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## เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



THAI HEART CALIBRATION CO., LTD.  
2299/12-13 Moo 4, Thepharak, Muang, Samut Prakan 10270  
Tel. 0-2394-2162, 0-2757-8435, 0-2757-8496 Fax.: 0-2757-8507  
Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com



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Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

## CERTIFICATE OF CALIBRATION

Certificate No.: CO-0711017/19 Page 1 of total 3 pages

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

**Equipment** pH Meter

**Manufacturer** HACH

**Serial No.** 03050002108

**Description** Range : 0 - 14 pH, Resolution : 0.01 pH

**Model** session3

**ID No.** WWL 0023



**Environmental Conditions** Ambient Temperature: (23 ± 3) °C  
Relative Humidity: (50 ± 15) %

**Calibration Location** Atmospheric Pressure:  
Chemical Laboratory

**Received Date** 7 November 2019

**Calibration Date** 7 November 2019

**Date of Issue** 9 November 2019

**Checked by**  **Approved by** 

**Act as Technical Manager** ( ) (Krisyosl K.) ( ) (Sakda Y.)  
( ) (Paiphan K.) ( ) (Onnapa P.)  
( ) (Pongsak H.) ( ) (Nitiphong K.)  
( ) (Kanung C.) ( ) (Nonthachai K.)  
( ) (Pramong P.) ( ) (Noppol P.)

**Representative of Managing Director** (Dr. Ekachai Puttiwong)

This calibration certificate shall not be reproduced other than in full except with the prior written approval of the Thai Heart Calibration Co., Ltd.

F-140

REV.03 16/08/61



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Certificate No.: CO-0711017/19 Page 2 of total 3 pages

### Reference Method:

- The calibration method used was CM-062 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 Buffer Solution	4.01	280319	Apr. 23, 2020	NIMT
pH Standard Buffer Solution	7.00	280119	Apr. 23, 2020	
pH Standard Buffer Solution	10.009	C02626	Dec. 17, 2019	HACH

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	IO-0409003/19	Sep. 3, 2020	THC

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

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

### Measurement Results:

1.) Calibration of pH Electrode (Serial No.: 17195 008)

pH Standard Buffer Solution (pH)	Measured Value		Uncertainty (± pH)	Coverage Factor, k
	(pH)	(mV)		
4.01	4.00	166.6	0.016	2.00
7.00	7.01	-5.6	0.016	2.00
10.009	9.98	-174.7	0.016	2.00

Note : Adjust Curve to Buffer Solution pH (4,7,10)  
Temperature stability of micro bath : 25 ± 0.2°C

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

Calibrated by Ommapa  
REV.03 16/08/61



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Website : www.thaiheartcal.com E-mail : service@thaiheartcal.com

Certificate No.: CO-0711017/19

Page 3 of total 3 pages

#### Reference Method:

- The calibration method used was CM-003 based on an in-house method.
- The temperature scale used was an ITS-90.
- 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 Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Thermometer Readout	1529-R	B7C853	18E4877	Dec. 18, 2019	TPA
Semi-Standard Platinum Resistance Thermometer	5628	2166	TT-0063-17	Jul. 4, 2020	NIMT
Liquid Bath	XORTS-40A	XOI11019	IO-0506003/19	Jun. 7, 2021	THC

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

- TPA, Technology Promotion Association (Thailand-Japan).
- NIMT, National Institute of Metrology (Thailand).
- THC, Thai Heart Calibration Co., Ltd.

#### Measurement Results:

( X ) Without Adjustment

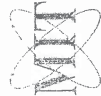
Dimension of probe : Diameter 3 mm.		Sensor Type : RTD (PT100)	
Immersion Depth (mm.)	Standard Reading (°C)	UUC <sup>(1)</sup> Reading (°C)	Correction (°C)
100	22.00	22.2	-0.20
100	25.00	25.1	-0.10
100	28.00	28.1	-0.10

UUC<sup>(1)</sup> : 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 Chalerms  
REV.03 16/08/61



**MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD**  
214 Bangwek Rd. Bangpai Bangkok 10160  
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

## CALIBRATION CERTIFICATE

Certificate No. : L1909-100  
Date Issued : 10-Sep-19

Customer : Water Analysis Center Co.,Ltd. (Head Office)  
30/5 Soi Vibhavadeerangsit 60, Vibhavadeerangsit RD.,  
Talarad Bangkhen, Laksi, Bangkok 10210

Equipment : DO Meter  
Display : YSI  
Sensor : YSI  
Manufacturer : YSI  
Model : 5000-230V  
Serial No. : 04K17959 AC  
ID No./Tag No. : WWL 0027  
Date Received : 06-Sep-19  
Date Calibrated : 08-Sep-19  
Calibrated by : Ms. Jaruchat Junthavorn

#### Calibration Method or Calibration Procedure Used

In-house method : CP-77 by direct measurement with standard dissolved oxygen solution at defined temperature.

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

#### Result of Calibration

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

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

Approved by :

( Mr. Tassanai Suksukon )  
Technical Manager



Page 1 of 2



MASTER CALIBRATION CO., LTD.

547 Soi Ratchadaniwet, 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

## Calibration Report



### ENCLOSURES TEMPERATURE CONTROLLED

Report No.: MC 1909145

Page 1 of 4

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

Reference Job No. : 19-1904 Received Date : 15 July 2019  
Description : Refrigerator  
Manufacturer : SANDENINTERCOOL Model : SEC-1500SBD  
Serial No. : SEC1500201A-0708-00304 ID. No. : WWL0038  
Marking : Additionally for the purpose of identification by this laboratory a label marked with this report number (MC 1909145) has been attached to the case.

Method : MWI-T-010 Temperature Calibration Method on Chamber

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

Environmental Conditions : Ambient Temperature : ( 25.6 to 26.0 ) °C

Relative Humidity : ( 37.0 to 44.0 ) %

Date of Calibration : 15 July 2019 Date of Issue : 17 July 2019

Checked by :

Thanagorn

Thanagorn Limchatcharoen

(Calibration Supervisor)

Approved by :

Aittipong

Aittipong Klujajawasit

(Technical Manager)

NATA Accredited Laboratory Number: 14355

Accredited for compliance with ISO/IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to national standards. This report may not be reproduced except with the prior written approval of the issuing laboratory.

[MCF-O-048 ; Rev.4 ; Date : 01/01/2015]

Certificate No : L1909-100

Environment : Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading (mg/l)	UUC Reading Before (mg/l)	UUC Reading After (mg/l)	Error (mg/l)	Uncertainty (± mg/l)
8.976 @ 20.21°C	9.03	-	0.054	0.039

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. L1901-006 for HI Accuracy Thermometer Serial No. 130508842, Due 07-Jan-20

MIT Certificate No. L1907-239, L1907-240 for Data Logger Serial No. AI.74547, Due 08-Jul-20

HANNA Certificate No. 13C81 for Zero Oxygen Solution Serial No. S0021/18, Due 14-Mar-2023

End of Certificate

Page 2 of 2

Continuation of Report No. : MC 1909145

Page 2 of 4

## The Reference Standard :

Description	Report No.	Serial No.	Due date
Data Acquisition/Switch Unit With Thermocouple Type " T " ID. No.29/1 to 29/9	MC 1907974	93000641	11 June 2020

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

National Physical Laboratory (NPL), National Measurement Institute (NMI) Australia  
through the reference standards laboratory of Master Calibration Co., Ltd.

## 1. Calibration Procedure:

The equipment list above was calibrated an accuracy of temperature in a chamber of the Refrigerator

The calibration was performed by direct measurement of generated temperatures using the standard thermometer with nine temperature sensors. The following data was gathered during the uniformity analysis. The data was recorded in a period of sixty minutes after the specified temperature reach a steady state. The temperature scale used was based on ITS - 90.

The Refrigerator has been examined for the following feature in accordance with the requirements, for accuracy of test method MWI-T-010 "Temperature Calibration Method on Chamber" (based on ASTM Designation: E 1292-94 "Standard Specification for Gravity Convection And Forced-Ventilation Incubators" but does not necessarily comply with all methods or determinations).

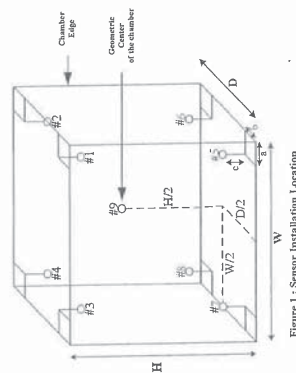


Figure 1 : Sensor Installation Location

They may be reported in terms of a three-dimensional region of the chamber and of the associated sensor positions:

$$\begin{aligned}
 - W \times H \times D &= 171 \text{ cm} \times 157 \text{ cm} \times 60 \text{ cm} \\
 - a \times b \times c &= 5 \text{ cm} \times 5 \text{ cm} \times 5 \text{ cm}
 \end{aligned}$$

Checked by : *Thanyaporn*

[MCF-Q-048 ; Rev.4 ; Date : 01/01/2015]

Continuation of Report No. : MC 1909145

Page 3 of 4

## 2. Definitions :

Uniformity of temperature : 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.

Stability of temperature : One-half of the greatest maximum difference of measured temperatures at any one sensor, for at least half an hour after reaching steady state or after one achieved complete cycle of control whichever comes first. The specific check of temperature stability at specific positions or locations of working space within the chamber according to the way of use should be specified.

## 3. Result of calibration :

UUC* Temperature Setting (°C)	2.0
UUC* Temperature reading (°C)	2.8
Measurement location	Average of Standard Reading (°C)
Location #1	3.77
Location #2	3.66
Location #3	3.86
Location #4	3.88
Location #5	3.67
Location #6	3.69
Location #7	4.40
Location #8	4.29
Location #9	4.31
Maximum Measured Temperature	5.39 °C
Minimum Measured Temperature	2.70 °C
Uniformity of temperature	0.8 °C
Stability of temperature ( ± )	1.1 °C
Uncertainty of Measurement ( ± )	1.2 °C

Note : UUC\* : Unit Under Calibration

Checked by : *Thanyaporn*

[MCF-Q-048 ; Rev.4 ; Date : 01/01/2015]



Continuation of Report No. : MC 1909145

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#### 4. Uncertainty of Measurement

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2.28$ , providing a level of confidence of approximately 95 %.

*The measured values in this report refer to the time of examination. The equipment used in this examination was in a current calibration state and traceable to national standards of measurement.*

#### End of Calibration Report

Checked by : *Thanyaporn*

[MCF-Q-048 ; Rev.4 ; Date : 01/01/2015]

## Certificate of Calibration

Certificate No. : MT19-7468  
Page : 1 of 2

Customer : Water Analysis Center Co.,Ltd.  
 Address : 1/84 M.5, Rojana Industrial Park, T.Kanharm A.U-Thai, Ayuthaya 13210

Description : Hot Air Oven  
 Manufacturer : Termaks  
 Model : TS8138  
 Serial No. : 7-1454  
 Identification No. : WWL0040  
 Calibration Place : Customer Laboratory  
 Order No. : 3562/19  
 Received date : Nov 26, 2019  
 Calibration date : Nov 26, 2019  
 Environment Condition :  
 Temperature : ( 25 $\pm$ 10 ) °C  
 Humidity : ( 50 $\pm$ 30 ) %RH

Calibration Method : Calibration were conducted using In-house calibration procedure CP-MT-006 According to comparison with LXI Data Acquisition Switch Unit. The calibration methods based on DKD-R5-7 guidelines for calibration of climatic chamber edition 07:2009.

#### Reference Standard Instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
LXI Data Acquisition Switch Unit with Sensor	34972A	MY49028922	MT18-7389	Dec 21, 2019

This result of calibration was found accurate as shown on date and place of calibration only.  
 Traceability : This measurement are traceable to the International System of Unit (SI), through National Institute of Metrology Thailand ( NIMT )

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2$ , providing a level of confidence of not less than 95%



Calibrated by : Mr. Jiraphan Sreebannasarn

Issue date : Dec 25, 2019

Approved by : ( Mr. Panuwat Phukian )

This calibration certificate shall not be reproduced other than in full except with the prior written approval of Inctech Metrological Center Co.,Ltd

Rev.00 / Sep 2019

FM-MT-013



# Inctech Metrological Center Co.,Ltd.

39/1 Soi 82, Sukhapiban 5 Rd., O ngoen,  
Saimai, Bangkok 10220, Thailand  
Tel. (662) 909-8820 (Auto 10 lines) www.imcinstrument.com



Calibration Cert. # 384.01  
ISO/IEC 17025

Certificate No. : MT19-7468

Page : 2 of 2

Result : Without adjustment

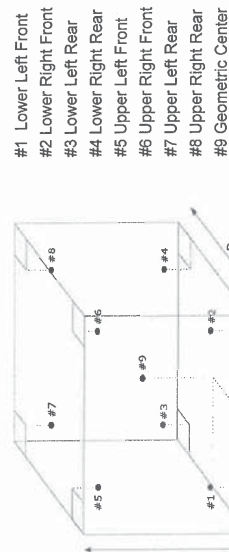
Resolution : 0.1 °C

Function : Temperature measurement

Calibration point : 103, 104, 180 °C

Calibration point (°C)	Temperature of UUC* at each position (°C)									Uncertainty of measurement (+/- °C)
	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5	Ch.6	Ch.7	Ch.8	Ch.9	
103	102.770	102.834	102.756	102.883	102.789	102.688	102.750	102.766	102.855	0.44
104	104.269	104.169	104.492	104.369	104.027	104.426	104.373	104.483	104.210	0.44
180	180.402	180.382	180.651	180.597	180.456	180.246	180.340	180.204	180.488	0.60

Setting temperature (°C)	Indicating Temperature (°C)	Measured stability (+/- °C)	Measured uniformity (°C)	Overall variation (°C)
103.0	103.0	0.13	0.21	0.50
104.0	105.0	0.22	0.38	0.83
180.0	180.0	0.49	0.63	1.2



Front view

UUC\* = Unit under calibration

Uniformity = Maximum and Minimum difference of measured temperature at any probes and the measured temperature at the reference and same time.

Overall Variation = Difference of temperature value between the maximum and minimum any time.

Stability = One half of the maximum difference of measured temperatures at any one probe.

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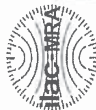
Rev.00 / Sep 2019

FM-MT-013



# SPC CALIBRATION CENTER CO.,LTD.

1194 Soi Wachirathamsatit 57 Sukhumvit 101/1 Bangchak Prakanong Bangkok 10260  
Tel : +66(0) 2185-4333 Fax : +66(0) 2185-4424  
website : <http://www.spc-rt.com>



## Certificate of Calibration

Equipment: Balance Certificate No.: C01192930  
Model: BL210S Issued Date: 05 August 2019  
Serial No. (or ID.): 12909234 (WWL 0010) Job No.: KCAL1910636  
Manufacturer: Sartorius Page: 1 of 2  
Condition: In condition

Customer: Water Analysis Center Co., Ltd.  
1/94 Moo 5, Rojana Industrial Park, Rojana Road,  
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Environment Condition: Temperature 25 °C ± 0.4 °C  
Humidity 44 %RH ± 3.2 %RH

Calibration Place: Water Analysis Center Co., Ltd. ( ห้างเครื่องชั่ง )  
1/94 Moo 5, Rojana Industrial Park, Rojana Road,  
Tambol Kanham, Amphur U-Thai, Ayutthaya 13210 Thailand

Calibration By: Mr. Polawad Ruamrup

Calibration Date: 05 August 2019

The Method used: In house method, SPC-WI-47, base on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC Calibration Center Co., Ltd. Certificate No. C02182226

(Mr. Polawad Ruamrup)

Person in charge



(Mr. Rungroo Jenkitrakulchai)

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. This report shall not be reproduced except in full without approval of SPC Calibration Center Co., Ltd.

SPCC-FM-C01-06: 01 Aug 2019

### 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	Reference Points (g)				
	A	B	C	D	E
-	0.0002	0.0001	-0.0002	-0.0002	-0.0002

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

Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00007

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	0.99999	1.0000	0.0000	0.00012	2.08
2	1.99999	2.0000	0.0000	0.00012	2.08
5	4.99999	5.0000	0.0000	0.00012	2.07
10	10.00001	10.0000	0.0000	0.00013	2.07
20	19.99997	20.0000	0.0000	0.00013	2.06
50	49.99997	49.9999	0.0001	0.00014	2.04
70	69.99994	70.0000	-0.0001	0.00017	2.02
100	99.99998	100.0000	0.0000	0.00018	2.01
120	119.99995	120.0000	-0.0001	0.00022	2.01
150	149.99995	150.0002	-0.0003	0.00024	2.00
200	199.99990	200.0003	-0.0004	0.00030	2.00

The End of Certificate





**BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.**  
**CALIBRATION LABORATORY**  
 300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2350-1  
 Email: bkk@becthai.com Website: www.becthai.com

Certificate No.: CAL-19-867

### CERTIFICATE OF CALIBRATION

Equipment	:	CHAMBER (Incubator)
Manufacturer	:	MEMMERT
Model	:	IN 260
Serial No.	:	D619.0170
ID No.	:	N/A
Customer	:	Water Analysis Center Co.,Ltd
	:	1/94 Moo 5, Kanham, U-Thai,
	:	Phra Nakhon Si Ayuthaya 13210
Location	:	Becthai Laboratory
Date of Receipt	:	8 November 2019
Date of Calibration	:	11 November 2019
Date of Issue	:	11 November 2019
Ambient Temperature	:	(30±10) °C
Relative Humidity	:	(60±20) %
Condition As-Received	:	New Item

Calibrated by  
  
 ( Mr. Anusit Boonmee )  
 Calibration Engineer

Approved by  
  
 ( Ms. Jintana Sangthajaroenlap )  
 Calibration Manager

The reported expanded uncertainty of measurement was based on a combined standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%.  
 This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.  
 Indicated values are valid for the state of the Chamber at the time of calibration only.





**BECTHAI BANGKOK EQUIPMENT & CHEMICAL CO., LTD.**  
**CALIBRATION LABORATORY**

300 Phaholyothin Road, Phayathai, Bangkok 10400, Thailand Tel: +66 2615-2929 Fax: +66 2615-2356-1  
Email: bkk@becthai.com Website: www.becthai.com



NSC-TS-1715-17025  
CALIBRATION 0311

Certificate No. : CAL-19-867

Page : 2 of 3

**CALIBRATION REPORT**

Conditions of calibration

1. Reference standard instrument :

Instrument	Model	Serial No.	Module S/N	Certificate No.	Due date
LXI Data Acquisition / Switch Unit  With Sensors	34972A	MY57003286	MY58060140	QR19-1036	10 June 2020
	RTD	P1 to P9 / TC 101-109			

2. Traceability : This certification is traceable to the International System of Unit maintained at :

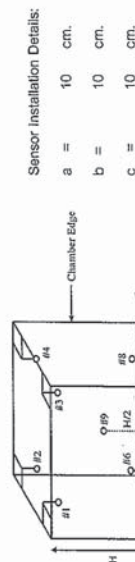
- Quality Reborn Company Limited, Accredited Calibration Laboratory No. 0292.

3. Method of calibration : The calibration procedure was carried out according to CPM-CAL-08 based on TLAS G-20-1/02-08(E):

Guidelines for Calibration and Checks of Temperature Controlled Enclosures. The temperature scale in use is ITS-90.

4. Result of calibration :

(✓) without adjustment ( ) after adjustment



Position of working standard

Chamber Size (mm)			Capacity
Wide	Depth	High	Liter
640	500	800	256

Event	Environment		AC Line
	°C	%RH	Volt
Beginning of Calibration	23.1	55.6	226.5
End of Calibration	22.9	58.4	226.8
Minimum	22.7	55.2	225.3
Maximum	23.2	59.4	227.1



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



# Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-138/19  
Equipment UV/Vis Spectrophotometer  
Model UV-1800  
Manufacturer Shimadzu  
Serial No. A11635405598CD  
ID No. WWL0082  
Date of receipt 2 May 2019  
Date of calibration 2 May 2019  
Date of issue 8 May 2019

Customer name Water Analysis Center Co., Ltd.  
Address 1194 Moo 5, T. Kantham, A. Uthai, Ayutthaya 13210

Temperature (26.3-26.9) °C (On site)  
Humidity (23.0-24.8) %RH (On site)

Equipment condition Good Operation

Calibration Location Laboratory Room Water Analysis Center

Calibration Procedure In-house method WI-UV-504-01 based on ASTM E275-01

Traceability  
Wavelength Accuracy is traceable to certificate No. 67633 and 67652  
Photometric Accuracy is traceable to certificate No. 67648 and 66675  
Stray Light is traceable to certificate No. 67650  
The above certificate are traceable to SI unit through Starna Scientific Ltd (UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Waruth Jangphung

Checked by

Approved by

Mr. Kanchit Choothep  
Technical Manager

Mr. Narong Wongsirirungsie  
Asst. Product Manager

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 except in full, without written approval of the Bara Scientific Co., Ltd.



Bara Scientific Co., Ltd.  
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Bangrak Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barascientific.com



# Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-138/19

Calibration Results:

## 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
360.89	360.81	-0.08	0.18
418.53	418.73	0.20	0.18
445.82	446.06	0.24	0.18
453.67	453.65	-0.02	0.18
459.99	459.93	-0.06	0.18
638.00	638.23	0.23	0.18
431.22	431.14	-0.08	0.18
513.39	513.46	0.07	0.18
528.90	528.87	-0.03	0.18
572.99	573.38	0.39	0.18
585.25	585.26	0.01	0.18
684.50	684.76	0.25	0.18
741.02	741.16	0.13	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
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	0.0000	-0.0001	-0.0001	0.0075
	0.6339	0.6315	-0.0024	0.0075

\*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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# Certificate of Calibration

Certificate No. BSCC-UV-138/19  
Calibration Results:  
3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
440.0	0.0000 0.5111 0.7393 1.0464	0.0000 0.5119 0.7398 1.0472	0.0000 0.0008 0.0005 0.0008	0.0042 0.0042 0.0042 0.0042
465.0	0.0000 0.4644 0.6821 0.9543	0.0000 0.4648 0.6824 0.9549	0.0000 0.0004 0.0003 0.0006	0.0042 0.0042 0.0042 0.0042
546.1	0.0000 0.4782 0.6909 0.9772	0.0000 0.4773 0.6892 0.9757	0.0000 -0.0009 -0.0017 -0.0015	0.0042 0.0042 0.0042 0.0042
590.0	0.0000 0.7187 1.0171	0.0000 0.7165 1.0150	0.0000 -0.0011 -0.0022	0.0042 0.0042 0.0042
635.0	0.0000 0.4913 0.6865 0.9707	0.0000 0.4902 0.6844 0.9686	0.0000 -0.0011 -0.0021 -0.0021	0.0042 0.0042 0.0042 0.0042

\*CNR = Customer not request

## 4. Stray Light

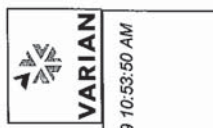
Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.82±0.1nm	200.95	0.9850	2.0086

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

The measurement uncertainty is based 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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# SVD Results Report

Report ID:6 Diagnostic Start Time:21-Feb-19 10:17:13 AM Diagnostic End Time:21-Feb-19 10:53:50 AM  
Customer: WAC Service Engineer: Agilent  
Address: Ayulthaya Contact Details: 026376363

## Instrument Configuration

Configuration: ๖๐๒11A๖๐  
Serial Number: AA0911M073 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: 4362.000 D2 Run Hours: 177.000  
Zero Wavelength Offset: D2 Serial Number: not set !  
Mono Correction: D2 Install Date: 01-Jan-70  
Flame Hours: 191.333 D2 Original Intensity: 1.000  
D2 Last Intensity: 597.000

## Frequency: ๖๐๒11A๖๐

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

Result: Passed



## Power Supply:

Averaging Period: 30.0  
Datapoint Count: 20

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

## Optics

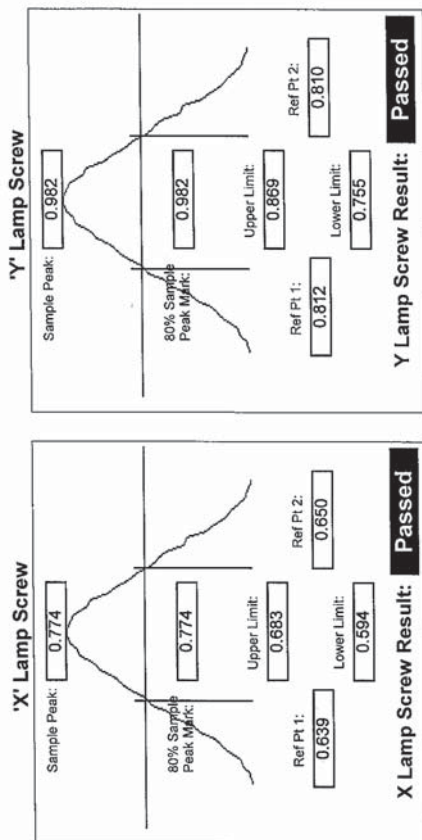
Beam Balance: *Align Lamp*

Lamp Type: Copper

Lamp Socket Used: 3

Peak Selected: 324.80

Lamp Alignment: **Performed**



Grating Squareness: *Wavelength 190 - 900 nm*

Lamp Element(s): Copper

Lamp Turret Position: 3

Lamp Current(mA): 4.00

Slit Width(nm): 0.5

1st Order Wavelength(nm): 324.80

Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.73	325.15	Passed
Second Order	649.23	649.55	649.97	Passed

### 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 end)

(Approach from Zero Order)

Sample 1: 324.811

Sample 2: 324.815

Sample 3: 324.815

Sample 4: 324.815

Sample 5: 324.815

Sample 6: 324.815

Sample 7: 324.815

Sample 8: 324.815

Sample 9: 324.815

Sample 10: 324.815

Mean: 324.815 Standard Deviation: 0.001

Result: **Passed**

ความถี่ของ wavelength  
10 ครั้ง  
10.000

### 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	249	297	Passed
S1	156	165	191	Passed
S2	271	294	332	Passed
S3	474	506	579	Passed
S4	825	908	1008	Passed
S5	1435	1517	1754	Passed
S6	2498	2724	3053	Passed
S7	4347	4682	5313	Passed

Interlocks: **Working**

Burner Fitted: **Working**  
N2O Burner Fitted: **Working**  
Flame Shield Closed: **Working**  
Gas Control Fitted: **Untested**  
Pressure Release Bung Fitted: **Working**  
Liquid Trap Fitted: **Working**

Flame Detect: **Working**  
GCU Active: **Working**  
Oxidant Pressure: **Working**  
Oxidant Changeover: **Untested**  
Ignition: **Working**



#### Auto Lamp Recognition:

Lamp 1: Uncoded Lamp/Not Connected  
Lamp 2: Uncoded Lamp/Not Connected  
Lamp 3: 14 - Copper (Cu)  
Lamp 4: Uncoded Lamp/Not Connected

Lamp 5: Not Supported  
Lamp 6: Not Supported  
Lamp 7: Not Supported  
Lamp 8: Not Supported

Result: **Passed**

#### GTA Temperature Monitoring:

**Not Performed**

#### Notes:

PM6003100106

#### Signatures:

Thansita 91-02-2019  
WAC Date

Agilent 22-Feb-2019  
Date



Agilent Technologies

#### 55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard

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.

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

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

#### Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of 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 costs.

#### Service Engineer's Responsibilities

- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only complete/printout pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox. Add hand written 'additional details' if required.
- 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

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System Information

Instrument System Name / I.D.:	Instrument Location:
AA-240TS	AA-240TS
1. AA-240TS	1. AA-240TS
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Guidance:

- ☒ Check box if instrument configuration report is attached instead of completing the table above.

Preparation, Safe operation and Initial performance checks

- ☒ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).
- NOTE: If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.**

- ☒ Review the instrument logbook.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Check for required firmware 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.
- ☒ Discuss any specific issues with the customer prior to starting.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test\_1"
- ☒ Perform a Basic Cu ABS test - "As found test\_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

FLAME SYSTEM section

- ☐ Section NOT Applicable

Electronic components

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

Mechanical components

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

Optics components

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

Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.

**55 240 280 Series Atomic Adsorption Spectroscopy  
System Preventive Maintenance Checklist - Standard**

- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery barbs
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.

**Gas handling components and safety interlocks**

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

**Analytical performance for Flame systems**

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

**55 240 280 Series Atomic Adsorption Spectroscopy  
System Preventive Maintenance Checklist - Standard****FURNACE SYSTEM section**

☒ Section NOT Applicable

**Electronic components**

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

**Mechanical components**

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

**Optic components**

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

**Gas handling, water system and workload component checks**

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



**Analytical performance for Furnace systems**

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

**PSD autosampler accessory for Furnace systems**

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

**Sample introduction pump system (SIPS) accessory**

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.
- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

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

- ☒ Section NOT Applicable
- The Agilent SPS 4 autosampler is designed to need minimal maintenance. The following maintenance requirements are suggested to maintain the performance of the autosampler.
- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.



- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes..
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

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

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

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

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

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

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

**UltraAA lamp accessory (external)**

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



## 55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard

### Restore system

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

### Guidance:

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

### Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the PM service activity in the customer's instrument records/logbook
- ☒ Update/reset instrument maintenance counters as appropriate
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Review Comments section below if there are additional comments
- ☒ 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.

### AA PM Performance test results and measurements table

Flame optics PMT Gain test	
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	50%
Flame performance test with 5 ppm copper sample	
Air /acetylene, mixing paddle removed	Abs value > 0.5
	%RSD < 1.0
Furnace optics PMT Gain test	
For copper at 324.7 nm, 4 mA, 0.5 nm slit width	—
Furnace performance test with 25 ppb copper sample	
Precision %RSD	≤ 4.0
Abs value	≥ 0.15
Zeeman furnace analytical performance: 25 ppb copper sample	
Precision %RSD	≤ 4.0
Abs value	≥ 0.15



## 55 240 280 Series Atomic Adsorption Spectroscopy System Preventive Maintenance Checklist - Standard

### AA consumable and parts list table

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

### NOTE:

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

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

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





Agilent Technologies

55 240 280 Series Atomic Adsorption Spectroscopy  
System Preventive Maintenance Checklist - Standard

### Service Engineer Comments

Handwritten signature: *[Signature]*

### Other Important Customer Web Links

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

### Service Completion

Service Request number: *60300106* Date service completed: *21-Feb-2019*  
Agilent Signature: *[Signature]* Customer Signature: *Thansila*

Total no. of pages for this document: 10

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Page 10 of 10



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204/303 M.5 Romkiao Rd. Ladkrabang Bangkok10520  
Tel: +66(0)2916-1220 Fax:+66(0)2916-1221  
<http://www.labmicrotech.com>

## Certificate of Calibration

Cer.No. : DOP 1446 Page 1/9

Certificate No. : DOP 1446 Equipment : BSC Class II Type A2  
Manufacturer : Microtech Model : V6-T (2x6 ft)  
Serial No. : 0972 ID No. : WWL 0084  
Cline : Laboratory WATER ANALYSIS CENTER CO.,LTD  
: 1/94 Moo 5 T.Kanharm, A.U-Thai, Phra nakorn sri Ayutthaya 13210

### Calibration Equipments Use.

Description	Serial No.	Cer.No.	Cal Due Date
- Air Velocity			
: Anemometer Dwyer series 471B-1	: 471B-1	: SPR19030163-2	: Mar 20,2020
- Inflow Velocity			
: Air Flow Hoods	: 7879	: SPR19030163-4	: Mar 20,2020
- Efficiency and Integrity for HEPA Filter			
: Aerosol Photometer ATI	: 30979	: A111421	: Apr 28,2020
- Ultra violet radiation			
: Digital UV radiometer 8.0	: 355	: SPR19030163-1	: Mar 20,2020
- Light			
: Lux meter LX-50	: R.019426	: SPR19030163-3	: Mar 20,2020
Environment Condition	Temperature	: 24.39 °C	: ± 0.80 °C
	Humidity	: 73.64 %RH	: ± 3 %RH

Calibration Method or Calibration Procedure used : EN12469:2000,NFS 49 (Smoke Test),AS 1807.1(UV)  
Calibrated Date : 27 September 2019  
Issued Date : 27 September 2019  
Next Test Due : 27 September 2020

## Calibration result

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### -Air velocity downstream of HEPA filter

- Downflow velocity test
- Inflow velocity test

- : Average between 0.25 - 0.50 m/s  $\pm$  20% of the mean
- : Average  $\geq$  0.4 m/s  $\pm$  20% of the mean

### -Airflow Smoke Patterns Test

- Downflow Test
- View Screen Retention
- Work Opening Edge Retention
- Sash / Window Seal

- : Result Pass or Failed
- : Result Pass or Failed
- : Result Pass or Failed
- : Result Pass or Failed

### -Leakage test of HEPA filter


- Maximum local penetration main filter downstream = 0.01 by PAO test

- : Leakage of main filter (scanning)
- : Filter media scanning of main filter
- : Exhaust filter (scanning)
- : Should be at least 750 lux
- : Not less than 400 mW/m<sup>2</sup>

### -Light intensity

### -Ultra violet radiation

Calibrated by

:   
( Mr. Punyawat Chanvaro )  
Technician certified

Approved by

:   
( Mr. Kamol Kijprathuang )  
Engineering manager



## Downflow velocity test

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Turn the BSC on with the anemometer inside, make air velocity measurements in the horizontal plane 50 mm. to 100 mm. above the top edge of the front aperture. Measure in 2 rows along a line 1/4 of the dept of the working space forward of the rear wall along a line the same distance behind the front windows. Start 150 mm. from the left side and with 300 mm. between the measuring spots.

### Downflow velocity of HEPA filter (m/s)

Back wall				
0.40	0.45	0.48	0.49	0.47
0.35	0.36	0.38	0.37	0.36

Front window

### Characteristic of downflow velocity

Mean downflow velocity to achieve product protection -0.25 -0.50 m/s - All measurements should be within $\pm$ 20% of the mean	Mean	Minimum	Maximum	$\pm$ 20% of mean
	0.410	0.350	0.490	0.328 — 0.492
Result downflow air velocity				Pass

## Inflow velocity test by Direct inflow measurement method DIM.

Turn the BSC on. Seal by taping the device to the center of the front opening of a biological safety cabinet.

Seal the open areas on either side of the capture hood portion of the DIM as necessary. All cabinet and exhaust blowers must be operating. Take at least five readings, and average them to determine inflow volume rate. Care should be taken not to restrict the airflow through the instrument intake area. Calculate the average inflow velocity in feet/minute (meters/second) by dividing the average

### Characteristic of inflow velocity

Mean inflow velocity to achieve operator protection $\geq$ 0.4 m/s	Mean	Minimum	Maximum	$\pm$ 20% of mean
	0.900	0.90	0.90	0.720 — 1.080
Result inflow velocity				Pass



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## Airflow Smoke Patterns Test

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## HEPA Filter Efficiency

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### 1.Downflow 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 in (10 cm) above the top of the access opening.

#### Result downflow Test



Pass



Failed

### 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 in (15 cm) above the top of the access opening.

#### Result view screen retention test



Pass



Failed

### 3.Work opening edge retention test

Smoke shall be passed along the entire perimeter of the work opening edges, approximately 1.5 in (3.8 cm) outside the cabinet. Particular attention should be paid to corners and vertical edges.

#### Result work opening edge retention test



Pass



Failed

### 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.

#### Result sash/window seal test



Pass



Failed

### Leak Test of HEPA Filter

Instruction : The aerosol challenged through valve "Challenge" or Challenged into backside of filter and maximum local penetration main filter (downstream) = 0.01% by "PAO Test" (A substitute for DOP)

PAO Aerosol Concentration Upstream	20.00 µg/l
Concentration Upstream	100%
Leakage of Main Filter (Scanning)	0.0018%
Filter Media Scanning of Main Filter	0.0022%
Leakage of Exhaust Filter (Scanning)	0.0023%
Filter Media Scanning of Exhaust Filter	0.0023%

Pass

Pass

Pass

Pass

# HEPA Filter Efficiency (Down Flow Filter )

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Back wall



Front window

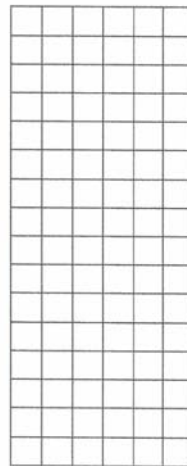
## Filter frame and gasket scan data (Down flow filter)

Maximum measured penetration	0.0031	%
Minimum measured penetration	0.0001	%
Average measured penetration	0.0018	%

Result Pass or Fail

Pass

Back wall



Front window

## Filter media scan data(Down flow filter)

Maximum measured penetration	0.0041	%
Minimum measured penetration	0.0002	%
Average measured penetration	0.0022	%

Result Pass or Fail

Pass

10cm x 10 cm

M

Media Leak Position

MX

Maximum Media Leak Position

G

Gasket Leak Position

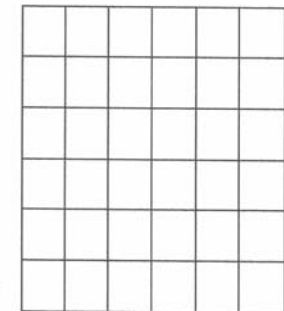
GX

Maximum Gasket Leak Position

# HEPA Filter Efficiency (Exhaust Filter )

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Back wall



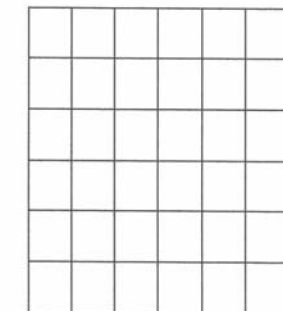
## Filter frame and gasket scan data (Exhaust filter)

Maximum measured penetration	0.0034	%
Minimum measured penetration	0.0001	%
Average measured penetration	0.0023	%

Result Pass or Fail

Pass

Back wall



Front window

## Filter media scan data(Exhaust filter)

Maximum measured penetration	0.0042	%
Minimum measured penetration	0.0012	%
Average measured penetration	0.0023	%

Result Pass or Fail

Pass

10cm x 10 cm

M

Media Leak Position

MX

Maximum Media Leak Position

G

Gasket Leak Position

GX

Maximum Gasket Leak Position





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### Lighting intensity test

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Lighting should be adequate for safe working within cabinet. Illumination measured at the work surface should be at least 750 lux

#### Lighting Intensity (Lux)

Back wall			
810.0	911.0	1098.0	787.0
832.0	1312.0	1684.0	845.0

Front window

Average measured penetration 1105.92 Lux

#### Intensity of radiation of germicidal ultraviolet lamps

When ultraviolet lamps are tested in accordance with AS 1807-23 the irradiance at 254 nm wavelength shall be not less than 400 mW/m<sup>2</sup> at the work for surface.

#### Ultraviolet intensity (mW/m<sup>2</sup>)

Back wall			
630.0	1150.0	1950.0	730.0
540.0	680.0	1010.0	590.0

Front window

Average measured penetration 1050.83 mW/m<sup>2</sup>

### Total result testing laminar flow biohazard Class II

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#### 1.Air velocity of HEPA filter at

-Mean downflow velocity :Between 0.25-0.50 m/s 0.410 m/s Pass  
-Mean inflow velocity : Average  $\geq 0.4$  m/s 0.90 m/s Pass

#### 2.Airflow Smoke Patterns Test

- Downflow Test Pass  
- View screen retention test Pass  
- Work opening edge retention test Pass  
- Sash/window seal test Pass

#### 3.HEPA Filter Efficiency

- Leakage of Main Filter (Scanning) 0.0011% Pass  
- Media Scanning of Main Filter 0.0022% Pass  
- Leakage of Exhaust Filter (Scanning) 0.0023% Pass  
- Media Scanning of Exhaust Filter 0.0023% Pass

Maximum local penetration filter = 0.01% by "PAO Test" (A substitute for DOP)

#### 4.Lighting intensity at

- Illumination measured at the work surface 1105.92 Lux Pass  
should be at least 750 lux

#### 5.Intensity of radiation of Ultraviolet at

- Irradiance at 254 nm wavelength shall be not less than 400 mW/m<sup>2</sup> at the work for surface. 1050.83 mW/m<sup>2</sup> Pass

Calibrated by

:   
( Mr.Punyawat Chanyaro )

Technician certified

: 

Approved by

( Mr. Kamol Kijprathuang )

Engineering manager



End of Certificate.