008

Error of indication from nominal or conventional mass value., Readability 0.001 (mg)

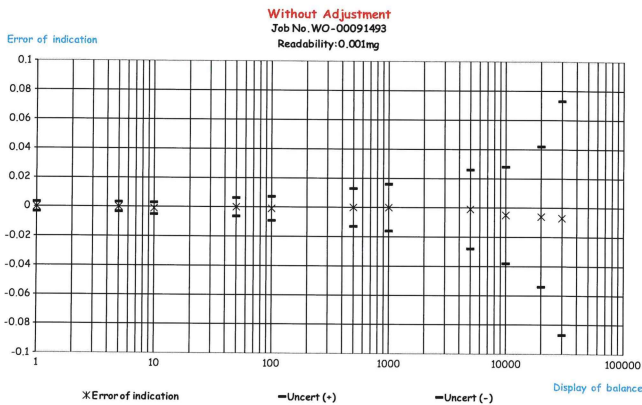
Nominal Value (mg)	Conventional Mass (mg)	Displayed Value (mg)	Error of indication (mg)	Uncertainty (± mg)	k
1	1.0020	1.002	0.000	0.0033	2.00
5	5.0010	5.001	0.000	0.0033	2.00
10	10.0020	10.001	-0.001	0.0040	2.00
50	50.0000	50.000	0.000	0.0063	2.00
100	100.0040	100.003	-0.001	0.0082	2.00
500	500.0030	500.003	0.000	0.013	2.00
1000	1000.0120	1000.012	0.000	0.016	2.00
5000	5000.0120	5000.011	-0.001	0.027	2.00
10000	10000.0100	10000.005	-0.005	0.033	2.00
20000	20000.0070	20000.001	-0.006	0.048	2.00
30000	30000.0170	30000.010	-0.007	0.080	2.00

The End of Certificate

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CAL-FM-C01-15: 30 Jun 2025



ใบตรวจสอบสภาพเครื่องชั่ง

Electronic Balance Checklist

Equipment: Electronic Balance

Certificate No.: C01253246

Model: ME36S

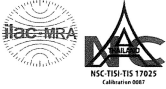
Job No.: WO-00091493

Serial No.: 27206085

Check date	รายการตรวจเช็ค (Description)		Check before delivery	หมายเหตุ (Remark)	
29 Oct 2025			29 Oct 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
General					
☒	☐	1. สายไฟ/ อะแดปเตอร์ (Electrical wire/ Adaptor)	☒	☐	
☒	☐	2. ความสมบูรณ์ชุดกระจกักแก๊ส (Cover)	☒	☐	
☒	☐	3. ความสมบูรณ์ของระดับน้ำ (Bubble spirit level)	☒	☐	
☒	☐	4. ความสมบูรณ์ของชุดขาตั้งเครื่อง (Leveling foot)	☒	☐	
☒	☐	5. การตอบสนองของปุ่มกด (Keys)	☒	☐	
☒	☐	6. ความสมบูรณ์ของหน้าจอ (Display)	☒	☐	
☒	☐	7. การแสดงผลของหน้าจอ (Screen display)	☒	☐	
☒	☐	8. ชุดรองจานชั่ง (Stopper/ Pan support)	☒	☐	
☒	☐	9. การทำงานของฟังก์ชัน (Internal/ External Function)	☒	☐	
☒	☐	10. ความสะอาดของตัวเครื่องภายนอก (External cleanliness of the balance)	☒	☐	
☒	☐	11. สภาพแวดล้อม ณ สถานที่ตั้งเครื่องชั่ง (Environment at the location of the balance)	☒	☐	

ข้อแนะนำ/ Note :

Mr. Piyapat Saidoung
Service Engineer



Certificate of Calibration

Certificate No.: C01253238

Page: 2 of 2

Equipment: Electronic Balance
Manufacturer: Sartorius
Model: BSA224S-CW
Serial No.: 34490341
ID No.: -
Condition of the item: Normal

Certificate No.: C01253238
Job No.: WO-00091491
Issued Date: 03 November 2025
Page: 1 of 2

Customer: Integrated Research Center Co.,Ltd.
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 25 °C ± 0.5 °C
Relative Humidity 67 % ± 3.3 %

Calibration Place: Double A (1991) Public Company Limited.
(Water Laboratory IP1 (Balance Room))
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Piyapat Saidoung

Calibration Date: 28 October 2025

The Method Used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02250448

Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	100	(g)
Reference Points (g)					
A	B	C	D	E	
-	0.0001	-0.0002	-0.0001	0.0001	

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00005
200	0.00007

Error of indication from nominal or conventional mass value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of indication (g)	Uncertainty (±g)	k
0.1	0.10000	0.1000	0.0000	0.00012	2.06
0.2	0.20000	0.2000	0.0000	0.00012	2.06
0.5	0.50000	0.5000	0.0000	0.00012	2.06
1	1.00001	1.0000	0.0000	0.00012	2.06
2	2.00002	2.0000	0.0000	0.00012	2.06
5	5.00001	5.0000	0.0000	0.00012	2.06
10	10.00001	10.0000	0.0000	0.00012	2.05
20	20.00001	20.0000	0.0000	0.00012	2.05
50	50.00001	50.0000	0.0000	0.00014	2.03
100	99.99992	100.0000	0.0001	0.00018	2.01
200	199.99992	200.0000	0.0001	0.00030	2.00

The End of Certificate

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
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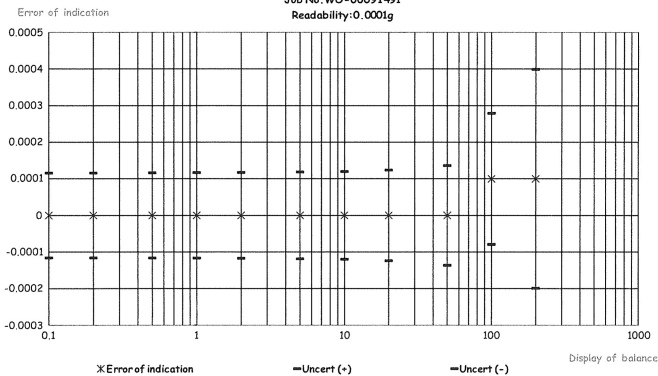
CAL-FM-C01-15: 30 Jun 2025

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CAL-FM-C01-15: 30 Jun 2025

Without Adjustment
Job No. WO-00091491
Readability: 0.0001g

ใบตรวจสอบสภาพเครื่องชั่ง
Electronic Balance Checklist

Equipment: Electronic Balance

Certificate No.: C01253238

Model: BSA224S-CW

Job No.: WO-00091491

Serial No.: 34490341

Check date		รายการตรวจเช็ค (Description)	Check before delivery		หมายเหตุ (Remark)
28 Oct 2025			28 Oct 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
		General			
☒	☐	1. สายไฟ/ อะแดปเตอร์ (Electrical wire/ Adaptor)	☒	☐	
☒	☐	2. ความสมบูรณ์ชุดกระชกกันลม (Cover)	☒	☐	
☒	☐	3. ความสมบูรณ์ของระดับน้ำ (Bubble spirit level)	☒	☐	
☒	☐	4. ความสมบูรณ์ของชุดขาตั้งเครื่อง (Leveling foot)	☒	☐	
☒	☐	5. การตอบสนองของปุ่มกด (Keys)	☒	☐	
☒	☐	6. ความสมบูรณ์ของหน้าจอ (Display)	☒	☐	
☒	☐	7. การแสดงผลของหน้าจอ (Screen display)	☒	☐	
☒	☐	8. ชุดรองจานชั่ง (Stopper/ Pan support)	☒	☐	
☒	☐	9. การทำงานของฟังก์ชัน (Internal/ External Function)	☒	☐	
☒	☐	10. ความสะอาดของตัวเครื่องภายนอก (External cleanliness of the balance)	☒	☐	
☒	☐	11. สภาพแวดล้อม ณ สถานที่ตั้งเครื่องชั่ง (Environment at the location of the balance)	☒	☐	

ข้อแนะนำ/ Note :

Mr. Piyapat Saidoung

Service Engineer

CERTIFICATE OF CALIBRATION

Certificate No. : COF-022-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5028A
SERIAL NUMBER : 2926
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Integrated Research Center Company Limited,
122 Moo 2, Thathom, Srimahaphote,
Prachinburi 25140, Thailand.

RECEIVED DATE : 05 Jun 2025
MEASUREMENT DATE : 12 Jun 2025
ISSUE DATE : 13 Jun 2025

ENVIRONMENTAL CONDITIONS:

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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 22.7 °C and 52.1 %RH.

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

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G55/MQ/W2-dp. The MW-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0016-25.

Uncertainty of Measurement:

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

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.698	752.986	22.65	22.05	60.043	1.071	1.034	0.643
2	1.003	752.904	22.57	21.90	44.794	2.326	1.524	0.944
3	1.120	752.767	22.83	22.21	39.589	2.939	1.712	1.061
4	1.167	752.907	22.91	22.32	37.026	3.231	1.795	1.109
5	1.417	752.831	23.13	22.57	25.460	4.930	2.217	1.368

Slope (m): 1.63233
Intercept (b): -0.01636
Correlation coefficient (r): 0.99980
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.698	752.986	22.65	22.05	60.043	1.071	0.649	0.644
2	1.003	752.904	22.57	21.90	44.794	2.326	0.956	0.945
3	1.120	752.767	22.83	22.21	39.589	2.939	1.075	1.063
4	1.167	752.907	22.91	22.32	37.026	3.231	1.127	1.112
5	1.417	752.831	23.13	22.57	25.460	4.930	1.393	1.372

Slope (m): 1.02238
Intercept (b): -0.01025
Correlation coefficient (r): 0.99981
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

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



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager



THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-69/0162

MTC No. EEL. BP. 63/0169

CALIBRATION CERTIFICATE

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED
Address : 122 MOO 2, T.THATOOM, A.SRIMAHAPHOTE, PRACHINBURI, 25140.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Integrating Sound Level Meter
Manufacturer : ACO
Model : 6236
Serial No. : 192015
Microphone : Type 7052NR No.73303
Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

1 / 9

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-69/0162

MTC No. EEL. BP. 63/0169

- 8 Power Amplifier Brüel&Kjær 2706 S/N 1517650.
- 9 Speaker Tannoy Limited, Great Britain British Patent No. 215300.
- 10 Digital Multimeter Agilent 34401A S/N MY44005560.
- 11 Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 13-17 Feb. 2026

2 / 9

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

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.96	94.2	94.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.2 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
23.3	0.10	N/A

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	13.6	0.10	N/A
C-Weight	19.6	0.10	N/A
Flat	23.7	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

3 / 9

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Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoimai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

FMBL.MTC.002 Rev.5

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 13-17 Feb. 2026

5 / 9

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

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Fax. (66) 0 2577 9009

Office/Laboratory
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Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

FMBL.MTC.002 Rev.5

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.2	0.2	0.0	1.5	0.45	0.6
1 000	0.2	0.2	0.2	1.0	0.45	0.6
8 000	-5.0	-5.0	-5.1	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.1	0.1	0.0	2.0	0.20	0.6
125	0.0	0.1	0.0	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	0.0	0.0	2.0	0.20	0.6
4 000	-0.4	-0.3	0.0	3.0	0.20	0.6
8 000	-0.6	-0.6	-0.1	5.0	0.20	0.7

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
122	122.0	0.0	1.1	0.30	0.3
121	121.0	0.0	1.1	0.30	0.3
120	119.9	-0.1	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	103.9	-0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.1	0.1	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.1	0.1	1.1	0.30	0.3
49	49.1	0.1	1.1	0.30	0.3
44	44.1	0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.2	0.2	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3

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7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
32	32.3	0.3	1.1	0.30	0.3
31	31.3	0.3	1.1	0.30	0.3
30	30.3	0.3	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	93.9	-0.1	1.1	0.30	0.3
20-100	94.0	93.9	-0.1	1.1	0.30	0.3

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated	Acceptance limit	Uncertainty	Maximum-permitted uncertainty
Positive one-half cycle	Negative one-half cycle	value (dB)	class 2 (±dB)	(±dB)	of measurement (±dB)
132.5	132.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by : 
(Mr. Pannasit Phasingsri)

Approved by :


(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095001

End of Certificate

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	44.6	-0.4	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.3	0.3	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3
20-90	25	25.2	0.2	1.1	0.30	0.3
20-80	25	25.1	0.1	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.6	-0.4	+1.0; -2.5	0.20	0.3
	0.25	89.0	-1.0	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
SEL	200	109.9	-0.1	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

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CALIBRATION CERTIFICATE

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED

Address : 122 MOO 2, T.THATOOM, A.SRIMAHAPHOTE, PRACHINBURI, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Ambient Environment

Description : Sound Level Meter

Temperature : (23 ± 3) °C

Manufacturer : Delta OHM

Relative Humidity : (50 ± 15) %

Model : HD 2010UC

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No. : 11040842480

Microphone : Type UC-52 No.121411

Preamplifier : Delta Type HD2010PNE2 No.11001019

Standards used :

- Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
- Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
- Decade Attenuator Ando AL-205 S/N 00464602.
- Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
- Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
- Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
- Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 13-17 Feb. 2026

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.3	0.3	0.2	1.5	0.45	0.6
1 000	-0.3	-0.3	-0.3	1.0	0.45	0.6
8 000	-5.3	-5.1	-5.3	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	-0.1	-0.3	2.0	0.20	0.6
125	0.0	0.0	-0.1	1.5	0.20	0.6
250	0.0	0.0	0.0	1.5	0.20	0.6
500	0.0	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.1	0.0	2.0	0.20	0.6
4 000	0.0	0.1	0.0	3.0	0.20	0.6
8 000	0.0	0.1	0.0	5.0	0.20	0.7

Date of Calibration : 13-17 Feb. 2026

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
93.95	93.7	94.0	0.1	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.6	0.10	N/A

2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	18.7	0.10	N/A
C-Weight	25.1	0.10	N/A
Flat	27.2	0.10	N/A

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5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
120	120.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
43	43.0	0.0	1.1	0.30	0.3
42	42.1	0.1	1.1	0.30	0.3

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
60-140	65	65.0	0.0	1.1	0.30	0.3
50-130	55	55.0	0.0	1.1	0.30	0.3
40-120	45	45.0	0.0	1.1	0.30	0.3
30-110	35	35.2	0.2	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.8	-0.2	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.6	-0.4	+1.5; -5.0	0.20	0.3
Slow	200	109.4	-0.2	±1.0	0.20	0.3
	2	89.8	-0.2	+1.0; -5.0	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13-17 Feb. 2026

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
41	41.1	0.1	1.1	0.30	0.3
40	40.1	0.1	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
60-140	94.0	94.0	0.0	1.1	0.30	0.3
50-130	94.0	94.0	0.0	1.1	0.30	0.3
40-120	94.0	94.0	0.0	1.1	0.30	0.3
30-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 13-17 Feb. 2026

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10. Peak C sound level

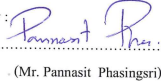
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.3	-0.1	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-0.2	2.0	0.20	0.35

11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	140.5	0.0	1.5	0.20
Negative one-half cycle	140.5	0.0	1.5	0.20

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	139.0	0.0	0.3	0.10	0.1
End	139.0	0.0	0.3	0.10	0.1

Calibrated by : 
(Mr. Pannasit Phasingsri)

Approved by : 
(Mr. Prawate Khuaypa)
Director

Date of Calibration : 13-17 Feb. 2026
Date of Issue : 17 Feb. 2026

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref : 2011269010900095010

End of Certificate

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ภาคผนวก จ-2

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

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	IRON	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
			Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	26/1/2026	25/1/2027
2	Digestion Units	TOTAL KJELDAHL NITROGEN	FOSS Analytical Co.,Ltd (China)	DT2508/2520 / 91905060	FOSS South East Asia	15257	12/2/2026	11/2/2027
3	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC9L0013	Technology Promotion Association (Thailand-Japan)	26CH144	2/2/2026	2/2/2027
4	SCT Meter	CONDUCTIVITY (umhos/cm)	Horiba	LAQUA-EC210 / HC1L0016	Technology Promotion Association (Thailand-Japan)	25CH168	5/2/2025	3/2/2026
5	Ion Selective Electrode Meter	FLUORIDE	Thermo Fisher Scientific, Indonesia And USA	Orion Star A214 / X36836	Science Tech Co.,Ltd.	ST014/25	20/5/2025	19/5/2026
			Thermo Fisher Scientific, Indonesia And USA	Orion Star A214 / X36836	Science Tech Co.,Ltd.	ST018/26	18/5/2026	17/5/2027
6	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	KT9 / 91905393	FOSS South East Asia	15256	12/2/2026	11/2/2027
7	Kjeltec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	13319	27/1/2025	26/1/2026
8	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltec 8100 / 91889052	FOSS South East Asia	13854	24/2/2025	23/2/2026
9	UV-VIS Spectrophotometer	COLOUR (pH 7.0) COLOUR (pH Sample)	Agilent	Cary 60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP25-019	26/5/2025	25/5/2026
			Agilent	Cary 60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP26-013	18/5/2026	17/5/2027
10	UV-VIS Spectrophotometer	NITRATE PHOSPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP25-021	26/5/2025	25/5/2026
			Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP26-012	18/5/2026	17/5/2027

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

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	TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MX204 / C511670418	METTLER TOLEDO	TH2068-032-050825-ACC-TH	8/5/2025	7/5/2026

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

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

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Important Customer Web Links

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

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Instrument Maintenance

System Information

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

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

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3432 A	M 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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

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

- ☒ Discuss any specific issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. ๓๓๓
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ Section not applicable

Electronic components

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

Mechanical components

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

Optics components

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

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Sample Introduction and Atomization

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

Gas handling components and safety interlocks

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

Analytical performance for Flame systems

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

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FURNACE SYSTEM section

☒ Section not applicable

Electronic components

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

Mechanical components

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

Optics components

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

Gas handling, water system and workhead component checks

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

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

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

Analytical performance for Furnace systems

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

PSD autosampler accessory for Furnace systems

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

Sample introduction pump system (SIPS) accessory

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

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

Sample preparation system (SPS 4) accessory

☒ Section NOT Applicable

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

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

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

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

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

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

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

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Vapor generation accessory VGA (hydride generator)

☐ Section NOT Applicable

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

UltrAA lamp accessory (external)

☒ Section NOT Applicable

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

Restore System

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

Guidance

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

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Signature Page

Service Review

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

Test Results

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

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AA consumable and parts list table

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

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

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

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

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Service Engineer Comments (optional)

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

Service Completion

Service request number 6007949143 Date service completed 30 Jan 2025
Agilent signature Kanyakorn S. Customer signature Janida Y.
Total number of pages in this document 13

Revision: 10.00, Issued: November 2021
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Frequency:

Averaging Period: 30.0
Datapoint Count: 20
Upper Limit: 51.00
Average Frequency: 50.00
Lower Limit: 49.00
Highest Measured Frequency: 50.00
Lowest Measured Frequency: 50.00
Result: **Passed**

Power Supply:

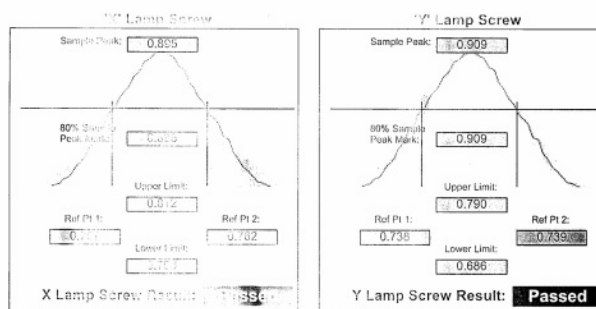
Averaging Period: 30.0
Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3
Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Spectral Alignment:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current (mA): 4.00
Grating Wavelength (nm): 0.5
1st Order Wavelength (nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.65	324.75	325.15	Passed
Second Order	649.27	649.51	649.97	Passed

Wavelength Repeatable Data:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal
Lamp Alignment: 
Lower Limit(nm) 324.750 324.888 Upper Limit(nm)
(Approach from Zero Order) (Approach from end)
Sample 1: 324.823 Sample 2: 324.823
Sample 3: 324.873 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.819
Sample 7: 324.819 Sample 8: 324.819
Sample 9: 324.823 Sample 10: 324.819
Mean: 324.823 Standard Deviation: 0.003

Result: 

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

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SVD Results Report SVD

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Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected
Lamp 2: 87 - Silver/Cadmium/Land/Zinc(UltrAA) (Ag/C Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu)
Lamp 4: Uncoded Lamp/Not Connected
Lamp 5: Not Supported
Lamp 7: Not Supported
Lamp 8: Not Supported

Result: 

GTA Temperature Monitoring:

Notes:

Signatures:

Date
Kanyakorn S.
30 Jan 2025
Date

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

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SVD Results Report SVD

เอกสารไม่ควบคุม

Manual Drive:

Wavelength Drive:

Slit Drive:

Turret Drive:

Auto Burner Adjuster Drive:

Manual Drive:

Signal Processing Linearity:

Calculate Mode: New Only Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	134	134	297	
S1	118	118	191	
S2	271	271	332	
C2	474	474	579	
S4	935	935	1008	
S7	1495	1495	1754	
S9	2408	2408	3053	
S7	4947	4947	5313	

Interlock:

Burner Filter: 
H2O Burner Filter: 
Flame Off: Closed: 
Gas Control Filter: 
Pressure Release Soling Filter: 
Liquid Trap Filter: 
Flame Detect: 
SCU Active: 
Oxidant Pressure: 
Oxidant Changeover: 
Ignition: 

Report Generated At: 1/30/2025 10:53 AM

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SVD Results Report SVD

เอกสารไม่ควบคุม

Sequential by time report

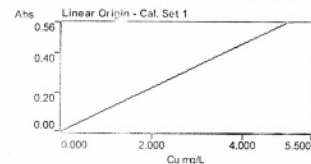
1/30/2025 10:53 AM
Page 1 of 1

SpectrAA

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

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs		
CAL ZIRCO	0.000	38.8	0.0002		
Readings	0.0002	0.0003	0.0001	1/30/2025	10:51:46 AM
STANDARD 1	5.000	0.1	0.5571		
Readings	0.5574	0.5563	0.5575	1/30/2025	10:52:22 AM



Curve Fit = Linear Origin
Characteristic Conc = 0.030 mg/L
r = 1.0000
Calculated Conc = 0.002 5.000
Residuals = -0.002 0.000

Abs = 0.11141 x C

5 ppm Cu	5.025	0.3	0.5558		
Readings	0.5552	0.5596	0.5615	1/30/2025	10:52:54 AM

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

6

SVD Results Report SVD

เอกสารไม่ควบคุม

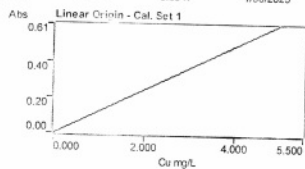
เอกสารไม่ควบคุม

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

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	64.1	-0.0002
Readings			
-0.0003	-0.0003	-0.0001	1/30/2025 10:46:52 AM

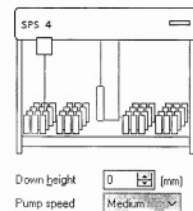
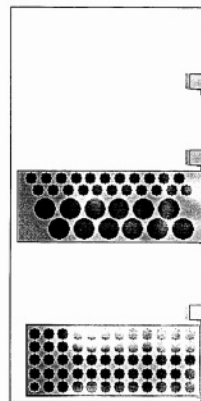
STANDARD 1	5.000	0.3	0.6052
Readings			
0.6036	0.6073	0.6047	1/30/2025 10:47:24 AM



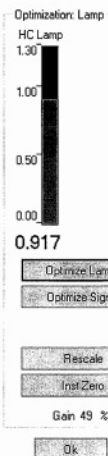
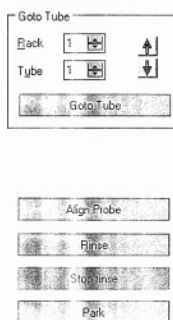
Curve Fit = Linear Origin
Characteristic Conc = 0.605 mg/L
 r = 1.0000
Calculated Conc = -0.002 5.000
Residuals = 0.002 0.000

Abs = 0.12105 x C

5 ppm Cu	5.007	0.2	0.6051
Readings			
0.6055	0.6052	0.6047	0.6042
0.6055	0.6076	0.6064	0.6079
			1/30/2025 10:48:32 AM



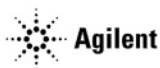
Key to tube colors
● Sample
● Calibration
● Calibration/QC
● Sample/QC
● Not Assigned



Sensitivity Check 1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Agilent AA Series Spectrometers

Preventative Maintenance Checklist

Foreword

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>

Agilent AA Series Spectrometers Preventative Maintenance Checklist

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Customer information

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

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.

Other important Customer Web links

- How to get information on your product: Literature Library – <http://www.agilent.com/chem/library>
- Need to know more? www.agilent.com/chem/education
- Need technical support, FAQs? www.agilent.com/chem/techsupport
- Need supplies? www.agilent.com/chem/supplies

System information

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

Instrument system name and ID	240 FS AAS
Instrument system site and location	United Analyst and Engineering Consultant
List system component product numbers	List the serial numbers of each component
1 G 8452 A	1 M7 13160001
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Preparation, Safe operation and Initial performance checks

- ☐ 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 questions or issues with the customer prior to starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. ☒
- ✓ Review the instrument logbook for recorded problems and comments.
- ✓ Save instrument control settings before starting the procedure.
- ✓ Perform a general inspection of the system for cleanliness.
- ✓ Check for proper installation of parts, assemblies, sensors etc.
- ✓ Check system for required installation of components, settings as defined by current Service Notes

- ✓ Check for required firmware updates and verify with customers if they would like them installed.
- ✓ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ✓ Perform a Basic Cu ABS test - "As found test_2"
- ✓ Print the Details page or screen captures of the test results and attach to the end of this checklist.

Preventative maintenance procedures

Flame systems

- ☐ 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
- ☐ Automatic Burner Adjuster

Optics components

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

Sample introduction and Atomization

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

Gas handling components and safety interlocks

- ✓ Pressure test for leaks
- ✓ Leak test gasbox internal components using gasbox leak tester G8434-67013
- ✓ 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 systems

- ✓ Section NOT applicable.

Electronic components

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

Mechanical components

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

☐ Lamp selector

Optics components

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

Gas handling, water system, and workhead component checks

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

Accessories

- ☐ Section NOT applicable.

Sample introduction pump system (SIPS) accessory

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

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Vapor generation accessory VGA (hydride generator)

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

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

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Test Results

Test description	Expected test result	Actual test result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	46.7.
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.6331
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.71.
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
MSR% (327.4 nm)	≥ 70 %	-

AA consumable and parts list

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	55 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	55 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	55 240 280	*	Common
Kit, Mix 7 O-rings, aqueous, complete set	9910093400	55 240 280	PM supplied	Flame
Organic Kit	9910093500	55 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	55 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	55 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	55 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	55 240 280	consumable	Flame

Teflon impact beads (5/pk): (organics only)	9910053300	55 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	55 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	55 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	55 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	55 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	55 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-6279 can be used as a cheaper alternative for 6610030100.

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

Service Engineer Comments (optional)

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

Service Completion

Service Request Number:

6008056466

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Date of Service Completion:

26 Jan 2026

Customer Name:

Chaiwan Heng

Customer Signature:

SVD Results Report



Report ID:3 Diagnostic Start Time:1/26/2026 9:39:56 AM Diagnostic End Time:1/26/2026 9:05:49 AM

Customer: UAE

Service Engineer: Kanyakorn S.

Address:

Contact Details: 026376363#1

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: "Y" Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 79270.602 D2 Run Hours: 58906.000
Zero Wavelength Offset: 30.095 D2 Serial Number: not set !
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 35125.582 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0

Datapoint Count: 20

Upper Limit:
51.00Average Frequency:
50.00Highest Measured Frequency:
50.00Lower Limit:
49.00Lowest Measured Frequency:
50.00Result: **Passed**

Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

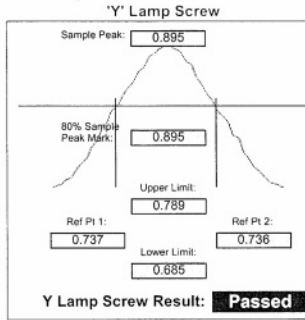
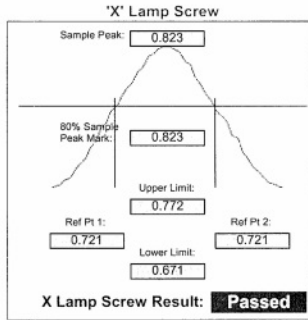
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.02	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

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

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.74	325.15	Passed
Second Order	649.23	649.50	649.97	Passed

Report Generated At: 1/26/2026 9:06:40 AM

3

SVD Results Report

เอกสารไม่ควบคุม

Wavelength Repeatability:

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

Lamp Alignment: **Performed**

Lower Limit(nm) 324.768 324.888 Upper Limit(nm)

(Approach from Zero Order)

Sample 1: 324.828

Sample 3: 324.823

Sample 5: 324.823

Sample 7: 324.823

Sample 9: 324.819

(Approach from end)

Sample 2: 324.823

Sample 4: 324.823

Sample 6: 324.819

Sample 8: 324.819

Sample 10: 324.819

Mean: 324.823

Standard Deviation: 0.003

Result: **Passed**

Report Generated At: 1/26/2026 9:06:40 AM

4

SVD Results Report

เอกสารไม่ควบคุม

Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	508	579	Passed
S4	825	919	1008	Passed
S5	1435	1529	1754	Passed
S6	2498	2771	3053	Passed
S7	4347	4755	5313	Passed

Interlocks:

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

Report Generated At: 1/26/2026 9:06:40 AM

5

SVD Results Report

เอกสารไม่ควบคุม

Auto Lamp Recognition:

Lamp 1: 87 - Silver/Cadmium/Lead/Zinc(UltraAA) (Ag/CLamp 5: Not Supported
Lamp 2: 68 - Zinc (Zn) Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: Uncoded Lamp/Not Connected Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

David Hagi 26 Jan 26 Kanyakorn S. 26 Jan 2026
UAE Date Kanyakorn S. Date

Report Generated At: 1/26/2026 9:06:40 AM

6

SVD Results Report

เอกสารไม่ควบคุม

Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Sensitivity Test
Comment
Methods Cu
Computer name DESKTOP-R9UIFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.633	1.4	0.6331
Readings			
0.6413	0.6340	0.6241	1/26/2026

Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-R9UIFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.618	0.7	0.6180
Readings			
0.6145	0.6187	0.6081	0.6168 0.6253 0.6196
0.6197	0.6195	0.6188	0.6189 1/26/2026

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

FOSS

Customer Service Report

Date: Feb 12, 2026
Job No.: 14590
Instrument: DT2520

FOSS South East Asia
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Report No.: 15257

Customer: JAE

Address: Bangkok

Serial: 99905060

Start	Finish	Travel To Customer (Hrs)	Labour (Hrs)	Travel From Customer (Hrs)
			13.30 15.00 1.5	

Application	Special	Standard
Distributor	Courtesy Visit	Installation
Digital Service	PMA Approval Check	Quote
Internal	Warranty	Repair
Training	Sales Support	Investigate
		HC Visit
		Others

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test
- PM
- Visual Check
+ No leak -ok
+ No damage -ok
- Change PM kit x 1 Set -ok
- Function Check
+ Quick mode
+ Set Temp / timer -ok
+ Run -ok
- heating -ok
- Lift UP/down -ok
- Clean x20 holes with dried hand

Instrument Ready for Use OK X Not OK*

Part No.	Batch	Description	Q'ty
60079730	37.09.2025	Fold PM kit, digester 25 pcf, 12 unit	1

Signed FOSS	Signed Customer
Name: Anna / Pichana / Sukkarn	Name: ธีรณ
Tel:	Tel:
Email:	Email:

*Remark:

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Please scan QR code

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 26CH144
Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC9L0013
ID No. : UAE.EFM.011/2563(EFM.SCT.05/63)
Condition As-Received: Used Item
Received Date : 02 February 2026
Calibration Date : 03 February 2026
Reference : 2602-0038WSC-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 : Walalak Sirithean
Approved by : Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saitip Meangmai
Issue Date : 04 February 2026

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.



Cert.No.: 26CH144

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	9549224	130RC003	251440	16 Apr 2026
2) Ref. Std. Thermometer	4982054	110RC044	251708	03 July 2026

- This measurement result 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
1413.5 µS/cm	CPA Chem	1150497	30 Oct 2026
12.881 mS/cm	CPA Chem	1081099	11 Mar 2026

- Control Conductivity calibration solution temperature by Water bath (25 ± 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 1413.5 µS/cm

Conductivity Electrode Serial No.: 9B9F0286

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.5 µS/cm	1431 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	12.92 mS/cm	12.76 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration



Cert.No.: 26CH144

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement**

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	9383
- Serial No. :	9B9F0286

Dimension of probe;

- Length :	110 mm
- Diameter :	16 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	15.002	15.0	-0.002	0.13	2.00
30.0	30.001	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)
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TEL.0-2717-3000-29 FAX.0-2719-9484

**Certificate of Calibration**

Cert.No.: 25CH168

Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC1L0016
ID No. : UAE.EFM.014/2565(EFM.SCT.01/65)
Condition As-Received: Used Item
Received Date : 04 February 2025
Calibration Date : 05 February 2025
Reference : 2502-0107WSC-4
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 Lerngagtrakul
Approved by : 
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saitip Meangmai
Issue Date : 06 February 2025

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 25CH168

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 µS/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 ± 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 µS/cm

Conductivity Electrode Serial No.: 9B1J0042

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1412.9 µS/cm	1355 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	12.26 mS/cm	12.72 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

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Cert.No.: 25CH168
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. : 9B1J0042

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	15.003	15.0	-0.003	0.13	2.00
30.0	30.002	29.9	-0.102	0.13	2.00
45.0	45.001	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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SCIENCE TECH CO., LTD.

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Job No. : J014/25

Certificate No. : ST014/25

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
UUC Condition As-Received : Good
Submitted by : บริษัท ยูไนเทค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Calibration Procedure : In - house method : WI-ST-LAB-7.2/1 based on direct measurement by using standard voltage calibrator
Issue date : Wednesday, May 21, 2025

Calibrated by : Khannika Sangkham

Approved by :

(Khannika Sangkham)
Laboratory manager

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 Science Tech Laboratory.

F/W-ST-LAB-7.2/1 #2

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Certificate of Calibration

Job No. : J014/25

Certificate No. : ST014/25

Received date : Friday, May 16, 2025

Page : 2 of 2

Calibration date : Tuesday, May 20, 2025

Condition of this calibration result

- Reference standard instrument : Voltage calibrator Yokogawa 7651 S/N. 91H441999 Certificate No. 24E3876
Due date 12 June 2025 TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
- This certificate was certified only for the instrument we calibrated
- This result of calibration was found accurate as shown on date and place of calibration only

Result of Calibration

Function : pH meter

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

Unit Under Calibration	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (mV)	Correction (mV)	Uncertainty (± mV)	k Factor
pH Meter	177.48	4	177.4	0.1	0.060	2.00
Model STAR A214	0.0	7	0.0	0.0	0.064	2.00
S/N. X36836	-177.48	10	-177.4	-0.1	0.078	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%

-0000- End of Certificate of Calibration -0000-

เอกสารไม่ควบคุม

F/W-ST-LAB-7.2/1 #3



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Science Tech Laboratory : 279/27-29 Soi Watpoman Sathupradit 19 Rd. Chongnondsee Yannawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856

Job No. : JF006/25

Certificate No. : FT006/25

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Ion Selective Model : 9409BN
Serial No. : ZW1-18420
Reference Electrode Model : 900100
Serial No. : ZW1-16834
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
Submitted by : บริษัท ยูไนเทค แอนาไลติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Issue date : Wednesday, May 21, 2025
Calibrated by : Khannika Sangkham
Approved by : (Khannika Sangkham)
Laboratory manager

เอกสารไม่ควบคุม



Certificate of Calibration

Job No. : JF006/25

Certificate No. : FT006/25

Received date : Friday, May 16, 2025

Page : 2 of 2

Calibration date : Tuesday, May 20, 2025

Condition of this calibration result

1 Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)

2 This certificate was certified only for the instrument we calibrated

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

Result of Calibration

Function : pH/ISE Meter with Probe

Direct Measurement

First Standard concentrated = 0.1 ppm
Secondary Standard concentrated = 1 ppm
Tertiary Standard concentrated = 10 ppm
Fourthly Standard concentrated = 100 ppm
Slope = -58.4 mV/Dec.

Channel : 1

Unit Under Calibration	Standard Concentrated (ppm)	UUC Reading (ppm)	Correction (ppm)	Stdev (ppm)
Model :	0.1	0.109	-0.009	0.00
9409BN S/N. ZW1-18420	1	1.03	-0.02	0.01
900100 S/N. ZW1-16834	10	9.97	0.03	0.03
	100	99.6	0.4	1.17

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2

เอกสารไม่ควบคุม



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Science Tech Laboratory : 279/27-29 Soi Watpoman Sathupradit 19 Rd. Chongnondsee Yannawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856



Job No. : J018/26

Certificate No. : ST018/26

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
UUC Condition As-Received : Good
Submitted by : บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ อินจิเนียริ่ง คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Calibration Procedure : In - house method : WI-ST-LAB-7.2/I based on direct measurement by using standard voltage calibrator
Issue date : Wednesday, May 20, 2026

Calibrated by : Khannika Sangkham

Approved by :

(Khannika Sangkham)
Laboratory manager

The uncertainties are for a confidence probability of approximately 95%

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F/W-ST-LAB-7.2/I #2

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เอกสารไม่ควบคุม



Certificate of Calibration

Job No. : J018/26

Certificate No. : ST018/26

Received date : Friday, May 15, 2026

Page : 2 of 2

Calibration date : Monday, May 18, 2026

Condition of this calibration result

1 Reference standard instrument : Voltage calibrator Yokogawa 7651 S/N. 91H441999 Certificate No. 26E7
Due date 5 June 2026 TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

2 This certificate was certified only for the instrument we calibrated

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

Result of Calibration

Function : pH meter

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

Unit Under Calibration	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading (mV)	Correction (mV)	Uncertainty (± mV)	k Factor
pH Meter	177.48	4	177.4	0.1	0.060	2.00
Model STAR A214	0.0	7	0.0	0.0	0.064	2.00
S/N. X36836	-177.48	10	-177.4	-0.1	0.078	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%

-00000- End of Certificate of Calibration -00000-

เอกสารไม่ควบคุม

แก้ไขครั้งที่ 00 วันที่ประกาศใช้ 1/7/63

F/W-ST-LAB-7.2/I #3



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Science Tech Laboratory : 279/27-29 Soi Watpoman Sathupradit 19 Rd. Chongnondsee Yannawa Bangkok 10120 Tel. 0-2285-4101 Fax. 0-2285-4856

Job No. : JF004/26

Certificate No. : FT004/26

Page : 1 of 2

Certificate of Calibration

Equipment : pH/ISE Meter
Manufacturer : Orion
Made in : USA
Model : STAR A214
Serial No. : X36836
ID No. : UAE.WAT.025/2560
Ion Selective Model : 9409BN
Serial No. : ZW1-18420
Reference Electrode Model : 900100
Serial No. : ZW1-16834
Range : 0 to 14 pH
Resolution : 0.001 pH 0.1 mV
Submitted by : บริษัท ยูนิเทค แอนาไลติกส์ แอนด์ อินจิเนียริ่ง คอนซัลแตนท์ จำกัด
3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพฯ 10260
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (50 ± 15)%
Issue date : Wednesday, May 20, 2026

Calibrated by : Khannika Sangkham

Approved by :

(Khannika Sangkham)
Laboratory manager

เอกสารไม่ควบคุม



Certificate of Calibration

Job No. : JF004/26

Certificate No. : FT004/26

Received date : Friday, May 15, 2026

Page : 2 of 2

Calibration date : Tuesday, May 19, 2026

Condition of this calibration result

1 Reference standard materials : Certified Fluoride standard reference solution (Directly measured by differential potentiometry with the aid of potassium fluoride "quasi without transference" against solutions prepared from primary reference materials from NIST)

2 This certificate was certified only for the instrument we calibrated

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

Result of Calibration

Function : pH/ISE Meter with Probe

Direct Measurement

First Standard concentrated = 0.1 ppm
Secondary Standard concentrated = 1 ppm
Tertiary Standard concentrated = 10 ppm
Fourthly Standard concentrated = 100 ppm
Slope = -57.9 mV/Dec.

Channel : I

Unit Under Calibration	Standard Concentrated (ppm)	UUC Reading (ppm)	Correction (ppm)	Stdev (ppm)
Model :	0.1	0.107	-0.007	0.00
9409BN S/N. ZW1-18420	1	1.02	-0.02	0.01
900100 S/N. ZW1-16834	10	10.1	-0.1	-0.05
	100	100	0	0.46

-00000-

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FOSS

Customer Service Report

Date:	Feb 12, 2026	Customer:	UAE
Job No.:	14589	Address:	Bangkok
Instrument:	KT9 Distillator	Serial:	919105393

Start	Travel To Customer (Hrs)	Labour (Hrs)	Travel From Customer (Hrs)
Finish	07.00 09.30	1.5 13.30	4

Application	Special	Standard
Distributor	Courtesy Visit	Installation
Digital Service	PMA Approval Check	Quote
Internal	Warranty	Repair
Training	Sales Support	Investigate

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test				
- BM-				
- Visual Check				
+ No leak			-ok	
+ No damage			-ok	
- change BM kit x1	Set		-ok	
- Function Check				
+ Distillation			-ok	
+ Alkali:			-ok	
+ Receiver			-Not use	
+ Steam Control			-ok	
-				

Part No.	Batch	Description	Qty
60100196	11-03-2025	PM kit kjeltec 9 Distillator	1

I confirm this report is accurate and complete	
Signed FOSS	Signed Customer
Name: Anonita Petchan / Jekhan	Name: ปิทยา
Tel: 0819509894	Tel: 0819509894
Email: pitiya.sukwan199@gmail.com	Email: pitiya.sukwan199@gmail.com

*Remark:

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Please scan QR code

FOSS

Customer Service Report

Date:	Jan 27, 2025	Customer:	UAE
Job No.:	11695	Address:	Bangkok
Instrument:	KT200	Serial:	91790524

Start	Travel To Customer (Hrs)	Labour (Hrs)	Travel From Customer (Hrs)
Finish	09.00 10.00	1 13.00	3

Application	Special	Standard
Distributor	Courtesy Visit	Installation
Digital Service	PMA Onboarding	Quote
Internal	Warranty	Repair
Investigate	Sales Support	Remote

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test				
- PM - + Visual Check + - No leak - ok - have damage on heater & main switch - Not ok + replace heater 10. main switch 10.000 VOA - ok + replace PM kit x 1 Set - ok + Function Check - Power on OFF - Alkali - Steam - Condenser				
Instrument Ready for Use		OK	Not OK*	

Part No.	Batch	Description	Qty
10069965	11-06-2024	FOSS PM kit KT200 better Analyser / 2100	1
10003512	29-03-2024	Heating element Steam	1
15630111	19-10-2022	Unit for K555 kit + 2 PM	1

I confirm this report is accurate and complete	
Signed FOSS	Signed Customer
Name: Anonita Petchan / Jekhan	Name: เอกสาร
Email:	Customer Contact:

*Remark:

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FOSS

Customer Service Report

Date:	24 February 2025	Customer:	UAE
Job No.:	11735	Address:	Bangkok
Instrument:	KT8100	Serial:	91887052

Start	Travel To Customer (Hrs)	Labour (Hrs)	Travel From Customer (Hrs)
Finish	07:00 09:00	2hrs 13:00-14:00	0hrs 17:00

Application	Special	Standard
Distributor	Courtesy Visit	Installation
Digital Service	PMA Onboarding	Quote
Internal	Warranty	Repair
Investigate	Sales Support	Remote

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test				
PM KIT800 12mo				
- test before PM				
- cleaning KIT800, 36 mo replace				
- flushing Alkali pump				
- test operation				
- Distillation 80 - 80 ml				
- Distillation 6 min 150-120ml				
- Alkali 50-50ml				
- All pass				

Part No.	Batch	Description	Qty
60031210	08-01-2024	FOSS PM kit KT800 8100 36 Mo	1

I confirm this report is accurate and complete	
Signed FOSS	Signed Customer
Name: Anonita Petchan / Jekhan	Name: สุทธิกรณ์
Email:	Customer Contact:

*Remark:

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DQEServices

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DQE
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP25-019Page 1 of 5

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, 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 : (Mr.Tanawut Rittidach)Approved by : (Ms.Chonticha Sangnern)Quality Manager

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

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

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DQE
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 2 of 5

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 : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.
Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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DQE
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 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
	2.1876	2.1876	0.0000	0.0084	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0219	0.0020	0.0035	2.00
	2.1230	2.1207	0.0023	0.0085	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	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
546.1	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
	1.9973	2.0021	-0.0048	0.0102	2.00
590	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
635	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

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CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019Page 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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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ISO 17025:2017

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP25-019

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC 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
360.93	360.5	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 : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- End of Certificate -

เอกสารไม่ควบคุม

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ISO 17025:2017

LABORATORY DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP26-013

Page 1 of 5

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

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, 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 : 18 May 2026

Calibration Date : 18 May 2026

Issue Date : 21 May 2026

Condition Instrument : Good

Calibrated by :

Mr.Pacit Mathavorn

Calibration Engineer

Approved by :

Ms.Chonticha Sangngern

Quality Manager

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

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

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ISO 17025:2017

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-013

Page 2 of 5

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	136858	5 November 2027
Absorbance Standard set	25757	136848	5 November 2027
Wavelength Standard set	25806	136824	5 November 2027
Wavelength Standard set	25758	136827	5 November 2027

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 : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.000 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-013

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	0.0001	-0.0001	0.0028	2.00
	0.5772	0.5731	0.0041	0.0031	2.00
	1.0478	1.0427	0.0051	0.0029	2.00
	2.1879	2.1782	0.0097	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5581	0.5574	0.0007	0.0034	2.00
	1.0224	1.0210	0.0014	0.0035	2.00
	2.1227	2.1159	0.0068	0.0083	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5225	0.5184	0.0041	0.0029	2.00
	0.9628	0.9603	0.0025	0.0028	2.00
	1.9744	1.9698	0.0046	0.0073	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5174	0.5150	0.0024	0.0031	2.00
	0.9990	0.9964	0.0026	0.0033	2.00
	1.9953	1.9884	0.0069	0.0085	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5508	0.5491	0.0017	0.0030	2.00
	1.0801	1.0781	0.0020	0.0029	2.00
	2.0356	2.0274	0.0082	0.0078	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5579	0.5570	0.0009	0.0031	2.00
	1.0512	1.0491	0.0021	0.0029	2.00
	1.9257	1.9201	0.0056	0.0079	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP26-013 Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000 0.7455	0.0000 0.7457	0.0000 -0.0002	0.0050 0.0056	2.00 2.00
257	0.0000 0.8656	0.0000 0.8669	0.0000 -0.0013	0.0050 0.0059	2.00 2.00
313	0.0000 0.2910	0.0000 0.2907	0.0000 0.0003	0.0050 0.0051	2.00 2.00
350	0.0000 0.6414	0.0000 0.6414	0.0000 0.0000	0.0050 0.0055	2.00 2.00

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REPORT OF CALIBRATION

Certificate No. : SP26-013 Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.70	241.6	0.10	0.18	2.00
279.44	279.2	0.24	0.18	2.00
287.71	287.6	0.11	0.18	2.00
334.02	333.5	0.52	0.18	2.00
360.89	360.2	0.69	0.18	2.00
418.53	417.8	0.73	0.18	2.00
445.82	445.2	0.62	0.18	2.00
453.67	453.0	0.67	0.18	2.00
459.99	459.6	0.39	0.18	2.00
536.52	536.4	0.12	0.18	2.00
638.00	638.2	-0.20	0.18	2.00
431.22	430.5	0.72	0.18	2.00
472.66	472.2	0.46	0.18	2.00
513.39	513.3	0.09	0.18	2.00
528.90	528.7	0.20	0.18	2.00
572.99	573.6	-0.61	0.18	2.00
585.19	585.7	-0.51	0.20	2.00
684.50	684.5	0.00	0.18	2.00
741.02	741.2	-0.18	0.20	2.00
748.56	749.0	-0.44	0.18	2.00
807.02	806.8	0.22	0.18	2.00
879.41	879.4	0.01	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

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CERTIFICATE OF CALIBRATION

Certificate No. : SP25-021 Page 1 of 5

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

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

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 26 May 2025

Calibration Date : 26 May 2025

Issue Date : 29 May 2025

Condition Instrument : Good

Calibrated by : ปัทม (Mr.Tanawut Rittidach) Technical Manager

Approved by : ชลจิณี (Ms.Chonticha Sangnarn) Quality Manager

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

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

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REPORT OF CALIBRATION

Certificate No. : SP25-021 Page 2 of 5

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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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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DQE Services

MSC-TS1705 17025 CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-021Page 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	1.043	0.0054	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	0.0034	2.00
	1.0239	1.022	0.0019	0.0035	2.00
	2.1230	2.121	0.0020	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	0.960	0.0033	0.0029	2.00
	1.9753	1.973	0.0023	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.998	0.0022	0.0033	2.00
	1.9973	1.995	0.0023	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.036	0.0013	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.926	0.0014	0.0079	2.00

เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

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

DQE Services

MSC-TS1705 17025 CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-021Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.866	0.0014	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.640	0.0030	0.0055	2.00

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DQE Services

MSC-TS1705 17025 CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP25-021Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.0	0.72	0.18	2.00
279.45	278.8	0.65	0.18	2.00
287.81	287.2	0.61	0.18	2.00
334.06	333.6	0.46	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.2	0.39	0.18	2.00
445.94	445.6	0.34	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.6	-0.01	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.8	0.08	0.18	2.00
573.17	573.2	-0.03	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.2	-0.17	0.18	2.00
879.28	879.6	-0.32	0.18	2.00

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DQE Services Co.,Ltd.

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

DQE Services

MSC-TS1705 17025 CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP26-012Page 1 of 5

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

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

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 18 May 2026

Calibration Date : 18 May 2026

Issue Date : 21 May 2026

Condition Instrument : Good

Calibrated by :

Mr.Pacit Mathavorn

Calibration Engineer

Approved by :

Ms.Chonticha Sangngern

Quality Manager

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

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

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เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

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ISO 17025

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

Page 2 of 5

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	136858	5 November 2027
Absorbance Standard set	25757	136848	5 November 2027
Wavelength Standard set	25806	136824	5 November 2027
Wavelength Standard set	25758	136827	5 November 2027

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

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LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

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
	0.5772	0.575	0.0022	0.0031	2.00
	1.0478	1.043	0.0048	0.0029	2.00
	2.1879	2.197	-0.0091	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5581	0.558	0.0001	0.0034	2.00
	1.0224	1.022	0.0004	0.0035	2.00
	2.1227	2.131	-0.0083	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5225	0.518	0.0045	0.0029	2.00
	0.9628	0.961	0.0018	0.0028	2.00
	1.9744	1.981	-0.0066	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5174	0.515	0.0024	0.0031	2.00
	0.9990	0.997	0.0020	0.0033	2.00
	1.9953	1.995	0.0003	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5508	0.549	0.0018	0.0030	2.00
	1.0801	1.079	0.0011	0.0029	2.00
	2.0356	2.036	-0.0004	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5579	0.558	-0.0001	0.0031	2.00
	1.0512	1.050	0.0012	0.0029	2.00
	1.9257	1.928	-0.0023	0.0079	2.00

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

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LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7455	0.742	0.0035	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8656	0.860	0.0056	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2910	0.288	0.0030	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6414	0.635	0.0064	0.0055	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

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LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.3	0.42	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.5	0.16	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.3	0.17	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udom Suk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong
Zip / Postal: 10260
State / Province: Bangkok
Order Number: 

Weighing Device

Manufacturer: Mettler Toledo
Model: MX204
Serial No.: C511670418
Building: N/A
Floor: 2
Room: Balance Room 206

Instrument Type: Weighing Instrument
Asset Number: UAE.AIR.011/2568
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CPW002/20
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/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 20.9 °C End: 21.2 °C	Start: 53.6 % End: 52.3 %

As Found Calibration Date: 09-May-2025
As Left Calibration Date: N/A
Issue Date: 10-May-2025

Calibrator: Naruephon C
Naruephon Chonprasertsuk

Approved Signatory: 
Technical Manager / Head of Calibration Center

เอกสารไม่ควบคุม

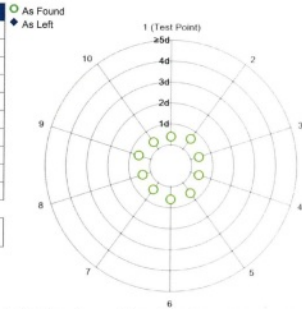
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9999 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	99.9999 g	N/A
9	100.0000 g	N/A
10	99.9999 g	N/A

Standard Deviation	0.00005 g	N/A
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The "1" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.9999 g	N/A
2	99.9999 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A
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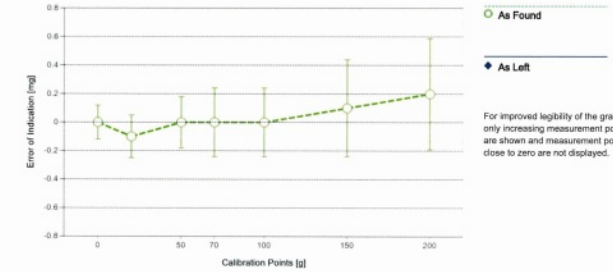
The "1" in the graph represents the readability of the range/interval in which the test was performed.

เอกสารไม่ควบคุม

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
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	2
4	3.0000 g	3.0000 g	0.0000 g	0.15 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	0.15 mg	2
8	50.0000 g	50.0000 g	0.0000 g	0.18 mg	2
9	69.9999 g	69.9999 g	0.0000 g	0.24 mg	2
10	99.9999 g	99.9999 g	0.0000 g	0.24 mg	2
11	149.9999 g	150.0000 g	0.0001 g	0.34 mg	2
12	199.9999 g	200.0001 g	0.0002 g	0.39 mg	2



For improved legibility of the graphics only increasing 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 such that 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 E2

Weight Set No.: WS22
Certificate Number: 194558
Date of Issue: 23-Sep-2024
Calibration Due Date: 17-Mar-2026

Thermo Hygrometer

Equipment No.: IN284
Certificate Number: SG-H-00169/68
Date of Issue: 23-Jan-2025
Calibration Due Date: 20-Jan-2026

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Remarks

FACT adjustment functionality activated
Equipment condition: Good
Calibration after installation
Next calibration according to customer's procedure
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.

เอกสารไม่ควบคุม

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: $2.0 \cdot 10^{-6} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use: $3 K$

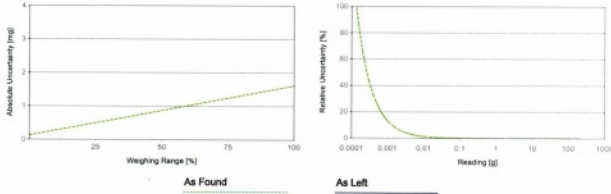
Linearization of Uncertainty Equation

Range	d	Max	As Found	As Left
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.00876 \text{ mg/g} \cdot R$	N/A

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test 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 (Examples)

Net Indication	As Found	As Left
0.0220 g	0.13 mg	0.59%
0.2200 g	0.13 mg	0.060%
2.2000 g	0.14 mg	0.0086%
22.0000 g	0.28 mg	0.0013%
220.0000 g	1.6 mg	0.00074%



เอกสารไม่ควบคุม

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%	0.13255 g	0.26692 g	0.40315 g	0.68132 g	1.41207 g
0.2%	0.06605 g	0.13255 g	0.19951 g	0.33480 g	0.68132 g
0.3%	0.04398 g	0.08817 g	0.13255 g	0.22193 g	0.44898 g
0.5%	0.02637 g	0.05281 g	0.07932 g	0.13255 g	0.26692 g
1%	0.01317 g	0.02637 g	0.03958 g	0.06605 g	0.13255 g
2%	0.00659 g	0.01317 g	0.01977 g	0.03297 g	0.06605 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01317 g	0.02637 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%	0.13255 g	0.26692 g	0.40315 g	0.68132 g	1.41207 g
0.2%	0.06605 g	0.13255 g	0.19951 g	0.33480 g	0.68132 g
0.3%	0.04398 g	0.08817 g	0.13255 g	0.22193 g	0.44898 g
0.5%	0.02637 g	0.05281 g	0.07932 g	0.13255 g	0.26692 g
1%	0.01317 g	0.02637 g	0.03958 g	0.06605 g	0.13255 g
2%	0.00659 g	0.01317 g	0.01977 g	0.03297 g	0.06605 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01317 g	0.02637 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 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear 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 looks at the behavior of the instrument from the past until test 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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GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

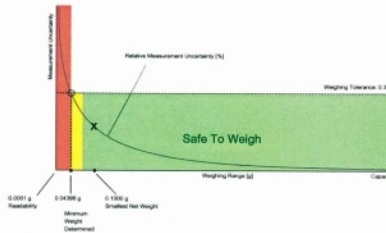
The weighing device meets the given process requirements.

Tests Performed: ☒ As Found ☐ As Left ☒ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: 0.3% | Smallest Net Weight: 0.1000 g | Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

เอกสารไม่ควบคุม

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed
✗ = Failed
⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

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

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.3%	0.1500 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

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

เอกสารไม่ควบคุม

Error of Indication

As Found

Control 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
69.9999 g	0.0000 g	0.0350 g	0.0700 g	0.1050 g	0.1750 g	0.3500 g	0.7000 g	1.7500 g
99.9999 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
149.9999 g	0.0001 g	0.0750 g	0.1500 g	0.2250 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	0.0002 g	0.1000 g	0.2000 g	0.3000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓	✓

As Left

Control 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
69.9999 g	0.0000 g	0.0350 g	0.0700 g	0.1050 g	0.1750 g	0.3500 g	0.7000 g	1.7500 g
99.9999 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
149.9999 g	0.0001 g	0.0750 g	0.1500 g	0.2250 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
199.9999 g	0.0002 g	0.1000 g	0.2000 g	0.3000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓	✓

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

ใบรับรองการสอบเทียบเครื่องชั่ง (Verification of Certificate)

Certificate No.: TH2068-032-050825-ACC-TH						Equipment: Electronic Balance		
Brand: Mettler Toledo						Model: MP204		
Serial No.: C512670418						ID No.: LAE-AR-011/2548		
Nominal Value	Standard Value	Average Reading	Error	Correction	Uncertainty of Measurement	U + Error	Judgement	(Total Error < Judgement)
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(Pass / Fail)
-	0.0000	0.0000	0.0000	0.0000	0.00012	0.00012	0.0000	Pass
-	0.1000	0.1000	0.0000	0.0000	0.00013	0.00013	0.0000	Pass
-	1.0000	0.9999	-0.0001	0.0001	0.00013	0.00023	0.0000	Pass
-	3.0000	3.0000	0.0000	0.0000	0.00015	0.00015	0.0000	Pass
-	5.0000	5.0000	0.0000	0.0000	0.00014	0.00014	0.0000	Pass
-	10.0000	10.0000	0.0000	0.0000	0.00014	0.00014	0.0000	Pass
-	20.0000	19.9999	-0.0001	0.0001	0.00015	0.00025	0.0000	Pass
-	50.0000	50.0000	0.0000	0.0000	0.00018	0.00018	0.0000	Pass
-	69.9999	69.9999	0.0000	0.0000	0.00020	0.00020	0.0000	Pass
-	99.9999	99.9999	0.0000	0.0000	0.00020	0.00024	0.0000	Pass
-	149.9999	150.0000	0.0001	-0.0001	0.00020	0.00024	0.0000	Pass
-	199.9999	200.0001	0.0002	-0.0002	0.00020	0.00019	0.0000	Pass
ผู้สอบ: 11/6/58								
ผู้ตรวจ: 11/6/58								
1.1								

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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 24H005159JEN	Technology Promotion Association (Thailand-Japan)	25CH1181	15 Oct 25	14 Oct 26	-
2	Conductivity Meter	Conductivity	YSI	Pro30 18K100976	Technology Promotion Association (Thailand-Japan)	25CH1183	15 Oct 25	14 Oct 26	-

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	Apex Instruments, USA.	XC-572-V 0707048	Envi Equipment Service Co., Ltd.	E25-060064	23 Jun 25	22 Jun 26	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 61658806/0419	Entech Industrial Solution Co., Ltd.	G 250001	7 Jul 25	6 Jul 26	-



Certificate of Calibration

Cert.No.: 25CH1181
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : 24H005159JEN
ID No. : UAE,EFM.041/2567(EFM,pH.04/67)
Condition As-Received: Used Item
Received Date : 14 October 2025
Calibration Date : 15 October 2025
Reference : 2510-0389WSC-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 : Walalak Sirithean

Approved by :
Approved Signatory

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

Issue Date : 17 October 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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Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	25E2743	25 Aug 2026
2) Ref. Standard Thermometer	4982054	110RC044	25I708	03 July 2026

- 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 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	1114384	12 June 2027
pH 6.999	Hach Lenge GmbH	C03273	13 May 2027
pH 10.010	CPA chem	1135355	16 Aug 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
	pH	mV	mV	pH		
pH Meter S/N.: 24H005159JEN	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



Cert.No.: 25CH1181
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.: 240904SIA605377	4,007	4,01	167	0,0085	2,05
	6,999	7,00	-8	0,0096	2,00
	6,999	6,99	-7	0,0095	2,00
	10,010	10,00	-179	0,0092	2,00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 240904SIA605377
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 (± °C)	Coverage factor k
15,0	15,001	14,8	-0,201	0,13	2,00
30,0	30,002	29,8	-0,202	0,13	2,00
45,0	45,002	44,8	-0,202	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.: 25CH1183
Page.: 1 of 3

Equipment : Conductivity Meter
Manufacturer : YSI Environmental
Model : Pro 30
Serial No. : 18K100976
ID No. : UAE,EFM,071/2562(ENV,SCT,01/62)
Condition As-Received: Used Item
Received Date : 14 October 2025
Calibration Date : 15 October 2025
Reference : 2510-0392WSC-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 certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by :
Approved Signatory

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

Issue Date : 17 October 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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Cert.No.: 25CH1183

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	9549224	130RC003	25440	16 Apr 2026
2) Ref. Std. Thermometer	4982054	110RC044	251708	03 July 2026

- This measurement result 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
1413.5 µS/cm	CPA Chem	1135361	16 Aug 2026
12.881 mS/cm	CPA Chem	1081099	11 Mar 2026

- Control Conductivity calibration solution temperature by Water bath (25 ± 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 1413.5 µS/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1413.5 µS/cm	1415 µS/cm	1414 µS/cm	9.2 µS/cm	2.00
12.881 mS/cm	12.91 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark : - UUC* = Unit Under Calibration

Cert.No.: 25CH1183

Page.: 3 of 3

Calibration Results**Function : Temperature Measurement**

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO30 COND-T
- Serial No. : 18L100008

Dimension of probe;

- Length : 93.6 mm
- Diameter : 2.7 mm
- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
15.0	15.002	14.9	-0.102	0.13	2.00
30.0	30.002	29.9	-0.102	0.13	2.00
45.0	45.001	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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เอกสารไม่ควบคุม

EES

Envi Equipment Service Co., Ltd.

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

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E25-060064

Page.: 1 of 6

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 0707048
ID./Control No. : UAE.EFM 154/2550
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 23/06/2025
Issue Date : 23/06/2025

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by :



(Mr. Mana Fuekhud)

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EES

Certificate No. : E25-060064

Page : 2 of 6

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	23/06/2025	10:10 AM	Std Temp	293	K
Console Serial Number	0707048	Calibration Reference No.	SER25-060026			Std Press	760	mm Hg
DGM Model Number	SK2SEX	Barometric Pressure	756.66 mmHg			K ₁	0.386	
DGM Serial Number	00005715	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _m)	(V _m)	(V _m)	(t _m)	(t _m)	(V _w)	(V _w)	(t _w)	(t _w)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.43	13.0	1494.165	1494.305	30	30	318.24808	318.38780	27	27
12.48	13.0	1494.305	1494.445	29	29	318.38780	318.52746	26	26
8.68	26.0	1494.453	1494.593	29	29	318.53544	318.67534	26	26
8.68	26.0	1494.593	1494.733	29	29	318.67534	318.81470	26	26
14.00	40.0	1494.744	1495.024	29	29	318.82562	319.10360	26	26
13.95	40.0	1495.024	1495.304	29	29	319.10360	319.38016	26	26
10.43	70.0	1495.317	1495.597	29	29	319.39396	319.66846	25	25
10.42	70.0	1495.597	1495.877	29	29	319.66846	319.94278	25	25
9.13	90.0	1495.888	1496.168	29	29	319.95320	320.22582	25	25
9.12	90.0	1496.168	1496.448	30	30	320.22582	320.49780	25	25



เอกสารไม่ควบคุม

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

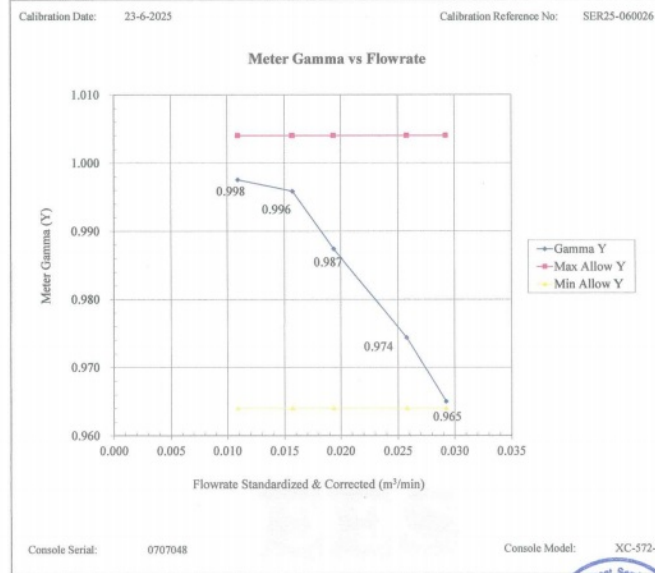
Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	23/06/2025	10:10 AM	Std Temp	293	K
Console Serial Number	0707048	Calibration Reference No.	SER25-060026			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.66			K ₁	0.386	
DGM Serial Number	00005715	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate			
(V _{std})	(Q _{std})	(V _w)	(Q _w)	(Y)	(ΔY)	Std & Corr	(Q _{std})	(ΔH _g)	Variation
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O		(ΔH _g)
0.136	0.011	0.136	0.011	0.998	0.014	0.011	47.763	0.542	
0.137	0.011	0.136	0.011	0.997	0.013	0.011	48.028	0.808	
0.137	0.016	0.137	0.016	0.998	0.014	0.016	46.435	-0.786	
0.137	0.016	0.136	0.016	0.994	0.010	0.016	46.795	-0.425	
0.274	0.020	0.271	0.019	0.990	0.006	0.019	47.163	-0.058	
0.274	0.020	0.270	0.019	0.985	0.001	0.019	47.308	0.088	
0.276	0.026	0.269	0.026	0.975	-0.009	0.026	47.123	-0.098	
0.276	0.026	0.269	0.026	0.974	-0.010	0.026	47.034	-0.186	
0.276	0.030	0.267	0.029	0.966	-0.018	0.029	47.253	0.033	
0.276	0.030	0.267	0.029	0.964	-0.020	0.029	47.303	0.082	
				0.984	Y Average		47.221	ΔH _g Average	

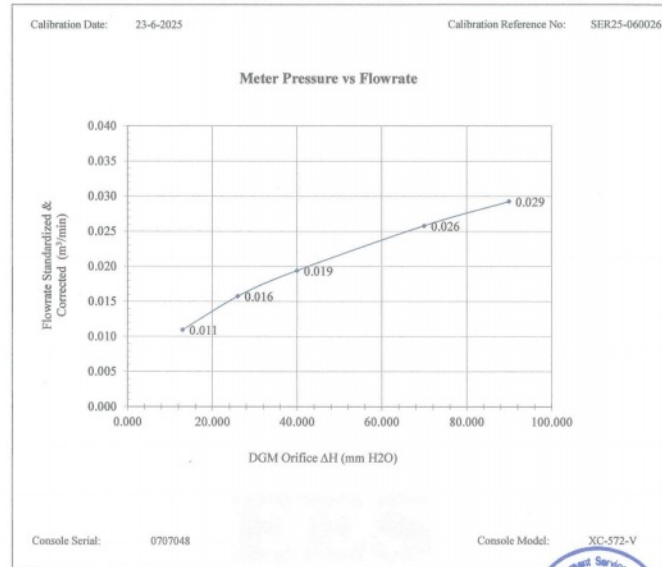
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable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



Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	23/06/2025	10:10 AM	Std Temp	293	K
Console Serial Number	0707048	Calibration Reference No.	SER25-060026			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.66			K ₁	0.386	
DGM Serial Number	00005715	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	23/06/2025	10:10 AM	Std Temp	293	K
Console Serial Number	0707048	Calibration Reference No.	SER25-060026			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.66			K ₁	0.386	
DGM Serial Number	00005715	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	23/06/2025	00:15 PM
Console Serial Number	0707048	Calibration Reference No.		SER25-060026	
DGM Model Number	SK25EX	Reference Thermometer		DIGICON	
DGM Serial Number	00005715	Serial Number		183169105	
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 15588				

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-17.0	24.0	38.0	92.0	147.0	256.0	366.0	476.0	585.0	805.0	1036.0
Aux	-17.0	24.0	38.0	92.0	147.0						
Probe	-17.0	24.0	38.0	92.0	147.0						
Filter	-17.0	24.0	38.0	92.0	147.0						
Oven	-17.0	24.0	38.0	92.0	147.0						
Exit	-17.0	24.0	38.0								

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



Certificate No: G 250001
Date of issue : 07-Jul-25

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 61658806/0419
Control unit serial no. : 03345171/0419
ID no. or control no. : UAE.EFM 122/2562
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : United Analyst and Engineering Consultant Co.,Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10260

Total pages of certificate : 2 Pages
Receiving no. : L-252465
Receiving date. : 30-Jun-25
Parameter of calibration : Gas Calibration(Oxygen 2.50, 9.984, 21.01 %vol, Carbon Monoxide 80.45, 300.9, 1007 ppm, Nitrogen Dioxide 30.68, 81.8, 202.6 ppm, Nitric Oxide 30.0, 151.8, 322.5 ppm, Sulphur Dioxide 50.36, 100.7, 600.8 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized labotary
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent 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 item under test Environmental condition.

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

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

Date of calibration : 07-Jul-25


Mr. Kwanchai Khamdoug

Calibration Technician


Mrs. Nongluck Wongsettee

Technical Manager

Certificate No.: G 250001

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 9.984 % Vol	CG-0113-24	Nimitt	01-Aug-29
Oxygen (O2) 21.01 % Vol	CG-0112-24	Nimitt	01-Aug-29
Carbon monoxide (CO) 80.45 ppm	CG-0132-24	Nimitt	10-Sep-29
Carbon monoxide (CO) 300.9 ppm	1422/25	Linde	21-May-29
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-26
Nitrogen Dioxide (NO2) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO2) 202.6 ppm	3794/24	Linde	23-Dec-26
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimitt	06-May-26
Nitric Oxide (NO) 151.8 ppm	0404/25	Linde	09-Feb-27
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.7 ppm	2662/24	Linde	25-Aug-26
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 21.7 °C Humidity : 68.3 %RH Pressure : 1010.4 mbar

Calibration conditions

Gas Temperature : 22 °C Flow rate : 1,300 ml/min Gas pressure : 1014.2 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.45	-0.05	0.15
O2 (%Vol)	9.984	9.89	-0.094	0.20
O2 (%Vol)	21.01	21.07	0.06	0.30
CO (ppm)	80.45	80	-0.45	3.0
CO (ppm)	300.9	300	-0.9	6.0
CO (ppm)	1007	1004	-3	12
NO2 (ppm)	30.68	28.9	-1.78	8.0
NO2 (ppm)	81.8	80.4	-1.4	8.0
NO2 (ppm)	202.6	199.5	-3.1	12
NO (ppm)	30.0	32	2.0	8.0
NO (ppm)	151.8	154	2.2	8.0
NO (ppm)	322.5	323	0.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.7	101	0.3	6.0
SO2 (ppm)	600.8	603	2.2	13

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm., Sensor (CO, NO2, NO, SO2) New.

End of Report