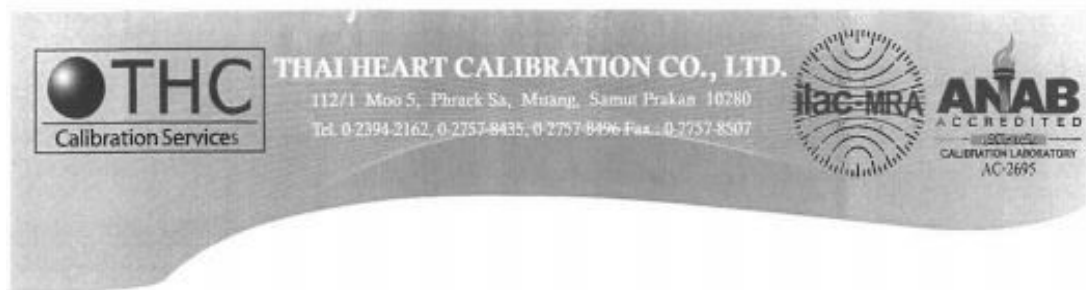




ภาคผนวก ง  
เอกสารสอบเทียบเครื่องมือตรวจวัด

เอกสารสอบเทียบเครื่องมือตรวจวัด



## CERTIFICATE OF CALIBRATION

Certificate No.: C0-2008004/21 Page 1 of total 4 pages

**Customer** WATER ANALYSIS CENTER CO., LTD.  
30/5 Soi Viphavadee 60, Viphavadee Rangsit Road,  
Kwaeng Taladbangkhen, Khet Laksi, Bangkok 10210

<b>Equipment</b>	pH Meter	<b>Model</b>	SevenCompact
<b>Manufacturer</b>	METTLER TOLEDO	<b>ID No.</b>	WWL 0068
<b>Serial No.</b>	B327527211		
<b>Description</b>	Range : 0 - 14 pH, Resolution : 0.01 pH		

**Environmental Conditions** Ambient Temperature:  $(20 \pm 2) ^\circ\text{C}$   
Relative Humidity:  $(50 \pm 10) \%$   
Atmospheric Pressure: -

**Calibration Location** Jayhawks Laboratory (CL&GL)

**Received Date** 20 August 2021

**Calibration Date** 20 August 2021

**Date of Issue** 23 August 2021

**Checked by** [Redacted]  
Act as Technical Manager

**Approved by** [Redacted]

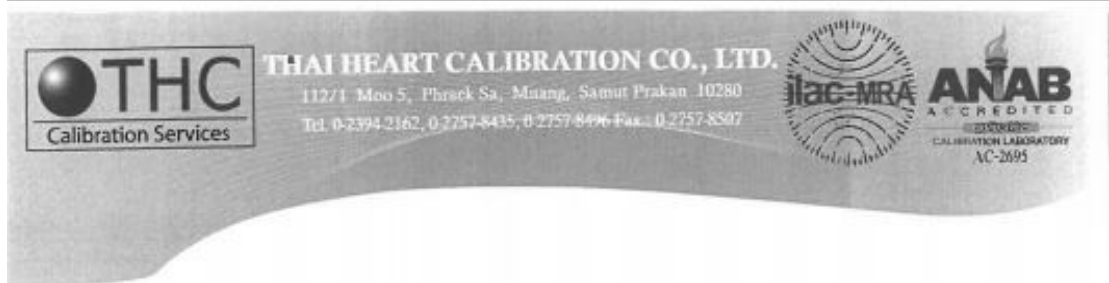
Rep

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FE-169

REV.02 02/24/21

เอกสารสอบเทียบเครื่องมือตรวจวัด



Certificate No.: C0-2008004/21

Page 2 of total 4 pages

Reference Method:

- The calibration method used was CP-178 based on an in-house method.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard:

Type	pH Value	Lot No.	Due Date	Traceability
pH Standard Solution	4.01	081020	Feb. 1, 2022	NIMT
	7.01	020221	Dec. 25, 2021	
	10.00	091020	Jan. 19, 2022	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	753	3101007	10-0804001/21	Apr. 7, 2022	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	10-1006001/21	Jun. 10, 2022	

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

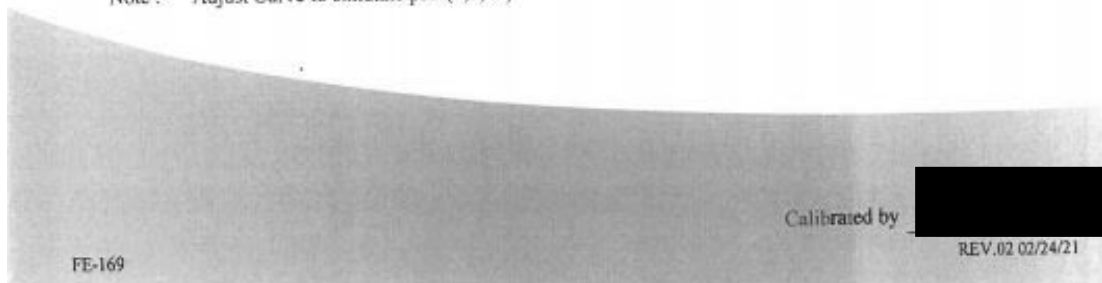
Measurement Results:

1. Function Simulated pH Meter


Standard Applied ( mV )	Nominal Value ( pH )	UUC Reading		Uncertainty ( ± mV )
		pH	mV	
177.48	4.00	4.01	177.4	0.060
0.00	7.00	7.00	0.0	0.060
-177.48	10.00	10.01	-177.4	0.060

UUC : Unit Under Calibration



Note : Adjust Curve to simulate pH (4,7,10)



เอกสารสอบเทียบเครื่องมือตรวจวัด



**THAI HEART CALIBRATION CO., LTD.**  
112/1 Moo 5, Phraek Sai, Muang, Samut Prakan 10280  
Tel: 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax: 0-2757-8507

**Certificate No.:** C0-2008004/21 **Page 3 of total 4 pages**

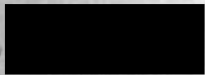
**Measurement Results (Cont.):**  
2. Calibration of pH Electrode

pH Standard Solution ( pH )	Measured Value		Uncertainty ( ± pH )
	( pH )	( mV )	
4.01	4.00	187.0	0.013
7.01	7.00	11.1	0.013
10.00	10.02	-161.6	0.013

Note : Adjust Curve to Buffer Solution pH (4,7,10)  
Temperature stability of micro bath :  $25 \pm 0.2^{\circ}\text{C}$

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

FE-169

Calibrated by   
REV.02 02/24/21

### เอกสารสอบเทียบเครื่องมือตรวจวัด

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	20E3985	Nov. 9, 2021	TPA
Platinum Resistance Thermometer	5626	4853	C0A30046	Oct. 28, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	10-0306002/21	Jun. 3, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- TPA, Technology Promotion Association (Thailand-Japan).
- FLUKE, Fluke Corporation, U.S.A.
- THC, Thai Heart Calibration Co., Ltd.

Measurement Results: ( X ) Without Adjustment

Dimension of probe : Diameter 4 mm. Sensor Type : RTD (PT100)

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
120	22.00	22.0	0.00	0.058
120	25.00	25.0	0.00	0.058
120	28.00	28.0	0.00	0.058

UUC : Unit Under Calibration

The above reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -

Calibrated by [REDACTED]

FE-169 REV.02 02/24/21

เอกสารสอบเทียบเครื่องมือตรวจวัด

	<b>THAI HEART CALIBRATION CO., LTD.</b> 112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280 Tel. 0 2394-2162, 0-2757-8435, 0 2757-8496 Fax: 0 2757-8507	 
<b>CERTIFICATE OF CALIBRATION</b>		
<b>Certificate No.:</b>	C0-2107005/21	<b>Page 1 of total 2 pages</b>
<b>Customer</b>	WATER ANALYSIS CENTER CO., LTD. 30/5 Soi Viphavadee 60, Viphavadee Rangsit Road, Kwaeng Taladbangkhen, Khet Lakxi, Bangkok 10210	
<b>Equipment</b>	Conductivity Meter	
<b>Manufacturer</b>	EUTECH	<b>Model</b> CON 2700
<b>Serial No.</b>	2657889	<b>ID No.</b> WWL 0136
<b>Description</b>	-	
<b>Environmental Conditions</b>	Ambient Temperature: $(20 \pm 2) ^\circ\text{C}$ Relative Humidity: $(50 \pm 10) \%$ Atmospheric Pressure: -	
<b>Calibration Location</b>	Jayhawks Laboratory (CL&GL)	
<b>Received Date</b>	21 July 2021	
<b>Calibration Date</b>	21 July 2021	
<b>Date of Issue</b>	22 July 2021	
<b>Checked by</b>		
	Act as Technical Manager	
<b>Approved by</b>		
	Re	
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This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.		
FE-169		
REV.02 02/24/21		



### เอกสารสอบเทียบเครื่องมือตรวจวัด

Certificate No : AD2012-017-0001  
Environment : Ambient Temperature :  $(25 \pm 2)^{\circ}\text{C}$   
Relative Humidity :  $(50 \pm 15)\%\text{RH}$

STD Reading (mg/l)	UUC Reading Before (mg/l)	UUC Reading After (mg/l)	Error (mg/l)	Uncertainty ( $\pm$ mg/l)
9.046	9.07	-	0.024	0.013

STD = Standard

UUC = Unit Under Calibration

Description of UUC : Range 0.00 to 60.00 mg/l  
Resolution 0.01 mg/l

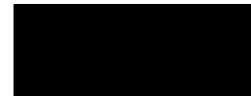
#### Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L2002-756, L2002-757 for Data Logger (Lutron Temperature & Humid & Baro) Serial No. B014887, Due 28-Feb-21

MIT Certificate No. L2001-629 for Hi Accuracy Thermometer Serial No. 130508834, Due 07-Jan-21

End of Certificate







### เอกสารสอบเทียบเครื่องมือตรวจวัด

Instrument : DO Meter  
Model : DO-31P  
Serial No. : 780065

Cert. No. WAC-065  
Page 2 of 2

#### Calibrate Procedure

- ☐ This instrument was calibrated by comparison with standard solution (PH/ORP)
- ☐ This instrument was calibrated by comparison with scattering plate value (Turbidity)
- ☐ This instrument was calibrated by comparison with conductivity (Conductivity)
- ☒ This instrument was calibrated by comparison with Sodium sulfite anhydrous (DO)

#### Condition of this result of calibration

##### 1). Reference Standard Solution

<u>Standard</u>	<u>Lot No</u>	<u>Batch.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Sodium Sulfite Power	1.06657.0500	K52300357	-	31 Mar 2022

##### 2). Traceability This certification is traceable to

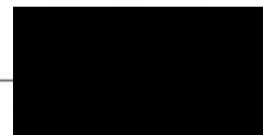
- ☒ Merck KGaA 64271 Darmstadt
- ☐ DKK Corporation

#### Result Of Calibration

Standard Solution (mg/l) at 26.0°C		Before Adjust		After Adjust	
		Indicator	Error	Indicator	Error
Zero	0.00	0.10	+ 0.10	0.00	-
Span	7.99	8.21	+ 0.22	7.99	-

DO Electrode No. OE270AA(5) S/N 111F0029

Calibrated By



Technician

เอกสารสอบเทียบเครื่องมือตรวจวัด



Master Calibration Co., Ltd.

547 Soi Ratchadaniyat, Kwang Samseonok, Khet Huaykwang, Bangkok 10310

Tel. : (02) 274 2978-9, (02) 2742987-8 Fax : (02) 274 2518, (02) 274 2989

Website : www.mastercalibration.com E-mail : calibrate@mastercalibration.com

Certificate of Calibration

TEMPERATURE  
CONTROLLER ENCLOSURES



Certificate No.: MC 2107214

Page 1 of 3



Customer : Water Analysis Center Co., Ltd.  
1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.

Reference Job No. : 21-1565 Received Date : 13 July 2021

Description : Refrigerator

Manufacturer : SANDENINTERCOOL Model : SEC-1500SBD

Serial No. : SEC1500201A-0708-00304 ID. No. : WW1.0038

Marking : Additionally for the purpose of identification by this laboratory a label marked with this certificate number ( MC 2107214 ) has been attached to the case.

Method : In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".

Location of Calibration : Water Analysis Center Co., Ltd. : Laboratory.

Environmental Conditions : Ambient Temperature : ( 26.3 ) °C  
Relative Humidity : ( 56.4 to 59.3 ) %

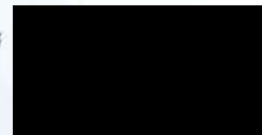
Date of Calibration : 13 July 2021 Date of Issue : 14 July 2021

Checked by :



(Calibration Supervisor)

Approved by :




The uncertainties are for a confidence probability of approximately 95%

This certificate is issued in accordance with the conditions of accreditation granted by the National Standardization Council of Thailand-Office of the National Standardization Council that 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 Master Calibration Co., Ltd.

[MCF-Q-077 ; Rev.6 ; Date : 22/04/2021]

## เอกสารสอบเทียบเครื่องมือตรวจวัด



**MCAL**  
MASTER CALIBRATION CO., LTD.

597 Soi Ratchadaneu, Klong Samsenok, Khet Huaykwang, Bangkok 10310  
Tel : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989  
<http://www.mastercalibration.com>

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**Certificate No.:** MC 2107214

Page 2 of 3

**The Reference Standard :**

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2009600	MY44095818	8 August 2021

With Thermocouple Type "T" ID. No.6/1 to 6/9

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd. And Quality Reborn Co., Ltd.

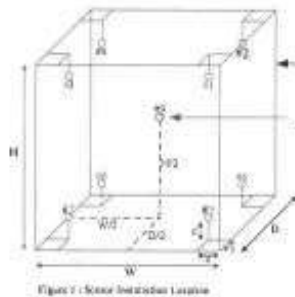
**1. Calibration Procedure:**

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

*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. The reference sensor should preferably be located at the geometric center of the chamber.

*Temperature Stability* - one-half of the greatest maximum difference of measured temperatures at any one sensor.

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



Overall Ambient Temperature around the Chamber variation : 4.4 °C

Overall Line Voltage variation : 0.1 V

Chamber Size (W\*H\*D) : 171 cm x 157 cm x 60 cm

Checked by : [REDACTED]

## เอกสารสอบเทียบเครื่องมือตรวจวัด



547 Soi Ratchadonivat, Kwang Samsenok, Khwa Huaykwang, Bangkok 10310  
Tel : (02) 274 2938-9, (02) 274 2987-8 Fax : (02) 274 2515, (02) 274 2989  
<http://www.mastercalibration.com>

Certificate No.: MC 2107214

Page 3 of 3

### 2. Result of calibration :

#### Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
2.6	4.0	4.0	4.1	4.0	3.9	3.8	3.7	3.8	3.4	1.2

#### Chamber Characterization Result

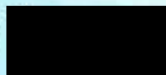
Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.6	2.7	1.4	5.8

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

This report will certify of the calibrated equipment only.

End of Certificate

Checked by :



เอกสารสอบเทียบเครื่องมือตรวจวัด



**Master Calibration Co., Ltd.**

547 Soi Ratchadaniwat, Kwang Samsenok, Khet Huaykwang, Bangkok 10310

Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989

<http://www.mastercalibration.com>

*Calibration Report*

**TEMPERATURE  
CONTROLLER ENCLOSURES**



**Report No. : MC 2103787**

Page 1 of 3



Customer : Water Analysis Center Co., Ltd.  
1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.

Reference Job No. : 21-0710 Received Date : 25 March 2021  
Description : Oven  
Manufacturer : Memmert Model : UF260  
Serial No. : B620.0814 ID. No. : N/A  
Marking : Additionally for the purpose of identification by this laboratory a label marked  
with this report number ( MC 2103787 ) has been attached to the case.  
Method : In-House calibration procedure MWI-T-033 this method is reference to  
TLAS G-20 "Temperature Controlled Enclosures".  
Location of Calibration : Water Analysis Center Co., Ltd. ; Laboratory.  
Environmental Conditions : Ambient Temperature : ( 31.8 to 35.3 ) °C  
Relative Humidity : ( 44.7 to 55.9 ) %  
Date of Calibration : 25 March 2021 Date of Issue : 26 March 2021

Checked by :



(Calibration Supervisor)

Approved by :



( Technical Manager )

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

This certificate is issued in accordance with the condition 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 issuing laboratory.

[MCF-Q-077 ; Rev.5 ; Date : 15/07/2014]



### เอกสารสอบเทียบเครื่องมือตรวจวัด



547 Soi Ratchadaniwat, Kwaeng Samsenok, Khet Huaykwang, Bangkok 10310  
Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989  
<http://www.mastercalibration.com>

Continuation of Report No. : MC 2103787

Page 2 of 3

#### The Reference Standard :

Description	Report No.	Serial No.	Due date
Data Acquisition/Switch Unit With Thermocouple Type "T" ID. No.17/1 to 17/9	MC 2016027	MY41010916	10 January 2022

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

#### 1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

*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. The reference sensor should preferably be located at the geometric center of the chamber.

*Temperature Stability* - one-half of the greatest maximum difference of measured temperatures at any one sensor.

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

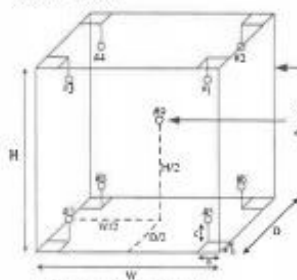


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 1.1 °C

Overall Line Voltage variation : 1.2 V

Chamber Size (W\*H\*D) : 65 cm x 80 cm x 50 cm

Checked by :



(MCE-0.077 - Rev 5 - Date : 15/07/2014)



## เอกสารสอบเทียบเครื่องมือตรวจวัด



547 Soi Ratchadaniyat, Kwaeng Samsenok, Khet Huaykwang, Bangkok 10310  
Tel : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989  
<http://www.mastercalibration.com>

Continuation of Report No. : MC 2103787

Page 3 of 3

### 2. Result of calibration :

#### Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104.0	103.7	103.7	103.7	103.9	104.2	104.3	104.3	104.3	104.0	0.67
180.0	179.1	179.1	179.0	179.2	180.4	180.5	180.6	180.6	180.2	0.99

#### Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.27	0.44	1.0
180.0	180.0	0.29	1.31	1.9

### 3. Uncertainty of Measurement

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

This report will certify of the calibrated equipment only.

End of Calibration Report

Checked by :



[MCF-Q-077 ; Rev.5 ; Date : 15/07/2014]

เอกสารสอบเทียบเครื่องมือตรวจวัด



**Master Calibration Co., Ltd.**

547 Soi Ratchadensivat, Kwang Samsenrok, Khet Huaykwang, Bangkok 10310

Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989

<http://www.mastercalibration.com>

## Calibration Report

### TEMPERATURE CONTROLLER ENCLOSURES



Report No. : MC 2103787

Page 1 of 3



Customer : Water Analysis Center Co., Ltd.  
1/94 Moo 5, T.Kantham, A.U-Thai, Ayutthaya 13210.

Reference Job No.	: 21-0710	Received Date	: 25 March 2021
Description	: Oven		
Manufacturer	: Memmert	Model	: UF260
Serial No.	: B620.0814	ID. No.	: N/A
Marking	: Additionally for the purpose of identification by this laboratory a label marked with this report number ( MC 2103787 ) has been attached to the case.		
Method	: In-House calibration procedure MWI-T-033 this method is reference to TLAS G-20 "Temperature Controlled Enclosures".		
Location of Calibration	: Water Analysis Center Co., Ltd. ; Laboratory.		
Environmental Conditions	: Ambient Temperature : ( 31.8 to 35.3 ) °C Relative Humidity : ( 44.7 to 55.9 ) %		
Date of Calibration	: 25 March 2021	Date of Issue	: 26 March 2021

Checked by :



(Calibration Supervisor)

Approved by :



( Technical Manager )

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

This certificate is issued in accordance with the condition 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 issuing laboratory.

[MCP-Q-077 ; Rev.5 ; Date : 15/07/2014]

### เอกสารสอบเทียบเครื่องมือตรวจวัด



547 Soi Ratchadaniyat, Kweng Samsenok, Khet Huaykwang, Bangkok 10310  
Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989  
<http://www.mastercalibration.com>

Continuation of Report No. : MC 2103787

Page 2 of 3

#### The Reference Standard :

Description	Report No.	Serial No.	Due date
Data Acquisition/Switch Unit With Thermocouple Type " T " ID. No.17/1 to 17/9	MC 2016027	MY41010916	10 January 2022

This certificate is traceable to the international system of units maintained at:

- Master Calibration Co., Ltd.

#### 1. Calibration Procedure:

This Instrument was calibration according to TLAS G-20 by comparison with calibrated thermocouple type T under no load condition. The Thermocouples were placed on nine points and located one thermocouple in each of the eight corners of the chamber and was away from the each wall of 5 cm to 10 cm. And placed the ninth thermocouple within 2.5 cm of the geometric center of the chamber.

*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. The reference sensor should preferably be located at the geometric center of the chamber.

*Temperature Stability* - one-half of the greatest maximum difference of measured temperatures at any one sensor.

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

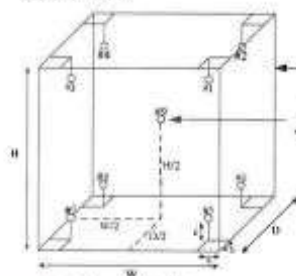


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 1.1 °C

Overall Line Voltage variation : 1.2 V

Chamber Size (W\*H\*D) : 65 cm x 80 cm x 50 cm

Checked by :



[MCF-Q-077 ; Rev 5 ; Date : 15/07/2014]

## เอกสารสอบเทียบเครื่องมือตรวจวัด



547 Soi Rachadaniwat, Kwang Samsenack, Khet Huaykwang, Bangkok 10310  
Tel. : (02) 274 2978-9, (02) 274 2987-8 Fax : (02) 274 2518, (02) 274 2989  
http://www.mastercalibration.com

Continuation of Report No. : MC 2103787

Page 3 of 3

### 2. Result of calibration :

#### Temperature Measurement Accuracy Test

Indicating Temperature (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. #9	
104.0	103.7	103.7	103.7	103.9	104.2	104.3	104.3	104.3	104.0	0.67
180.0	179.1	179.1	179.0	179.2	180.4	180.5	180.6	180.6	180.2	0.99

#### Chamber Characterization Result

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	0.27	0.44	1.0
180.0	180.0	0.29	1.31	1.9

### 3. Uncertainty of Measurement

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

This report will certify of the calibrated equipment only.

End of Calibration Report



Checked by :



[MCF-Q-077 ; Rev.5 ; Date : 15/07/2014]



### เอกสารสอบเทียบเครื่องมือตรวจวัด

<b>Business Unit</b> <b>SPC Calibration Center</b>		 <b>Part of DKSH Group</b>
  <b>NIST-151-715 17025</b> Calibration MPT	<b>Certificate of Calibration</b>	
<b>Equipment:</b>	Balance	<b>Certificate No.:</b> C01211841
<b>Model:</b>	BL210S	<b>Issued Date:</b> 24 June 2021
<b>Serial No. (or ID.):</b>	15808131 ( WWL 0022 )	<b>Job No.:</b> KSPR2107989
<b>Manufacturer:</b>	Sartorius	<b>Page:</b> 1 of 2
<b>Condition:</b>	In condition	
<b>Customer:</b>	Water Analysis Center Co., Ltd. 1/94 Moo 5, Rojana Industrial Park, Rojana Road, Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand	
<b>Environment Condition:</b>	Temperature 27 °C ± 0.3 °C Humidity 40 %RH ± 1.7 %RH	
<b>Calibration Place:</b>	Water Analysis Center Co., Ltd. ( ห้องเครื่องชั่ง ) 1/94 Moo 5, Rojana Industrial Park, Rojana Road, Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand	
<b>Calibration By:</b>	Mr. Phakapol Donmin	
<b>Calibration Date:</b>	10 June 2021	
<b>The Method used:</b>	In house method, SPCC-WI-47, base on UKAS Lab 14	
<b>Traceability:</b>	This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02210017	
 <b>Person in charge</b>		 <b>Authorized signatory</b>
<p>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.</p> <p>The measurement uncertainty stated in 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).</p> <p>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.</p>		
<p>บริษัท เอสพีซี อาร์ที จำกัด SPC RT CO., LTD. เลขที่ 00003 1194 แขวงวิเศษสุริย 37 เขตสุริย 10/1 แขวงวิเศษสุริย กรุงเทพมหานคร 10260 Branch 00003 1194 Soi Wichitsathasuri 37 Subzone 10/1 Road, Bangkok, Phraekhansong, Bangkok 10260 Thailand Tel: 0 2185 4333 Ext: 9109-9108 Fax: 0 2185 4424 E-mail: info@spc-rt.com Website: www.spc-rt.com</p> <p>SPCC-FM-C01-10: 23 Nov 2020</p>		

## เอกสารสอบเทียบเครื่องมือตรวจวัด

SPC Calibration Center



Certificate No.: C01211841

Page: 2 of 2

### Calibration Results:

Without Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	50	(g)
Reference Points (g)					
A	B	C	D	E	
-	0.0000	-0.0001	-0.0001	0.0000	

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00005

Departure of indication from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	1.00001	1.0000	0.0000	0.00010	2.03
2	2.00002	2.0000	0.0000	0.00010	2.03
5	4.99999	5.0000	0.0000	0.00010	2.03
10	10.00000	10.0000	0.0000	0.00011	2.02
20	19.99999	20.0000	0.0000	0.00011	2.02
50	49.99997	50.0000	0.0000	0.00012	2.01
70	69.99996	70.0000	0.0000	0.00015	2.00
100	100.00000	100.0000	0.0000	0.00017	2.00
120	119.99999	120.0001	-0.0001	0.00021	2.00
150	149.99997	150.0000	0.0000	0.00023	2.00
200	199.99990	200.0003	-0.0004	0.00029	2.00



The End of Certificate

บริษัท เอสพีซี แอร์ที จำกัด  
SPC RT CO., LTD.  
เลขที่ 00003 : 194 ซอยวิภาวดีรังสิต 37 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10060  
โทร 00005 : 194 ซอยวิภาวดีรังสิต 37 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10060 Thailand  
Tel: 0 2865 4333 Ext. 1900-1939 Fax: 0 2865 4424 E-mail: info.spc@spcrt.com Website: www.spcrt.com


SPCC-FM-Q01-10: 23 Nov 2020





### เอกสารสอบเทียบเครื่องมือตรวจวัด

	<b>Bara Scientific Co., Ltd.</b> 968 U Chu Liang Building Floor7 Rama4 Road Silom Bangkok Bangkok Thailand 10500 Tel : 02-6324300 Fax : 02-6375496-7 www.barascientific.com		
<h2>Certificate of Calibration</h2>			
		Number of Page(s)	1 of 3
<b>Certificate No.</b>	BSCC-UV-135/21		
<b>Equipment</b>	UV/Vis Spectrophotometer		
<b>Model</b>	UV-1800		
<b>Manufacturer</b>	SHIMADZU		
<b>Serial No.</b>	A11635405598CD		
<b>ID No.</b>	WWL0082		
<b>Date of receipt</b>	30 April 2021		
<b>Date of calibration</b>	30 April 2021		
<b>Date of issue</b>	10 May 2021		
<b>Customer name</b>	Water Analysis Center Co., Ltd.		
<b>Address</b>	1/94 Moo 5, T.Kanitham, A.Uthai, Ayuthaya 13210		
<b>Temperature</b>	(29.9-32.1) °C (On site)		
<b>Humidity</b>	(48.7-52.6) %RH (On site)		
<b>Equipment condition</b>	Good Operation		
<b>Calibration Location</b>	Laboratory Room Water Analysis Center		
<b>Calibration Procedure</b>	In-house method WI-UV-702-01 based on ASTM E275-01		
<b>Traceability</b>	Wavelength Accuracy is traceable to certificate No. 79670 and 79671 Photometric Accuracy is traceable to certificate No. 79672 and 79673 Stray Light is traceable to certificate No. 79669 The above certificate are traceable to SI unit through Stama Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)		
<b>Calibrated by</b>	Mr.Waruth Janphung		
<p>Approved by</p>  <p>Technical Manager</p>			
<p>The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Adversising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.</p>			
FM-UV-708-02 Rev.01 (23/01/63)			

## เอกสารสอบเทียบเครื่องมือตรวจวัด



**Bara Scientific Co., Ltd.**  
968 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com

# Certificate of Calibration

Certificate No. **BSCC-UV-135/21**

Number of Page(s) **2 of 3**

**Calibration Results:**

**1.Wavelength Accuracy**

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
360.89	360.82	-0.07	0.18
418.53	418.71	0.18	0.18
445.82	446.38	0.56	0.18
453.67	453.58	-0.09	0.18
459.99	459.80	-0.19	0.18
638.00	638.10	0.10	0.18
431.22	431.38	0.16	0.18
513.39	513.57	0.18	0.18
528.90	528.82	-0.08	0.18
572.99	572.58	-0.41	0.18
585.25	585.37	0.12	0.18
684.50	684.65	0.15	0.18
741.02	741.14	0.12	0.18
879.41	879.29	-0.12	0.18

**2.Photometric Accuracy (UV)**


Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6358	0.6310	-0.0048	0.0075

\*CNR = Customer not request



The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
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FM-UV-708-02 Rev.01 (23/01/63)

### เอกสารสอบเทียบเครื่องมือตรวจวัด



**Bara Scientific Co., Ltd.**  
958 U Chu Liang Building Floor7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375495-7  
www.barascientific.com

## Certificate of Calibration

Certificate No. **BSCC-UV-135/21** Number of Page(s) **3 of 3**

Calibration Results:

**3. Photometric Accuracy (Visible)**

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm A$ )
420.0	0.0000	0.0000	0.0000	0.0042
	0.5473	0.5511	0.0038	0.0042
	0.7625	0.7655	0.0030	0.0042
	1.0484	1.0525	0.0041	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5369	0.5401	0.0032	0.0042
	0.7446	0.7464	0.0018	0.0042
	1.0235	1.0259	0.0024	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.4873	0.4906	0.0033	0.0042
	0.6868	0.6882	0.0014	0.0042
	0.9433	0.9453	0.0020	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5009	0.5027	0.0018	0.0042
	0.6952	0.6950	-0.0002	0.0042
	0.9568	0.9556	-0.0012	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5292	0.5303	0.0011	0.0042
	0.7228	0.7218	-0.0010	0.0042
	0.9993	0.9974	-0.0019	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5140	0.5151	0.0011	0.0042
	0.6902	0.6889	-0.0013	0.0042
	0.9539	0.9519	-0.0020	0.0042

\*CNR = Customer not request

**4. Stray Light\***

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.97 $\pm$ 0.11nm	200.40	0.9524	2.0215

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A  
\*Stray Light not NSC-ONSC Accredited.

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

**\*\*\*End of Certificate\*\*\***

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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FM-UV-708-02 Rev.01 (23/01/63)

เอกสารสอบเทียบเครื่องมือตรวจวัด



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-5, 0-2280-1787, Fax. 0-2280-1788, E-mail : thaunique@thaunique.com, Website : www.thaunique.com

PREVENTATIVE MAINTENANCE (PM) CHECK LIST

FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: 240FS AA & M913230004

Customer : Water Analysis Center Co., Ltd

Date: 7 Apr 2021

Safety

- ☒ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner
- ☒ Flame, Clean nebulizer, spray chamber and burner
- ☒ Flame, Check liquid trap interlock, burner interlock, pressure relief bung interlock and shield interlock
- ☐ Furnace, Clean work head, electrode and shroud N/A
- ☐ Furnace, Clean PSD and PSD tray N/A
- ☐ Furnace, Check water pressure N/A
- ☒ Check drain tube
- ☒ Check exhaust system
- ☒ Check gas pressure sensor interlock
- ☒ Check and all gas hoses for SpectrAA
- ☒ Clean computer control

Optics

- ☒ Inspect/Replace that external optics surfaces
- ☒ Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.5 nm
- ☒ Check that PMT % Gain the copper at 324.8 nm, 4 mA, 0.5 nm slit width, Gain = 32% (should be  $\leq 64\%$  or  $\leq 380V$ )
- ☒ Flame, Check D2 lamp is work

เอกสารสอบเทียบเครื่องมือตรวจวัด

**THU** **บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.**  
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200  
80-82 Prachathipatai Rd., Bangkhruaphrom, Pranakorn, Bangkok 10200  
Tel. 0-2629-0191-5, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

**Electronics**

- ☒ Check power supply voltage
- ☒ Check cables and connectors
- ☒ Check/Clean all boards in the instrument
- ☐ Furnace, Check camera and align\*\* *N/A*

\*\*Option for Graphite Zeeman only

**Mechanisms**

- ☒ Flame, Check the burner adjuster
- ☐ Furnace, Check PSD accessories *N/A*

**Analytical performance**

- ☒ Clear the sample compartment
- ☒ Flame, Check uptake rate form 7.2-10.6 mL per minute = *10.4* mL/min
- ☒ Test Photometric noise, STDV = *0.0002* Abs (should be  $\leq 0.00050$  Abs)
- ☒ Flame, Test high solids nebulizer setting use

-Air/acet Cu 5 ppm = *0.76* Abs, and Precision  
(%RSD)= *0.5* % (should be  $> 0.55$  Abs and  $< 0.5\%$  RSD)

or

-N20/Acet Cu 5 ppm = \_\_\_\_\_ Abs, and Precision  
(%RSD)= \_\_\_\_\_ % (should be  $> 0.3$  Abs and  $< 0.5\%$  RSD)

- ☐ Furnace, Characteristic mass and sensitivity Cu 25 ppb = \_\_\_\_\_ Abs, and *N/A*  
Precision (%RSD)= \_\_\_\_\_ % (should be  $\geq 0.15$  Abs and  $\leq 4.0\%$  RSD)

SIGN :

Engineer

Customer :



เอกสารสอบเทียบเครื่องมือตรวจวัด

## SVD Results Report



Report ID: 4 Diagnostic Start Time: 4/7/2021 11:21:56 AM Diagnostic End Time: 4/7/2021 12:04:17 PM

Customer: Water Analysis Center Co., Ltd.

Service Engineer: Suriya Nacharoen

Address: Uthai Ayutthaya

Contact Details: Kanitsara

### Instrument Configuration

#### Configuration:

Serial Number: MY18230004	Turret Type: Automatic
Instrument Model: Varian AA140/240/280	Number Of Lamps: 4
Flame Instrument: True	Mono Type: Automatic
Furnace Instrument: True	Gasbox Type: Y Gas Box
Zeeman Present: False	Auto Burner Adjuster: False
Internal Zeeman: False	Mains Frequency: 50
Internal UltraAA: False	Firmware Version: 2.12
Optics Type: Double Beam	Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True	PWB Version: 181
Boot Block Version: 2.02	

#### EEPROM Data:

Instrument Run Hours: 16347.950	D2 Run Hours: 4626.033
Zero Wavelength Offset: 25.877	D2 Serial Number: not set
Mono Correction: -0.605	D2 Install Date: 1/1/1970
Flame Hours: 5461.417	D2 Original Intensity: 1.000
	D2 Last Intensity: 400.000

#### Frequency:

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

Result: **Passed**

Report Generated At: 4/7/2021 12:07:04 PM

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SVD Results Report



### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.10	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.00	5.50	Passed
310.00 V Rail	279.00	318.00	341.00	Passed

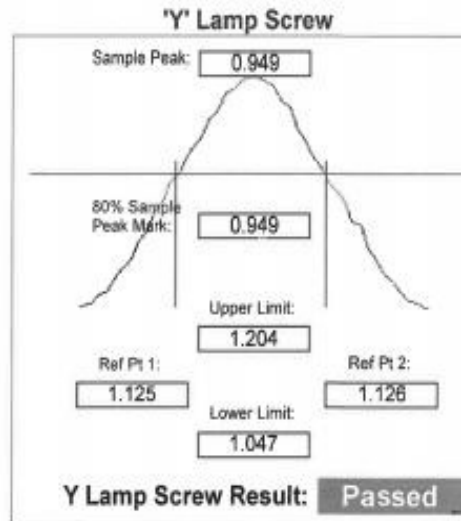
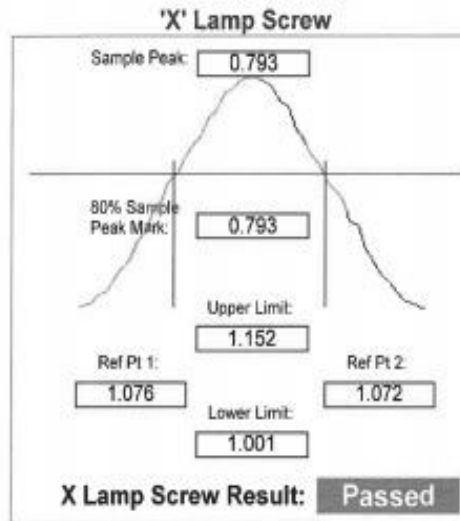
### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Optics

#### Beam Balance:

Lamp Type: Copper  
Lamp Socket Used: 3

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



#### Grating Squareness:

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

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	<b>Passed</b>
First Order	324.45	324.62	325.15	<b>Passed</b>
Second Order	649.23	649.54	649.97	<b>Passed</b>

### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Wavelength Repeatability:

<b>Lamp Used:</b> Copper	<b>Lamp Current(mA):</b> 4
<b>Peak Used(nm):</b> 324.750	<b>Slit Width(nm):</b> 0.2
<b>Connected to Socket:</b> 3	<b>Slit Height:</b> Normal
<b>Lamp Alignment:</b> <b>Performed</b>	
<b>Lower Limit(nm)</b> 324.551	324.671 <b>Upper Limit(nm)</b>
<i>(Approach from Zero Order)</i>	<i>(Approach from end)</i>
Sample 1: 324.611	Sample 2: 324.611
Sample 3: 324.611	Sample 4: 324.611
Sample 5: 324.615	Sample 6: 324.611
Sample 7: 324.615	Sample 8: 324.611
Sample 9: 324.615	Sample 10: 324.611
<b>Mean:</b> 324.613	<b>Standard Deviation:</b> 0.002
<b>Result:</b> <b>Passed</b>	

### เอกสารสอบเทียบเครื่องมือตรวจวัด

Mechanical				
Wavelength Drive:		Passed		
Slit Drive:		Passed		
Turret Drive:		Passed		
Auto Burner Adjuster Drive:		Untested		
Miscellaneous				
Signal Processing Linearity:				
Calculate Mode: New Calc Mode				
	Lower Limit	Actual	Upper Limit	Result:
S0	114	258	297	Passed
S1	156	166	191	Passed
S2	271	300	332	Passed
S3	474	516	579	Passed
S4	825	933	1008	Passed
S5	1435	1555	1754	Passed
S6	2498	2802	3053	Passed
S7	4347	4795	5313	Passed
Interlocks:				
Burner Fitted:	Working	Flame Detect:	Working	
N2O Burner Fitted:	Working	GCU Active:	Working	
Flame Shield Closed:	Working	Oxidant Pressure:	Working	
Gas Control Fitted:	Untested	Oxidant Changeover:	Working	
Pressure Release Bung Fitted:	Working	Ignition:	Working	
Liquid Trap Fitted:	Working			

Report Generated At: 4/7/2021 12:07:04 PM

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SVD Results Report 

### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Auto Lamp Recognition:

Lamp 1: 42 - Potassium (K)

Lamp 2: 53 - Sodium (Na)

Lamp 3: 14 - Copper (Cu)

Lamp 4: 37 - Nickel (Ni)

Lamp 5: Not Supported

Lamp 6: Not Supported

Lamp 7: Not Supported

Lamp 8: Not Supported

Result: **Passed**

#### GTA Temperature Monitoring:

**Not Performed**

#### Notes:

C2104SU29 PM 1/2

#### Signatures:

\_\_\_\_\_  
Water Analysis Center Co., Ltd. Date

\_\_\_\_\_  
Suriya Nacharoen

\_\_\_\_\_  
Date

เอกสารสอบเทียบเครื่องมือตรวจวัด



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawan@thaiunique.com, Website : www.thaiunique.com

PREVENTATIVE MAINTENANCE (PM) CHECK LIST  
FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial Number: AA 240FS > AA0911M073

Customer : Water Analysis Center Co., Ltd.

Date: 04 Feb 2021

Safety

- ☒ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner
- ☒ Flame, Clean nebulizer, spray chamber and burner
- ☒ Flame, Check liquid trap interlock, burner interlock, pressure relief bung interlock and shield interlock
- ☐ Furnace, Clean work head, electrode and shroud N/A
- ☐ Furnace, Clean PSD and PSD tray N/A
- ☐ Furnace, Check water pressure N/A
- ☒ Check drain tube
- ☒ Check exhaust system
- ☒ Check gas pressure sensor interlock
- ☒ Check and all gas hoses for SpectrAA
- ☒ Clean computer control

Optics

- ☒ Inspect/Replace that external optics surfaces
- ☒ Check Wavelength Accuracy the copper line at 323.0-326.0 nm = 324.8 nm
- ☒ Check that PMT % Gain the copper at 324.8 nm, 4 mA, 0.5 nm slit width, Gain = 56% (should be  $\leq 64\%$  or  $\leq 380V$ )
- ☒ Flame, Check D2 lamp is work



เอกสารสอบเทียบเครื่องมือตรวจวัด



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel: 0-2629-0191-6, 0-2280-1787, Fax: 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Electronics

- ☒ Check power supply voltage
- ☒ Check cables and connectors
- ☒ Check/Clean all boards in the instrument
- ☐ Furnace, Check camera and align\*\* N/A

\*\*Option for Graphite Zeeman only

Mechanisms

- ☒ Flame, Check the burner adjuster
- ☐ Furnace, Check PSD accessories N/A

Analytical performance

- ☒ Clear the sample compartment
- ☒ Flame, Check uptake rate form 7.2-10.6 mL per minute = 9.8 mL/min
- ☒ Test Photometric noise, STDV = 0.0001 Abs (should be  $\leq 0.00050$  Abs)
- ☒ Flame, Test high solids nebulizer setting use

-Air/acet Cu 5 ppm = 0.75 Abs, and Precision

(%RSD)= 0.5 % (should be  $> 0.55$  Abs and  $< 0.5\%$  RSD)

or

-N2O/Acet Cu 5 ppm = \_\_\_\_\_ Abs, and Precision

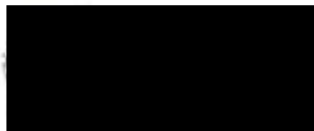
(%RSD)= \_\_\_\_\_ % (should be  $> 0.3$  Abs and  $< 0.5\%$  RSD)

- ☐ Furnace, Characteristic mass and sensitivity Cu 25 ppb = \_\_\_\_\_ Abs, and N/A

Precision (%RSD)= \_\_\_\_\_ % (should be  $\geq 0.15$  Abs and  $\leq 4.0\%$  RSD)

SIGN :

Engineer



Customer



## เอกสารสอบเทียบเครื่องมือตรวจวัด

# SVD Results Report



**Report ID:** 3      **Diagnostic Start Time:** 05-Dec-20 10:38:29 AM      **Diagnostic End Time:** 04-Feb-21 11:58:44 AM  
**Customer:** Water Analysis Center Co., Ltd.      **Service Engineer:** Suriya Nacharoen  
**Address:** Prana khron si ayuthaya      **Contact Details:** K\_Kanitsara

### Instrument Configuration

#### Configuration:

<b>Serial Number:</b> AA0911M073	<b>Turret Type:</b> Automatic
<b>Instrument Model:</b> Varian AA140/240/280	<b>Number Of Lamps:</b> 4
<b>Flame Instrument:</b> True	<b>Mono Type:</b> Automatic
<b>Furnace Instrument:</b> True	<b>Gasbox Type:</b> 'Y' Gas Box
<b>Zeeman Present:</b> False	<b>Auto Burner Adjuster:</b> False
<b>Internal Zeeman:</b> False	<b>Mains Frequency:</b> 50
<b>Internal UltraAA:</b> False	<b>Firmware Version:</b> 2.12
<b>Optics Type:</b> Double Beam	<b>Photomultiplier Type:</b> Normal(900nm)
<b>D2 BG Correction Fitted:</b> True	<b>PWB Version:</b> 181
<b>Boot Block Version:</b> 2.02	

#### EEPROM Data:

<b>Instrument Run Hours:</b> 20613.650	<b>D2 Run Hours:</b> 2906.000
<b>Zero Wavelength Offset:</b> -18.731	<b>D2 Serial Number:</b> not set !
<b>Mono Correction:</b> -0.370	<b>D2 Install Date:</b> 01-Jan-70
<b>Flame Hours:</b> 4025.000	<b>D2 Original Intensity:</b> 1.000
	<b>D2 Last Intensity:</b> 661.000

#### Frequency:

<b>Averaging Period:</b> 30.0	
<b>Datapoint Count:</b> 20	
<b>Upper Limit:</b> 51.00	<b>Highest Measured Frequency:</b> 50.00
<b>Average Frequency:</b> 50.00	
<b>Lower Limit:</b> 49.00	<b>Lowest Measured Frequency:</b> 50.00

**Result:** **Passed**

Report Generated At: 04-Feb-21 11:58:45 AM

1

SVD Results Report

### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	Passed
-12.00 V Rail	-13.20	-12.00	-10.80	Passed
5.00 V Rail	4.50	5.10	5.50	Passed
310.00 V Rail	279.00	318.00	341.00	Passed

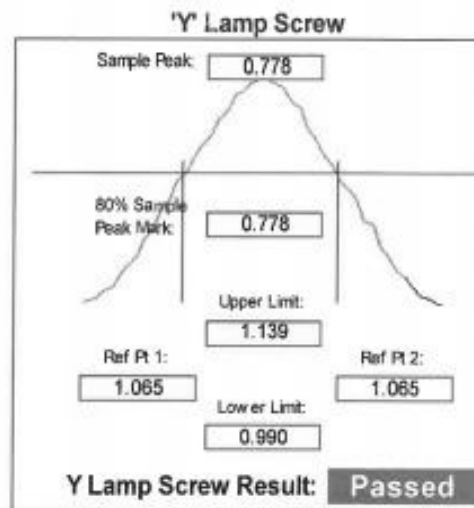
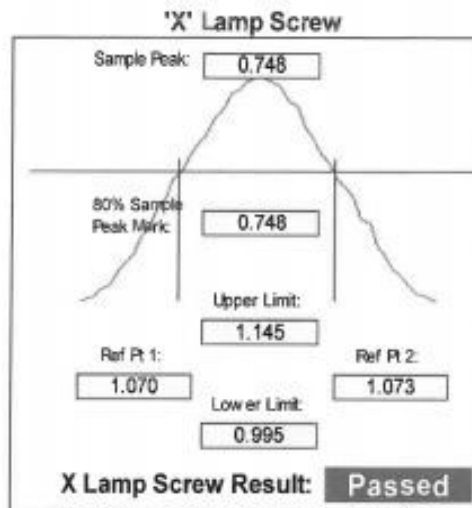
### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Optics

#### Beam Balance:

Lamp Type: Copper  
Lamp Socket Used: 3

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



#### Grating Squareness:

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

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	<b>Passed</b>
First Order	324.45	324.73	325.15	<b>Passed</b>
Second Order	649.23	649.56	649.97	<b>Passed</b>

### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Wavelength Repeatability:

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

Lamp Alignment: **Performed**

Lower Limit(nm) 324.751 324.871 Upper Limit(nm)

(Approach from Zero Order)

(Approach from end)

Sample 1: 324.811

Sample 2: 324.807

Sample 3: 324.811

Sample 4: 324.811

Sample 5: 324.815

Sample 6: 324.811

Sample 7: 324.815

Sample 8: 324.811

Sample 9: 324.815

Sample 10: 324.815

Mean: 324.812

Standard Deviation: 0.003

Result: **Passed**



## เอกสารสอบเทียบเครื่องมือตรวจวัด

### Mechanical

#### Wavelength Drive:

Passed

#### Slit Drive:

Passed

#### Turret Drive:

Passed

#### Auto Burner Adjuster Drive:

Untested

### Miscellaneous

#### Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	248	297	Passed
S1	156	165	191	Passed
S2	271	294	332	Passed
S3	474	506	579	Passed
S4	825	908	1008	Passed
S5	1435	1516	1754	Passed
S6	2498	2723	3053	Passed
S7	4347	4681	5313	Passed

#### Interlocks:

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

### เอกสารสอบเทียบเครื่องมือตรวจวัด

#### Auto Lamp Recognition:

Lamp 1: 50 - Selenium (Se)

Lamp 2: 3 - Arsenic (As)

Lamp 3: 14 - Copper (Cu)

Lamp 4: 42 - Potassium (K)

Lamp 5: Not Supported

Lamp 6: Not Supported

Lamp 7: Not Supported

Lamp 8: Not Supported

Result: **Passed**

#### GTA Temperature Monitoring:

**Not Performed**

#### Notes:

C2102SU11 PM1/2

Signatures:

\_\_\_\_\_  
Water Analysis Center Co., Ltd. Date

\_\_\_\_\_  
Sunya Wacharoen

\_\_\_\_\_  
Date

04 Feb 21

### เอกสารสอบเทียบเครื่องมือตรวจวัด



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**Certificate No. :** M0979/21

- Procedure Used :**
- : European Standard EN12469 : 2000 has the status of British Standard, Biotechnology Performance criteria for microbiological safety cabinets.
  - : NSF International Standard / American National Standard NSF / ANSI 49-2008 Biosafety Cabinet : Design, Construction, Performance and Field Certification.
  - : Australian Standard : AS 1807.23-2000 Determination of intensity of radiation from germicidal ultraviolet lamps.
  - : Manufacturer's specification.

#### 1. Downflow velocity test.

##### Measurement Information

No. of Rows	No. of Readings	Grid Spacing Front-Back	Grid Spacing Side-Side	Probe height Above sash
2	8	1/4,3/4	1/8,3/8	100 mm.

##### Measurement Data.

0.34	0.37	0.36	0.35
0.32	0.33	0.32	0.34

Average velocity 0.34 m/s ( 67 FPM.)      Velocity range 0.25-0.50 m/s ( 49-98 FPM.)

Uniformity( EN: +/-20%avg. 0.27 - 0.41 m/s ( 54 - 80 FPM.)

Supply filter dimension 24 x 72 (inch x inch)      Supply filter area 10.69 SQ.FT

Downflow volume (Q) 716 CFM.

**Result Summary**      ☒ **Pass**      ☐ **Fail**

**Equipment used :** Thermo Anemometer   **Model** 425   **S/N :** 03004786   **Calibration date :** 23/02/2021

เอกสารสอบเทียบเครื่องมือตรวจวัด



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Certificate No. : M0979/21

**2. Inflow velocity test.**

Select method. : ☐ DIM ☒ Exhaust velocity. ☐ MFG's Specifications

0.57	0.59	0.56	0.61	0.63
0.58	0.6	0.56	0.59	0.58
0.61	0.57	0.56	0.54	0.56
0.59	0.56	0.62	0.59	0.62
0.59	0.57	0.63	0.59	0.58

Average Inflow velocity 0.50 m/s (98 FPM.) Velocity range ≥0.40 m/s ( ≥79 FPM.)

Inflow dimension 8 x 72 (Inch x Inch) Inflow area 4.00 SQ.FT

Inflow volume(Q) 392 CFM

Result Summary ☒ Pass ☐ Fail

Adjustments Required ☐ Fan Speed ☐ Damper

Equipment used : Thermo Anemometer Model 425 S/N : 03004786 Calibration date 23/02/2021

**3. HEPA filter leak test.**

**Measurement Data**

HEPA Filter	PAO Upstream Conc.(calculated)	Specification	Measured leak penetration
Supply HEPA Filter	18 µg/L	<0.003%	<0.003%
Exhaust HEPA Filter	18 µg/L	<0.003%	<0.003%

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Certificate No. : M0979/21

#### Leak location

Supply HEPA Filter  
Back



Exhaust HEPA Filter  
Back



Result Summary

☒ Pass

☐ Fail

Equipment used : Aerosol Photometer Model TDA-2H S/N : 21683 Calibration date 24/02/2021

Equipment used : Smoke Generator Model TDA-6C S/N : 21623

#### 4. Airflow smoke patterns test

##### Measurement Information

1. Downflow Pattern test : Smoke shall be passed from one end of the cabinet to the other, along the centerline of the work surface, at a height of 4 inch (10 cm) above the top of the access opening
2. View screen retention test : Smoke shall be passed from one end of the cabinet to the other, 1.0 in (2.5 cm) behind the view screen, at a height 6.0 inch (15 cm) above the top of the access opening.
3. Work opening edge retention test : Smoke shall be passed along the entire perimeter of the work opening. Particular attention should be paid to corners and vertical edges.
4. Sash/window seal test : Smoke shall be passed up the inside of the window 2 in (5 cm) from the sides and along the top of the work area.

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Certificate No. : M0979/21

#### Result Summary

Downflow Pattern test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
View screen retention test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
Work opening edge retention test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming
Sash/window seal test	<input checked="" type="checkbox"/> Accept	<input type="checkbox"/> Non-Conforming

#### 5. Site installation

Sash Alarm.	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Interlock System.	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Exhaust System Performance	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A

#### Remark / Recommendation

ระบบ Site installation ไม่มีการตรวจสอบ เนื่องจากตู้ไม่มีฟังก์ชันนี้

#### 6. Illumination Test (Lighting) : Option

Lighting should be adequate for safe working within the cabinet. Illumination measured at the work surface.

Lux

632	1000	997	630
947	1456	1449	921

Remark :

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**Certificate No. :** M0979/21

**7. Ultraviolet Lamp Test (UV) : Option**

Ultraviolet radiation where UV Lamp are fitted, the intensity of radiation at a wavelength of 254 nm.

Shall be not less than 400 mW/m<sup>2</sup> when measures at work floor surface.

mW/m<sup>2</sup>

740	1580	1570	750
480	1040	1020	480

**Remark :**

-o0o-

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