

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง  
ของเครื่องมือเก็บตัวอย่าง

# CERTIFICATE OF CALIBRATION

**Certificate No.:** C0-1908005/22

Page 1 of total 4 pages

## Customer

<b>Equipment</b>	pH Meter		
<b>Manufacturer</b>	METTLER TOLEDO	<b>Model</b>	SevenCompact S220
<b>Serial No.</b>	B327527211	<b>ID No.</b>	WWL 0068
<b>Description</b>	Range : 0 - 14 pH, Resolution : 0.01 pH		

<b>Environmental Conditions</b>	Ambient Temperature:	(20 ± 2) °C
	Relative Humidity:	(50 ± 10) %
	Atmospheric Pressure:	-

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

Received Date 19 August 2022

Calibration Date 19 August 2022

**Date of Issue** 22 August 2022

## Check

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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.

Certificate

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	Jan. 22, 2023	NIMT
	7.01	020221	Jan. 18, 2023	
	10.00	091020	Feb. 7, 2023	

Type	Model	Serial No.	Certificate No.	Due Date	Traceability
Documenting Process Calibrator	753	3101007	10-0804001/22	Apr. 7, 2023	THC
Digital Thermometer with Sensor	1523 / 5622	1709138 / 4605984-005	10-1006004/22	Jun. 9, 2023	

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)

Certificate

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Measurement Results (Cont.):

2. Calibration of pH Electrode (Serial No.: 3322791)

pH Standard Solution ( pH )	Measured Value		Uncertainty ( ± pH )
	( pH )	( mV )	
4.01	4.01	185.9	0.013
7.01	7.01	9.3	0.013
10.00	10.01	-164.9	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%.

Certificate No.: C0-1908005/22

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Reference Method:

- The calibration method used was CP-096 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	I0-1011001/21	Nov. 10, 2022	THC
Platinum Resistance Thermometer	5626	4854	C0A30047	Oct. 22, 2023	FLUKE
Liquid Bath	XORTS-40A	XO111019	I0-0306002/21	Jun. 3, 2023	THC

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

- THC, Thai Heart Calibration Co., Ltd.
- FLUKE, Fluke Corporation, U.S.A.

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 ( $\pm$ °C)
120	22.00	22.0	0.00	0.060
120	25.00	25.0	0.00	0.060
120	28.00	28.0	0.00	0.060

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 -

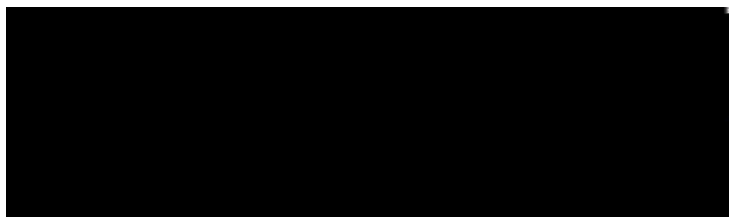


## CERTIFICATE OF CALIBRATION

Certificate No.: C0-2007006/22

Page 1 of total 2 pages

Customer



Equipment Conductivity Meter

Manufacturer EUTECH

Model CON 2700

Serial No. 2657889

ID No. WWL 0136

Description -

Environmental Conditions Ambient Temperature:  $(20 \pm 2) ^\circ\text{C}$

Relative Humidity:  $(50 \pm 10) \%$

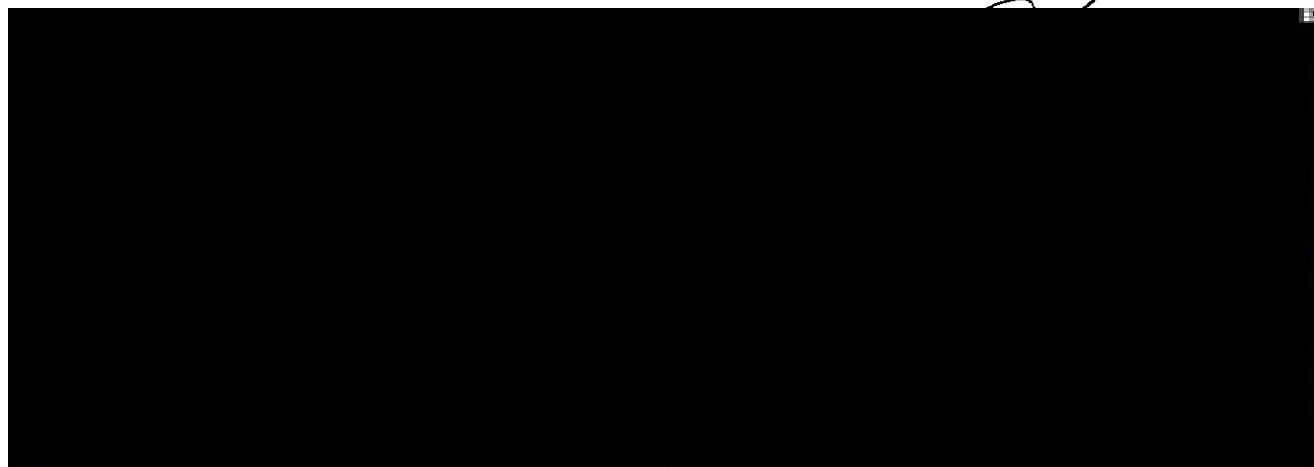
Atmospheric Pressure: -

Calibration Location Jayhawks Laboratory (CL&GL)

Received Date 20 July 2022

Calibration Date 20 July 2022

Date of Issue 21 July 2022



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Calibrated by





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

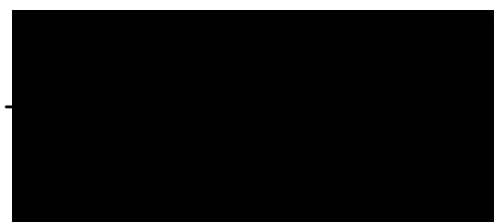
- ☒ Merck KGaA 64271 Darmstadt  
☐ DKK Corporation

**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





MASTER CALIBRATION CO.,LTD.

# Master Calibration Co.,Ltd.

547 Soi Ratchadanivat, Kwaeng Samsennok, 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

## TEMPERATURE CONTROLLER ENCLOSURES



Certificate No.: MC 2207678

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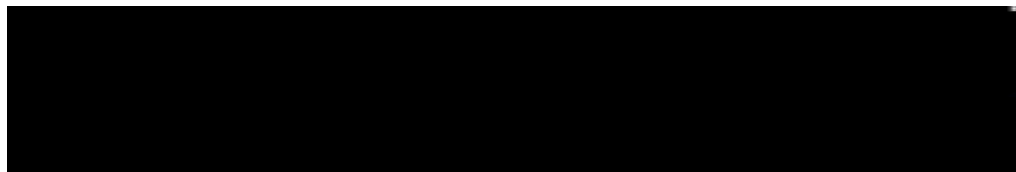


Customer



Reference Job No. : 22-1601 Received Date : 12 July 2022  
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 certificate number ( MC 2207678 ) 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 : ( 25.8 to 27.5 ) °C  
Relative Humidity : ( 48.8 to 52.2 ) %  
Date of Calibration : 12 July 2022 Date of Issue : 19 July 2022

Checked 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.

Certificate No.: MC 2207678

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### The Reference Standard :

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2114432	MY44096104	20 December 2022
With Thermocouple Type " T " ID. No.2/1 to 2/9			

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 eigh 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 minnum measured temperatures throughout observation.

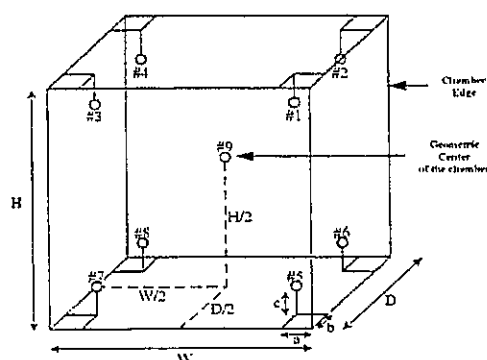


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 3.4 °C

Overall Line Voltage variation : 0.1 V

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

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Certificate No.: MC 2207678

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**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	
2.5	3.5	3.6	3.7	3.5	3.6	3.4	3.4	3.3	3.4	1.1

**Chamber Characterization Result**

Controller Temperature (°C)	Indicating Temperature (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
2.0	2.5	1.5	0.6	3.1

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 :



# *Certificate of Calibration*

## TEMPERATURE CONTROLLER ENCLOSURES



NSC-TISI-TIS 17025  
CALIBRATION 0183

Certificate No.: MC 2203933

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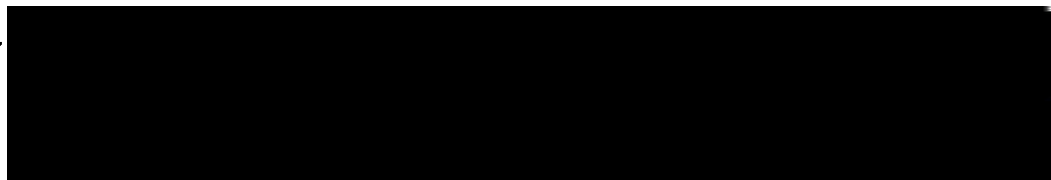


Customer



Reference Job No. : 22-0740 Received Date : 24 March 2022  
Description : Oven  
Manufacturer : Memmert Model : UF260  
Serial No. : B620.0814 ID. No. : WWL0212  
Marking : Additionally for the purpose of identification by this laboratory a label marked  
with this certificate number ( MC 2203933 ) 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 : ( 30.5 to 32.6 ) °C  
Relative Humidity : ( 56.2 to 61.2 ) %  
Date of Calibration : 24 March 2022 Date of Issue : 28 March 2022

Checked 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.

Certificate No.: MC 2203933

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**The Reference Standard :**

Description	Certificate No.	Serial No.	Due date
Data Acquisition/Switch Unit	MC 2106035	93000641	8 August 2022
With Thermocouple Type " T " ID. No.30/1 to 30/9			

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 eigh 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 minnum measured temperatures throughout observation.

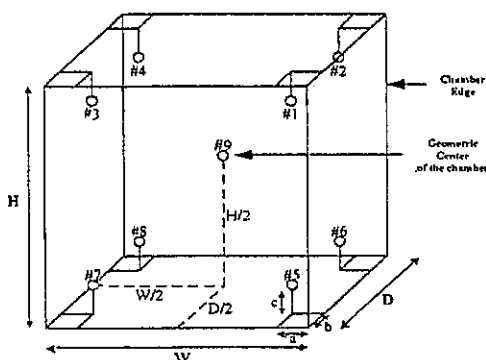


Figure 1 : Sensor Installation Location

Overall Ambient Temperature around the Chamber variation : 1.1 °C

Overall Line Voltage variation : 0.2 V

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

Checked by :



Certificate No.: MC 2203933

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## 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	103.9	103.9	103.9	104.1	104.3	104.2	104.2	104.1	104.0	0.67
180.0	179.3	179.3	179.3	179.5	180.1	180.3	180.5	180.4	180.1	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	0.45	0.92
180.0	180.0	0.29	1.00	1.65

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 :

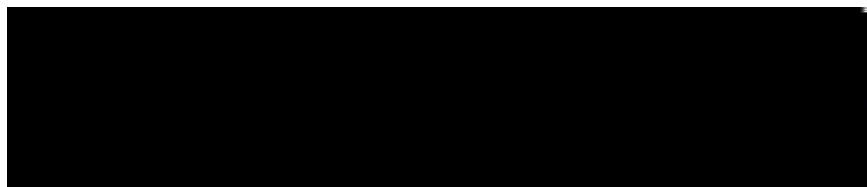




# Certificate of Calibration

<b>Equipment:</b>	Balance	<b>Certificate No.:</b>	C01221685
<b>Model:</b>	BL210S	<b>Issued Date:</b>	08 June 2022
<b>Serial No. (or ID.):</b>	15808131 (WWL 0022)	<b>Job No.:</b>	KSPR2206906
<b>Manufacturer:</b>	Sartorius	<b>Page:</b>	1 of 2
<b>Condition:</b>	In condition		

**Customer:**



**Environment Condition:**

Temperature	27 °C	±	0.5 °C
Humidity	42 %RH	±	4.7 %RH

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

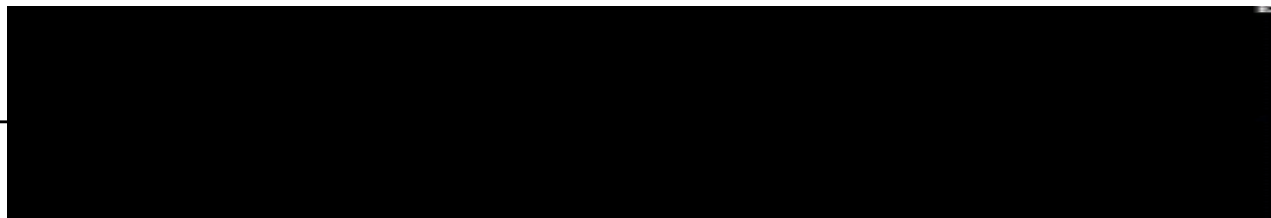
**Calibration By:**



**Calibration Date:** 08 June 2022

**The Method used:** In-house method, SPCC-WI-47, based on UKAS Lab 14

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C02220794



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

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

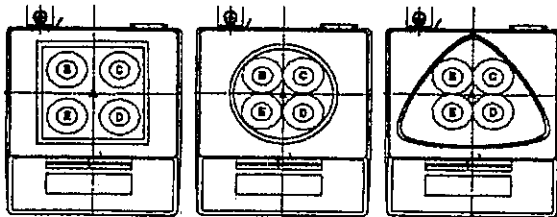
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of SPC RT Co., Ltd.



### Calibration Results:

#### Without Adjustment

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



Nominal Test Value 100 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0001	0.0001	-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	0.00004

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

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	0.99998	1.0000	0.0000	0.000097	2.02
2	1.99999	2.0000	0.0000	0.000098	2.02
5	5.00000	5.0000	0.0000	0.000099	2.02
10	10.00002	10.0000	0.0000	0.00010	2.02
20	19.99995	20.0000	0.0000	0.00011	2.01
50	50.00002	50.0000	0.0000	0.00012	2.01
70	69.99997	70.0000	0.0000	0.00015	2.00
100	100.00007	100.0001	0.0000	0.00017	2.00
120	120.00002	120.0000	0.0000	0.00020	2.00
150	150.00009	150.0002	0.0001	0.00023	2.00
200	199.99993	200.0003	0.0004	0.00029	2.00

**The End of Certificate**

# Certificate of Calibration

Number of Page(s) 1 of 3

**Certificate No.** BSCC-UV-149/22  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635405598CD  
**ID No.** WWL0082  
**Date of receipt** 29 April 2022  
**Date of calibration** 29 April 2022  
**Date of issue** 6 May 2022

**Customer name**

**Address**

**Temperature** (29.9-31.8) °C (On site)  
**Humidity** (48.7-52.6) %RH (On site)

**Equipment condition** Good Operation

**Calibration Location** Laboratory Room Water Analysis Center

**Calibration Procedure** In-house method WI-UV-702-01 based on ASTM E275-01

**Traceability** Wavelength Accuracy is traceable to certificate No. 95917 and 95918  
Photometric Accuracy is traceable to certificate No. 95924 and 95937  
Stray Light is traceable to certificate No. 95908  
The above certificate are traceable to SI unit through Sarna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by**

Approved by

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# Certificate of Calibration

Certificate No.

BSCC-UV-149/22

Number of Page(s)

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## Calibration Results:

### 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty ( $\pm$ nm)
360.89	360.86	-0.03	0.18
418.53	418.72	0.19	0.18
445.82	446.51	0.69	0.18
453.67	453.56	-0.11	0.18
459.99	459.81	-0.18	0.18
638.00	638.17	0.17	0.18
431.22	431.52	0.30	0.18
513.39	513.60	0.21	0.18
528.90	528.80	-0.10	0.18
572.99	576.13	3.14	0.18
585.25	585.30	0.04	0.18
684.50	684.68	0.18	0.18
741.02	741.22	0.20	0.18
879.41	879.30	-0.11	0.18

### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm$ 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
	0.6429	0.6404	-0.0025	0.0075

\*CNR = Customer not request

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**Bara Scientific**  
Solution of Success

## 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

Certificate No. **BSCC-UV-149/22**

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
	0.5783	0.5806	0.0023	0.0042
	0.7628	0.7650	0.0022	0.0042
	1.0206	1.0245	0.0039	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5635	0.0014	0.0042
	0.7455	0.7466	0.0011	0.0042
	0.9985	1.0007	0.0022	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5240	0.0013	0.0042
	0.6880	0.6895	0.0015	0.0042
	0.9487	0.9508	0.0021	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5205	-0.0002	0.0042
	0.6973	0.6966	-0.0007	0.0042
	0.9959	0.9955	-0.0004	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5536	-0.0008	0.0042
	0.7253	0.7240	-0.0013	0.0042
	1.0942	1.0924	-0.0018	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5609	-0.0007	0.0042
	0.6927	0.6915	-0.0012	0.0042
	1.0881	1.0869	-0.0012	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96 $\pm$ 0.11nm	199.31	0.9668	2.0147

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\*\*\*

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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 No

Customer :

Date: 10 กพ 22

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 = 96% (should be  $\leq 64\%$  or  $\leq 380V$ )
- ☒ Flame, Check D2 lamp is work



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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 = 9.5 mL/min
- ☒ Test Photometric noise, STDV = 0.0003 Abs (should be  $\leq 0.00050$  Abs)
- ☒ Flame, Test high solids nebulizer setting use

-Air/acet Cu 5 ppm = 0.77 Abs, and Precision

(%RSD)= 0.4 % (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

# SVD Results Report

**VARIAN**

Report ID:1 Diagnostic Start Time:10/2/2022 11:56:32 Diagnostic End Time:10/2/2022 12:36:59

Customer:

Address:

## Instrument Configuration

### Configuration:

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: 29533.551

D2 Run Hours: 4026.533

Zero Wavelength Offset: -18.735

D2 Serial Number: not set !

Mono Correction: -0.360

D2 Install Date: 1/1/1970

D2 Original Intensity: 1.000

Flame Hours: 7417.833

D2 Last Intensity: 678.000

### 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**

---

## 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

---

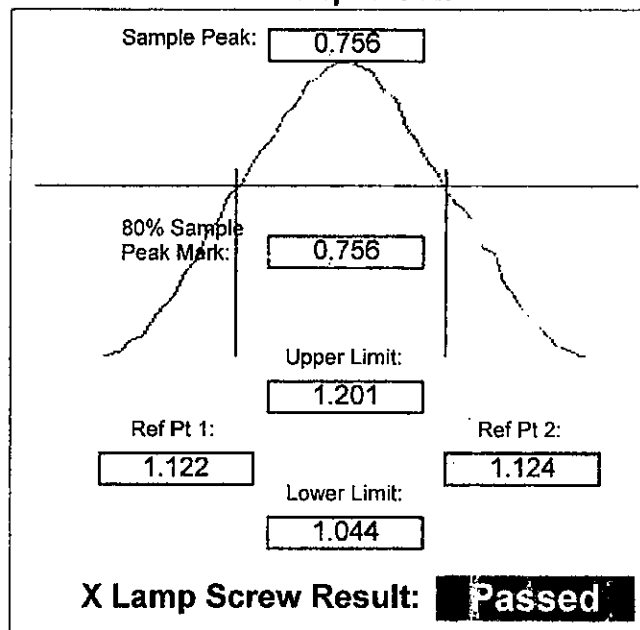


## Beam Balance:

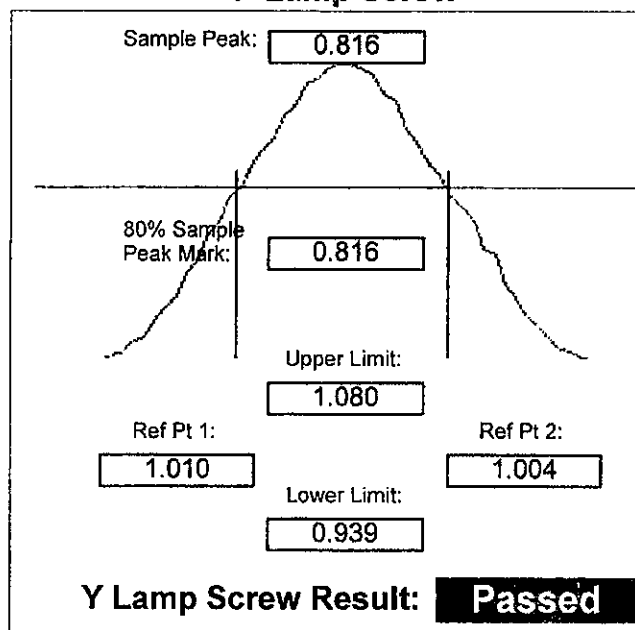
Lamp Type: Copper  
Lamp Socket Used: 3

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

### 'X' Lamp Screw



### 'Y' Lamp Screw



## 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	324.74	325.15	<b>Passed</b>
Second Order	649.23	649.56	649.97	<b>Passed</b>

---

## 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) 324.759

324.879 Upper Limit(nm)

*(Approach from Zero Order)*

*(Approach from end)*

Sample 1: 324.819

Sample 2: 324.811

Sample 3: 324.819

Sample 4: 324.811

Sample 5: 324.815

Sample 6: 324.811

Sample 7: 324.819

Sample 8: 324.815

Sample 9: 324.819

Sample 10: 324.819

Mean: 324.816

Standard Deviation: 0.004

Result: **Passed**

---

## 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	293	332	Passed
S3	474	504	579	Passed
S4	825	904	1008	Passed
S5	1435	1510	1754	Passed
S6	2498	2711	3053	Passed
S7	4347	4658	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

---

## 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**

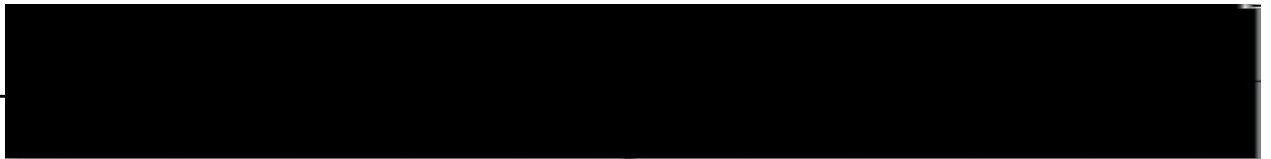
---

## Notes:

C2202SU09\_1  
PM 10 Feb 2022

---

## Signatures:

A large black rectangular redaction box covering the signature area.



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PREVENTATIVE MAINTENANCE (PM) CHECK LIST

FOR ATOMIC ABSORPTION SPECTROMETER

Model & Serial

Customer :

Date: 29 ธ.ค. 22

Safety

- ☐ Flame, Inspect/replace o-ring nebulizer, spray chamber and burner N/A
- ☐ Flame, Clean nebulizer, spray chamber and burner N/A
- ☐ Flame, Check liquid trap interlock, burner interlock, pressure relief bung N/A
- interlock and shield interlock
- ☒ Furnace, Clean work head, electrode and shroud
- ☒ Furnace, Clean PSD and PSD tray
- ☒ 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 = 324.7 nm
- ☒ Check that PMT % Gain the copper at 324.8 nm, 4 mA, 0.5 nm slit width, Gain = 49% (should be  $\leq 64\%$  or  $\leq 380V$ )
- ☐ Flame, Check D2 lamp is work N/A



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Electronics

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

\*\*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 = \_\_\_\_\_ mL/min
- ☒ Test Photometric noise, STDV = 0.0001 Abs (should be  $\leq 0.00050$  Abs)
- ☐ Flame, Test high solids nebulizer setting use

N/A

N/A

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

(%RSD)= \_\_\_\_\_ % (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 = 0.22 Abs, and Precision (%RSD)= 2.4 % (should be  $\geq 0.15$  Abs and  $\leq 4.0\%$  RSD)

SIGN :

Engineer

## BSC Certification Test Report

Page 1 of 6

Certificate No. : M01075/22

Customer Name :

Customer Address :

Equipment : Biological Safety Cabinet Class II Type A2

Manufacturer : Microtech

Model : V6-T

Serial No : 0972

ID No. : WWL0084

Were in accordance with ☒ EN 12469 ☐ NSF 49 ☐ Manufacturer's specification

Test Date : 23/09/2022

Due Date : 23/09/2023 or after HEPA filters are replaced or unit is moved

Test by :

Approved by :

Issued Date : 26/09/2022

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

This certificate may not be reproduced other than in full except with the prior written approval of the Megafil Company Limited.

**Certificate No. :** M01075/22

**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	100mm

**Measurement Data.**

0.36	0.42	0.43	0.41
0.40	0.34	0.34	0.33

**Average velocity** 0.38 m/s ( 75 FPM.) **Velocity range** 0.25-0.50 m/s ( 49-98 FPM.)

**Uniformity( EN: +/-20%avg.)** 0.30 - 0.46 m/s ( 60 - 90 FPM.)

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

**Downflow volume (Q)** 802 CFM.

**Result Summary** ☒ **Pass** ☐ **Fail**
**Equipment used :** Thermo Anemometer **Model** 425 **S/N :** 02623979 **Calibration date :** 14/07/2022



Certificate No. : M01075/22

**2. Inflow velocity test.**

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

0.53	0.47	0.48	0.50	0.51
0.57	0.46	0.52	0.53	0.50
0.54	0.57	0.55	0.52	0.53
0.53	0.51	0.57	0.54	0.51
0.51	0.48	0.53	0.55	0.56

Average Inflow velocity 0.44 m/s (86 FPM.) Velocity range  $\geq 0.40$  m/s (  $\geq 79$  FPM.)

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

Inflow volume(Q) 344 CFM

Result Summary ☒ Pass ☐ Fail

Adjustments Required ☐ Fan Speed ☐ Damper

Equipment used : Thermo Anemometer Model 425 S/N : 02623979 Calibration date : 14/07/2022

**3. HEPA filter leak test.**

**Measurement Data**

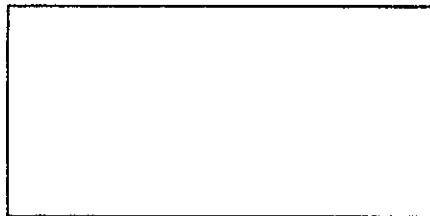
HEPA Filter	PAO Upstream Conc.(calculated)	Specification	Measured leak penetration
Supply HEPA Filter	18 $\mu\text{g/l.}$	<0.003%	<0.003%
Exhaust HEPA Filter	18 $\mu\text{g/l.}$	<0.003%	<0.003%

**Certificate No. :** M01075/22

**Leak location**

**Supply HEPA Filter**

**Back**



**Exhaust HEPA Filter**

**Back**



**Result Summary**

☒ **Pass**

☐ **Fail**

**Equipment used :** Aerosol Photometer **Model** 2I **S/N :** 26468 **Calibration date** 14/07/2022

**Equipment used :** Smoke Generator **Model** TDA-6D **S/N :** 26530

**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.

Certificate No. : M01075/22

**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

620	965	938	561
867	1446	1492	768

Remark :

**Certificate No. :** M01075/22

**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>

720	1510	1540	760
470	980	990	450

**Remark :**

-o0o-

0-1-35