

ภาคผนวก ฎ  
เอกสารสอบเทียบเครื่องมือ

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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ และคุณภาพน้ำ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือสำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	TSP PM 10	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	TH2058-097-040722- ACC-TH	7 Apr 22	6 Apr 23	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	TH2058-098-040722- ACC-TH	7 Apr 22	6 Apr 23	-
3	Gas Chromatography - Mass Spectrometer (GC-MS)	VOCs (BTEX)	Bruker Scion	451-GC / BR1201M099 Scion-SQ / GQS1203F021 CP8400 / BR1203M331	World Tech Enterprise Co.,Ltd.	SV2205/20385	19 May 22	18 May 23	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์									
1	pH Meter	ค่าความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature)	Hanna Instrument	HI2020-02 / C0051107	National Food Institute, Ministry of Industry, Thailand	2103272-001-02	14 Jun 21	13 Jun 22	BOD
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2101930-001-01	17 Mar 21	16 Mar 22	WW, Soil น้ำทิ้งไป
3	Conductivity Meter	ค่าการนำไฟฟ้า (EC) ความเค็ม (Salinity)	SI Analytics	Lab955 / 16300356	SPC Calibration Center Co.,Ltd.	C24210091	29 Mar 21	28 Mar 22	WW, Soil น้ำทิ้งไป
4	BOD Incubator	บีโอดี (BOD)	Arco	UR-1320 / (UAE.LAB.006/2553)	Technology Promotion Association (Thailand-Japan)	21TM812	21 Apr 21	20 Apr 22	-
5	BOD Incubator		Arco	UC4-1320 / (UAE.LAB002/2550)	Technology Promotion Association (Thailand-Japan)	21TM1405	17 Aug 21	16 Aug 22	-
6	BOD Incubator		Arco	UC4-1320 / (UAE.LAB018/2559)	Technology Promotion Association (Thailand-Japan)	21TM1406	17 Aug 21	16 Aug 22	-
7	UV-VIS Spectrophotometer	ऑปติค (SO <sub>a</sub> <sup>2+</sup> )	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP21-015	29 May 21	28 May 22	-
8	UV-VIS Spectrophotometer		Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP21-008	25 Jan 21	24 Jan 22	-
9	UV-VIS Spectrophotometer		Merck	Pharo 100 / 12390016	DQE Services Co.,Ltd.	SP21-009	25 Jan 21	24 Jan 22	-

บริษัท ยูนิเทค แอแนลิสต์ แอนด์ เอ็นจิเนียริง คอนสัลแตนท์ จำกัด  
ห้องปฏิบัติการวิเคราะห์มาตรฐาน ISO/IEC 17025

Certificate Page 1/2

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ และคุณภาพน้ำ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
10	Analytical Balance (Repeatability 0.01 mg)	ของแข็งแขวนลอย (SS) ของแข็งละลายน้ำทั้งหมด (TDS)	Mettler-Toledo	AX105DR / 1122100406	National Food Institute, Ministry of Industry, Thailand	2200708-001-01	24 Nov 21	23 Nov 22	-
11	Hot Air Oven		Memmert	UF55 / B216.1666	Technology Promotion Association (Thailand-Japan)	21TM1876	29 Oct 21	28 Oct 22	-
12	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	21TM813	21 Apr 21	20 Apr 22	-
13	Inductively Coupled Plasma (ICP)	<u>กลุ่มโลหะหนัก</u> As ,Cd ,Total Cr ,Pb ,Total Hg , Ni ,Se ,Ba ,Cu ,Zn ,Fe ,Mn	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	9 Dec 21	8 Dec 22	-
14	Atomic Absorption Spectrometer (AAS)	โพแทสเซียม (K) แคลเซียม (Ca) โซเดียม (Na)	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research (TISTR).	MTC.ACL. No. 335/64	4 Feb 21	3 Feb 22	-
15	Incubator	ฟิคอลโคลิฟอร์มแบคทีเรีย (FCB)	Memmert	IPP 260 / V618.0033	Technology Promotion Association (Thailand-Japan)	21TM1875	28 Oct 21	27 Oct 22	-
16	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	21TM1874	28 Oct 21	27 Oct 22	-
17	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	21TM708	21 Apr 21	20 Apr 22	-
18	Water Bath		Memmert	WNE 14 / L416.0614	Technology Promotion Association (Thailand-Japan)	21TM424	22 Feb 21	21 Feb 22	-
19	Analytical Balance		Mettler-Toledo	MS6035 / B0070110311	National Food Institute, Ministry of Industry, Thailand	2200705-001-01	24 Nov 21	23 Nov 22	-
20	Autoclave		ALP	CL-40L / 802664	Technology Promotion Association (Thailand-Japan)	21TM425	23 Feb 21	22 Feb 22	-
21	Autoclave		ALP	CL-40L / 807298	Technology Promotion Association (Thailand-Japan)	21TM831	7 May 21	6 May 22	-

Mettler-Toledo (Thailand) Ltd.  
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District  
Bangna District, Bangkok 10260  
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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 Contact: Suwit Chotnok  
Zip / Postal: 10260  
State / Province: Bangkok  
Order Number: 

### Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument  
Model: AB204-S Asset Number: UAE.AIR.019/2550  
Serial No.: 1128312528 Terminal Model: N/A  
Building: N/A Terminal Serial No.: N/A  
Floor: 2 Terminal Asset No.: N/A  
Room: Balance Room 2 (208)

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: CP/W002/20

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: 22.5 °C	End: 21.4 °C	Start: 56.1 %	End: 63.2 %

As Found Calibration Date: 07-Apr-2022 Calibrator:   
As Left Calibration Date: N/A  
Issue Date: 08-Apr-2022  
Approved Signatory:   
☒ Kassakorn Tassanachaisakul  
☐ Santi Jitniyom  
☐ Surachet Sukkate

## Measurement Results

### Repeatability

Test Load: 100 g

	As Found	As Left
1	99.9999 g	N/A
2	100.0000 g	N/A
3	99.9998 g	N/A
4	100.0000 g	N/A
5	99.9999 g	N/A
6	100.0000 g	N/A
7	99.9999 g	N/A
8	100.0001 g	N/A
9	99.9999 g	N/A
10	100.0000 g	N/A

Standard Deviation	0.00008 g	N/A
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

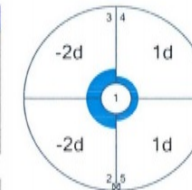
The results of this graph are based upon the absolute values of the differences from the mean value.

### Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	99.9998 g	N/A
3	99.9998 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A

Maximum Deviation	0.0002 g	N/A
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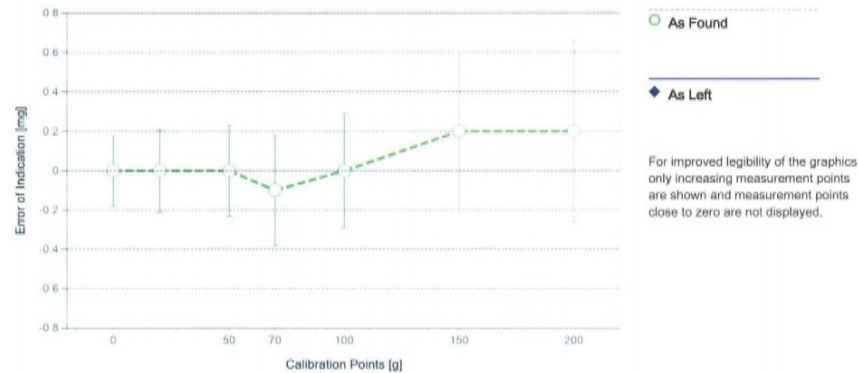
As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

## Error of Indication

### As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.18 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.19 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.19 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.19 mg	2
5	10.0000 g	9.9999 g	-0.0001 g	0.20 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.21 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.23 mg	2
8	70.0001 g	70.0000 g	-0.0001 g	0.28 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.29 mg	2
10	150.0000 g	150.0002 g	0.0002 g	0.40 mg	2
11	200.0001 g	200.0003 g	0.0002 g	0.46 mg	2



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor  $k$  – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

## 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.:	WS80	Date of Issue:	23-Feb-2022
Certificate Number:	C208581631	Calibration Due Date:	14-Aug-2023

### Thermo Hygrometer

Equipment No.:	IN161	Date of Issue:	14-Jun-2021
Certificate Number:	21H1220	Calibration Due Date:	01-Jun-2022

## Remarks

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

Test weight by Filter pan : 1 g = 0.9999 g, 3 g = 3.0000 g, 5 g = 5.0000 g

### End of Accredited Section

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



## Measurement Uncertainty of the Weighing Instrument in Use

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

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

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

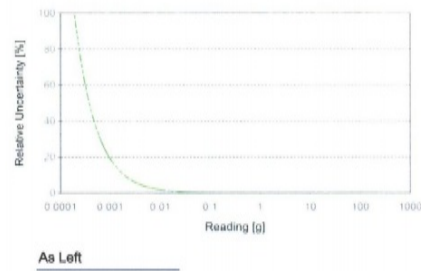
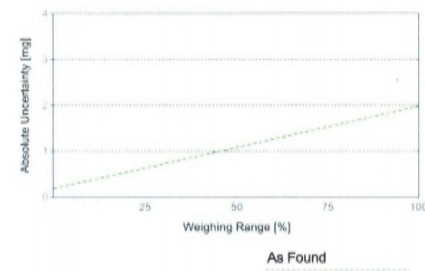
### Linearization of Uncertainty Equation

1	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.19 \text{ mg} + 0.00817 \text{ mg/g} \cdot R$	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	0.19 mg	0.86%	N/A	N/A
0.2200 g	0.19 mg	0.087%	N/A	N/A
2.2000 g	0.21 mg	0.0095%	N/A	N/A
22.0000 g	0.37 mg	0.0017%	N/A	N/A
220.0000 g	2.0 mg	0.00090%	N/A	N/A



## Mettler-Toledo (Thailand) Ltd.

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Bangna District, Bangkok 10260


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## 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: 

Contact: Suwit Chotnok

### Weighing Device

Manufacturer: Mettler Toledo  
Model: AB204-S/FACT  
Serial No.: B108115858  
Building: N/A  
Floor: 2  
Room: Balance Room 2 (206)

Instrument Type: Weighing Instrument  
Asset Number: UAE.AIR.016/2555  
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: CP/W002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations 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: 22.6 °C	End: 22.1 °C	Start: 56.0 %	End: 51.9 %
As Left	Start: 22.3 °C	End: 22.4 °C	Start: 46.2 %	End: 55.8 %

As Found Calibration Date: 07-Apr-2022

As Left Calibration Date: 07-Apr-2022

Issue Date: 08-Apr-2022

Calibrator:



Sirawit Chamchan

Approved Signatory:



- ☒ Kassakorn Tassanachaisakul  
☐ Santi Jitniyom  
☐ Surachet Sukkate

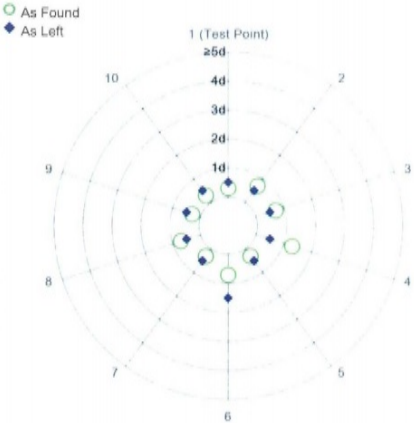
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0005 g	99.9999 g
2	100.0004 g	100.0000 g
3	100.0004 g	99.9999 g
4	100.0006 g	100.0000 g
5	100.0005 g	99.9999 g
6	100.0004 g	99.9998 g
7	100.0005 g	100.0000 g
8	100.0004 g	100.0000 g
9	100.0005 g	100.0000 g
10	100.0005 g	100.0000 g

Standard Deviation	0.00007 g	0.00007 g
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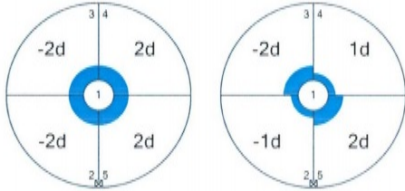
The "d" in the graph represents the readability of the range/interval in which the test was performed.  
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0005 g	100.0000 g
2	100.0003 g	99.9999 g
3	100.0003 g	99.9998 g
4	100.0007 g	100.0001 g
5	100.0007 g	100.0002 g

Maximum Deviation	0.0002 g	0.0002 g
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

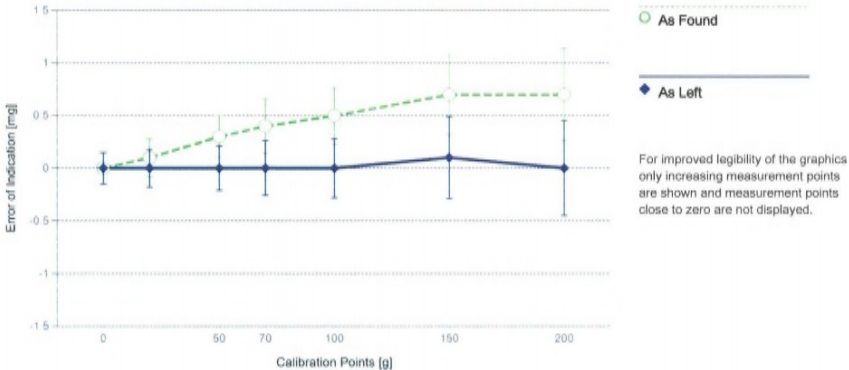
Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1001 g	0.0001 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.16 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.16 mg	2
5	10.0000 g	10.0001 g	0.0001 g	0.17 mg	2
6	20.0000 g	20.0001 g	0.0001 g	0.18 mg	2
7	50.0000 g	50.0003 g	0.0003 g	0.20 mg	2
8	70.0001 g	70.0005 g	0.0004 g	0.26 mg	2
9	100.0000 g	100.0005 g	0.0005 g	0.27 mg	2
10	150.0000 g	150.0007 g	0.0007 g	0.38 mg	2
11	200.0001 g	200.0008 g	0.0007 g	0.44 mg	2

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.15 mg	2
2	0.1000 g	0.1000 g	0.0000 g	0.16 mg	2
3	1.0000 g	0.9999 g	-0.0001 g	0.17 mg	2
4	5.0000 g	5.0000 g	0.0000 g	0.17 mg	2
5	10.0000 g	10.0000 g	0.0000 g	0.17 mg	2
6	20.0000 g	20.0000 g	0.0000 g	0.18 mg	2
7	50.0000 g	50.0000 g	0.0000 g	0.21 mg	2
8	70.0001 g	70.0001 g	0.0000 g	0.26 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.28 mg	2
10	150.0000 g	150.0001 g	0.0001 g	0.39 mg	2
11	200.0001 g	200.0001 g	0.0000 g	0.45 mg	2



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

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

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.: WS80 Date of Issue: 23-Feb-2022  
Certificate Number: C208581631 Calibration Due Date: 14-Aug-2023

Thermo Hygrometer

Equipment No.: IN161 Date of Issue: 14-Jun-2021  
Certificate Number: 21H1220 Calibration Due Date: 01-Jun-2022

Remarks

FACT adjustment functionality activated  
Value of the built-in weight adjusted  
Equipment condition: Good  
Next calibration according to customer's procedure  
Calibration data not decide by calibration laboratory  
Test weight by Filter pan : 1 g = 1.0000 g, 3 g = 3.0000 g, 5 g = 5.0000 g

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:  $2.5 \cdot 10^{-6} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

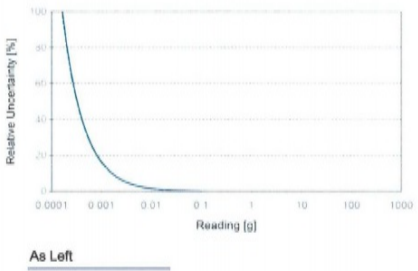
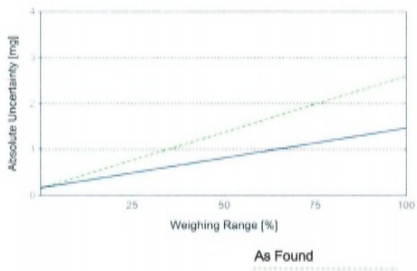
Linearization of Uncertainty Equation

1	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.16 \text{ mg} + 0.0111 \text{ mg/g} \cdot R$	$U_1 = 0.16 \text{ mg} + 0.00592 \text{ mg/g} \cdot R$

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	0.16 mg	0.73%	0.16 mg	0.73%
0.2200 g	0.16 mg	0.074%	0.16 mg	0.073%
2.2000 g	0.18 mg	0.0084%	0.17 mg	0.0079%
22.0000 g	0.40 mg	0.0018%	0.29 mg	0.0013%
220.0000 g	2.6 mg	0.0012%	1.5 mg	0.00066%



เอกสารไม่ควบคุม





## Calibration Certificate

**Certificate No.:** 2200704-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** Electronic Balance

**Manufacturer:** Mettler Toledo

**Model:** AB204-S

**Serial No.:** 1128312528

**ID No.:** UAE.AIR.019/2550


**Order No.:** 2200704

**Operation No.:** 2200704-001

**Date of Receipt:** 24 November 2021

**Date of Calibration:** 24 November 2021

**Calibrated by** Mr.Worapob Sooktong  
 Scientist

**Approved by**   
 ( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 30 November 2021

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1128312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021

Page 2 of 5

**Environment Condition:** Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 43 ± 2.5 %

**Place of Calibration:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M21010975	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M21010985	13 January 2022

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	สพ.พ.จ. BTH 003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

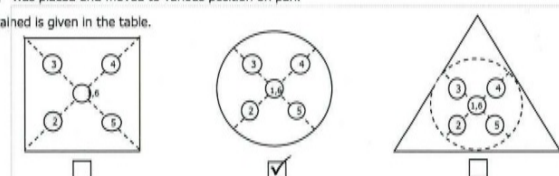
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
10	0.00000
20	0.00000

**2. Off-Center Error:**

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
49.9999	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2200704-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** Mettler Toledo

**Model:** AB204-S

**Resolution:** 0.0001 g

**Serial No.:** 1128312528

**ID No.:** UAE.AIR.019/2550

**Capacity:** 200 g

**Date of Calibration:** 24 November 2021

Page 3 of 5

**Calibration Results:** (Continued)

**Calibration Range:** 0-20 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

(Test Weight by filter pan)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.01	0.01000	0.0100	0.0000	0.000082	2.00
0.05	0.05000	0.0500	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.50000	0.5000	0.0000	0.000083	2.00
1	1.00001	1.0000	0.0000	0.000083	2.00
2	2.00001	2.0000	0.0000	0.000083	2.00
3	3.00001	3.0000	0.0000	0.000084	2.00
4	4.00001	4.0000	0.0000	0.000085	2.00
5	5.00000	4.9999	0.0001	0.000084	2.00
10	9.99998	9.9999	0.0001	0.000087	2.00
15	14.99998	14.9999	0.0001	0.000089	2.00
20	19.99999	19.9999	0.0001	0.000089	2.00

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2200704-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** Mettler Toledo

**Model:** AB204-S

**Resolution:** 0.0001 g

**Serial No.:** 1128312528

**ID No.:** UAE.AIR.019/2550

**Capacity:** 200 g

**Date of Calibration:** 24 November 2021

Page 4 of 5

**Environment Condition:** Ambient Temperature: 21.5 ± 0.5 °C Relative Humidity: 43 ± 2.5 %

**Place of Calibration:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M2101097S	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M2101098S	13 January 2022

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	สพ.พ.ล. BTH 003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

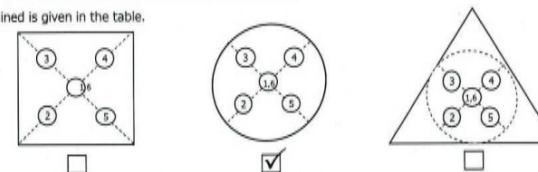
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
100	0.00000
200	0.00000

**2. Off-Center Error:**

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 ( g )	2 ( g )	3 ( g )	4 ( g )	5 ( g )	6 ( g )	(Maximum Difference) ( g )
49.9999	49.9999	49.9999	49.9999	49.9999	49.9999	0.0000

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2200704-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S  
**Serial No.:** 1128312528  
**Capacity:** 200 g  
**Manufacturer:** Mettler Toledo  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.019/2550

**Date of Calibration:** 24 November 2021

Page 5 of 5

**Calibration Results:** (Continued)

**Calibration Range:** 0-200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.50000	0.5000	0.0000	0.000083	2.00
1	1.00001	1.0000	0.0000	0.000083	2.00
5	5.00000	4.9999	0.0001	0.000084	2.00
10	9.99998	9.9999	0.0001	0.000087	2.00
20	19.99999	19.9999	0.0001	0.000089	2.00
50	49.99990	49.9999	0.0000	0.00012	2.00
70	69.99989	69.9999	0.0000	0.00014	2.00
100	100.00000	99.9999	0.0001	0.00017	2.00
120	119.99999	119.9999	0.0001	0.00019	2.00
150	149.99990	149.9999	0.0000	0.00022	2.00
200	200.00009	199.9999	0.0002	0.00029	2.00

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

----- End -----

เอกสารไม่ควบคุม

## Calibration Certificate

**Certificate No.:** 2102572-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AB204-S/FACT

**Serial No.:** B108115858

**ID No.:** UAE.AIR.016/2555


**Order No.:** 2102572

**Operation No.:** 2102572 -001

**Date of Receipt:** 26 April 2021

**Date of Calibration:** 26 April 2021

**Calibrated by** Mr.Manas Somsak  
Expert

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 29 April 2021

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 2 of 5

**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFL.BTH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

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

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

### Calibration Results:

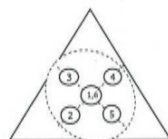
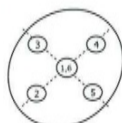
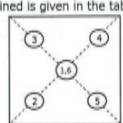
#### 1. Repeatability of Reading:

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

#### 2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
50.0001	50.0001	50.0001	50.0002	50.0002	50.0001	0.0001

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 3 of 5

### Calibration Results: (Continued)

**Calibration Range:** 0 - 200 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.49999	0.5000	0.0000	0.000083	2.00
1	0.99999	1.0000	0.0000	0.000086	2.00
2	1.99999	2.0000	0.0000	0.000084	2.00
5	4.99998	5.0000	0.0000	0.000084	2.00
10	10.00003	10.0000	0.0000	0.00011	2.00
15	15.00001	15.0000	0.0000	0.00012	2.00
20	20.00004	20.0000	0.0000	0.00013	2.00
30	30.00006	30.0001	0.0000	0.00015	2.00
40	40.00000	40.0001	-0.0001	0.00014	2.00
50	49.99999	50.0002	-0.0002	0.00015	2.00
70	70.00003	70.0002	-0.0002	0.00019	2.00
100	99.99997	100.0003	-0.0003	0.00020	2.00
150	149.99997	150.0004	-0.0004	0.00027	2.00
200	199.99999	200.0005	-0.0005	0.00043	2.00

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 4 of 5

**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFI.BTH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:** (Calibration with filter pan)

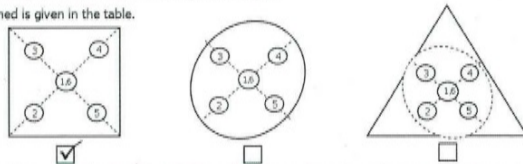
### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
10	0.0000
20	0.0000

### 2. Off-Center Error:

A mass of 5 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
5.0000	5.0002	5.0001	5.0001	5.0000	5.0000	0.0002

## Calibration Report

**Certificate No.:** 2102572-001-01  
**Equipment:** Electronic Balance  
**Model:** AB204-S/FACT  
**Serial No.:** B108115858  
**Capacity:** 220 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.0001 g  
**ID No.:** UAE.AIR.016/2555

**Date of Calibration:** 26 April 2021 Page 5 of 5

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 200 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Calibration with filter pan)

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000082	2.00
0.01	0.01000	0.0100	0.0000	0.000082	2.00
0.05	0.05000	0.0500	0.0000	0.000082	2.00
0.1	0.10000	0.1000	0.0000	0.000082	2.00
0.5	0.49999	0.5000	0.0000	0.000083	2.00
1	0.99999	1.0000	0.0000	0.000086	2.00
2	1.99999	2.0000	0.0000	0.000084	2.00
3	2.99998	3.0000	0.0000	0.000087	2.00
4	3.99999	4.0000	0.0000	0.000085	2.00
5	4.99998	5.0000	0.0000	0.000084	2.00
10	10.00003	10.0000	0.0000	0.00011	2.00
15	15.00001	15.0000	0.0000	0.00012	2.00
20	20.00004	20.0000	0.0000	0.00013	2.00



## Calibration Certificate

**Certificate No.:** 2102572-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XP6

**Serial No.:** B322373893

**ID No.:** UAE.AIR.019/2556


**Order No.:** 2102572

**Operation No.:** 2102572 -002

**Date of Receipt:** 26 April 2021

**Date of Calibration:** 26 April 2021

**Calibrated by** Mr.Manas Somsak  
Expert

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

**Date of Issue:** 29 April 2021

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 is valid only for the purpose stated and is not to be used in full except with the prior written approval of the National Food Institute.

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-002-01  
**Equipment:** Electronic Balance  
**Model:** XP6  
**Serial No.:** B322373893  
**Capacity:** 6.1 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.000001 g  
**ID No.:** UAE.AIR.019/2556

Page 2 of 3

**Date of Calibration:** 26 April 2021

**Environment Condition:** Ambient Temperature: 22.0 ± 0.2 °C Relative Humidity: 48 ± 2 %

**Place of Calibration:** Balance Room (306), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method Based on UKAS LAB 14 Calibration of Weighing Machines : 2006

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M21010975	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M21010985	13 January 2022

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFI.BTH 004/18	Quality Reborn	QR21-0300	15 February 2022

3. This certification is traceable to SI UNIT

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

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

**Calibration Results:**

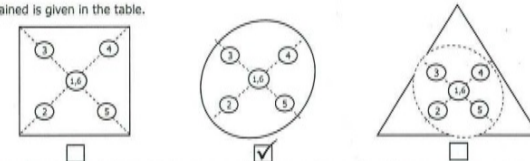
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
3	0.00000042
6	0.00000032

**2. Off-Center Error:**

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
1.999997	1.999996	1.999997	1.999996	1.999996	1.999998	0.000002

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2102572-002-01  
**Equipment:** Electronic Balance  
**Model:** XP6  
**Serial No.:** B322373893  
**Capacity:** 6.1 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.000001 g  
**ID No.:** UAE.AIR.019/2556

**Date of Calibration:** 26 April 2021

Page 3 of 3

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 6 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000087	2.00
0.01	0.010002	0.010000	0.000002	0.0000032	2.00
0.05	0.050004	0.050000	0.000004	0.0000047	2.00
0.10	0.100000	0.099998	0.000002	0.0000056	2.00
0.15	0.150004	0.150000	0.000004	0.0000072	2.00
0.17	0.170007	0.170004	0.000003	0.0000079	2.00
0.20	0.200002	0.200000	0.000002	0.0000065	2.00
0.50	0.499999	0.499998	0.000001	0.000011	2.00
1.00	1.000005	1.000004	0.000001	0.000014	2.00
1.50	1.500004	1.500004	0.000000	0.000016	2.00
2.00	2.000006	2.000005	0.000001	0.000014	2.00
3.00	3.000011	3.000007	0.000004	0.000018	2.00
4.00	4.000014	4.000009	0.000005	0.000021	2.00
4.50	4.500013	4.500008	0.000005	0.000024	2.00
5.00	5.000002	5.000000	0.000002	0.000018	2.00
6.00	6.000007	5.999988	0.000019	0.000029	2.00

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

----- End -----

เอกสารไม่ควบคุม


## Calibration Certificate

**Substitute for Certificate No.:** 2103272-001-01  
**Certificate No.:** 2103272-001-02  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanhong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** HANNA INSTRUMENTS  
**Model:** HI2020-02  
**Serial No.:** C0051107  
**ID No.:** UAE.WAO.005/2557  
**Order No.:** 2103272  
**Operation No.:** 2103272-001  
**Date of Receipt:** 11 June 2021  
**Date of Calibration:** 14 June 2021

**Calibrated by** Mr.Manas Somsak  
Expert

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 2 July 2021

Responsible for the Technical Management Team

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

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

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2103272-001-02

**Equipment:** pH Meter **Resolution:** 0.01 pH ; 0.1 mV

**Manufacturer:** HANNA INSTRUMENTS **Model:** HI2020-02

**Serial No.:** C0051107 **Type:** Bench top

**ID No.:** UAE.WAO.005/2557

**Date of Calibration:** 14 June 2021 **Page 2 of 5**

**Location:** Chemical Calibration Laboratory, National Food Institute

**Environment Condition:** **Ambient Temperature:** ( 23.7 ± 1.5 ) °C **Relative Humidity:** ( 53.5 ± 5 ) %

**Condition of Equipment:** Good Condition

**Condition of this Results of Calibration**

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-20F-0682	17 June 2021
2.2 Digital Thermometer	2709007	Fluke	CC 630609-01	30 October 2021
2.3 Thermo-Hygro Meter	NFI.BTH003/17	PONPE	QR20-1578	21 September 2021

Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710048	CPAchem	PH216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710049	CPAchem	PH217.L5	2 October 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	710050	CPAchem	PH220.L5	2 October 2021
2.7 pH buffer 7.00 (Standard pH buffer Solution)	710051	CPAchem	PH107.L5	2 October 2021

3. This certification is traceable to The International System of Unit (SI Unit)

- 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
- 3.2 Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
- 3.3 Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
- 3.4 Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.5 Certified Reference Material No. 2.7 traceable to BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

## Calibration Report

**Certificate No.:** 2103272-001-02

**Equipment:** pH Meter **Resolution:** 0.01 pH ; 0.1 mV

**Manufacturer:** HANNA INSTRUMENTS **Model:** HI2020-02

**Serial No.:** C0051107 **Type:** Bench top

**ID No.:** UAE.WAO.005/2557

**Date of Calibration:** 14 June 2021 **Page 3 of 5**

**Calibration Results:**

1. Calibration of pH Meter ( Manual Temperature Compensation at 25 °C )

Nominal pH	DC Voltage Standard ( mV )	Average Indicator Reading		Uncertainty ( ± mV )	Coverage Factor ( k )
		mV	pH		
0.00	414.118	415.7	0.00	0.063	2.00
2.00	295.811	297.3	2.00	0.063	2.00
4.00	177.461	179.0	4.00	0.063	2.00
6.00	59.160	60.7	6.00	0.063	2.00
7.00	0.000	1.5	7.00	0.063	2.00
8.00	-59.158	-57.7	8.00	0.063	2.00
10.00	-177.461	-176.0	10.00	0.063	2.00
12.00	-295.812	-294.4	12.00	0.063	2.00
14.00	-414.118	-412.4	14.00	0.063	2.00

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )

**Equipment:** pH Electrode **Type:** Combined Electrode

**Manufacturer:** HANNA INSTRUMENTS **Model:** HI11310

**Serial No.:** 078743 **ID.No.:** N/A

**Performance of Electrode system** (Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty ( ± pH )	Coverage Factor ( k )
	pH	mV			
4.008	4.01	162.7	99.1	0.0071	2.00
6.866	6.87	-4.9		0.0075	2.00
6.866	6.87	-4.9	95.0	0.0075	2.00
10.008	10.01	-181.3		0.0093	2.00
6.985	7.00	-13.6	-	0.0093	2.00



## Calibration Report

**Certificate No.:** 2103272-001-02  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C **Model:** SevenEasy pH  
**Serial No.:** C0051107 **ID No.:** UAE.WAO.005/2557  
**Manufacturer:** HANNA INSTRUMENTS  
**Date of Calibration:** 14 June 2021 Page 4 of 5

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature 24 °C ± 1 °C  
Relative Humidity 54 % ± 2 %

### Condition of this results of Calibration:

- Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 640028-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

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

6. Condition of Calibrated Item : Good  
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

## Calibration Report

**Certificate No.:** 2103272-001-02  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C **Model:** SevenEasy pH  
**Serial No.:** C0051107 **ID No.:** UAE.WAO.005/2557  
**Manufacturer:** HANNA INSTRUMENTS  
**Date of Calibration:** 14 June 2021 Page 5 of 5

**Calibration point:** 15.0, 25.0 and 35.0 °C \*\*  
**Calibration result:**

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model : HI11310 S/N : 078743
- Dimension of probe : Diameter 4 mm., Length 118 mm.,
- Sheath material : Stainless Steel

UUC* Reading	(°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1		15.001	-0.1	0.13
25.1		24.999	-0.1	0.13
35.2		34.999	-0.2	0.13

Remark: Edited Model from edge to HI2020-02.

### Note

- UUC\* : Unit Under Calibration
- NFI Laboratory is not accredited ISO/IEC 17025 for calibration. In the scope marked with \*\*

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

----- End -----



## Calibration Certificate

**Certificate No.:** 2103189-002-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanhong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2103189  
**Operation No.:** 2103189-002  
**Date of Receipt:** 9 June 2021  
**Date of Calibration:** 14 June 2021

**Calibrated by** Mr.Manas Somsak  
Expert

**Approved by**   
( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

**Date of Issue:** 15 June 2021 **Responsible for the Technical Management Team**

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

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

## Calibration Report

**Certificate No.:** 2103189-002-01  
**Equipment:** pH Meter  
**Resolution:** 0.01 pH ; 1 mV  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**Type:** Bench top  
**ID No.:** UAE.WAT.010/2553

**Date of Calibration:** 14 June 2021 **Page 2 of 5**

**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** **Ambient Temperature:** ( 23.7 ± 1.5 ) °C **Relative Humidity:** ( 53.5 ± 5 ) %  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	SCL-20F-0682	17 June 2021
2.2 Digital Thermometer	2709007	Fluke	CC 630609-01	30 October 2021
2.3 Thermo-Hygro Meter	NFI.BTH003/17	PONPE	QR20-1578	21 September 2021

Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	710048	CPAchem	PH216.L5	2 October 2022
2.5 pH buffer 6.865 (Primary pH buffer Solution)	710049	CPAchem	PH217.L5	2 October 2022
2.6 pH buffer 10.01 (Primary pH buffer Solution)	710050	CPAchem	PH220.L5	2 October 2021
2.7 pH buffer 7.00 (Standard pH buffer Solution)	710051	CPAchem	PH107.L5	2 October 2021

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No. 2.7	traceable to	BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

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

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

## Calibration Report

Certificate No.: 2103189-002-01

Equipment:

pH Meter

Resolution: 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1231155210

Type: Bench top

ID No.: UAE.WAT.010/2553

Date of Calibration: 14 June 2021

Page 3 of 5

Calibration Results:

1. Calibration of pH Meter

( Manual Temperature Compensation at 25 °C )

Nominal pH	DC Voltage Standard ( mV )	Average Indicator Reading		Uncertainty ( ±mV )	Coverage Factor ( k )
		mV	pH		
0.00	414.118	414	0.00	0.58	2.00
2.00	295.811	296	2.00	0.58	2.00
4.00	177.461	178	4.00	0.58	2.00
6.00	59.160	59	6.00	0.58	2.00
7.00	0.000	0	7.00	0.58	2.00
8.00	-59.158	-59	8.00	0.58	2.00
10.00	-177.461	-177	10.00	0.58	2.00
12.00	-295.812	-296	12.00	0.58	2.00
14.00	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode ( Manual Temperature Compensation at 25 °C )

Equipment: pH Electrode

Type: Combined Electrode

Manufacturer: METTLER TOLEDO

Model: InLab Solids

Serial No.: 115862

ID.No. N/A

Performance of Electrode system

(Three-Point Calibration at pH4, pH7 and pH10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty ( ± pH )	Coverage Factor ( k )
	pH	mV			
4.008	4.01	185	99.9	0.0071	2.00
6.866	6.87	16		0.0075	2.00
6.866	6.87	16	98.0	0.0075	2.00
10.008	10.01	-166		0.0093	2.00
6.985	6.99	9	-	0.0093	2.00

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## Calibration Report

Certificate No.: 2103189-002-01

Equipment:

Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C

Model: SevenEasy pH

Serial No.: 1231155210

ID No.: UAE.WAT.010/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 14 June 2021

Page 4 of 5

Location:

Chemical Calibration Laboratory, National Food Institute

Environment Condition:

Ambient Temperature 24 °C ± 1 °C

Relative Humidity 54 % ± 2 %

Condition of this results of Calibration:

- Calibration Method :
  - In house method: W-TE-025 by comparison with standard thermometer.
  - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
  - The temperature scale in use at this laboratory is the International Temperature scale of 1990 ( ITS-90 ).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 640028-01	12-Dec-21	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

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

6. Condition of Calibrated item : Good

7. Result of Calibration :

☒ X

Without adjustment

☐

After adjustment

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National Food Institute, Ministry of Industry, Thailand

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand.  
Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8545 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Report

Certificate No.: 2103189-002-01  
Equipment: Digital Thermometer with RTD (pH Meter)  
Resolution: 0.1 °C Model: SevenEasy pH  
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553  
Manufacturer: METTLER TOLEDO  
Date of Calibration: 14 June 2021

Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 25 mm.

- Description of probe, model : InLab Solids S/N : 115882

Dimension of probe : Diameter 6 mm., Length 25 mm.,

Sheath material : Glass

UUC* Reading	(°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1		15.001	-0.1	0.13
25.1		24.999	-0.1	0.13
35.1		34.999	-0.1	0.13

Note

- UUC\* : Unit Under Calibration

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

\*\*\*\*\* End \*\*\*\*\*

Business Unit

SPC Calibration Center



## Certificate of Calibration

Equipment: CONDUCTIVITY METER Certificate No.: C24210091  
Model: Lab955 Issued Date: 29 March 2021  
Serial No. (or ID.): 16300356 Job No.: KSPR2104894  
Manufacturer: SI Analytics Page: 1 of 2  
Electrode Serial No. 16070067 Model : LF413T Brand : SI Analytics  
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC RT Co., Ltd.  
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr.Imron Ama  
Calibration Date: 29 March 2021  
The Method used: In house method, SPCC-WI-49, base on ASTM D 1125-14 and D 5391-14  
Traceability: This certificate is traceable to the CRM maintained by DAkkS/DKD calibration laboratory through Radiometer Analytical Co., Ltd. Certificate No. 1561, 1515, 1377

*Imron Ama*

(Mr. Imron Ama)  
Person in charge

**SPC RT**  
บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT Co., Ltd.

*Dumrong Boonsopon*

(Mr. Dumrong Boonsopon)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

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

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

บริษัท เอสพีซี อาร์ที จำกัด  
SPC RT CO., LTD.  
สาขาที่ 00003 1194 ซอยวชิรธรรมสาร 57 ถนนสุขุมวิท 101/1 แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260  
Branch 00003 1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Road, Bangchak, Prakanong, Bangkok 10260 Thailand  
Tel: 0 2185 4333 Ext. 3300-3309 Fax: 0 2185 4424 E-mail: info.spc@spc-rt.com Website: www.spc-rt.com

F-CS-012 Revision: 00 Date: 14-12-61

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SPCC-FM-C24-06: 23 Nov 2020



**Calibration Results:**

**Before Adjustment**

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor ( k )	Uncertainty ( ± )
24.97 $\mu\text{S/cm}$	26.7 $\mu\text{S/cm}$	-1.73 $\mu\text{S/cm}$	2.00	0.52 $\mu\text{S/cm}$
1408.3 $\mu\text{S/cm}$	1439 $\mu\text{S/cm}$	-30.7 $\mu\text{S/cm}$	2.00	7.8 $\mu\text{S/cm}$
111.31 $\text{mS/cm}$	112.4 $\text{mS/cm}$	-1.09 $\text{mS/cm}$	2.00	0.58 $\text{mS/cm}$

**After Adjustment ; at 1408.3  $\mu\text{S/cm}$**

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor ( k )	Uncertainty ( ± )
24.97 $\mu\text{S/cm}$	25.8 $\mu\text{S/cm}$	-0.83 $\mu\text{S/cm}$	2.00	0.52 $\mu\text{S/cm}$
1408.3 $\mu\text{S/cm}$	1410 $\mu\text{S/cm}$	-1.7 $\mu\text{S/cm}$	2.00	7.8 $\mu\text{S/cm}$
111.31 $\text{mS/cm}$	110.1 $\text{mS/cm}$	1.21 $\text{mS/cm}$	2.00	0.58 $\text{mS/cm}$

The End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM812  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator  
**Manufacturer :** ARCO  
**Model :** UR-1320  
**Serial No. :** -  
**ID No. :** UAE.WAO.006/2553  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2  
**Received Order :** 21 April 2021  
**Calibration Date :** 21 April 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Khit Ruttanaprapachai  
**Approved by :**   
Approved Signatory  
( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai  
**Issue Date :** 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2104-0024OC-4

Cert. No.: 21TM812  
 Page.: 2 of 3

#### Procedure Used :-

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	20LM7	NIST, NIMT	18 May 2021

2. This certification is traceable to the SI unit.

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

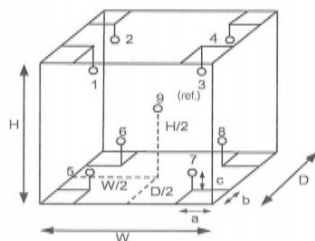
**Remark :** NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available



#### Probe Installation Details :

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

#### Dimension of Chamber :

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

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	27	28
REL.Humid. ( % )	47	51
AC Supply ( Volt )	221	222

Position :	Ref. Std./ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	18-18RTD-06
7	18-18RTD-07
8	18-18RTD-08
9 (ref.)	18-18RTD-09

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a 1052719



Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2104-0024OC-4

Cert. No.: 21TM812  
 Page.: 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.0	20.0	19.8	0.37	0.39	1.0	0.58	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.059	20.108	19.849	19.766	20.117	20.291	19.725	19.756	20.008

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

-o0o-

เอกสารไม่ควบคุม

a 1052718



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1405  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** BOD Incubator  
**Manufacturer :** Arco  
**Model :** UC4-1320  
**Serial No. :** -  
**ID No. :** UAE.WAO.002/2550  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2  
**Received Order :** 17 August 2021  
**Calibration Date :** 17 August 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Khit Ruttanaprapachai

**Approved by :**

*Malee*  
Approved Signatory

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

**Issue Date :** 1 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0031567



**Equipment :** BOD Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2108-0364OC-1  
**Procedure Used :-**

Cert. No.: 21TM1405  
Page.: 2 of 3

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

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY41021843	21LM2	18 Feb 2022

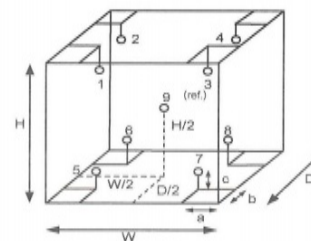
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available



**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.53 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.76 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	29
REL.Humid. ( % )	52	55
AC Supply ( Volt )	220	221

Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

เอกสารไม่ควบคุม

a 1069646





Equipment : BOD Incubator  
 Condition As-Received : Used Item  
 Reference : 2108-0364OC-1  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Not Available

Cert. No.: 21TM1405  
 Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.0	19.5	19.3	0.46	0.45	1.0	0.78	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.018	20.137	20.086	19.942	20.157	20.093	19.968	19.860	20.048

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

A 1069645



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
 534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
 TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1406  
 Page.: 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
 Manufacturer : Arco  
 Model : UC4-1320  
 Serial No. : -  
 ID No. : UAE.WAO.018/2559  
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Phrakhanong,  
 Bangkok 10260  
 Location : Lab Floor 2  
 Received Order : 17 August 2021  
 Calibration Date : 17 August 2021  
 Ambient Temperature : ( 26 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %  
 Calibrated by : Khit Ruttanaprapachai

Approved by :   
 Approved Signatory

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

Issue Date : 1 September 2021

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0031568



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2108-0364OC-2  
Procedure Used :-

Cert. No.: 21TM1406  
Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY41021843	21LM2	18 Feb 2022

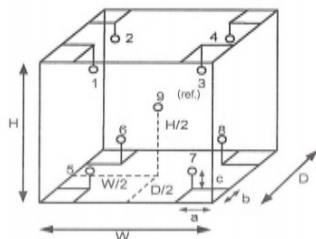
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available



Probe Installation Details :

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

Dimension of Chamber :

D = 0.53 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.76 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	29
REL.Humid. ( % )	52	55
AC Supply ( Volt )	220	221

Position :	Ref. Std. ID No.:
1	21-04RTD-11
2	21-04RTD-12
3	21-04RTD-13
4	21-04RTD-14
5	21-04RTD-15
6	21-04RTD-16
7	21-04RTD-17
8	21-04RTD-18
9 (ref.)	21-04RTD-19

Malu .

เอกสารไม่ควบคุม  
a 106964



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2108-0364OC-2  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

Cert. No.: 21TM1406  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
20.0	19.8	19.7	0.37	0.50	1.1	0.62	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.040	19.742	20.203	19.762	19.784	19.819	19.764	19.797	19.787

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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Malu .

เอกสารไม่ควบคุม  
a 106964

**DQE Services**

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

NSC-TISI-TIS 17025  
CALIBRATION 0343

## CERTIFICATE OF CALIBRATION

**Certificate No. :** SP21-015

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** Laboratory 315

**Equipment :** Spectrophotometer

**Manufacturer :** Agilent Technologies

**Model :** Cary 60

**Serial No. :** MY15410009

**ID No. :** N/A

**Received Date :** 29 May 2021

**Calibration Date :** 29 May 2021

**Issue Date :** 30 May 2021

**Condition of Instrument :** Used

**Calibrated by :**

( Mr.Tanawut Rittidach )

Technical Manager

**Approved by :**

( Miss Chonthicha 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.

**DQE Services**

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

NSC-TISI-TIS 17025  
CALIBRATION 0343

## REPORT OF CALIBRATION

**Certificate No. :** SP21-015

Page 2 of 5

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

Relative humidity  $50 \pm 15$  %RH

**Calibration method :** In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

**Certified Reference Materials :**

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	11/7/2021
Absorbance Standard set	25757	80105	11/7/2021
Wavelength Standard set	25806	80103	11/7/2021
Wavelength Standard set	25758	80104	11/7/2021

**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 :** 90 nm./min

**Scan Interval of UUC :** 0.15 nm.

**Resolution of UUC :** Photometric 0.0001 Abs.

Wavelength 0.1 nm.



REPORT OF CALIBRATION

Certificate No. : SP21-015
Page 3 of 5

Wavelength Accuracy :

Table with 5 columns: CRMs Values (nm.), UUC Reading (nm.), Correction (nm.), Uncertainty (nm.), Coverage factor k. Rows include wavelength values from 241.72 to 879.28 nm.

REPORT OF CALIBRATION

Certificate No. : SP21-015
Page 4 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Table with 6 columns: Wavelength (nm.), CRMs Values (Abs), UUC Reading (Abs), Correction (Abs), Uncertainty (Abs), Coverage factor k. Rows include wavelength values from 420 to 635 nm.

## REPORT OF CALIBRATION

Certificate No. : SP21-015

Page 5 of 5

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.0001	-0.0001	0.0075	2.00
	0.7498	0.7438	0.0060	0.0075	2.00
257	0.0000	0.0000	0.0000	0.0075	2.00
	0.8712	0.8647	0.0065	0.0075	2.00
313	0.0000	0.0000	0.0000	0.0075	2.00
	0.2920	0.2900	0.0020	0.0075	2.00
350	0.0000	0.0000	0.0000	0.0075	2.00
	0.6459	0.6428	0.0031	0.0075	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 -

## CERTIFICATE OF CALIBRATION

Certificate No. : SP21-008

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 : Laboratory 315

Equipment : Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

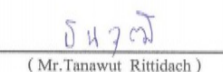
Received Date : 25 January 2564

Calibration Date : 25 January 2564

Issue Date : 26 January 2564

Condition of Instrument : Used

Calibrated by :

  
( Mr. Tanawut Rittidach )

Technical Manager

Approved by :

  
( Miss Chonthicha 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.

## REPORT OF CALIBRATION

Certificate No. : SP21-008

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $50 \pm 15$  %RH

Calibration method : In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

## Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	7/11/2021
Absorbance Standard set	25757	80105	7/11/2021
Wavelength Standard set	25806	80103	7/11/2021
Wavelength Standard set	25758	80104	7/11/2021

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

of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 4.0 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.

## REPORT OF CALIBRATION


Certificate No. : SP21-008

Page 3 of 5


## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.54	240.8	0.74	0.19	2.00
279.40	278.6	0.80	0.19	2.00
288.70	287.6	1.10	0.19	2.00
334.22	333.6	0.62	0.19	2.00
361.26	360.6	0.66	0.19	2.00
418.48	418.0	0.48	0.19	2.00
446.70	445.8	0.90	0.19	2.00
453.20	452.8	0.40	0.19	2.00
460.06	459.6	0.46	0.19	2.00
536.90	536.2	0.70	0.19	2.00
637.94	637.4	0.54	0.19	2.00
440.74	440.2	0.54	0.19	2.00
472.22	471.8	0.42	0.19	2.00
513.70	513.0	0.70	0.19	2.00
528.72	528.2	0.52	0.19	2.00
574.60	574.0	0.60	0.19	2.00
585.48	584.8	0.68	0.19	2.00
684.63	684.0	0.63	0.19	2.00
740.27	739.8	0.47	0.19	2.00
748.28	747.8	0.48	0.19	2.00
807.16	806.6	0.56	0.19	2.00
879.70	879.0	0.70	0.19	2.00





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




## REPORT OF CALIBRATION

Certificate No. : SP21-008
Page 4 of 5


Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0042	2.00
	0.5791	0.577	0.0021	0.0042	2.00
	1.0488	1.045	0.0038	0.0042	2.00
	2.1914	2.183	0.0084	0.0092	2.00
440	0.0000	0.000	0.0000	0.0042	2.00
	0.5618	0.560	0.0018	0.0042	2.00
	1.0260	1.025	0.0010	0.0042	2.00
	2.1259	2.122	0.0039	0.0091	2.00
465	0.0000	0.000	0.0000	0.0042	2.00
	0.5240	0.522	0.0020	0.0042	2.00
	0.9639	0.965	-0.0011	0.0042	2.00
	1.9788	1.978	0.0008	0.0092	2.00
546.1	0.0000	0.000	0.0000	0.0042	2.00
	0.5194	0.519	0.0004	0.0042	2.00
	0.9991	1.001	-0.0019	0.0042	2.00
	1.9970	1.998	-0.0010	0.0092	2.00
590	0.0000	0.000	0.0000	0.0042	2.00
	0.5523	0.553	-0.0007	0.0042	2.00
	1.0810	1.082	-0.0010	0.0042	2.00
	2.0369	2.035	0.0019	0.0092	2.00
635	0.0000	0.000	0.0000	0.0042	2.00
	0.5596	0.561	-0.0014	0.0042	2.00
	1.0513	1.052	-0.0007	0.0042	2.00
	1.9268	1.925	0.0018	0.0092	2.00



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



## REPORT OF CALIBRATION

Certificate No. : SP21-008
Page 5 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	0.000	0.0000	0.0076	2.00
	0.7498	0.745	0.0048	0.0076	2.00
257	0.0000	0.000	0.0000	0.0076	2.00
	0.8712	0.864	0.0072	0.0076	2.00
313	0.0000	0.000	0.0000	0.0076	2.00
	0.2920	0.290	0.0020	0.0076	2.00
350	0.0000	0.000	0.0000	0.0076	2.00
	0.6459	0.632	0.0139	0.0076	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 -

## CERTIFICATE OF CALIBRATION

Certificate No. : SP21-009

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 : Laboratory 213

Equipment : Spectrophotometer

Manufacturer : Merck

Model : Pharo 100

Serial No. : 12390016

ID No. : UAE.WAT.009/2556


Received Date 25 January 2021

Calibration Date 25 January 2021

Issue Date : 26 January 2021

Condition of Instrument Used

Calibrated by :

  
 ( Mr.Tanawut Rittidach )

Technical Manager

Approved by :

  
 ( Miss Chonthicha 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.

## REPORT OF CALIBRATION

Certificate No. : SP21-009

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $50 \pm 15$  %RH

Calibration method In-house method CP-01 Calibration of UV-Vis Spectrophotometer Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	80102	7/11/2021
Absorbance Standard set	25757	80105	7/11/2021
Wavelength Standard set	25806	80103	7/11/2021
Wavelength Standard set	25758	80104	7/11/2021

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 : 4.0 nm.

Scan Speed of UUC : N/A

Scan Interval of UUC : N/A nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 1.0 nm.

## REPORT OF CALIBRATION

Certificate No. SP21-009

Page 3 of 5

### Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.54	N/A	N/A	N/A	2.00
279.40	N/A	N/A	N/A	2.00
288.70	N/A	N/A	N/A	2.00
334.22	332	2.22	0.61	2.00
361.26	360	1.26	0.61	2.00
418.48	418	0.48	0.61	2.00
446.70	447	-0.30	0.61	2.00
453.20	453	0.20	0.61	2.00
460.06	459	1.06	0.61	2.00
536.90	537	-0.10	0.61	2.00
637.94	638	-0.06	0.61	2.00
440.74	441	-0.26	0.61	2.00
472.22	471	1.22	0.61	2.00
513.70	514	-0.30	0.61	2.00
528.72	529	-0.28	0.61	2.00
574.60	575	-0.40	0.61	2.00
585.48	586	-0.52	0.61	2.00
684.63	685	-0.37	0.61	2.00
740.27	739	1.27	0.61	2.00
748.28	747	1.28	0.61	2.00
807.16	805	2.16	0.61	2.00
879.70	878	1.70	0.61	2.00

## REPORT OF CALIBRATION

Certificate No. SP21-009

Page 4 of 5

### Calibration Results Without adjustment

### Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
420	0.0000	0.000	0.0000	0.0042	2.00
	0.5791	0.576	0.0031	0.0042	2.00
	1.0488	1.045	0.0038	0.0042	2.00
	2.1914	2.192	-0.0006	0.0092	2.00
440	0.0000	0.000	0.0000	0.0042	2.00
	0.5618	0.559	0.0028	0.0042	2.00
	1.0260	1.024	0.0020	0.0042	2.00
	2.1259	2.125	0.0009	0.0092	2.00
465	0.0000	0.000	0.0000	0.0042	2.00
	0.5240	0.520	0.0040	0.0042	2.00
	0.9639	0.965	-0.0011	0.0042	2.00
	1.9788	1.982	-0.0032	0.0092	2.00
546.1	0.0000	0.000	0.0000	0.0042	2.00
	0.5194	0.518	0.0014	0.0042	2.00
	0.9991	0.999	0.0001	0.0042	2.00
	1.9970	1.995	0.0020	0.0092	2.00
590	0.0000	0.000	0.0000	0.0042	2.00
	0.5523	0.551	0.0013	0.0042	2.00
	1.0810	1.080	0.0010	0.0042	2.00
	2.0369	2.033	0.0039	0.0092	2.00
635	0.0000	0.000	0.0000	0.0042	2.00
	0.5596	0.558	0.0016	0.0042	2.00
	1.0513	1.050	0.0013	0.0042	2.00
	1.9268	1.925	0.0018	0.0092	2.00



## REPORT OF CALIBRATION

Certificate No. SP21-009

Page 5 of 5

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000	N/A	N/A	N/A	2.00
	0.7498	N/A	N/A	N/A	2.00
257	0.0000	N/A	N/A	N/A	2.00
	0.8712	N/A	N/A	N/A	2.00
313	0.0000	N/A	N/A	N/A	2.00
	0.2920	N/A	N/A	N/A	2.00
350	0.0000	N/A	N/A	N/A	2.00
	0.6459	N/A	N/A	N/A	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 -

## Calibration Certificate

Certificate No.:

2200708-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment:

Electronic Balance

Manufacturer:

METTLER TOLEDO

Model:

AX 105 DR

Serial No.:

1122100406

ID No.:

UAE.WAO.004/2546

Order No.:

2200708

Operation No.:

2200708-001

Date of Receipt:

24 November 2021

Date of Calibration:

24 November 2021

Calibrated by

Mr.Worapob Sooktong  
Scientist

Approved by

( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

Date of Issue:

30 November 2021

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

## Calibration Report

**Certificate No.:** 2200708-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** AX 105 DR  
**Resolution:** 0.00001 g/ 0.0001 g  
**Serial No.:** 1122100406  
**ID No.:** UAE.WAO.004/2546  
**Capacity:** 110 g

**Date of Calibration:** 24 November 2021

Page 2 of 4

**Environment Condition:** Ambient Temperature: 22.0 ± 0.5 °C Relative Humidity: 39 ± 1 %

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

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M20111955	28 November 2021
Standard Weight Class E2	1-500g	15882	TCS	M20111965	28 November 2021

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	11A1	สวท.นพ. BTH 003/55	Quality Reborn	QR21-0297	15 February 2022

3. This certification is traceable to SI UNIT

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

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

### Calibration Results:

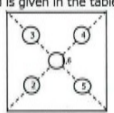
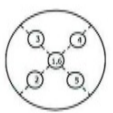
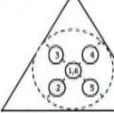
#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
15	0.0000057
30	0.0000084
50	0.000053
100	0.000048

#### 2. Off-Center Error:

A mass of 50 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

		
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 ( g )	2 ( g )	3 ( g )
50.0000	50.0000	49.9999
4 ( g )	5 ( g )	6 ( g )
50.0000	49.9999	49.9999
(Maximum Difference)		
0.0001		

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## Calibration Report

**Certificate No.:** 2200708-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** AX 105 DR  
**Resolution:** 0.00001 g/ 0.0001 g  
**Serial No.:** 1122100406  
**ID No.:** UAE.WAO.004/2546  
**Capacity:** 110 g

**Date of Calibration:** 24 November 2021

Page 3 of 4

### Calibration Results: (Continued)

**Calibration Range:** 0-100 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** ( Range: 0 - 30 g ; Resolution: 0.00001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000089	2.00
0.01	0.009998	0.010000	0.000000	0.000011	2.00
0.02	0.019997	0.020000	0.000000	0.000012	2.00
0.05	0.050001	0.050000	0.000000	0.000011	2.00
0.1	0.100002	0.100000	0.000000	0.000012	2.00
0.2	0.200004	0.200000	0.000000	0.000013	2.00
0.5	0.499994	0.500000	-0.000001	0.000014	2.00
1	0.999986	1.000000	-0.000001	0.000026	2.00
2	1.999989	1.999998	0.000001	0.000019	2.00
5	4.999979	4.999998	0.000000	0.000022	2.00
10	10.000026	9.999994	0.000009	0.000074	2.00
20	20.000037	19.999991	0.00013	0.000099	2.00
30	30.000063	30.000000	0.000066	0.00013	2.00

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National Food Institute, Ministry of Industry, Thailand

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Tel : +66 (0) 2422 8688 Fax : +66 (0) 2422 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Report

**Certificate No.:** 2200708-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** AX 105 DR

**Resolution:** 0.00001 g/ 0.0001 g

**Serial No.:** 1122100406

**ID No.:** UAE.WAO.004/2546

**Capacity:** 110 g

**Date of Calibration:** 24 November 2021

Page 4 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0-100 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** ( Range: 31 - 100 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
40	40.00000	39.9999	0.0001	0.00014	2.00
45	44.99998	44.9999	0.0001	0.00015	2.00
50	49.99999	49.9999	0.0001	0.00016	2.00
55	54.99997	54.9998	0.0002	0.00016	2.00
60	60.00002	59.9999	0.0001	0.00018	2.00
65	65.00000	64.9999	0.0001	0.00018	2.00
70	70.00003	69.9999	0.0001	0.00019	2.00
75	75.00001	74.9999	0.0001	0.00020	2.00
80	80.00005	79.9998	0.0003	0.00021	2.00
85	85.00003	84.9998	0.0002	0.00022	2.00
90	89.99999	89.9998	0.0002	0.00021	2.00
100	99.99997	99.9998	0.0002	0.00020	2.00

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

----- End -----

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1876

Page.: 1 of 3

## Certificate of Calibration

**Equipment :**

Hot Air Oven

**Manufacturer :**

Memmert

**Model :**

UF 55

**Serial No. :**

B216.1666

**ID No. :**

UAE.WAO.027/2559

**Submitted by :**

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

**Location :**

Lab Floor 2

**Received Order :**

29 October 2021

**Calibration Date :**

29 October 2021

**Ambient Temperature :**

( 26 ± 10 ) °C

**Relative Humidity :**

( 50 ± 30 ) %

**Calibrated by :**

Kunchit Promprat

**Approved by :**

Approved Signatory

( / ) Pornthippa Tameyakul

( / ) Malee Butkruea

( ) Suwit Imjai

**Issue Date :**

4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2110-0701OC-1

Cert. No.: 21TM1876  
Page.: 2 of 3

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

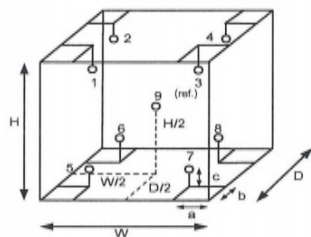
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close



**Probe Installation Details : Dimension of Chamber :**

a = 5.0 cm	D = 0.33 m
b = 5.0 cm	W = 0.40 m
c = 5.0 cm	H = 0.40 m
	Capacity = 0.053 m <sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL.Humid. ( % )	56	55
AC Supply ( Volt )	230	230

Ref. Std. ID No.: @ Calibration Point		
Position :	( 140, 180 ) °C	( 104 ) °C
1	21-15TC-01	15RTD2/11
2	21-15TC-02	15RTD2/12
3	21-15TC-03	15RTD2/13
4	21-15TC-04	15RTD2/14
5	21-15TC-05	15RTD2/15
6	21-15TC-06	15RTD2/20
7	21-15TC-07	15RTD2/17
8	21-15TC-08	15RTD2/18
9 (ref.)	21-15TC-09	15RTD2/19

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Equipment : Hot Air Oven  
Condition As-Received : Used Item  
Reference : 2110-0701OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

Cert. No.: 21TM1876  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
104.0	104.0	104.0	0.11	0.52	0.72	0.42	2
140.0	140.0	140.0	0.25	1.1	1.4	1.1	2
180.0	180.0	180.0	0.18	0.87	1.2	1.1	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.852	103.978	104.382	104.323	103.776	104.015	104.312	104.196	103.907
140.0	140.309	140.730	140.426	140.270	139.531	139.666	140.067	139.895	139.750
180.0	180.598	180.339	180.755	180.619	179.716	179.829	180.204	180.365	179.975

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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Cert. No.: 21TM813  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Hot Air Oven  
**Manufacturer :** Memmert  
**Model :** UF 55  
**Serial No. :** B212.0411  
**ID No. :** UAE.WAO.005/2556  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Lab Floor 2  
**Received Order :** 21 April 2021  
**Calibration Date :** 21 April 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Khit Ruttanaprapachai

**Approved by :**   
Approved Signatory

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

**Issue Date :** 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2104-0024OC-2  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source

Cert. No.: 21TM813  
Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
104.0	104.0	104.0	0.13	0.67	0.70	0.68	2
120.0	120.0	120.0	0.10	0.95	1.5	1.1	2
180.0	180.0	180.0	0.15	1.5	2.7	1.1	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.712	103.853	104.189	104.213	103.803	103.832	104.026	103.775	103.703
120.0	119.714	119.841	120.552	120.326	119.231	119.293	120.117	119.826	119.721
180.0	179.624	179.511	180.806	180.572	178.397	178.663	180.344	179.807	179.691

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2104-0024OC-2

Cert. No.: 21TM813  
 Page.: 2 of 3

#### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY57013711	20LM7	NIST, NIMT	18 May 2021

2. This certification is traceable to the SI unit.

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

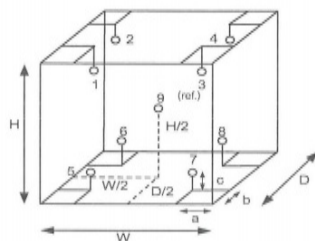
Remark : NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

Result of Calibration :- ( \*) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



#### Probe Installation Details :

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

#### Dimension of Chamber :

D = 0.50 m  
 W = 0.80 m  
 H = 0.75 m  
 Capacity = 0.30 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	29
REL.Humid. ( % )	50	54
AC Supply ( Volt )	221	222

Position :	Ref. Std./ID No.:
1	18-18TC-01
2	18-18TC-02
3	18-18TC-03
4	18-18TC-04
5	18-18TC-05
6	18-18TC-06
7	18-18TC-07
8	18-18TC-08
9 (ref.)	18-18TC-09



Agilent Technologies

#### Agilent 5110 and 5100 ICP-OES 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.

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

#### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.
- 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

#### Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Issued: 4 March 2021, Revision: A.01

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Page 1 of 8

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Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## System Information

Instrument system name and ID	ICP-OES 5110 VDV
Instrument system site and location	UAE Consultant
List system component product numbers	List the serial numbers of each component
1. 3015A	1. MY 19030001
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

ICP-OES Configuration table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray   OneNeb   other
Spray Chamber	Cyclonic Single Pass   Cyclonic Double Pass   other
Torch	Radial   Dual View   other
Injector Diameter	2.4mm   1.8mm   1.4mm   0.8mm   other
Injector Material	Quartz   Ceramic   other

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. NA
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

## Inspect and clean the system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. NA
- ☒ Remove and clean instrument water inlet filter.

## Agilent Water Recirculator

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean, and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Polyclear Plus cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**
**SPS 3 Auto Sampler**
☒ **Section NOT Applicable**

- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

**SPS 4 Auto Sampler**
☒ **Section NOT Applicable**

- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check 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 edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

**AVS 4, 6, 7**
☒ **Section NOT Applicable**

- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

**Instrument Adjustment**

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☒ Subsystem Communications Test
  - ☐ Air Flow

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

**Instrument Performance Test Results Table**

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4032.3	7956.1	4192.8	2920.7
Mn 257.610 nm SRBR	11415.2	30894.7	11993.6	34460.9
Al 396.152 nm SBR	7.9	15.7	8.7	13.5
K 766.491 nm SBR	5.3	39.9	5.7	44.6

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

**Instrument Test Results Table**

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	PASS
Air Flow	PASS
Water Flow	PASS
Gas Flows	PASS
RF Generator	PASS
Camera Test	PASS
Optics Test	PASS
Nebulizer test	PASS

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**
**ICP-OES Status Results Table**

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	225.767 VAC	194.510 VAC
Mains Current	0.229 A	3.233 A
Instrument Temperature	23.4 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	65.0 °C
Water Flow Oscillator	No measurement	2.03 L/min
Water Flow Detector	0.00 L/min	1.37 L/min
Water Inlet Temperature	19.2 °C	17.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	26.9 °C	-39.7 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	639.25 kPa	629.97 kPa
Purge Gas Supply Pressure*1	691.74 kPa	655.67 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.90 L/min
Nebulizer Back Pressure	No measurement	247.05 kPa
Plasma Gas Flow	No measurement	15.00 L/min
Auxiliary Gas Flow	No measurement	1.20 L/min
RF Power	No measurement	1201.1 W
RF Supply Current	No measurement	3.233 A
RF Supply Voltage	No measurement	194.510 V

\*1 If option installed

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**
**ICP-OES Parts List Table**

Part description	Part Number	Product /Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Plus Cooling Fluid	G3292-80012	Agilent Water Recirculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
<b>Additional Parts may be required from engineers stock:</b>			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

**Restore system**

For IIF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

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.

**Service Review**

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.





## Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

### 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.

### Other Important Customer Web Links

How to get information on your product:

- ☐ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☐ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☐ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

### Service Completion

Service request number 6004337217 Date service completed 09/12/21

Agilent signature Nukoon L. Customer signature Aphorn Onkong

Document part number: G8014-90075

### Report Summary

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 9:14:59 AM

### Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.27	
As (188.980 nm)	≤ 8.20	6.23	
C (193.027 nm)	≤ 11.50	8.26	
Mo (202.032 nm)	≤ 8.20	6.42	
Cr (206.158 nm)	≤ 13.40	9.27	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	7.12	
Co (228.615 nm)	≤ 17.20	11.88	
Ba (230.424 nm)	≤ 9.40	7.36	
Mn (257.610 nm)	≤ 13.30	9.52	
Mn (260.568 nm)	≤ 20.30	14.30	
Cr (267.716 nm)	≤ 11.00	7.99	
Cu (324.754 nm)	≤ 25.00	19.06	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.39	
Ba (455.403 nm)	≤ 44.00	33.86	
Sr (460.733 nm)	≤ 36.00	17.38	
Ba (493.408 nm)	≤ 36.00	25.53	
Ba (614.171 nm)	≤ 42.00	24.99	
Ar (675.283 nm)	≤ 74.00	59.49	
K (766.491 nm)	≤ 80.00	65.27	

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	167.2	1131.3	42.4	
Se (196.026 nm)	≥ 41.0	SRBR	119.1	1177.1	84.2	
Zn (213.857 nm)	≥ 1421.0	SRBR	4082.3	49908.2	148.6	
Pb (220.353 nm)	≥ 46.0	SRBR	191.1	2682.8	172.6	
Mn (257.610 nm)	≥ 3518.0	SRBR	11415.2	265002.2	536.8	
Al (396.152 nm)	≥ 3.4	SBR	7.8	49838.0	5676.5	
Ba (493.408 nm)	≥ 34.0	SBR	116.1	1999041.4	17066.5	
K (766.491 nm)	≥ 1.8	SBR	5.3	101078.4	16104.6	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	252.9	3214.2	147.0	
Se (196.026 nm)	≥ 159.0	SRBR	216.2	3839.7	272.2	
Zn (206.200 nm)	≥ 234.0	SRBR	1203.3	14046.1	133.7	
Zn (213.857 nm)	≥ 1743.0	SRBR	7856.1	171323.1	472.9	
Cd (214.439 nm)	≥ 4227.0	SRBR	7054.9	129539.3	335.4	
Pb (220.353 nm)	≥ 320.0	SRBR	531.7	13218.2	566.2	
Mn (257.610 nm)	≥ 10625.0	SRBR	30884.7	1314844.0	1807.4	
Cr (267.716 nm)	≥ 1048.0	SRBR	4442.1	174420.3	1515.1	
Cu (324.754 nm)	≥ 19.0	SBR	50.7	374603.6	7249.0	
Al (396.152 nm)	≥ 6.0	SBR	15.7	279915.3	16790.4	
Ba (493.408 nm)	≥ 60.0	SBR	209.7	10899956.6	51728.3	
K (766.491 nm)	≥ 24.0	SBR	38.9	1983197.5	49746.6	

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	1.21	
Zn (213.857 nm)	≤ 1.50	0.39	
Pb (220.353 nm)	≤ 2.60	0.41	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.41	
Ba (493.408 nm)	≤ 1.50	0.51	
K (766.491 nm)	≤ 1.50	0.36	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.51	
Se (196.026 nm)	≤ 1.50	0.73	
Zn (206.200 nm)	≤ 1.50	0.30	
Zn (213.857 nm)	≤ 1.50	0.37	
Cd (214.439 nm)	≤ 1.50	0.36	
Pb (220.353 nm)	≤ 1.50	0.28	
Mn (257.610 nm)	≤ 1.50	0.63	
Cr (267.716 nm)	≤ 1.50	0.30	
Cu (324.754 nm)	≤ 1.50	0.54	
Al (396.152 nm)	≤ 1.50	0.45	
Ba (493.408 nm)	≤ 1.50	0.64	
K (766.491 nm)	≤ 1.50	0.56	

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Nukoon L.	
Test Completed On	12/9/2021 12:55:49 PM	
Result Summary		
Subsystem Communications Test		Skipped
Air Flow Test		Skipped
Water Flow Test		Skipped
Gas Flows Test		Skipped
RF Generator Test		Skipped
Camera Test		Skipped
Optics Test		Pass
Advanced Valve System Test		Skipped
Resolution Test		Pass
Sensitivity Test		Pass
Precision Test		Pass
Optics Test		Pass
	Radial	Axial
Intensity	5296135	5755042
Wavelength	737.212	737.212

เอกสารไม่ควบคุม



Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.22	
As (188.980 nm)	≤ 8.20	6.15	
C (193.027 nm)	≤ 11.50	8.22	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.158 nm)	≤ 13.40	9.21	
Zn (213.857 nm)	≤ 8.70	6.87	
Pb (220.353 nm)	≤ 9.50	7.02	
Co (228.615 nm)	≤ 17.20	11.81	
Ba (230.424 nm)	≤ 9.40	7.46	
Mn (257.610 nm)	≤ 13.30	9.49	
Mn (260.568 nm)	≤ 20.30	14.19	
Cr (267.716 nm)	≤ 11.00	7.90	
Cu (324.754 nm)	≤ 25.00	18.92	
Cu (327.395 nm)	≤ 14.20	11.32	
Sr (338.071 nm)	≤ 33.50	24.29	
Ba (455.403 nm)	≤ 44.00	33.68	
Sr (460.733 nm)	≤ 36.00	17.64	
Ba (493.408 nm)	≤ 36.00	25.56	
Ba (614.171 nm)	≤ 42.00	24.75	
Ar (675.283 nm)	≤ 74.00	59.18	
K (766.491 nm)	≤ 80.00	65.19	

เอกสารไม่ควบคุม

Sensitivity Test			Pass		
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	154.8	1242.3	58.5
Se (196.026 nm)	≥ 41.0	SRBR	117.4	1259.6	97.9
Zn (213.857 nm)	≥ 1421.0	SRBR	4192.8	52402.6	155.3
Pb (220.353 nm)	≥ 46.0	SRBR	196.4	2814.2	179.9
Mn (257.610 nm)	≥ 3518.0	SRBR	11993.6	281210.1	547.6
Al (396.152 nm)	≥ 3.4	SBR	8.7	55103.6	5662.9
Ba (493.408 nm)	≥ 34.0	SBR	125.4	2152916.9	17032.2
K (766.491 nm)	≥ 1.8	SBR	5.7	107906.7	16079.8
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	297.5	4054.8	170.4
Se (196.026 nm)	≥ 159.0	SRBR	260.2	4794.9	298.5
Zn (206.200 nm)	≥ 234.0	SRBR	1305.9	16162.3	150.3
Zn (213.857 nm)	≥ 1743.0	SRBR	8920.7	200915.6	504.7
Cd (214.439 nm)	≥ 4227.0	SRBR	7958.3	149327.5	350.4
Pb (220.353 nm)	≥ 320.0	SRBR	606.7	15244.5	584.0
Mn (257.610 nm)	≥ 10625.0	SRBR	34460.9	1493092.8	1872.5
Cr (267.716 nm)	≥ 1048.0	SRBR	5018.6	198000.6	1532.6
Cu (324.754 nm)	≥ 19.0	SBR	57.5	423683.7	7248.6
Al (396.152 nm)	≥ 6.0	SBR	18.5	320004.9	16441.4
Ba (493.408 nm)	≥ 60.0	SBR	233.3	11882915.4	50714.5
K (766.491 nm)	≥ 24.0	SBR	44.6	2218974.4	48657.9

เอกสารไม่ควบคุม

**Precision Test****Pass****Radial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.38
Se (196.026 nm)	≤ 2.60	0.91
Zn (213.857 nm)	≤ 1.50	0.38
Pb (220.353 nm)	≤ 2.60	0.44
Mn (257.610 nm)	≤ 1.50	0.43
Al (396.152 nm)	≤ 1.50	0.38
Ba (493.408 nm)	≤ 1.50	0.66
K (766.491 nm)	≤ 1.50	0.36

**Axial**

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.61
Se (196.026 nm)	≤ 1.50	0.52
Zn (206.200 nm)	≤ 1.50	0.36
Zn (213.857 nm)	≤ 1.50	0.33
Cd (214.439 nm)	≤ 1.50	0.41
Pb (220.353 nm)	≤ 1.50	0.36
Mn (257.610 nm)	≤ 1.50	0.74
Cr (267.716 nm)	≤ 1.50	0.25
Cu (324.754 nm)	≤ 1.50	0.71
Al (396.152 nm)	≤ 1.50	0.44
Ba (493.408 nm)	≤ 1.50	0.73
K (766.491 nm)	≤ 1.50	0.97

**เอกสารไม่ควบคุม****Report Summary**

Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Nukoon L.
Test Completed On	12/9/2021 1:34:10 PM

**Result Summary**

Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flows Test	Pass
RF Generator Test	Pass
Camera Test	Pass
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Skipped
Sensitivity Test	Skipped
Precision Test	Skipped

**Subsystem Communications Test****Pass****Air Flow Test****Pass**

30% Air Flow (relative speed)	75% Air Flow (relative speed)
15.00	19.00

**Water Flow Test****Pass**

RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.98	1.36	17.16

**เอกสารไม่ควบคุม**

**Gas Flows Test****Pass**

Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	203.80	2.00	1.99	108.66

Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	113.89	18.00	17.93	24.24

**RF Generator Test****Pass**

RF Power Supply Test	Passed
RF Power Supply (V)	141.475

RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.874
Work Coil Current (A)	45.931
RF Power Supply Current (A)	2.000

**Camera Test****Pass**

	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.261	Passed
Dark Current Test	6000	0.734	Passed
Array Test	5	0.024	Passed
Linearity Test		0.118	Passed

Request No. 25-64 / 0247

MTC. ACL.No. 335 / 64

**CALIBRATION CERTIFICATE**

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies" Model AA240FS

Serial No. MY13160001

2. Working standard solution "Merck" , "PerkinElmer Pure"

Cadmium Lot No. 24-155CDY1, Chromium Lot No. 24-112CRAY1, Copper Lot No. 24-154CUY1, Iron Lot No. HC90432981,

Lead Lot No. 24-162PBY1, Manganese Lot No. 24-146MNY1, Nickel Lot No. 24-187NIY1, Zinc Lot No. 24-173ZNY1

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "AccuStandard"

Cadmium Lot No. 0099663190, Chromium Lot No. 0101187438, Copper Lot No. 0101965266, Iron Lot No. 216025090,

Lead Lot No. 0104659412, Manganese Lot No. 0106301916, Nickel Lot No. 0984273115, Zinc Lot No. 216035069

CALIBRATION RANGE: 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm.Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm.Cr, 0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm.Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm.Fe, 0.20,0.50,0.70,1.00,1.50 mg/l at 217.0 nm.Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm.Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm.Ni, 0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm.Zn

AMBIENT CONDITIONS : Temperature 19.9 °C Relative humidity 46 %

The Atomic Absorption Spectrophotometer set has been calibrated against Reference Material traceable to National Institute of Standards and Technology ( NIST ) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by .....  
( Mr. Danal Srithongkum )

Approved by.....  
(Mrs. Thippaya Junvee Fortune)

Director of Analytical Chemistry Laboratory

Ref. 2025264011500187001

Calibration Date : 4 February 2021

The results relate only to the items tested or calibrated.

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FM.BL.MTC.002 Rev.3

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Request No. 25-64 / 0247

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MTC. ACL. No. 335 / 64

## CALIBRATION DATA

## 1. Noise Level in term of standard deviation

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0009	-0.0003	-0.0004	-0.0011	-0.0001	-0.0003	-0.0002	0.0019
	0.0002	-0.0016	0.0003	0.0011	-0.0010	-0.0004	-0.0016	0.0006
	-0.0002	-0.0006	0.0001	-0.0007	-0.0006	-0.0003	-0.0014	0.0019
	0.0002	-0.0012	0.0002	-0.0010	-0.0013	-0.0010	-0.0017	0.0015
	0.0009	-0.0025	-0.0002	-0.0008	-0.0002	-0.0016	-0.0010	0.0011
	0.0001	-0.0023	0.0005	-0.0013	0.0000	-0.0001	-0.0005	0.0009
	0.0010	-0.0005	-0.001	0.0003	-0.0005	-0.0014	0.0006	0.0015
	0.0007	0.0000	0.0002	-0.0009	-0.0003	-0.0010	-0.0016	0.0011
	0.0005	-0.0006	-0.0004	-0.0009	0.0000	-0.0006	-0.0012	0.0011
	0.0007	-0.0013	-0.0003	-0.0005	-0.0007	-0.0001	-0.0003	0.0016
	0.0009	-0.0015	-0.0009	-0.0012	0.0002	-0.0006	-0.0015	0.0010
	0.0014	0.0006	-0.001	-0.0006	-0.0014	-0.0012	-0.0013	0.0005
	0.0002	0.0001	0.0003	-0.0003	-0.0006	-0.0013	-0.0006	0.0001
	0.0003	-0.0008	-0.0007	-0.0015	-0.0008	-0.0006	-0.0007	0.0011
	0.0008	-0.0011	0.0001	-0.0002	-0.0002	-0.0014	-0.0001	0.0002
	0.0000	-0.0006	-0.0005	-0.0018	0.0005	-0.0011	-0.0013	0.0007
	0.0001	0.0007	-0.0004	-0.0016	-0.0001	-0.0011	-0.0018	0.0013
	-0.0002	-0.0013	0.0000	-0.0008	-0.0008	-0.0005	-0.0007	0.0016
	0.0006	0.0003	0.0002	-0.0002	0.0000	-0.0013	-0.0011	0.0007
	0.0004	0.0004	0.0005	-0.0025	0.0001	-0.0014	-0.0014	0.0012
Average Absorbance	0.000	-0.001	0.000	-0.001	0.000	-0.001	-0.001	0.001
Standard Deviation	0.0004	0.0009	0.0005	0.0008	0.0005	0.0005	0.0006	0.0005

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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FM.BL.MTC.002 Rev.3

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เอกสารไม่ควบคุม



Request No. 25-64 / 0247

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MTC. ACL. No. 335 / 64

## 2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0075	0.0072	0.0069	0.0072	0.0069	0.0073	0.0075	0.0074	0.0083	0.0081	0.007	0.0005	6.19
	0.30	0.0944	0.0947	0.0949	0.0936	0.0947	0.0942	0.0950	0.0938	0.0942	0.0945	0.094	0.0005	0.48
	0.70	0.2154	0.2157	0.2156	0.2157	0.2158	0.2158	0.2157	0.2163	0.2167	0.2162	0.216	0.0004	0.18
Cr	0.10	0.0070	0.0079	0.0076	0.0084	0.0079	0.0082	0.0092	0.0094	0.0089	0.0076	0.008	0.0008	9.35
	0.30	0.0202	0.0226	0.0206	0.0207	0.0222	0.0209	0.0223	0.0215	0.0221	0.0222	0.022	0.0009	4.00
	0.70	0.0439	0.0453	0.0455	0.0425	0.0438	0.0449	0.0441	0.0452	0.0447	0.0452	0.045	0.0009	2.10
Cu	0.05	0.0071	0.0081	0.0074	0.0070	0.0070	0.0065	0.0072	0.0077	0.0073	0.0067	0.007	0.0005	6.45
	0.30	0.0411	0.0411	0.0424	0.0420	0.0419	0.0409	0.0413	0.0414	0.0419	0.0411	0.042	0.0005	1.21
	0.70	0.0909	0.0899	0.0905	0.0906	0.0904	0.0897	0.0905	0.0902	0.0899	0.0904	0.090	0.0004	0.41
Fe	0.10	0.0077	0.0078	0.0080	0.0071	0.0074	0.0086	0.0076	0.0081	0.0085	0.0088	0.008	0.0005	6.89
	0.50	0.0409	0.0405	0.0410	0.0406	0.0410	0.0404	0.0408	0.0404	0.0400	0.0400	0.041	0.0004	0.92
	1.00	0.0797	0.0795	0.0805	0.0789	0.0791	0.0813	0.0795	0.0806	0.0806	0.0794	0.080	0.0008	0.98
Pb	0.20	0.0082	0.0086	0.0102	0.0086	0.0087	0.0091	0.0086	0.0089	0.0083	0.0088	0.009	0.0006	6.34
	0.70	0.0327	0.0314	0.0312	0.0325	0.0331	0.0312	0.0321	0.0322	0.0320	0.0317	0.032	0.0006	2.01
	1.50	0.0673	0.0674	0.0677	0.0677	0.0686	0.0673	0.0663	0.0672	0.0673	0.0675	0.067	0.0006	0.84
Mn	0.05	0.0095	0.0102	0.0100	0.0096	0.0105	0.0100	0.0102	0.0101	0.0096	0.0100	0.010	0.0003	3.17
	0.30	0.0626	0.0626	0.0622	0.0621	0.0605	0.0628	0.0618	0.0626	0.0620	0.0626	0.062	0.0007	1.08
	0.70	0.1397	0.1404	0.1415	0.1407	0.1404	0.1388	0.1424	0.1412	0.1408	0.1399	0.141	0.0010	0.71
Ni	0.10	0.0088	0.0087	0.0093	0.0090	0.0086	0.0082	0.0088	0.0089	0.0084	0.0096	0.009	0.0004	4.62
	0.50	0.0455	0.0445	0.0460	0.0469	0.0457	0.0471	0.0462	0.0466	0.0468	0.0444	0.046	0.0010	2.08
	1.00	0.0865	0.0878	0.0858	0.0872	0.0858	0.0862	0.0846	0.0867	0.0863	0.0865	0.086	0.0009	1.00
Zn	0.05	0.0323	0.0328	0.0331	0.0326	0.0338	0.0325	0.0340	0.0331	0.0340	0.0327	0.033	0.0006	1.91
	0.30	0.1735	0.1734	0.1743	0.1734	0.1731	0.1734	0.1719	0.1731	0.1724	0.1740	0.173	0.0007	0.40
	0.70	0.3552	0.3551	0.3564	0.3530	0.3560	0.3564	0.3577	0.3559	0.3586	0.3559	0.356	0.0015	0.42

Continue 3 / 5

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 9523  
E-mail : s@tistr.or.th

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Request No. 25-64 / 0247

3 / 5

MTC. ACL. No. 335 / 64

## 3. Accuracy

## 3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.019	-0.001	5.00	± 0.005
	0.300	0.302	0.002	0.67	± 0.006
	0.700	0.698	-0.002	0.29	± 0.012

## 3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.100	0.106	0.006	6.00	± 0.015
	0.300	0.308	0.008	2.67	± 0.019
	0.700	0.657	-0.043	6.14	± 0.032

## 3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.04955	0.050	0.000	0.91	± 0.004
	0.29730	0.316	0.019	6.29	± 0.009
	0.69370	0.696	0.002	0.33	± 0.018

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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E-mail : samut@tistr.or.th

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Request No. 25-64 / 0247

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MTC. ACL. No. 335 / 64

## 3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.091	-0.009	9.00	± 0.012
	0.500	0.485	-0.015	3.00	± 0.015
	1.000	0.960	-0.040	4.00	± 0.060

## 3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.1988	0.205	0.006	3.12	± 0.013
	0.6958	0.703	0.007	1.03	± 0.018
	1.4910	1.463	-0.028	1.88	± 0.033

## 3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04955	0.049	-0.001	1.11	± 0.005
	0.29730	0.307	0.0097	3.26	± 0.007
	0.69370	0.694	0.0003	0.04	± 0.013

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Request No. 25-64 / 0247

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MTC. ACL. No. 335 / 64

## 3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.1003	0.099	-0.001	1.30	± 0.010
	0.5015	0.525	0.024	4.69	± 0.025
	1.0030	0.987	-0.016	1.60	± 0.045

## 3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.046	-0.004	8.00	± 0.011
	0.300	0.322	0.022	7.33	± 0.021
	0.700	0.681	-0.019	2.71	± 0.042

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 ( $k = 2$ ) which gives a level of confidence of approximately 95%

Calibrated by Dani Srithongkum  
(Mr. Danai Srithongkum)

Approved by Sor Thippaya Junvee Fortune  
(Mrs. Thippaya Junvee Fortune)  
Sor Director of Analytical Chemistry Laboratory  
Calibration date : 4 February 2021

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Fax. (66) 0 2579 1121-30  
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM1875

Page.: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V618.0033  
ID No. : UAE.MIC.021/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 28 October 2021  
Calibration Date : 28 - 29 October 2021  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Kunchit Promprat  
Approved by : Malee Butkruea  
Approved Signatory  
( ) Pornthippa Tameyakul  
( ✓ ) Malee Butkruea  
( ) Suwit Imjai  
Issue Date : 4 November 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2110-0698OC-2  
**Procedure Used :-**

**Cert. No.:** 21TM1875  
**Page.:** 2 of 3

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

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

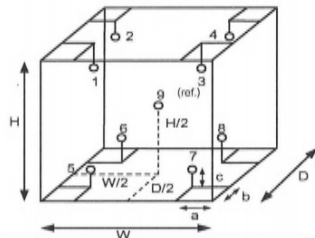
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available



**Probe Installation Details :**

a = 5.0 cm  
 b = 5.0 cm  
 c = 5.0 cm

**Dimension of Chamber :**

D = 0.50 m  
 W = 0.64 m  
 H = 0.80 m  
 Capacity = 0.26 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	22	22
REL.Humid. ( % )	59	60
AC Supply ( Volt )	226	226

Position :	Ref. Std. ID No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	21-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09

Mlu.

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**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2110-0698OC-2  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Not Available

**Cert. No.:** 21TM1875  
**Page.:** 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
22.0	22.0	21.5	0.022	0.11	0.13	0.30	2
35.0	35.0	35.0	0.062	0.56	1.0	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
22.0	21.872	21.877	21.800	21.770	21.813	21.786	21.832	21.824	21.778
35.0	35.468	35.405	35.216	35.202	34.621	34.763	34.525	34.730	35.049

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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Mlu.

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Cert. No.: 21TM1874  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Incubator  
**Manufacturer :** Memmert  
**Model :** IPP 260  
**Serial No. :** V616.0066  
**ID No. :** UAE.MIC.032/2559  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Microbiology Laboratory (302)  
**Received Order :** 28 October 2021  
**Calibration Date :** 28 - 29 October 2021  
**Ambient Temperature :**  $(26 \pm 10) ^\circ\text{C}$   
**Relative Humidity :**  $(50 \pm 30) \%$

**Calibrated by :** Kunchit Promprat

**Approved by :**

*Malee*  
Approved Signatory

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

**Issue Date :** 4 November 2021

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.



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2110-0698OC-1  
**Procedure Used :-**

**Cert. No.:** 21TM1874  
**Page.:** 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44067817	21LM10	20 Jul 2022

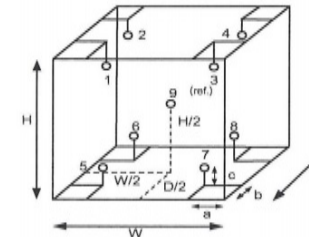
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Not Available



**Probe Installation Details :**

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

**Dimension of Chamber :**

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	22	22
REL.Humid. ( % )	59	60
AC Supply ( Volt )	226	226

Position :	Ref. Std. ID No.:
1	15RTD2/11
2	15RTD2/12
3	15RTD2/13
4	15RTD2/14
5	15RTD2/15
6	15RTD2/20
7	15RTD2/17
8	15RTD2/18
9 (ref.)	15RTD2/19

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Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2110-0698OC-1  
 Result of Calibration :- ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source  
 Fresh air setting : Not Available

Cert. No.: 21TM1874  
 Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
25.0	25.0	24.5	0.053	0.25	0.42	0.30	2
35.0	35.0	35.0	0.029	0.43	0.75	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
25.0	25.007	24.986	24.943	24.894	24.653	24.806	24.672	24.694	24.786
35.0	35.340	35.384	35.336	35.307	34.680	35.120	34.813	34.996	35.088

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

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

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

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

UUC\* : Unit Under Calibration

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

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

-o0o-

*Malee*

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Cert. No.: 21TM708  
 Page.: 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
 Manufacturer : Memmert  
 Model : WNE 14  
 Serial No. : L414.1407  
 ID No. : UAE.MIC.006/2558  
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Phrakhanong,  
 Bangkok 10260  
 Location : Microbiology Laboratory  
 Received Order : 21 April 2021  
 Calibration Date : 21 April 2021  
 Ambient Temperature : ( 26 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %  
 Calibrated by : Kritsada Chaitrong

Approved by : *Malee*  
 Approved Signatory

( ) Ponthippa Tameyakul  
 (✓) Malee Butkruea  
 ( ) Suwit Imjai

Issue Date : 5 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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A 0027612





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2104-0019OC-4  
Cert. No.: 21TM708  
Page.: 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY44060450	21LM4	NIMT	06 Mar 2022

2. This certification is traceable to the SI unit.

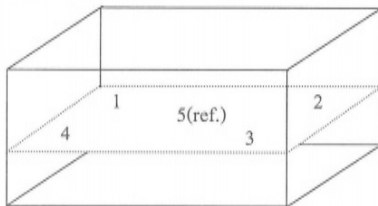
3. This certificate is valid only to the item calibrated on date and place of calibration.

**Remark :** NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	60	223
Finished of Calibration	23	65	224



Front

Position :	Ref. Std. S/N.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005

Malu.

เอกสารไม่ควบคุม

a 1092702



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2104-0019OC-4  
Cert. No.: 21TM708  
Page.: 3 of 3

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.524	44.507	44.501	44.518	44.518

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor k
44.5	0.052	0.035	0.16	2

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

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

**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\* :** Unit Under Calibration

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

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

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Malu.

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a 1092701



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM424  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Water Bath  
**Manufacturer :** Memmert  
**Model :** WNE 14  
**Serial No. :** L416.0614  
**ID No. :** UAE.MIC.020/2561  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Microbiology Laboratory  
**Received Order :** 22 February 2021  
**Calibration Date :** 22 February 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanapongpaiboon

**Approved by :**

*Manu*  
Approved Signatory

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

**Issue Date :** 3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2102-07510C-5  
**Procedure Used :-**

Cert. No.: 21TM424  
Page.: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY44036292	20LM5	NIST, NIMT	10 Apr 2021

2. This certification is traceable to the SI unit.

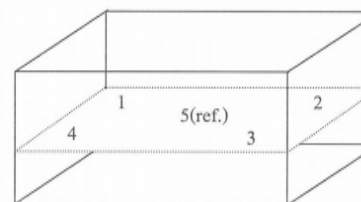
3. This certificate is valid only to the item calibrated on date and place of calibration.

**Remark :** NIST : National Institute of Standards and Technology, The United State of America.  
NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	58	221
Finished of Calibration	24	59	223



Front

Position :	Ref. Std. ID No.
1	70RC148
2	70RC149
3	70RC150
4	70RC151
5(ref.)	70RC152

*Manu*  
เอกสารไม่ควบคุม





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2102-07510C-5  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 21TM424  
Page.: 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.548	44.518	44.505	44.527	44.529
50.0	50.0	50.0	50.067	49.999	50.041	50.050	50.053

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
44.5	0.078	0.045	0.15	2
50.0	0.12	0.054	0.15	2

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

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

**Stability** : One-half of the greatest maximum difference of measured temperature at any one probe.

**UUC\*** : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



National Food Institute, Ministry of Industry, Thailand

2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand.  
Tel : +66 (0) 2422 8588 Fax : +66 (0) 2422 8558 Website : www.nfi.or.th E-mail : cal@nfi.or.th



## Calibration Certificate

Certificate No.: 2200705-001-01  
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address: 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: MS603S/01  
Serial No.: B007010311  
ID No.: UAE.MIC.008/2553  
Order No.: 2200705  
Operation No.: 2200705-001  
Date of Receipt: 24 November 2021  
Date of Calibration: 24 November 2021

Calibrated by Mr.Jumpon Pimsri  
Scientist

Approved by ( Mr.Pheraphat Tuanjit )

Manager, Division of Calibration Laboratory

Date of Issue: 30 November 2021

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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## Calibration Report

**Certificate No.:** 2200705-001-01  
**Equipment:** Electronic Balance  
**Model:** M5603S/01  
**Serial No.:** B007010311  
**Capacity:** 620 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.001 g  
**ID No.:** UAE.MIC.008/2553

**Date of Calibration:** 24 November 2021

Page 2 of 3

**Environment Condition:** Ambient Temperature: 24.1 ± 0.6 °C Relative Humidity: 48 ± 2.5 %

**Place of Calibration:** 306 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Condition of Equipment:** Good Condition

### Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	B308068554	TCS	M21010975	12 January 2022
Standard Weight Class E2	1-500g	B308068128	TCS	M21010985	13 January 2022
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	PONPE 490	NFI.BTH 001/17	Quality Reborn	QR21-0299	15 February 2022

3. This certification is traceable to SI UNIT

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

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

### Calibration Results:

#### 1. Repeatability of Reading:

Nominal Value ( g )	Standard Deviation of Reading ( g )
300	0.00052
600	0.00063

#### 2. Off-Center Error:

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

The balance reading obtained is given in the table.

200 g was placed and moved to various position on pan.

Reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)
( g )	( g )	( g )	( g )	( g )	( g )	( g )
200.001	200.000	200.002	200.001	200.000	200.002	0.002

เอกสารไม่ควบคุม

## Calibration Report

**Certificate No.:** 2200705-001-01  
**Equipment:** Electronic Balance  
**Model:** M5603S/01  
**Serial No.:** B007010311  
**Capacity:** 620 g  
**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.001 g  
**ID No.:** UAE.MIC.008/2553

**Date of Calibration:** 24 November 2021

Page 3 of 3

### Calibration Results: (Continued)

**Calibration Range:** 0-600 g

**Calibration Adjustment:** Internal Calibration

### 3. Departure from Nominal Value:

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00088	2.00
0.1	0.1000	0.099	0.001	0.00088	2.00
0.5	0.5000	0.500	0.000	0.00088	2.00
1	1.0000	1.000	0.000	0.00088	2.00
5	5.0000	5.000	0.000	0.00088	2.00
10	10.0000	10.000	0.000	0.00088	2.00
20	20.0000	20.000	0.000	0.00089	2.00
50	49.9999	50.001	-0.001	0.00089	2.00
70	69.9999	70.000	0.000	0.00089	2.00
100	100.0000	100.000	0.000	0.00090	2.00
150	149.9999	150.000	0.000	0.00091	2.00
200	200.0001	199.999	0.001	0.00093	2.00
300	300.0001	300.000	0.000	0.00097	2.00
400	400.0000	400.001	-0.001	0.0011	2.00
500	499.9999	500.001	-0.001	0.0012	2.00
600	599.9999	600.000	0.000	0.0013	2.00

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

----- End -----

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM425

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Autoclave  
**Manufacturer :** ALP  
**Model :** CL-40L  
**Serial No. :** 802664  
**ID No. :** UAE.MIC.014/2550  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Air Analysis Unit  
**Received Order :** 22 February 2021  
**Calibration Date :** 23 February 2021  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanapongpaiboon

**Approved by :**

*Malee*

Approved Signatory

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

**Issue Date :**

3 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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A 0025135



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2102-07510C-1  
**Procedure Used :-**

**Cert. No.:** 21TM425

**Page.:** 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49023932	20LM6	NIST, NIMT	20 Apr 2021

2. This certification is traceable to the SI unit.

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )  
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

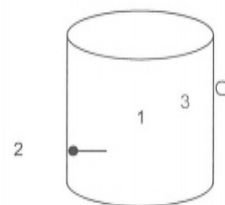
This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

**Remark :** NIST : National Institute of Standards and Technology, The United State of America.

NIMT : National Institute of Metrology Thailand.

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source



	Environmental		
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	26	61	222
Finished of Calibration	26	63	223

Position	Description	Ref. Std. Thermocouple
1 =	Center of chamber	19-16TC-08
2 =	Temperature sensor	19-16TC-09
3 =	Exhaust port	19-16TC-10

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a 1043935



Equipment : Autoclave  
 Condition As-Received : Used Item  
 Reference : 2102-0751OC-1  
 Result of Calibration :- ( \* ) Without Adjustment

Cert. No.: 21TM425  
 Page.: 3 of 3

Operating parameter Set : Temperature = 116 °C  
 Sterilization period = 15 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
116	116	1	117.021	0.23	0.08	0.92	2
		2	117.111				
		3	117.212				

Operating parameter Set : Temperature = 122 °C  
 Sterilization period = 15 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
122	122	1	122.817	0.15	0.12	1.10	2
		2	122.914				
		3	122.978				

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

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

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

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*Malu*

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a 1043934



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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 TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM831  
 Page.: 1 of 3

## Certificate of Calibration

Equipment : Autoclave  
 Manufacturer : ALP  
 Model : CL-40L  
 Serial No. : 807298  
 ID No. : UAE.MIC.019/2560  
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchak, Phrakhanong,  
 Bangkok 10260  
 Location : 301 Room  
 Received Order : 7 May 2021  
 Calibration Date : 7 May 2021  
 Ambient Temperature : ( 26 ± 10 ) °C  
 Relative Humidity : ( 50 ± 30 ) %  
 Calibrated by : Khit Ruttanaprapachai

Approved by : *Malu*  
 Approved Signatory

( ) Pornthippa Tameyakul  
 ( / ) Malee Butkruea  
 ( ) Suwit Imjai

Issue Date : 18 May 2021

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Autoclave  
 Condition As-Received : Used Item  
 Reference : 2105-0012OC-1

Cert. No.: 21TM831  
 Page.: 3 of 3

Result of Calibration :- ( \* ) Without Adjustment

Operating parameter Set : Temperature = 116 °C  
 Sterilization period = 15 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
116	116	1	116.744	0.12	0.08	0.90	2
		2	116.549				
		3	116.515				

Operating parameter Set : Temperature = 122 °C  
 Sterilization period = 30 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( MPa )	Uncertainty ( ± °C )	Coverage Factor k
122	122	1	122.672	0.076	0.12	1.1	2
		2	122.469				
		3	122.414				

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

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

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

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Equipment : Autoclave  
 Condition As-Received : Used Item  
 Reference : 2105-0012OC-1

Cert. No.: 21TM831  
 Page.: 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY57013711	20LM7	18 May 2021

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3\*\*

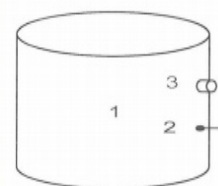
(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source



	Environmental		
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	62	222
Finished of Calibration	25	63	221

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	18-18TC-04
2 =	Temperature sensor	18-18TC-05
3 =	Exhaust port	18-18TC-06

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