

**ภาคผนวก จ**

เอกสารสอบเทียบ





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23T238

Page : 1 of 2

Equipment : Liquid-in Glass Thermometer

Manufacturer: SK

Model : -

Serial No.: -

ID No.: TNP.LAB.12

Condition As-Received: Used Item

Received Date: 27 January 2023

Calibration Date: 07 February 2023  
to 10 February 2023

Reference: 2301-0937WN

Submitted by: TNP ENVIRONMENT CO.,LTD

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,  
Nonthaburi 11110

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-T02 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Digital Thermometer	1529	A7A609	22I1274	17 Oct 2023
2) Industrial Platinum Resistance Thermometer	5627-12	571975	22I1274	17 Oct 2023

2.The UUC\* was immersed into liquid bath temperature controller and the top about 12 mm of the liquid column above the bath medium in every calibration points.

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

4.This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thammanoon Phuwadkien  
Issue Date : 14 February 2023

Approved Signatory :

- [ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpiluek  
[✓] Wanlop Larpkurn

B 0307331



Cert. No.: 23T238

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

Function:

Temperature measurement.

Type:

Total Immersion

Scale Division:

1 °C

Reference point ( 0 °C ) Error = -0.9681 °C, with Uncertainty of Measurement of  $\pm 0.16$  °C

<u>UUC*</u> <u>Reading</u> ( °C )	<u>Standard</u> <u>Temperature</u> ( °C )	<u>Error</u> ( °C )	<u>Uncertainty</u> <u>of Measurement</u> ( $\pm$ °C )
20	21.4342	-1.4342	0.16
30	31.5544	-1.5544	0.16
40	41.1382	-1.1382	0.16

**Note:** UUC\* : Unit Under Calibration

The UUC\* readings were made under magnification and resolved to one tenth of one scale division.

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

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CERT.No.: HS-T031D

**Certificate of Calibration**

Calibration Date : 22 Apr 22

Submitted by : PINTHONG UTILITIES COMPANY LIMITED

789 Moo1 Nong koh-Laen Chabang Rd,

Nong-kham Sriracha Chonburi Thailand 20230

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 757.00 mmHg

Salinity : 0 ppt

Model : YSI 4010-2W

S/N : 22051520

Probe : YSI 4100

S/N : 22C102711

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

**Calibration Details**

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.05	(PASS)	-
Measurement 2 (mg/l)	9.05	(PASS)	-
Measurement 3 (mg/l)	9.05	(PASS)	-
Measurement 4 (mg/l)	9.03	(PASS)	-
Measurement 5 (mg/l)	9.03	(PASS)	-
Measurement 6 (mg/l)	9.01	(PASS)	-
Measurement 7 (mg/l)	9.01	(PASS)	-
Measurement 8 (mg/l)	9.00	(PASS)	-
Measurement 9 (mg/l)	9.00	(PASS)	-
Measurement 10 (mg/l)	9.01	(PASS)	-

Mean Measurement	9.02	mg/l	-	-
Inaccuracy	0.07	mg/l	-	-

Overall Status (PASS)

**Manufacturer Specification**

Accuracy = +/- 0.2 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature



Laboratory Manager





**MCL**  
Microtech Calibration laboratory



NSC-TISI-TIS 17025  
CALIBRATION 0228

53/154 Moo 2, Semafahkarm Road, Tumbon Khukhot, Amphur Lamlukka, Pathumthani 12130

53/154 หมู่ 2 ถนนเสมาฟ้าคราม ตำบลลูกคต อำเภอลำลูกกา จังหวัดปทุมธานี 12130

Tel. 02-9877200 Fax. 02-9877205

Certificate No. : M22 - 1588A

Page : 1 of 4

# Certificate of Calibration

**Customer** : TNP ENVIRONMENT CO.,LTD.  
**Address** : 332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11111

**Description of Equipment** : Electronic Balance  
**Manufacturer** : Shimadzu  
**Model** : AP225WD  
**Serial Number** : D316301848  
**ID. / Control Number** : TNP.LAB.30  
**Made In** : Philippines  
**Location** : On - Site  
**Environmental Conditions** : Temperature ( 25 +/- 10 ) °C  
Humidity ( 50 +/- 25 ) % RH  
Atmospheric Pressure ( 1010 +/- 10 ) mbar  
**Calibration Date** : APR 18, 2022  
**Issue Date** : APR 20, 2022

## Uncertainty of Measurement

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2$ . It has been evaluated according to the "Expression of the Uncertainty of Measurement in Calibration (M3003)" which provides a level of confidence approximately 95%.

Calibrated by : Sarawut Khrueapan

Approved by : 

( Precha Pavachot )

Laboratory Manager

**Certificate of Calibration**

<b>Description</b> : Electronic Balance	<b>Serial Number</b> : D316301848	<b>Resolution</b> : 0.0001,0.00001 g
<b>Manufacturer</b> : Shimadzu	<b>ID. /Control Number</b> : TNP.LAB.30	<b>Order No.</b> : 1398 - 22
<b>Model</b> : AP225WD	<b>Made In</b> : Philippines	<b>Received Date</b> : APR 18, 2022
<b>Unit</b> : g	<b>Capacity</b> : 220 g	<b>Calibration Date</b> : APR 18, 2022

**Result of Calibration** : Without Adjustment      **Resolution** : 0.0001,0.00001 g  
**Range** : 200 g

**2. Departure From Nominal Value**

Nominal Value g	UUC* Reading g	UUC* Error g	Uncertainty of Measurement +/- g
0	0.00000	0.00000	0.00013
0.1	0.10003	0.00003	0.00013
0.2	0.20002	0.00002	0.00022
0.5	0.50002	0.00002	0.00043
1	1.00002	0.00002	0.00043
2	2.00005	0.00005	0.00043
5	5.00007	0.00007	0.00068
10	10.00006	0.00006	0.00068
20	20.00003	0.00003	0.00068
50	49.99997	-0.00003	0.00068
100	99.99999	-0.00001	0.00068
200	199.9999	-0.0001	0.00068

UUC\* = Unit Under Calibration

**Certificate of Calibration**

<b>Description</b> : Electronic Balance	<b>Serial Number</b> : D316301848	<b>Resolution</b> :
<b>Manufacturer</b> : Shimadzu	<b>ID. /Control Number</b> : TNP.LAB.30	<b>Order No.</b> : 1398 - 22
<b>Model</b> : AP225WD	<b>Made In</b> : Philippines	<b>Received Date</b> : APR 18, 2022
<b>Unit</b> : g	<b>Capacity</b> : 220 g	<b>Calibration Date</b> : APR 18, 2022

**Result of Calibration** : Without Adjustment **Resolution** : 0.0001, 0.00001 g

**Range** : 200 g

**3. Effect of Center Loading**


Nominal	UUC* Reading					
Load	A	B	C	D	E	Maximum Difference
g	g	g	g	g	g	g
50	49.99997	49.99997	49.99995	49.99996	49.99996	0.00002

A Mass of 50 g Was Placed to Various Position on The Pan.

The Weighing Machine Reading Error Obtained Is Given In Table

**4. Effect Tare Function**

Nominal Tare Weight	Standard Weight		UUC* Reading	UUC* Error
g	g		g	g
	Tare		0.00000	0.00000
100	at 20 %	20.0000	20.0001	0.0001
	at 100 %	100.0000	100.0002	0.0002

UUC\* = Unit Under Calibration

..... END.....



### Certificate of Calibration

<b>Description</b> : Electronic Balance	<b>Serial Number</b> : D316301848	<b>Resolution</b> : 0.0001,0.00001 g
<b>Manufacturer</b> : Shimadzu	<b>ID. /Control Number</b> : TNP.LAB.30	<b>Order No.</b> : 1398 - 22
<b>Model</b> : AP225WD	<b>Made In</b> : Philippines	<b>Received Date</b> : APR 18, 2022
<b>Unit</b> : g	<b>Capacity</b> : 220 g	<b>Calibration Date</b> : APR 18, 2022

### Calibration Method

The Electronic balance was measured using standard weight following to in house calibration method MCL-CP14 and based on UKAS LAB 14: Edition 5 July 2015

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

### Reference Standard

Description	Model	Serial No.	Certificate No.	Due Date
Standard Weight Set	50 mg - 2 kg	N/A	B0-0805057/20	MAY 09, 2021

### Traceability of Measurement

The measurements are traceable to international system of units (SI)

The certificate is traceable to through Thai Heart Calibration Co.,Ltd.

**Range** : 200 g

**Resolution** : 0.0001,0.00001 g

### 1. Repeatability of Balance

Nominal Value g	Standard Deviation of Reading g
0	0.00000
200	0.0000



TN-SCIENCE COMPANY LIMITED  
TEST AND TRUST

บริษัท ทีเอ็น-ไซน์ จำกัด (สำนักงานใหญ่)

TN-Science Co.,Ltd.( Head Office )

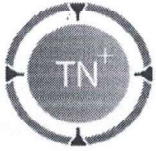
199/588 ต.รังสิต อ.ธัญบุรี จ.ปทุมธานี 12110 เลขประจำตัวผู้เสียภาษี : 0135552001728

โทร : 0-2150-9574-5 โทรสาร : 0-2150-9575 E-mail : info@tn-science.com Website: www.tn-science.com

<div>Test Certificate</div> <div>Conducted According to Test 110-95</div> <div>of ASHRAE</div>				หมายเลขตู้ (S/N) :		-	
				อ้างอิงสัญญาซื้อขาย :		-	
				อ้างอิงใบรับประกัน :		-	
				Model :		-	
ชื่อบริษัท		บริษัท ทีเอ็นพี เอ็นไวรอนเม้นท์ จำกัด (สำนักงานใหญ่) 332/173 ต.บางรักพัฒนา อ.บางบัวทอง จ.นนทบุรี 1110 เลขประจำตัวผู้เสียภาษี 0125560008957					
ระยะรับประกัน		-	นับตั้งแต่	-	กำหนดตรวจเช็ค	1 ครั้ง	2 ครั้ง
ตรวจเช็คบริการ ครั้งที่ 1		16/12/2563			ตรวจเช็คบริการ ครั้งที่ 2		

รายการตรวจสอบสภาพผู้ดูแลวันไอกรสารเคมี ดังนี้

ลำดับ	รายการตรวจเช็ค	ผลการตรวจสอบสภาพ			ลำดับ	รายการตรวจเช็ค	ผลการตรวจสอบสภาพ		
		ปกติ	พอใช้	ผิดปกติ			ปกติ	พอใช้	ผิดปกติ
1	ระบบ Air Foil By Pass	✓			19	ความเร็วลมดูดหน้าตู้		✓	
2	หน้าบานประตูตอนบน	✓			20	ระดับเสียงหน้าตู้		✓	
3	หน้าบานประตูตอนล่าง	✓			21	กระแสไฟฟ้าตู้คอนโทรล	✓		
4	กระจกด้านหน้า	✓			22	สวิทช์คอนโทรล	✓		
5	รางกระจก	✓			23	ชุดไฟแสงสว่าง	✓		
6	บานพับ	✓			24	เด้ารับไฟฟ้า	✓		
7	ระบบถ่วงดุลน้ำหนัก	✓			25	ระบบท่อลม	✓		
8	ลูกรอก	✓			26	พัดลม	✓		
9	สายสลิง / ตัวล็อก	✓			27	มอเตอร์	✓		
10	สื่อดูดอากาศกลิ่น	✓			28	ลูกปืน			
11	ก๊อกรน้ำ	✓			29	เซนเซอร์วัดความดันอากาศ			
12	วาล์วรีโมทน้ำ	✓			30	ปุ่มฉุกเฉิน	✓		
13	บอลลวาล์วน้ำ				31	ความสะอาดในการใช้งาน			
14	ข้อต่อท่อและสายน้ำ				32	Water Scrubber		✓	
15	ก๊อกรก๊าซ				33	Filter Scrubber			
16	วาล์วรีโมทก๊าซ				34	อื่น ๆ .....			
17	บอลลวาล์วก๊าซ								
18	ข้อต่อท่อและสายก๊าซ								



TN-SCIENCE COMPANY LIMITED  
TEST AND TRUST

บริษัท ทีเอ็น-ไซน์ จำกัด (สำนักงานใหญ่)

TN-Science Co.,Ltd.( Head Office )

199/588 ต.รังสิต อ.ธัญบุรี จ.ปทุมธานี 12110 เลขประจำตัวผู้เสียภาษี : 0135552001728

โทร : 0-2150-9574-5 โทรสาร : 0-2150-9575 E-mail : info@tn-science.com Website: www.tn-science.com

การตรวจสอบความเร็วลมด้านหน้าตู้

เปิดประตู ที่ความสูง 25 cm ความกว้างของประตู 160 cm

จุดที่	fpm/mps	จุดที่	fpm/ mps	จุดที่	fpm/ mps		
1	111	3	115	5	106		
2	102	4	106	6	124		
ค่าเฉลี่ย		110					
<p>*ความเร็วลมเฉลี่ย ไม่ต่ำกว่า 100 fpm/0.5 mps ควรเปิดหน้าบานกระชก ในระยะ 30 CM.</p> <p>**ผ่านการทดสอบตามมาตรฐาน ASHRE 110-95 PROTOCOL (American standard)</p>							

ความเร็วลมเฉลี่ย = 110 fpm / 0.55 mps

อัตราการไหล = 472 CFM / 13.4 m³/min

ผลการตรวจสอบ = อยู่ในเกณฑ์ยอมรับได้

เครื่องมือที่ใช้สำหรับการวัดค่าลม

ชื่อเครื่อง : Anemometer

รุ่น : DT-620

รหัสเครื่อง : 160415514

อ้างอิงเลขที่ใบรับรอง ISO/IEC 17025 : TTH-0-34257

ปัญหาที่พบ / ข้อเสนอแนะ

หมายเหตุ.....



เจ้าหน้าที่ผู้ดำเนินการ

07/12/63  
( 16/12/63 )



## Certificate of Calibration

**Certificate No. :** 65-400665-1

**Page : 1 of 2**

**Submitted by :** TNP Environment Co., Ltd.  
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

**Equipment :** Air Chamber (Oven)  
Manufacturer : Memmert Model : UF75  
Range : N/A °C Resolution : 0.1 °C  
Serial No. : B320.0251 ID No. : N/A

**Environment :** On site calibration was carried out at the Laboratory, TNP Environment Co., Ltd.  
Ambient Temperature : (27.0 to 28.0 °C  
Relative Humidity : (40 to 45) %  
Line Voltage : (228.0 to 230.0) V

**Date of Received :** 26 December 2022

**Date of Calibration :** 26 December 2022

**Date of Issue :** 28 December 2022

**Calibrated by :** Permpon Chanpu

**Calibration Method :** CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

**Reference Standard Instruments :** This certification is traceable to the International System of Units  
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	65-400548-1	26 Apr 2023	National Institute of Metrology Thailand (NIMT)

Approved by :



( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



## Certificate of Calibration

**Certificate No. : 65-400665-1**

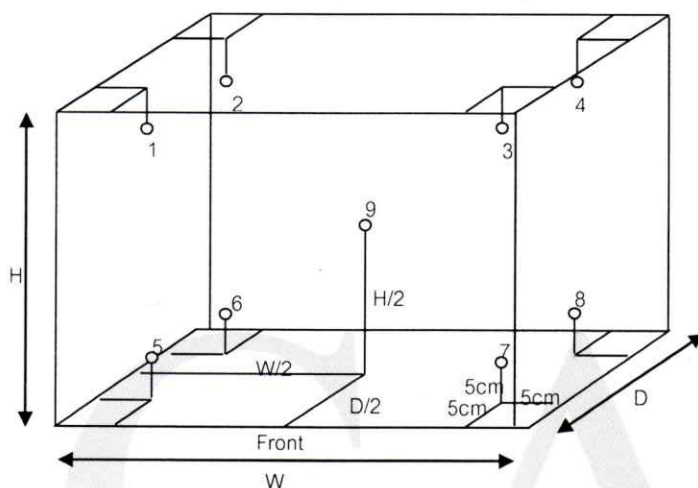
**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m<sup>3</sup>

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104.0	104.0	104.0	104.2	104.1	104.2	104.0	103.8	103.9	103.9	103.9	104.0	0.69
180.0	180.0	180.0	179.6	179.6	179.7	179.8	180.2	179.5	179.0	179.8	180.5	1.0

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104.0	104.0	104.0	0.4	0.1	0.7
180.0	180.0	180.0	1.7	0.3	2.0

**Remark** The uncertainty is not combine uniformity of the air chamber

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

This 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%

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*B*



www.calibratech.co.th

**Certificate No. T/O 660071**

**Date of issue : 14-Mar-2023**

**Equipment Description** : Incubator  
**Equipment Model** : SMART i250-DS  
**Equipment Serial No.** : 0410-0121-0003  
**I.D. No. or Control No.** : -  
**Manufacturer** : Entech Industrial Solution Co.,Ltd.  
**Customer Name** : TNP ENVIRONMENT CO.,LTD.  
**Customer Address** : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,  
Nonthaburi 11110  
**Total pages of certificate** : 2 pages  
**Instrument Receiving Date** : 3-Mar-2023  
**Receiving No.** : O-230081  
**Environmental Conditions** : All of the measurement were carried out in the working area  
Temperature : ( 25 ± 15 ) °C  
Humidity : ( 55 ± 30 ) % RH  
Voltage : ( 220 ± 22 ) VAC  
**Calibration Place** : 332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,  
Nonthaburi 11110

**Calibration Procedure No.** : This instrument was calibrated by comparison of reference radiation source standard  
according to calibration work instration no WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement  
multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%*

*The standard uncertainty of measurement has been determined in accordance with M 3003*

*The expression uncertainty and confidence in measurement.*

*This certificate is applied only to item under test environmental condition.*

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

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement  
according to the International system of units (SI).*

**Date of Calibration** : 3-Mar-2023



Mr. Kittipong Kaewsai  
**Calibration Engineer**



Ms. Nongluck Wongsettee  
**Technical Manager**



**Certificate No. : T/O 660071**

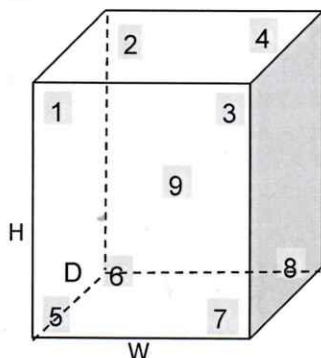
**The Reference Standard Instrument :-**

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert No.</u>	<u>Due date</u>
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0524-2/65	4-Apr-2023

**Measured room conditions**

<b>Temperature :</b>	Minimum: 21.3 °C	Maximum: 22.8 °C
<b>Humidity :</b>	Minimum: 49.3 %RH	Maximum: 54.7 %RH
<b>Voltage :</b>	Minimum: 220.1 VAC	Maximum: 223.4 VAC
<b>Fresh Air Setting:</b>	off	

**Sensor Position :**



**Working Space of chamber :**

(Inside Dimensions) W x D x H : 500 mm x 480 mm x 1100 mm

**Sensor Installation Details :**

- Sensor Number 1 to 8 installed approximately 50 mm From each wall.
- Sensor Number 9 installed approximately geometric of the chamber.

**Results :** The measurement results of the calibration were reported in the table below.

( \* ) Without adjustment

( ) After adjustment

<b>UUC*</b> <b>Setting</b>	<b>UUC*</b> <b>Reading</b>	<b>Temperature Reading of Standard Sensor</b>								
( °C )	( °C )	<b>Sensor Position</b>								
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
20.0	20.0	20.34	20.30	20.14	20.18	20.15	20.02	19.93	19.94	20.02

<b>UUC*</b> <b>Setting</b>	<b>UUC*</b> <b>Reading</b>	<b>Temperature</b> <b>Uniformity</b>	<b>Temperature</b> <b>Stability</b>	<b>Overall</b> <b>Variation</b>	<b>Uncertainty</b> <b>of Measurement</b>	<b>Coverage</b> <b>Factor</b>
( °C )	( °C )	( °C )	( ± °C )	( °C )	( ± °C )	<b>K</b>
20.0	20.0	0.50	0.40	1.00	0.61	2

**UUC\* = Unit Under Calibration**

**Remark :-**

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [ ( Maximum Temperature Value - Minimum Temperature Value ) / 2 ]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

**End of Report**



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



Cert.No.: 23CH126

Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Adwa  
Model : AD 12  
Serial No. : 1328  
ID No. : TNP.LAB.13  
Condition As-Received: Used Item  
Received Date : 27 January 2023  
Calibration Date : 30 January 2023  
Reference : 2301-0937WN-2  
Submitted by : TNP ENVIRONMENT CO.,LTD  
332/173 Moo 3, Bang Rak Phatthana,  
Bang Bua Thong, Nonthaburi 11110  
Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement  
with certified reference material (CRM)

Calibrated by : Walalak Sirithean

Approved by :

Approved Signatory

- ( / ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

Issue Date : 31 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0050390



Cert.No.: 23CH126

Page.: 2 of 2

**Condition of this calibration result**

1. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	826588	09 July 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.008	CPA chem	826590	09 July 2023

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

**Calibration Results**

**Function : pH Measurement**

**Performing two buffers standard curve by using buffer nominal pH (4,7)**

<b>Unit Under Calibration</b>	<b>Standard pH Buffer Solution</b>	<b>Actual pH Reading</b>	<b>Actual mV Reading (mV)</b>	<b>Uncertainty of pH Measurement (<math>\pm</math>)</b>	<b>Coverage factor <math>k</math></b>
pH Electrode S/N.: 1328	4.008	4.01	N/A	0.0085	2.05
	6.987	6.99	N/A	0.011	2.00
	10.008	10.02	N/A	0.0095	2.00

- Remark**
- pH meter does not have voltage mode.
  - Can not connect the BNC because the plug does not match with the socket.
  - N/A = Not Available

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

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Malu.





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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Cert.No.: 22CH1128

Page.: 1 of 3

## Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Horiba
Model :	LAQUA-PH1100
Serial No. :	B80A0042
ID No. :	TNP.LAB.02
Condition As-Received:	Used Item
Received Date :	24 August 2022
Calibration Date :	25 August 2022
Reference :	208-0843WN-1
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

- ( ) Malee Butkruea  
( ☒ ) Saihip Meangmai  
( ) Warakorn Lerngagtrakul

Issue Date : 29 August 2022

The Uncertainties are for a confidence probability of approximately 95%

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

A 0044697



Cert.No.: 22CH1128

Page.: 2 of 3

**Condition of this calibration result**

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	46530031	130RC098	21E3245	07 Oct 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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

**Calibration Results****Function : mV Measurement****Performing standard curve by Fluke at pH (4,7,10)**

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( ±mV )	Coverage factor k
			mV	pH		
pH Meter S/N.: B80A0042	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

Saithip

a 1123682



Cert.No.: 22CH1128

Page.: 3 of 3

**Calibration Results****Function : pH Measurement**

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading ( mV )	Uncertainty of pH measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N.: 9X0B0575	4.008	4.01	153.9	0.0086	2.05
	6.985	6.99	-18.8	0.012	2.05
	10.008	10.01	-190.3	0.011	2.05

**Function : Temperature Measurement****( \* ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : 961X5S  
- Serial No. : 9X0B0575

Dimension of probe;

- Length : 87 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 80 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
20.0	20.003	20.0	-0.003	0.13	2.00
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00

**Remark : - UUC\* = Unit Under Calibration**

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

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*Signature*

a 1123681



**Certificate No.:** T/O 650134

**Date of issue:** 11-Oct-2022

**Equipment Description** : Refrigerator  
**Equipment Model** : P1010  
**Equipment Serial No.** : P1010-1020-0005  
**I.D. No. or Control No.** : TNP.LAB.01  
**Manufacturer** : Entech Industrial Solution Co.,Ltd.  
**Customer Name** : TNP ENVIRONMENT CO.,LTD.  
**Customer Address** : 332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,  
 Nonthaburi 11110  
**Total pages of certificate** : 2 pages  
**Instrument Receiving Date** : 10-Oct-2022  
**Receiving No.** : O-220115  
**Environmental Conditions** : All of the measurement were carried out in the working area  
 Temperature : ( 25 ± 15 ) °C  
 Humidity : ( 55 ± 30 ) % RH  
 Voltage : ( 220 ± 22 ) VAC  
**Calibration Place** : 332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,  
 Nonthaburi 11110  
**Calibration Procedure No.** : WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k$ , which for a normal distribution corresponds to a coverage probability of approximately 95%*

*The standard uncertainty of measurement has been determined in accordance with M 3003  
 The expression uncertainty and confidence in measurement.*

*This certificate is applied only to item under test environmental condition.*

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory.  
 Calibration certificates without signature and seal are not valid.*

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).*

**Date of Calibration** : 10-Oct-2022



Mr. Kittipong Kaewsai  
**Calibration Engineer**



Ms. Nongluck Wongsettee  
**Technical Manager**

Certificate No. : T/O 650134

**The Reference Standard Instrument :-**

**Instrument**

1) Data logger with RTD Probe

**Model**

Agilent 34972A

**Serial No.**

MY60008352

**Cert No.**

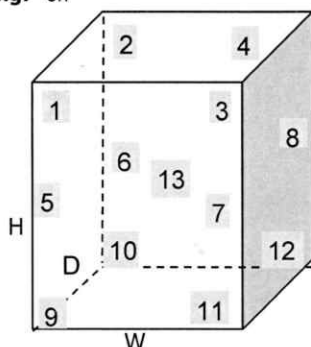
PSL-T 0524-3/65

4-Apr-2023

**Measured room conditions**

**Temperature :** Minimum: 30.4 °C Maximum: 31.6 °C  
**Humidity :** Minimum: 51.4 %RH Maximum: 56.7 %RH  
**Voltage :** Minimum: 220.1 VAC Maximum: 223.2 VAC  
**Fresh Air Setting:** off

**Sensor Position :**



**Working Space of chamber :**

(Inside Dimensions) W x D x H : 1560 mm x 500 mm x 1380 mm

**Sensor Installation Details :**

- Sensor Number 1 to 12 installed approximately 50 mm From each wall.
- Sensor Number 13 installed approximately geometric of the chamber.

**Results :** The measurement results of the calibration were reported in the table below.

( \* ) Without adjustment

( ) After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
( °C )	( °C )	Sensor Position								
		1	2	3	4	5	6	7	8	9
		4.52	4.36	4.21	4.00	4.52	4.20	4.77	4.39	4.07
		Sensor Position								
		10	11	12	13					
		4.16	4.17	4.54	4.07					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
( °C )	( °C )	( °C )	( ± °C )	( °C )	( ± °C )	K
4.0	4.0	1.07	0.93	2.23	1.2	2

**UUC\* = Unit Under Calibration**

**Remark :-**

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [ ( Maximum Temperature Value - Minimum Temperature Value ) / 2 ]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

**End of Report**



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23M455

Page : 1 of 2

Equipment : Standard Weight Set

Manufacturer: -

Model : Class:F1

Serial No.: 15022021-01

ID No.: TNP.LAB.25

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 04 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: ( 23 ± 2 ) °C

Relative Humidity: ( 50 ± 15 ) %

Atmospheric Pressure: 1015.25 mbar

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,  
Nonthaburi 11110

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of 1.2 kg/m<sup>3</sup> and a temperature of 23.4 °C material density of weight is 8000 kg/m<sup>3</sup>.

### Condition of this result of calibration

1. Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Standard Weight Set (E2)	73336	20026	MM-0018-22	28 Feb 2024
2) Standard Weight Set (E2)	73338	20028	MM-0019-22	28 Feb 2024

2. This certificate is not certified for any commercial transaction.

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

4. This Certification is traceable to the International System of Unit maintained at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thapakorn Thammachai

Issue Date : 07 March 2023

Approved Signatory : \_\_\_\_\_

☐ Phalinee Prabpaipal

☒ Sura Suwannasri

☐ Chaowalit Rittirak

B 0309848





Cert No.: 23M455

Page: 2 of 2

**Result of calibration**

Nominal Value	Conventional mass		Uncertainty of Measurement ( $\pm$ )	Maximum Permissible error ( $\pm$ )
	Before Adjustment	After Adjustment		
200 g	199.99986 g	-	0.30 mg	1.0 mg
100 g	100.00015 g	-	0.16 mg	0.50 mg
50 g	50.00015 g	-	0.10 mg	0.30 mg
20 g	20.000116 g	-	0.080 mg	0.25 mg
10 g	10.000041 g	-	0.060 mg	0.20 mg
5 g	5.000010 g	-	0.050 mg	0.16 mg
2 g	1.999936 g	-	0.040 mg	0.12 mg
1 g	0.999973 g	-	0.030 mg	0.10 mg
200 mg	200.059 mg	200.007 mg	0.020 mg	0.060 mg
100 mg	100.037 mg	99.981 mg	0.016 mg	0.050 mg

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 %.

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# Calibration Certificate

Cert. No. : CT-23-01-23295

Page : 1 of 4

Issued date : 24 January 2023

Equipment : Water Bath , Manufacturer : MLAB , Model : WBN30  
S/N = 0347 , Customer ID = -

Client : TNP ENVIRONMENT CO.,LTD.  
332/173 Moo 3 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 20 January 2023

Ref. Job No. : SO6601-00020

Calibrated by : Mr.Apiwat Mungsamak

Cert. prepare by : Ms.Nattanicha Panumram

Calibrated Date : 20 January 2023

Approved by : Mr.Montree Ruschasetkul

Calibration Place : ห้องปฏิบัติการ2

Environment Condition : Temperature  $28.5 \pm 2.7$  (°c) , Humidity  $57.5 \pm 14.5$  (%RH)

Calibration Method : In-house method based on ASTM E715-80 (Reapproved 2006) , (MTEC WI No. # WICAL-02-003-R01 )

## Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Data Logger	MTEC-CE-0175	MLAB	10/2023
2	Thermo Hygrometer	MTEC-CE-0183	TP-50	06/2023

## Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as show on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k =$  (see result table ) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.



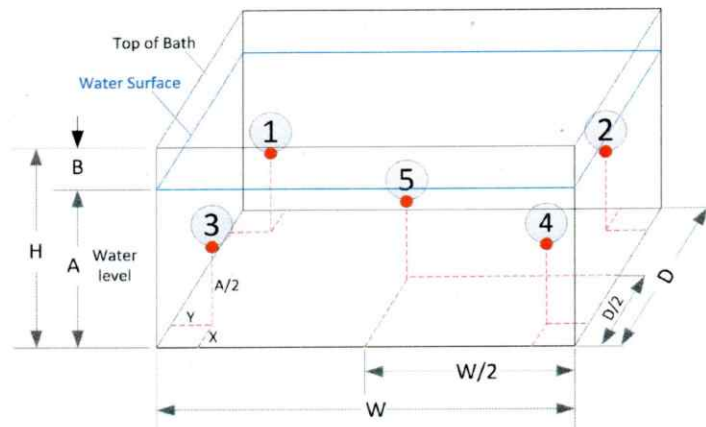
Approved Signatory

**Calibration Result :**

Page : 2 of 4

Condition of UUC :

- 1) Adjust Condition : Without Adjustment
- 2) Lid Cover : Flat Sheet (Plastic , from
- 3) Circulation : without circulation
- 4) X , Y = 5 cm. , B ~ 3 cm.



Pic 1 : Position of each sensor No.

(1) The quoted uncertainty include with " Stability".

(2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching sted state.

(3) Uniformity = The maximum difference of measured temperatures at two any sensor which are observed at the same time.

(4) Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.

**Section 1 : Report of Temperature distribution**

Unit : ( °C )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.					Uncertainty ( ± )	k (**)
			#1	#2	#3	#4	#5		
85	85	85.0	85.30	85.30	84.83	84.76	85.51	0.627	2

(\*) = The average of 30 values in each point , (\*\*) = Coverage factor (k) value

**Section 2 : Report of Chamber Performance**

Unit : ( °C )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Temperature Uniformity	Temperature Stability ( ± °C )	Temperature Overall Variation
85	85	85.0	1.34	0.45	1.64

(\*) = The average of 30 values in each point

Approved Signatory : 



Certificate No. : CT-23-01-23295

Page : 3 of 4

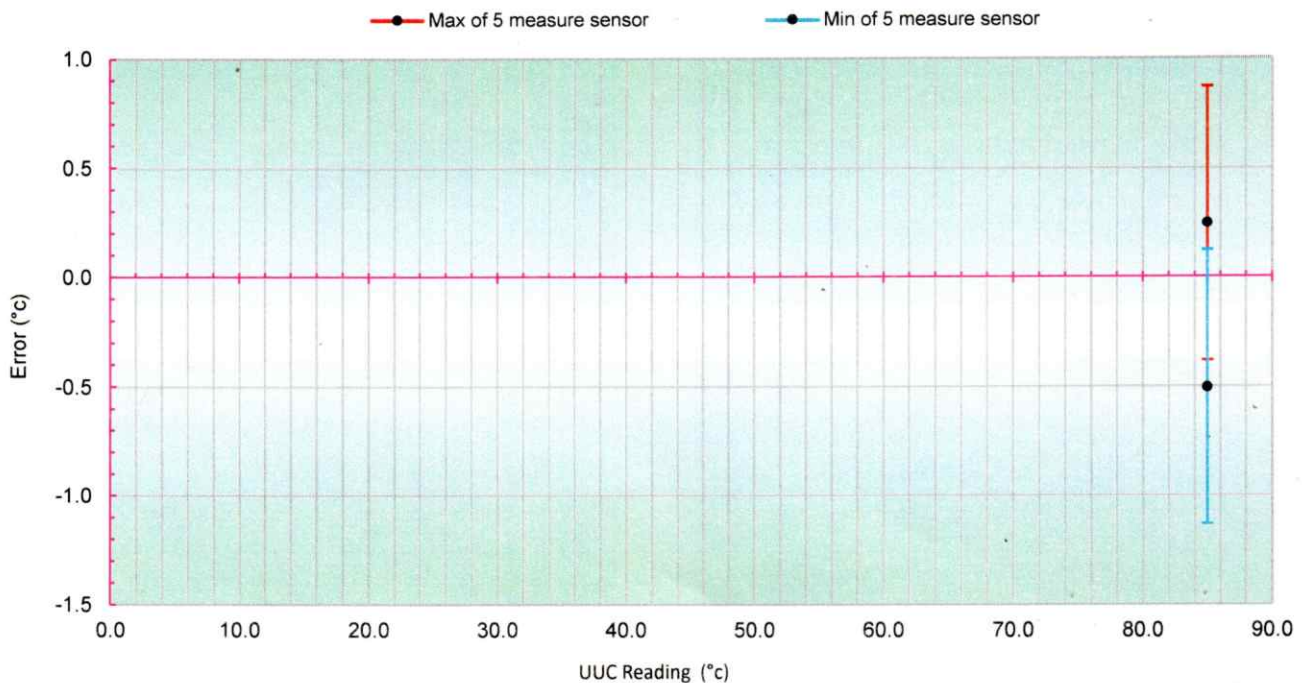
**Section 3 :** Possible of temperature in chamber. Show minimum and maximum of the average values and include with uncertainty of measurement. , The average values is average of each position standard sensor throughout observation time.

Unit : ( °C )

Calibration Point	UUC Setting (*)	UUC Reading (*)	Possible of Minimum temperature in chamber	Possible Maximum temperature in chamber
85	85	85.0	84.13	86.13

(\*) = The average of 30 values in each point

**Section 4 :** Trend of accuracy



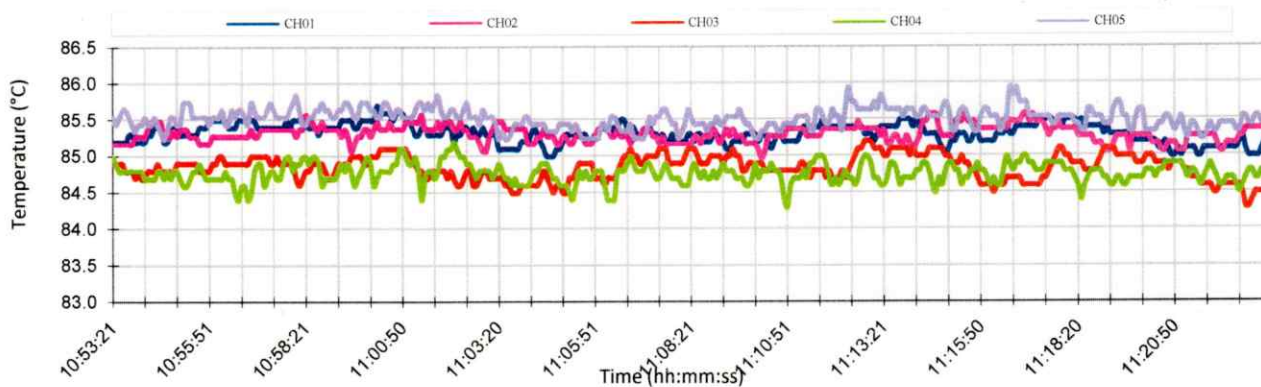
Approved Signatory : 

Certificate No. : CT-23-01-23295

Page : 4 of 4

Section 5 : Graph report for Temperature distribution , not include uncertainty of measurement

(5.1) Temperature Distribution at UUC Reading 85.0 °C



Approved Signatory : .....

## Certificate of Calibration

### Customer

Name : Innovative Instrument Co.,Ltd.  
Address : 7/139 Moo 13, Soi Suntinakorn 11 Tambon Bang Kaeo, Amphoe Bang  
Phli Samut Prakan Province 10540 Thailand

Certificate No : 22-DPM-236

Request No : Req-2022-1811

### Unit Under Calibration Details

Measurement Item : Bioaerosol Sampler Resolution : 0.001 inch H<sub>2</sub>O  
Manufacturer : Aquaria  
Model : Microflow  $\alpha$   
Serial Number : M3290  
ID : -

### Calibration Environment and Details

Temperature : 23 °C  $\pm$  3 °C  
Humidity : 55 %RH  $\pm$  15 %RH  
Received Date : 26 September 2022  
Calibrated Date : 6 October 2022  
Calibration By : Mr. Noppadon Luangart  
Location of Calibration : LAB 4 Air Velocity  
Calibration Procedure : In-house method CP-DPM-02 by Comparison With Standard Differential Pressure Transducer

Reference Standard	Model	Serial Number	Due Calibration
Digital Pressure Calibrator	ADT672-05-DP20-MBAR	273160C0023	4 July 2023
Thermo Hygrometer	SD700	Q597552	21 October 2022

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI). National Institute of Metrology (Thailand),(NIMT)

**Note** : The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor  $k=2$ , providing a level of confidence approximately 95 %.

Calibration By :                     *me*                      
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :                     *๗๗๔*                      
Mr. Pacit Mathavom  
Calibration Engineer Supervisor

Issue Date : 6 October 2022



Certificate No : 22-DPM-236

Request No : Req-2022-1811

Calibration Results : Without Adjustment

Flow Rate Accuracy

Flow Rate (L/min)	$\Delta P$ SETRA (inch H <sub>2</sub> O)	Mean STD Reading (inch H <sub>2</sub> O)	Error (inch H <sub>2</sub> O)		Uncertainty (±) (inch H <sub>2</sub> O)
30	0.014	0.014	0.0%	0.0000	0.0012
60	0.050	0.050	0.0%	0.0000	0.0012
90	0.118	0.118	0.0%	0.0000	0.0012
100	0.138	0.138	0.0%	0.0000	0.0012
120	0.206	0.206	0.0%	0.0000	0.0012

Note :

Mean : The average standard of 4 values on each Point

inch H<sub>2</sub>O = 249.0889 Pascal

$\Delta P$  = Differential Pressure

End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23H487

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: EXTECH

Model : 448515

Serial No.: PONPE5899555

ID No.: TNP.LAB.22

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 07 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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except with the prior written approval of the head of  
Corporate Services 3: Equipment Calibration and Testing Services.

332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong,  
Nonthaburi 11110

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Standard Humidity/Temperature Meter	400	10203027	TH-0082-22	22 Aug 2023

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

3.This Certification is traceable to the International System of Unit maintained at:-

- National Institute of Standards and Technology (NIST) , The United States of America
- National Institute of Metrology Thailand (NIMT)

Calibrated by : Viporn Tantiyawutti  
Issue Date : 10 March 2023

Approved Signatory :

- ☒ Chakrit Waewanjua  
☐ Pornthippa Tameyakul  
☐ Viporn Tantiyawutti

B 0310048



Cert. No.: 23H487

Page.: 2 of 2

**Result of Calibration:-**

Without Adjustment

Function:

Humidity Measurement

<u>Reference</u> <u>Temperature</u> (°C)	<u>Standard</u> <u>Humidity</u> (%R.H.)	<u>UUC*</u> <u>Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty</u> <u>of Measurement</u> (±%R.H.)
25.0	50.1	29	-21.1	1.6

**Result of Calibration:-**

Without Adjustment

Function:

Temperature Measurement

<u>Standard</u> <u>Temperature</u> (°C)	<u>UUC*</u> <u>Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> <u>of Measurement</u> (±°C)
20.06	19.9	-0.16	0.46
24.99	25.1	0.11	0.46

**UUC\*** : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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# FOSS

## Customer Service Report

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Report No:

6623

Date:

July 26, 2022

Customer:

United Analyst and Engineering

Address:

กรุงเทพฯ

Instrument:

KT8100

Serial:

31889052

Hours

Travel To Customer

Start

8.00

Finish

8.30

30 mins.

Labour

8.00-12.00

3+3

13.00-16.00 = 6 hrs.

Travel From Customer

16.30

17.30

1 hrs.

## Job Type

Application		Special		Standard			
Normal	<input checked="" type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>	Installation	<input checked="" type="checkbox"/>	Training	<input checked="" type="checkbox"/>
Distributor	<input checked="" type="checkbox"/>	PMA Onboarding	<input checked="" type="checkbox"/>	Quote	<input checked="" type="checkbox"/>	In House	<input checked="" type="checkbox"/>
Internal	<input checked="" type="checkbox"/>	Warranty	<input checked="" type="checkbox"/>	Repair	<input checked="" type="checkbox"/>	PM	<input checked="" type="checkbox"/>
Digital Service	<input checked="" type="checkbox"/>	Sales Support	<input checked="" type="checkbox"/>	Remote	<input checked="" type="checkbox"/>	Other	<input checked="" type="checkbox"/>

PO/Quote Number:

If applicable

PMA Type

If applicable

Contract No.

If applicable

## Details of Work / Test

## Condition / Status

- Unpack ตรวจสอบเครื่อง ไม่พบความเสียหาย

OK

- ตรวจสอบ Accessory kit

OK

- ตรวจสอบ น้ำยาละลาย ที่ Alkali, ที่ น้ำยาล้าง แก้ว เครื่อง

OK

- ตรวจสอบ เครื่อง ตาม IQ, OQ, PQ

OK

Instrument Ready for Use

OK

Not OK

If not OK, Comment

Part No:

Batch

Description

Qty

I confirm this report is accurate and complete

Signed FOSS

Pannipa O.

Signed Customer

Karnphong

Name

Pannipa Onnom

Name

Karnphong Boonpiang

Would you be willing to participate in a brief survey in order to tell us how we performed?

Email

เอกสารไม่ควบคุม

# FOSS

## Customer Service Report

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Report No:

6534

Date:

25/7/2022

**Customer:**

United Analyst and Engineering

Address:

10194

**Instrument:**

KT 9100

**Serial:**

91849052

Hours

### Travel To Customer

**Start**

952

0.5

## Labour

0 - 10 Am

i hr

1-4 22

Travel From Customer

9.36

9.30

4) in

Job Type							
Application		Special		Standard			
Normal	☒	Courtesy Visit	☒	Installation	☒	Training	☒
Distributor	☒	PMA Onboarding	☒	Quote	☒	In House	☒
Internal	☒	Warranty	☒	Repair	☒	PM	☒
Digital Service	☒	Sales Support	☒	Remote	☒	Other	☒

**PO/Quote Number:**

1. *Journal of the American Medical Association*, 1990; 263: 1033-1036.

PMA Type

If applicable

Contract No.

## 2. Application

Details of Work / Test		Condition / Status
Avic 1076 - Software - program Editor - mr Setting - Manual Run - User maintenance - Run Blank - Run Recovery		Done
Instrument Ready for Use	<input checked="" type="radio"/> OK <input type="radio"/> Not OK	Test OK Comment

[illegible]

**I confirm this report is accurate and complete**

Signed FOSS

**Signed Customer**

Name \_\_\_\_\_

*Tinidula* common

Name \_\_\_\_\_

Kannhang Boonpaang

*Would you be willing to participate in a brief survey in order to tell us how we performed?*

1000

## เอกสารไม่ควบคุม

## Kjeltec™ 8100 Distillation Unit

**This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.**

### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

### 2 Purpose

This installation Qualification is designed to assure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable
- The instrument is assembled and configured correctly
- Suitable electricity and water are supplied to the instrument, see table 2 for requirements.

### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	918 89052

#### Dedicated Analytical Solutions

**FOSS Analytical A/S**  
69 Slangerupgade  
DK-3400 Hillerød  
Denmark

Tel +45 7010 3370  
Fax +45 7010 3371  
E-mail support@foss.dk  
Web www.foss.dk

**FOSS Analytical AB**  
Box 70  
SE-263 21 Höganäs  
Sweden

Tel +46 42 361500  
Fax +46 42 340349  
E-mail support@foss.dk  
Web www.foss.dk



## 4 Control of Received Equipment

### 4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write “Y” in the right column of the table immediately following.

Packing List Item	Acceptance Criteria	Pass/Y/N)
Kjeltec 8100 Distillation Unit	No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Accessory kit, according to packing list	Included. No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Handling device for digestion tube	Included. No visible damage.	Y
Tanks with level sensors for Waste, Alkali and Water	Included. No visible damage.	Y
Receiver flask	Included. No visible damage.	Y
One digestion tube 250ml One digestion tube 100 ml	Included. No visible damage.	Y
Tube adapter	Included. No visible damage.	Y
User manual	Kjeltec 8100 Distillation Unit	Y
Owners guide	Kjeltec 8100 Distillation Unit	Y
Quick guide	Kjeltec 8100 Distillation Unit	Y
Spare parts manual	Kjeltec 8100 Distillation Unit	Y
Application notes	AN 300 included AN 303 included	Y

## 5 Installation

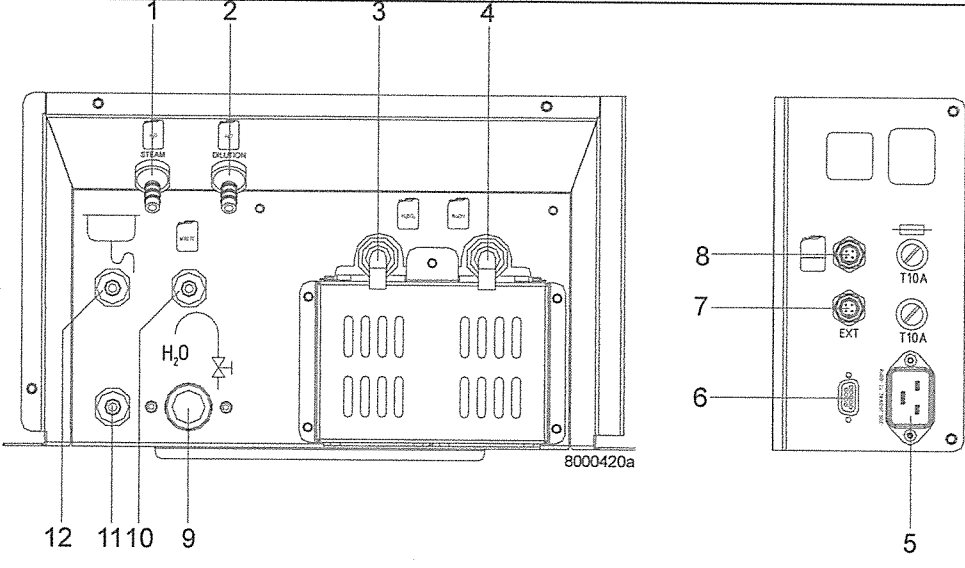
### 5.1 The equipment must be installed in a suitable location with power, water and draining available

Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write “Y” in the right column of the table immediately following.

Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions 48x58x69 cm	Y
AC supply available for instrument	200-240 V 50/60Hz	Y
Current	10 A	Y
Cold water supply available	2 L/min at 30°C	Y
Drain	For cooling water and waste (depending on local waste disposal legislation)	Y
Ambient temperature	Max. 40°C	Y
Ambient humidity	Max. 80% relative	Y
Internal fuses	T10A AH	Y

## 5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write “Y” in the right column of the table immediately following.

Instrument Tubing Connections	Acceptance Criteria	Pass (Y/N)
 <p>1. Deionised water in (steam generator)</p> <p>2. Deionised water in (dilution water)</p> <p>3. *) Receiver solution in</p> <p>4. Alkali in</p> <p>5. Power</p> <p>6. Not used</p> <p>7. External titration module</p> <p>8. Level sensors</p> <p>9. Cooling water in (tap water)</p> <p>10. Waste water out (tube drain vessel)</p> <p>11. Drain</p> <p>12. Cooling water out (tap water)</p> <p>*) Only on Kjeltrec 8200</p>	Visual verification by installer	Y



### 5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start up procedure and check that the expected response is obtained. If so, write “Y” in the right column of the table immediately following.

Action	Expected Response	Pass (Y/N)
Switch on the power	The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software.	Y
	After start-up, Program 1 is loaded and the Analyse menu is displayed.	Y
Turn on the cold water tap	No visible reaction	Y
Press the <b>“Manual”</b> view	The Manual menu is opened	Y
Open the door with the handle, place the test tube and receiver flask in position. Close the door.		Y
Select <b>Dilution</b> and press <b>Start</b>	Water is added to the tube	Y
Select <b>Alkali</b> and press <b>Start</b>	Alkali is added to the tube	Y
Select <b>Steam</b> and press start	After heating up, steam is entering the tube	Y
Select <b>Drain</b> and press <b>Start</b>	The tube is drained	Y

## 6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below.  
If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Installed By: Pannipa Onnom

Company: Foss SEA

Customer Name: United Analyst and Engineering

Company: United Analyst and Engineering

Date completed: July 25, 2022

## Kjeltec™ 8100 Distillation Unit

**This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.**

### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical Application Notes.

### 2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz	91889052

#### Dedicated Analytical Solutions

**FOSS Analytical A/S**  
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DK-3400 Hillerød  
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E-mail [support@foss.dk](mailto:support@foss.dk)  
Web [www.foss.dk](http://www.foss.dk)



## 4 Performance

### 4.1 Verify the dispensed volumes of reagents

**Note!** To verify the dispensed volumes of reagents a triple test should be done to be statistic correct. Then calculate a mean value.

1. Choose “Manual” in the menu. (When starting up the instrument Program 1 is loaded)
2. Open the safety door by pressing **Open** and place a tube in the instrument. Close the safety door.

#### Water

1. Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

**Note!** If the water volume needs to be calibrated, go to 4.8.5 Dilution Pump Calibration in the User Manual.

#### Alkali

1. Press **Alkali** and then press **Start**. 50 ml of alkali will be filled into the tube.
2. Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	<u>83</u> ml <u>83</u> ml <u>82</u> ml Mean <u>82.67</u> ml	76- 84 ml	Y
Alkali volume	<u>52</u> ml <u>52</u> ml <u>53</u> ml Mean <u>52.33</u> ml	47- 54 ml	Y

## 4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium ( $\text{NH}_4^+$ ) into ammonia ( $\text{NH}_3$ ) by using an alkali ( $\text{NaOH}$ ) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following.

### Chemical Check

Use ammonium sulphate ( $(\text{NH}_4)_2\text{SO}_4$ , purity > 99.5 % \*)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (99.5 %) = 21.09% \*)

### Analysis conditions according to AN 300

Water	80 ml
Alkali	50 ml $\text{NaOH}$ (40%w/w)
Receiver solution	30 ml boric acid (4%)
Distillation time	5 minutes
SAfE	5 seconds
Titrant	0.2N $\text{HCl}$

### For reagent preparation see Appendix A

1. Start the instrument and run two blanks without chemicals according to above analysis conditions, distil into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0,2 ml continue with the recovery tests:
2. Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
3. Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
4. Calculate the recovery according to below equations. Expected results of recovery should be  $100\% \pm 1\%$ .

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. <u>0.08</u> ml 2. <u>0.14</u> ml	0.05-0.20 ml	Y
Recovery	1. <u>100.20</u> % 2. <u>100.30</u> % 3. <u>100.63</u> % 4. <u>99.01</u> % 5. <u>99.97</u> % 6. <u>100.09</u> %		
Accuracy	Mean Value: <u>100.03</u>	99-101%	Y
Precision	SD: <u>0.557</u>	SD <1%	Y

\*) **Note!** Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available

Purity	Nitrogen content
99,5%	21.09%
99,6%	21.12%
99,7%	21.14%
99,8%	21.16%
99,9%	21.18%

$$\% \text{ Nitrogen} = \frac{(ml_{\text{sample}} - ml_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} \nearrow 0.1005 \\ 21.72 \end{matrix}$$

$N$  = Normality of titrant to 4 places of decimal.

$$\% \text{ Recovery} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

mg sample

- ① ~~0.1592~~ 23.56
- ②
- ③
- ④
- ⑤
- ⑥



## 5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: \_\_\_\_\_

Company: \_\_\_\_\_

Customer Name: \_\_\_\_\_

Company: \_\_\_\_\_

Date completed: \_\_\_\_\_

## 7 Appendix A

### 7.1 Preparation of Reagents

#### 7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

#### 7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

- **Standard substance**

Weigh approx. 10 g of anhydrous sodium carbonate ( $\text{Na}_2\text{CO}_3$ ). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.

- **Indicator solutions**

Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1g bromocresol green in 100 ml methanol.

- **Procedure**

Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight ( $W_1$ ). Transfer the sodium carbonate to a receiver flask and add 40 ml of  $\text{H}_2\text{O}$  (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used ( $A_1$ ). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume

( $A_2$ ). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume ( $A_3$ )

**Note!** Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)

## 7.2 Calculation

$$\text{Molarity (M)} = \frac{18,870 \times W_1}{(A_1 + A_2 + A_3)}$$

**Note!** Concentration must be accurate to four digits, i.e. 0.2000 M.

**Note!** The colour change of this official procedure (AOAC 936.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

## 7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05-0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5-6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

**Note!** The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 - 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

1. Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant x 40
2. Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
3. To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might create irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.



## **Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digester**

### **1 Scope**

This PQ applies to the Digestion system 2508/2520 (including exhaust and scrubber unit) and Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The user of the instrument performs the PQ.

### **2 Intended Use**

The Digestion system (including exhaust and scrubber) and Kjeltec 8100 Distillation Unit are intended for laboratory use analyzing parameters as specified in FOSS Application Notes.

### **3 Purpose**

The guidelines are intended to assist the user in successfully developing Performance Qualifications for the specific application(s) to which the instrument is applied.

The Performance Qualification (PQ) includes the process of demonstrating that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its routine use. Main activities in the PQ phase are:

- Preventive maintenance
- On-going verification tests

This document suggests routines to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local routines for similar equipment.

### **4 Definition of Test Procedures**

#### **4.1 Preventive Maintenance**

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 5. Maintenance. A yearly service is recommended (service agreement).

Maintenance of the Digestion block (including exhaust and scrubber) should be performed according to instruction in the user manual, see User Manual Tecator Digester, chapter 5. Maintenance.

#### **Dedicated Analytical Solutions**

**FOSS Analytical A/S**  
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Fax +46 42 340349  
E-mail [support@foss.dk](mailto:support@foss.dk)  
Web [www.foss.dk](http://www.foss.dk)

## 4.2 Ongoing Qualification Tests

### Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding a salt ( $K_2SO_4$ ) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept; please follow recommendation in AN 300 or suggested procedures for a specific kind of sample material.

The block temperature itself can be controlled external by inserting a temperature probe in the intended hole in the aluminium block (front row of holes).

Use the reagents and method procedure specified in AN 300. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or demineralised water or water of equivalent purity.

*Suggested standard material for internal quality control:*

Ammonium sulphate  $[(NH_4)_2SO_4]$ , min. 99.5 % (mass fraction), with certified purity.

**Note: The above chemical is usually readily available with a certificate specifying the purity.**

Alternatively ammonium iron(II) sulphate,  $(NH_4)_2 Fe (SO_4)_2 \times 6 H_2O$ , with certified purity may be used.

Tryptophan ( $C_{11}H_{12}N_2O_2$ ), minimum assay 99 % (mass fraction). Nitrogen content 137.2 g/kg. Do not dry in an oven before use.

Acetanilide ( $C_8H_9NO$ ), minimum assay 99 % (mass fraction). Nitrogen content 103.6 g/kg. Do not dry in an oven before use.

Sucrose, ( $C_{12}H_{22}O_{11}$ ), with a nitrogen content of not more than 0.002 % (mass fraction). Do not dry in an oven before use.

### Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 2 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

**Note: The amount of titrant used in the blank test should always be greater than 0.0 ml. Blanks within the same laboratory should be consistent across time.**

## 4.3 Recovery Tests

Regularly run recovery studies to check the accuracy of procedure and equipment:

- *Nitrogen loss.* - Use 0.12 g ammonium sulphate and 0.67 g sucrose per flask weighted to the nearest 0.1 mg. Add all other reagents as stated in the method currently used ( $Kjeltabs$ ,  $H_2SO_4$ , etc). Digest and distil under same conditions as for sample. Recoveries shall be >99 %.
- *Digestion efficiency* - Use a test portion of minimum 0.15 g of tryptophan or acetanilide and 0.67 g sucrose per flask weighed to the nearest 0.1 mg. Determine the nitrogen content according to the current procedure in use. The recoveries of tryptophan shall be >98.5 %; the recoveries of acetanilide shall be >99.5 %.
- *Distillation and titration efficiency* – Distil 0.10 – 0.15 g  $\pm 0.0001$  g ammonium sulphate, omitting the digestion step. The recoveries should be >99.5 %.

**Note: Results less than 98.5 % or more than 101.0 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimals accuracy according to procedure in AN 300)**

## External Quality Control Program

It is recommended to participate in an external quality control program, such a proficiency program or ring test, with equivalent sample material as analysed within the laboratory.

## Calculation and Expression of Results

$$w_n = \frac{14.007(V_s - V_b)N \times 100\%}{m}$$

Where:

$w_n$  is the nitrogen content of the sample, expressed as a percentage by mass.

$V_s$  is the numerical value of the volume of the hydrochloric acid standard volumetric solution) used in the sample test, in milliliters, expressed to the nearest 0.05 ml.

$V_b$  is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in milliliters, expressed to the nearest 0.05 ml.

$N$  is the numerical value of the exact normality of the hydrochloric acid standard volumetric solution, expressed to four decimal places.

$m$  is the numerical value of the mass of the test portion , in milligrams, expressed to the nearest 1 mg for sample weights >1 g or to the nearest 0.1 mg for sample weights <1 g.

## 5 Maintenance

### 5.1 Maintenance Kjeltex™ 8100

See instructions in User Manual - Kjeltex 8100/8200, chapter 5 Maintenance.

### 5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 5 Maintenance.

## 6 The Maintenance Record Charts

This record charts are provided to assist you in keeping your system in good working order. Please make copies and use them regularly as they can often help us to help you in the unlikely event a system malfunction.



## 6.1 FossCare™ Service Log

[illegible]

## เอกสารไม่ควบคุม

**D** Applicable for FOSS sales and service companies.

[illegible]

Applicable for FOSS sales and service companies.









6.2.4 Additional Maintenance

Date	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Cleaning of Steam Generator																				
Signature																				
Number of analyses																				

เอกสารไม่ควบคุม







## Verification Certificate

Page 1 of 4

**Certificate No.:** 2202361-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

**Equipment:** HEATING BLOCK DIGESTION

**Manufacturer:** FOSS

**Model:** 2520

**Serial No.:** 91794469

**ID No.:** UAE.WAS.011/2560


**Order No.:** 2202361

**Operation No.:** 2202361-001

**Date of Receipt:** 4 April 2022

**Date of Calibration:** 4-6 April 2022

**Calibrated by** Mr.Nuttapol Niyomchat  
Specialist

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

Manager, Division of Calibration Laboratory

**Date of Issue:** 11 April 2022

Responsible for the Technical Management Team

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

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

## Verification Report

**Certificate No.:** 2202361-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 4-6 April 2022

Page 2 of 4

**Location:** Laboratory Room, NATIONAL FOOD INSTITUTE  
**Environment Condition:** Ambient Temperature ( 25 ± 3 ) °C  
Relative Humidity ( 55 ± 15 ) %  
Line Voltage ( 220 ± 10 ) Volt

### Condition of this results of Calibration:

1. This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
  - The temperature scale used was based on ITS - 90 .
  - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A/34901A	MY44045576/MY41194453	TC21/0041	24-Apr-2022	N.M. Technical Center Laboratory
	Type R	TC#101-103 / CH#101-103			

3. This certificate is traceable to international system of units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

UUC\* Description

Time of Record - Hour 30 Minute At 380 °C

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

## Verification Report

**Certificate No.:** 2202361-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS

**Date of Calibration:** 4-6 April 2022

Page 3 of 4

**Calibration point:** 380 °C

**Calibration result:**

**Reporting of Temperature**

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.13	376.48	1.5
2	380	380	0.12	376.58	1.5
3	380	380	0.12	376.51	1.5
4	380	380	0.14	376.70	1.6
5	380	380	0.18	376.81	1.6
6	380	380	0.12	377.23	1.6
7	380	380	0.12	377.37	1.5
8	380	380	0.13	376.68	1.5
9	380	380	0.14	376.72	1.5
10	380	380	0.18	378.97	1.6
11	380	380	0.25	378.79	1.6
12	380	380	0.11	377.14	1.6
13	380	380	0.19	379.65	1.6
14	380	380	0.16	379.61	1.6
15	380	380	0.16	378.66	1.6
16	380	380	0.15	379.18	1.6
17	380	380	0.23	377.39	1.6
18	380	380	0.11	377.71	1.6
19	380	380	0.22	376.64	1.6
20	380	380	0.16	376.56	1.6

**Note:**

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

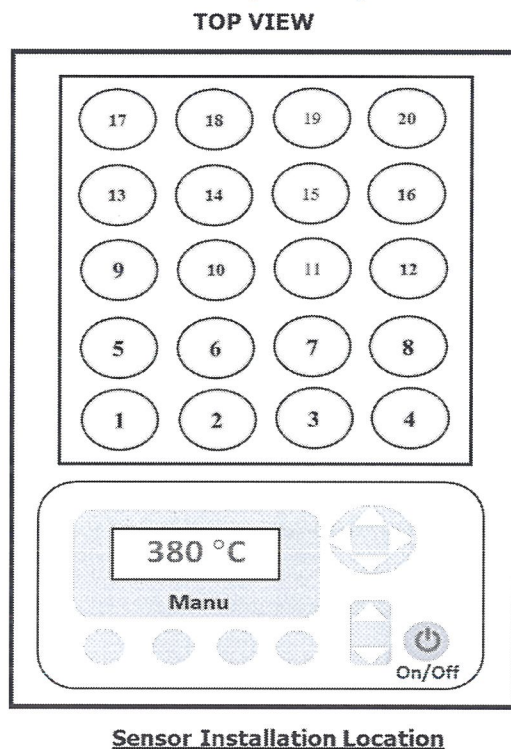


## Verification Report

**Certificate No.:** 2202361-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
Model: 2520 Serial No.: 91794469  
Resolution: 1 °C ID No.: UAE.WAS.011/2560  
Manufacturer: FOSS  
**Date of Calibration:** 4-6 April 2022  
**Calibration point:** 380 °C  
**Calibration result:** Continued

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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

----- End -----

# Performance Verification Certificate

Job No. LSPR2208846

**Equipment :** AA SPECTROMETER      **Customer :** Environment & Laboratory Co.,Ltd.  
**Manufacturer :** GBC Scientific      **Location :** Laboratory  
**Model Type :** SavantAA      **Verification Date :** 10 October 2022  
**Serial No. :** A8631

## Result of Verification

Test Description	Tolerance	Reading	Result
1. EHT Photometric Noise	< 350 V -	253 V -	PASS
2. Wavelength Accuracy , Cu 324.7 nm	± 0.20 nm	324.80 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.17 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.22 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.52 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	1.05 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs BC mode with gauze BC mode without gauze * Difference between With gauze and without gauze	± 0.02 Abs   < 0.02 Abs	0.489 Abs 0.0007 Abs 0.0009 Abs -0.0002 Abs	PASS   PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs	0.884 Abs	PASS
9. %RSD	< 0.5 %	0.19 %	PASS

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ SPCRT

**Verification By :** Mr. NIWAT SUPATANIT  
**Issued Date :** 12 October 2022

**Signatory :** 

DKSH Technology Limited  
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
 Phone +662 639 7000, Fax +662 333 1026  
 Email: [marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com) Website: [www.dksh.com](http://www.dksh.com)

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด  
 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260  
 โทรศัพท์ +662 639 7000 โทรสาร +662 333 1026  
 อีเมล [marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com) [www.dksh.com](http://www.dksh.com)



## PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

### ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 10/10/22

<b>Customer :</b> บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลบบอราตอรี จำกัด	<b>Manufacturer :</b> GBC Scientific Equipment Pty Ltd.
<b>Address :</b> 53/3 หมู่ 3 ถนนเรวดี ตำบลตลาดขวัญ อำเภอเมือง นนทบุรี จังหวัดนนทบุรี 11000	<b>Model :</b> SavantAA
<b>Contract :</b> คุณ อลิสา ทรงสวัสดิ์	<b>Serial No :</b> A8631
	<b>Location :</b> Laboratory

#### Power on switch and initial status

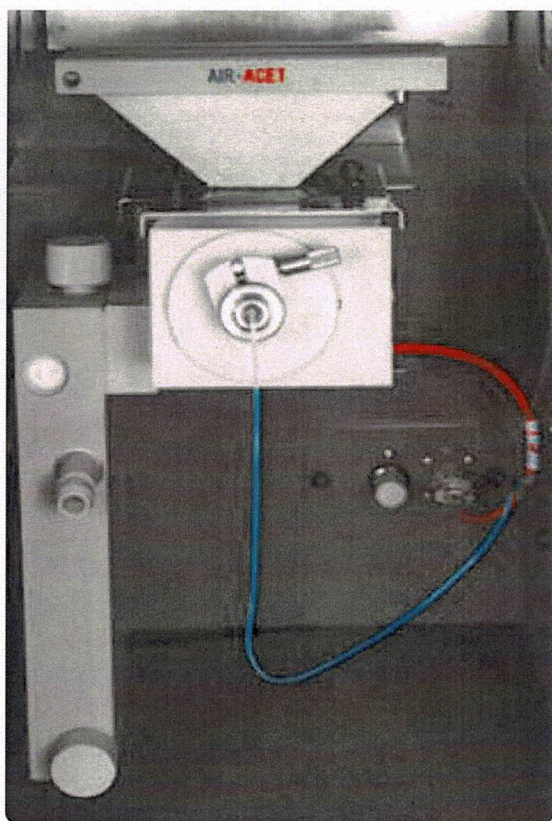
Instrument Ready สถานะเครื่องพร้อมใช้งาน

Preventive Maintenance	Pass	Fail	Remarks
<i>Electrical Voltage</i>			
- Main voltage ( power supply check 220V $\pm$ 10V ).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	236.5 VAC
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Environment</i>			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	25.2 C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	55%
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Optics</i>			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clean
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
<i>Gas system</i>			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4 Bar
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9 Bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Computer</i>			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 10
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SavantAA3.11
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

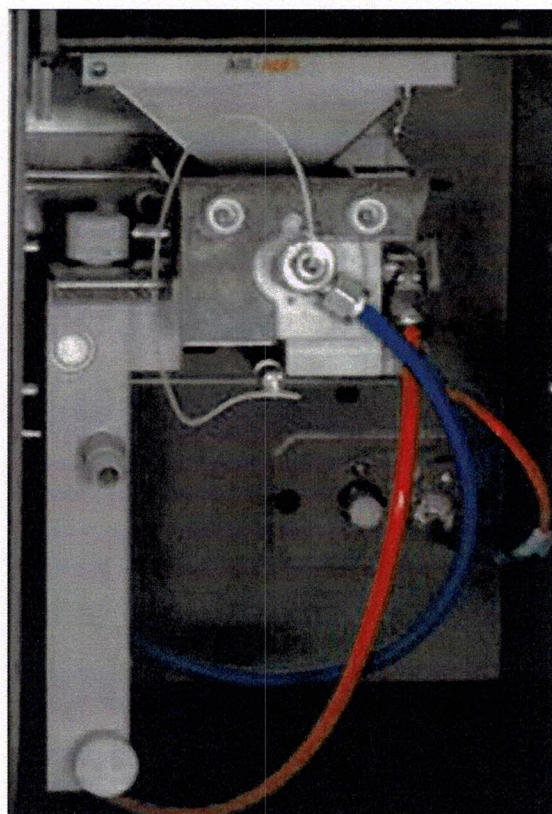


## Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
<i>Flame system</i>			
- <b>Burner head</b> (Clean the jaws using GBC Burner Cleaning Card).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Burner mount</b> (Check for wear. Replace the burner retaining plate if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Spray chamber</b> (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Safety interlocks</b>			
➢ Burner (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
➢ Spray chamber (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Pressure relief bung.</b> (Check or replace O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Nebulizer</b> (Clean and check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Gas connections</b> (Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Capillary tube</b> (Check bends and clog).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Liquid trap</b> (Drain / clean and replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready



Gas Flow Optimisation	Pass	Fail	Remark
- Bleed gas lines ( Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Ignitor (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Extinguish (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner Adjuster ( Check operation for ABR Spray Chamber)			
➢ Burner Angle (°C)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Workhead Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Workhead Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

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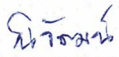
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Signature	
<b>Customer</b> ..... ( ..... )	<b>Date :</b> 
<b>Service Engineer</b>  ..... ( Mr. NIWAT SUPATANIT )	<b>Maintenance Date :</b> 10/Oct/2022

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm $\pm$ 0.2 nm	324.80 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	Cs 852.10 nm $\pm$ 0.2 nm	852.17 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm $\pm$ 0.02 nm	0.22 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	0.5 nm $\pm$ 0.05 nm	0.52 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	1.0 nm $\pm$ 0.10 nm	1.05 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
3. EHT	<350V	253 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ Gauze 0.49 A.U.	Reading $\pm$ 10% of calibrated value.	0.4891 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: 0.0007 Abs. BC on without gauze: 0.0009 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8839 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	<0.5% RSD	0.19 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A

Note:

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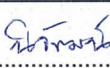
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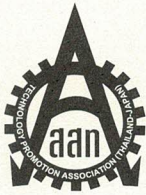
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Signature	
Customer ..... ( ..... )	Date :
Service Engineer  ..... ( Mr. NIWAT SUPATANIT )	Maintenance Date :  10/Oct/2022





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



Cert. No.: 22TM1185

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Autoclave

**Manufacturer :** Rexall

**Model :** LS-2D

**Serial No. :** 04131

**ID No. :** AUT-01

**Submitted by :** Environment & Laboratory Co.,Ltd.  
40 Soi Liangmueangnonthaburi 13,  
Talad Kwan, Mueang,  
Nonthaburi 11000

**Location :** Room No. 205

**Received Order :** 14 July 2022

**Calibration Date :** 15 July 2022

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

*Malee*

Approved Signatory

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

**Issue Date :**

27 July 2022

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

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

A 0043527





Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-0250OC-7

Cert. No.: 22TM1185  
Page.: 2 of 3

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1 ) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

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

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

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

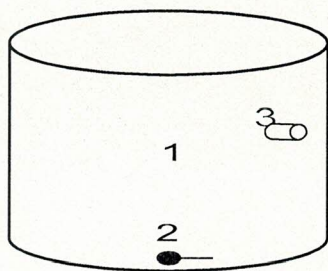
(\*\* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

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

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

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

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



	<u>Environmental</u>		
	( °C )	( %R.H. )	( Volt )
<b>Beginning of Calibration</b>	27	68	224
<b>Finished of Calibration</b>	28	63	223

<u>Position</u>	<u>Description</u>	<u>Ref. Std. ID No.:</u>
1 =	Center of chamber	20-01TC-01
2 =	Temperature sensor	20-01TC-02
3 =	Exhaust port	20-01TC-03

*Mah.*





Equipment : Autoclave  
Condition As-Received : Used Item  
Reference : 2207-0250OC-7

Cert. No.: 22TM1185

Page.: 3 of 3

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

Operating parameter Set : Temperature = 120 °C  
Sterilization period = 15 minute

UUC* Setting ( °C )	UUC* Reading ( °C )	Position	Average* Standard Reading ( °C )	Stability ( ± °C )	Pressure Reading ( kg/cm <sup>2</sup> )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
120	-	1	121.644	0.82	1.2	1.2	2
		2	121.524				
		3	121.570				

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

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

**UUC\*** : Unit Under Calibration

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

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

-o0o-

*Maha .*

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## Avio 200

<b>Customer :</b>	<u>Environment &amp; Laboratory</u>	<b>Date Tested:</b>	<u>September 9, 2022</u>
		<b>Recommendation Recertification</b>	
<b>Address :</b>	<u>40 Soi Liangmueangnon 13</u>	<b>Period</b>	<u>12</u> <b>Months</b>
	<u>Talad Kwan, Mueang</u>	<b>Recertification Due:</b>	<u>September 9, 2023</u>
	<u>Nonthaburi 11000</u>	<b>Date Last Certified:</b>	<u>January 14, 2021</u>
<b>User Name:</b>	<u>K. Alisa</u>	<b>Visit Number:</b>	<u>1 of 1</u>
<b>Phone:</b>	<u>086-568-4249</u>	<b>PerkinElmer Phone:</b>	<u>02-719-6420 ext 206</u>
<b>E - Mail :</b>		<b>PerkinElmer Fax:</b>	<u>02-318-5597</u>

CONFIGURATION TESTED		
<b>MODEL</b>	<b>SERIAL NUMBER</b>	<b>SOFTWARE</b>
<u>Avio 200</u>	<u>079S16062402</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Method</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>Jun 30,2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>Nov 30, 2023</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

**MAINTENANCE AND IPV TEST CERTIFICATE MODEL****Avio 200****SERIAL NUMBER:** 079S16062402**DATE TESTED:**September 9, 2022**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL

## Avio 200

SERIAL NUMBER: 079S16062402		DATE TESTED: September 9, 2022	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV			
As	193.696 nm	≤ 0.009 nm	0.00765 nm
Ni	231.604 nm	≤ 0.011 nm	0.00885 nm
Ni	341.476 nm	≤ 0.015 nm	0.01268 nm
Spectral Resolution : VIS			
Ba	455.403 nm	≤ 0.020 nm	0.01519 nm
Precision			
Zn	206.200 nm	% RSD ≤ 1.0 %	0.58 %
Mg	280.271 nm	% RSD ≤ 1.0 %	0.17 %
Mg	285.213 nm	% RSD ≤ 1.0 %	0.18 %
Ba	455.403 nm	% RSD ≤ 1.0 %	0.22 %
Detection Limits : Axial			
Tl	190.801 nm	3(sd)	0.25 ppb
As	193.696 nm	3(sd)	1.92 ppb
Se	196.026 nm	3(sd)	0.99
Pb	220.353 nm	3(sd)	1.24 ppb
Detection Limits : Radial			
As	193.696 nm	3(sd)	1.12 ppb
Zn	213.857 nm	3(sd)	0.06 ppb
Mn	257.610 nm	3(sd)	0.00 ppb
La	379.478 nm	3(sd)	0.09 ppb
Ba	455.403 nm	3(sd)	0.01 ppb
Ba	493.408 nm	3(sd)	0.01 ppb
BEC : Axial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	4.50 ppb
BEC : Radial (IB X 1000)/(IS-IB)			
Mn	257.610 nm	≤ 30 ppb	5.91 ppb



**MAINTENANCE AND IPV TEST CERTIFICATE MODEL****Avio 200****SERIAL NUMBER:** 079S16062402**DATE TESTED:** September 9, 2022**Remarks :**

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,  
including warranty terms.

**Service Department PerkinElmer Ltd.**

Customer Service Engineer:

(

Duang Hiransuk

)

Service Engineer



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



Cert. No.: 22TM1184

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** Memmert

**Model :** BM 500

**Serial No. :** D593.0342

**ID No. :** CHI-002

**Submitted by :** Environment & Laboratory Co.,Ltd.  
40 Soi Liangmueangnonthaburi 13,  
Talad Kwan, Mueang,  
Nonthaburi 11000

**Location :** Room No. 204

**Received Order :** 14 July 2022

**Calibration Date :** 15 July 2022

**Ambient Temperature :** (  $26 \pm 10$  ) °C

**Relative Humidity :** (  $50 \pm 30$  ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

Approved Signatory

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

**Issue Date :**

27 July 2022

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

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

A 0043524





Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2207-02500C-4

Cert. No.: 22TM1184  
Page.: 2 of 3

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

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

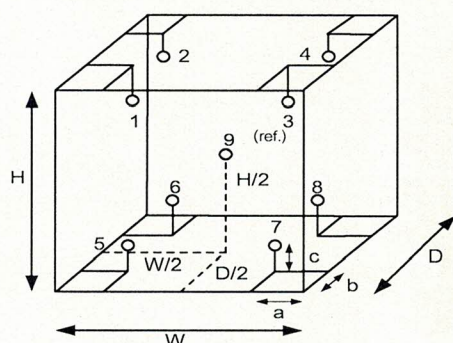
3. This certification is traceable to the International System of Unit.

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

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

**Fresh air setting :** Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	23	22
REL.Humid. ( % )	67	66
AC Supply ( Volt )	223	224



Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	1RTD-2/7
8	1RTD-2/8
9 (ref.)	1RTD-2/9

**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.40 m  
W = 0.56 m  
H = 0.48 m  
Capacity = 0.11 m<sup>3</sup>

*Mahu*





Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2207-0250OC-4  
**Result of Calibration :-** ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM1184

Page.: 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.035	0.55	0.63	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	35.100	34.653	35.131	34.871	35.067	34.888	35.092	35.235	35.170

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

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

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

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

**UUC\*** : Unit Under Calibration

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

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

-o0o-

Malu





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



Cert.No.: 22CHO415

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Spectrophotometer  
**Manufacturer :** Hach  
**Model :** DR 3900  
**Serial No. :** 1988383  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 14 July 2022  
**Calibration Date :** 14 July 2022  
**Reference :** 2207-0250OC-11  
**Submitted by :** Environment & Laboratory Co.,Ltd.  
40 Soi Liangmueangnonthaburi 13 Talad Kwan,  
Mueang, Nonthaburi 11000  
**Calibration Place :** Room No. 304  
**Ambient Temperature :** ( 27.5 - 27.2 ) °C (On-Site)  
**Relative Humidity :** ( 53.2 - 53.8 ) % (On-Site)  
**Calibration Procedure :** In - house method :  
CP-OCH4 based on ASTM E 275-01

**Calibrated by :** Saithip Meangmai

**Approved by :**

*Malee*

Approved Signatory

- ( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul

**Issue Date :** 27 July 2022

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

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A 0043531





Cert. No. : 22CHO415

Page : 2 of 3

**Condition of calibration result**

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	8331	86623	08 Sep 2022
2. Wavelength Standard set	14536	89302	19 Jan 2023
3. Wavelength Standard set	14537	89303	19 Jan 2023

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

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 5 nm  
Scan Speed : - nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

<b>Certified Values of Reference Material ( nm )</b>	<b>UUC Reading ( nm )</b>	<b>Uncertainty of Measurement ( <math>\pm</math> nm )</b>	<b>Coverage Factor <i>k</i></b>
418.40	418	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.66	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00

*Malu*





Cert. No. : 22CHO415

Page : 3 of 3

**Calibration Results : without adjustment**

**Photometric Accuracy**

Wavelength (nm)	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( $\pm$ Abs )	Coverage Factor <i>k</i>
420.0	Zero	0.000	0.0028	2.00
	0.5723	0.571	0.0034	2.00
	0.7522	0.750	0.0031	2.00
	1.0907	1.089	0.0033	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5616	0.560	0.0034	2.00
	0.7345	0.732	0.0032	2.00
	1.0646	1.063	0.0034	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5118	0.513	0.0034	2.00
	0.6773	0.678	0.0031	2.00
	0.9809	0.983	0.0034	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5228	0.522	0.0030	2.00
	0.6861	0.684	0.0030	2.00
	0.9941	0.992	0.0031	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5546	0.552	0.0029	2.00
	0.7159	0.714	0.0032	2.00
	1.0369	1.032	0.0030	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5401	0.538	0.0029	2.00
	0.6835	0.681	0.0030	2.00
	0.9889	0.987	0.0031	2.00

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

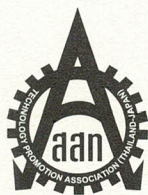
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k* , providing a level of confidence of approximately 95 %.

-o0o-

*Maku*

a 1119205





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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 22TM1183

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Water Bath

**Manufacturer :** Memmert

**Model :** WB22

**Serial No. :** I505.0053

**ID No. :** WAB-01

**Submitted by :** Environment & Laboratory Co.,Ltd.  
40 Soi Liangmueangnonthaburi 13,  
Talad Kwan, Mueang,  
Nonthaburi 11000

**Location :** Room No. 303

**Received Order :** 14 July 2022

**Calibration Date :** 14 - 15 July 2022

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

*Malee .*

Approved Signatory

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

**Issue Date :** 27 July 2022

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

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

A 0043523





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2207-0250OC-3

Cert. No.: 22TM1183  
Page.: 2 of 3

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1 ) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

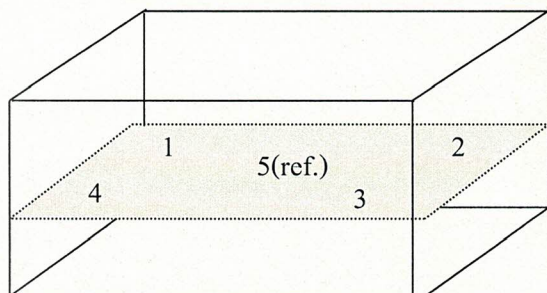
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

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

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

	<u>Environmental</u>		<u>AC Voltage Supply</u>
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	31	45	219
Finished of Calibration	30	52	218



Front

<u>Position :</u>	<u>Ref. Std. S/N.:</u>
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016

Malu





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2207-0250OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 22TM1183

Page.: 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.514	44.511	44.517	44.498	44.519
60.0	60.0	60.0	60.015	60.009	60.009	59.982	59.991

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Uncertainty ( ± °C )	Coverage Factor <i>k</i>
44.5	0.047	0.028	0.15	2
60.0	0.073	0.035	0.15	2

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

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

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

**UUC\*** : Unit Under Calibration

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

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

-o0o-

malu



# Performance Verification Certificate

Job No. LSPR2208846

**Equipment :** AA SPECTROMETER      **Customer :** Environment & Laboratory Co.,Ltd.  
**Manufacturer :** GBC Scientific      **Location :** Laboratory  
**Model Type :** SavantAA      **Verification Date :** 10 October 2022  
**Serial No. :** A8631

## Result of Verification

Test Description	Tolerance	Reading	Result
1. EHT Photometric Noise	< 350 V -	253 V -	PASS
2. Wavelength Accuracy , Cu 324.7 nm	± 0.20 nm	324.80 nm	PASS
3. Wavelength Accuracy , Cs 852.10 nm	± 0.20 nm	852.17 nm	PASS
4. Slit Width 0.2 nm	± 0.02 nm	0.22 nm	PASS
5. Slit Width 0.5 nm	± 0.05 nm	0.52 nm	PASS
6. Slit Width 1.0 nm	± 0.10 nm	1.05 nm	PASS
7. Standard Gauze Screen <u>0.49</u> Abs BC mode with gauze BC mode without gauze * Difference between With gauze and without gauze	± 0.02 Abs   < 0.02 Abs	0.489 Abs 0.0007 Abs 0.0009 Abs -0.0002 Abs	PASS   PASS
8. ABS Reading 5ppm,Cu	> 0.7 Abs	0.884 Abs	PASS
9. %RSD	< 0.5 %	0.19 %	PASS

We hereby certify that instrument complies with GBC factory specifications

Your satisfaction is our promise @ SPCRT

**Verification By :** Mr. NIWAT SUPATANIT  
**Issued Date :** 12 October 2022

**Signatory :** 

DKSH Technology Limited  
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
 Phone +662 639 7000, Fax +662 333 1026  
 Email: [marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com) Website: [www.dksh.com](http://www.dksh.com)

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด  
 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260  
 โทรศัพท์ +662 639 7000 โทรสาร +662 333 1026  
 อีเมล [marketing.tec.th@dksh.com](mailto:marketing.tec.th@dksh.com) [www.dksh.com](http://www.dksh.com)



## PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

### ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 10/10/22

<b>Customer :</b> บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลบบอราตอรี จำกัด	<b>Manufacturer :</b> GBC Scientific Equipment Pty Ltd.
<b>Address :</b> 53/3 หมู่ 3 ถนนเรวดี ตำบลตลาดขวัญ อำเภอเมือง นนทบุรี จังหวัดนนทบุรี 11000	<b>Model :</b> SavantAA
<b>Contract :</b> คุณ อลิสา ทรงสวัสดิ์	<b>Serial No :</b> A8631
	<b>Location :</b> Laboratory

#### Power on switch and initial status

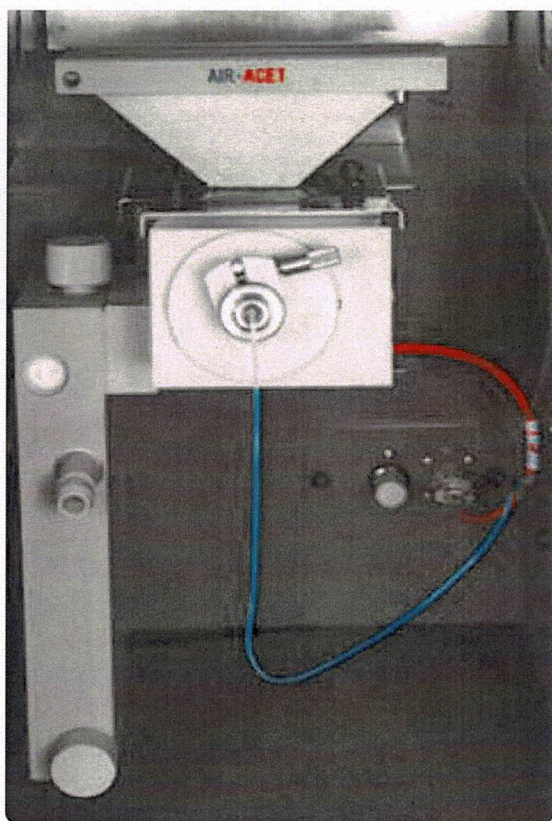
Instrument Ready สถานะเครื่องพร้อมใช้งาน

Preventive Maintenance	Pass	Fail	Remarks
<i>Electrical Voltage</i>			
- Main voltage ( power supply check 220V $\pm$ 10V ).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	236.5 VAC
- Power indicator light (Replace if faulty).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Power core (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- Fan (Clean or replace filter element as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Environment</i>			
- Temperature (10 to 35 deg.C)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	25.2 C
- Humidity (8 to 80%).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	55%
- Air Quality (No Dust)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
- No corrosive vapours present from laboratory sample preparation or external sources.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
<i>Optics</i>			
- Windows lens (Clean or replace as appropriate).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Clean
- Light Source (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- D2 Lamp (Check operation. Replace if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
<i>Gas system</i>			
- General (Tube and Fitting /Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Air Zero (Inlet pressure range 300-400 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4 Bar
- Acetylene (Inlet pressure range 55-96 kPa).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.9 Bar
- Nitrous oxide (Inlet pressure range 300-400 kPa).	<input type="checkbox"/>	<input type="checkbox"/>	
<i>Computer</i>			
- Operating system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Windows 10
- Software Version	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SavantAA3.11
- Verify that all computer links and installed software operate correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready

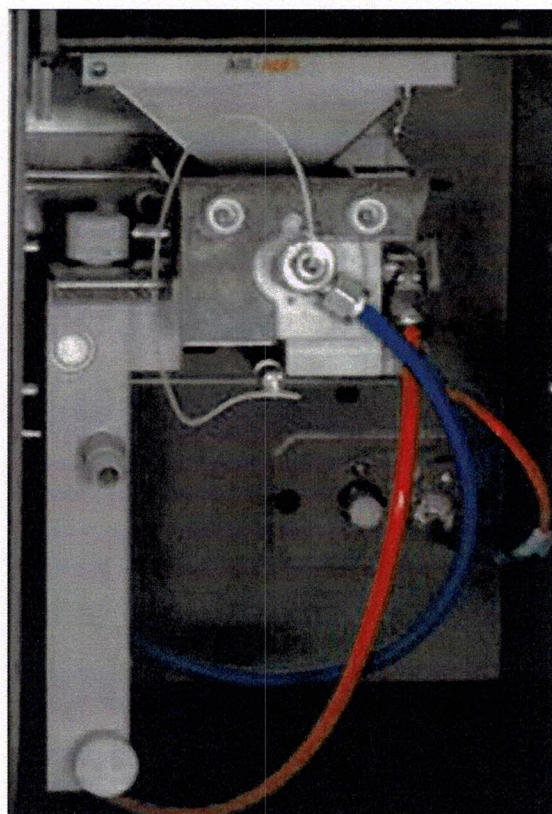


## Spray Chamber Type

☐ ABR Spray Chamber



☒ Standard Spray Chamber



Preventive Maintenance	Pass	Fail	Remark
<i>Flame system</i>			
- <b>Burner head</b> (Clean the jaws using GBC Burner Cleaning Card).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Burner mount</b> (Check for wear. Replace the burner retaining plate if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Spray chamber</b> (Visually inspect the bead for cracks, pitting or solid deposits. Check or replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Safety interlocks</b>			
➢ Burner (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
➢ Spray chamber (Check for Interlocks connector)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Pressure relief bung.</b> (Check or replace O-ring)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Nebulizer</b> (Clean and check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Gas connections</b> (Check for leaks).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Capillary tube</b> (Check bends and clog).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- <b>Liquid trap</b> (Drain / clean and replace O-ring kit).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready



Gas Flow Optimisation	Pass	Fail	Remark
- Bleed gas lines (Relieve pressure in the spray chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Ignitor (Ignite the flame several times to check ignition reliability. Replace the glow plug if required).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Extinguish (Check operation).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Horizontal movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Vertical movement (Check operation for STD. Spray Chamber).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Ready
- Burner Adjuster (Check operation for ABR Spray Chamber)			
➢ Burner Angle (°C)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Angle Zero (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Workhead Height (mm)	<input type="checkbox"/>	<input type="checkbox"/>	
➢ Workhead Centre (mm)	<input type="checkbox"/>	<input type="checkbox"/>	

Note:

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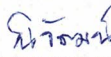
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Signature	
<b>Customer</b> ..... ( ..... )	<b>Date :</b> 
<b>Service Engineer</b>  ..... ( Mr. NIWAT SUPATANIT )	<b>Maintenance Date :</b> 10/Oct/2022

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. Wavelength accuracy (optic calibration check).	Cu 324.75 nm $\pm$ 0.2 nm	324.80 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	Cs 852.10 nm $\pm$ 0.2 nm	852.17 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
2. Slit width accuracy (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm $\pm$ 0.02 nm	0.22 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	0.5 nm $\pm$ 0.05 nm	0.52 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	1.0 nm $\pm$ 0.10 nm	1.05 nm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
3. EHT	<350V	253 V	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
4. Absorbance accuracy (absorbance calibration check). ➤ Gauze 0.49 A.U.	Reading $\pm$ 10% of calibrated value.	0.4891 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
5. Background correction (optics alignment check). difference between measurement with and without 0.49 A.U. gauze for 10 samples.	SavantAA <1% SensAA/XplorAA <2%	BC on with gauze: 0.0007 Abs. BC on without gauze: 0.0009 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
6. Sensitivity /noise flame test (aqueous Cu solution test under air-acetylene flame).	Cu 5 ppm >0.7 A.U.	0.8839 Abs.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A
	<0.5% RSD	0.19 %	<input checked="" type="checkbox"/>	<input type="checkbox"/>	N/A

Note:

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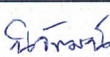
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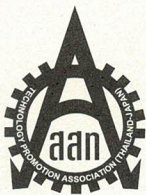
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Signature	
Customer ..... ( ..... )	Date :
Service Engineer  ..... ( Mr. NIWAT SUPATANIT )	Maintenance Date :  10/Oct/2022





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



Cert. No.: 22TM1185

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Autoclave

**Manufacturer :** Rexall

**Model :** LS-2D

**Serial No. :** 04131

**ID No. :** AUT-01

**Submitted by :** Environment & Laboratory Co.,Ltd.  
40 Soi Liangmueangnonthaburi 13,  
Talad Kwan, Mueang,  
Nonthaburi 11000

**Location :** Room No. 205

**Received Order :** 14 July 2022

**Calibration Date :** 15 July 2022

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Tawatchai Pama

**Approved by :**

*Malee*

Approved Signatory

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

**Issue Date :**

27 July 2022

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

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

A 0043527

# FOSS

## Customer Service Report

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

Report No: 6623

Date: July 26, 2022

Customer: United Analyst and Engineering

Address:

กรุงเทพฯ

Instrument: KT8100

Serial: 31889052

Hours

Travel To Customer

Start

8.00

Finish

8.30

30 mins.

Labour

8.00-12.00

3+3

13.00-16.00 = 6 hrs.

Travel From Customer

16.30

17.30

1 hrs.

### Job Type

Application		Special		Standard			
Normal	<input checked="" type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>	Installation	<input checked="" type="checkbox"/>	Training	<input checked="" type="checkbox"/>
Distributor	<input checked="" type="checkbox"/>	PMA Onboarding	<input checked="" type="checkbox"/>	Quote	<input checked="" type="checkbox"/>	In House	<input checked="" type="checkbox"/>
Internal	<input checked="" type="checkbox"/>	Warranty	<input checked="" type="checkbox"/>	Repair	<input checked="" type="checkbox"/>	PM	<input checked="" type="checkbox"/>
Digital Service	<input checked="" type="checkbox"/>	Sales Support	<input checked="" type="checkbox"/>	Remote	<input checked="" type="checkbox"/>	Other	<input checked="" type="checkbox"/>

PO/Quote Number:

If applicable

PMA Type

If applicable

Contract No.

If applicable

### Details of Work / Test

### Condition / Status

- Unpack ตรวจสอบเครื่อง ไม่พบความเสียหาย

OK

- ตรวจสอบ Accessory kit

OK

- ตรวจสอบ น้ำยา pH, น้ำยา Alkali, น้ำยา Clean และเครื่อง

OK

- ตรวจสอบ เครื่อง ตาม IQ, OQ, PQ

OK

Instrument Ready for Use

OK

Not OK

If not OK, Comment

Part No:

Batch

Description

Qty

I confirm this report is accurate and complete

Signed FOSS

Panipa O.

Signed Customer

Karnphong

Name

Panipa Onnom

Name

Karnphong Boonpiang

Would you be willing to participate in a brief survey in order to tell us how we performed?

Email

เอกสารไม่ควบคุม

# FOSS

## Customer Service Report

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Report No:

6534

Date:

25/7/2022

**Customer:**

United Analyst and Engineering

**Address:**

10194

**Instrument:**

KT 2100

Serial:

91889052

Hours

## Travel To Customer

## Start

9.00 ✓

0.5

## Finish

30

Labour

Q - 1293

t hr

1-4 sm

### Travel From Customer

4.3c

4) in

S. 30

Job Type							
Application		Special		Standard			
Normal	☒	Courtesy Visit	☒	Installation	☒	Training	☒
Distributor	☒	PMA Onboarding	☒	Quote	☒	In House	☒
Internal	☒	Warranty	☒	Repair	☒	PM	☒
Digital Service	☒	Sales Support	☒	Remote	☒	Other	☒

**PO/Quote Number:**

Applicant's:

**PMA Type**

If applicable

Contract No.

Application

Details of Work / Test		Condition / Status
ANALIS B276 - Software - program Editor - mp Setting - Manual Run - User maintenance - Run Blank - Run Recovery		Done
Instrument Ready for Use	<input checked="" type="radio"/> OK <input type="radio"/> Not OK	Print OK Comment

[illegible]

**I confirm this report is accurate and complete**

## Signed FOSS

**Signed Customer**

Name

Name

Would you be willing to participate in a brief survey in order to tell us how we performed?

1992

## เอกสารไม่ควบคุม



## Kjeltec™ 8100 Distillation Unit

**This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.**

### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

### 2 Purpose

This installation Qualification is designed to assure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable
- The instrument is assembled and configured correctly
- Suitable electricity and water are supplied to the instrument, see table 2 for requirements.

### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit	918 89052

#### Dedicated Analytical Solutions

**FOSS Analytical A/S**  
69 Slangerupgade  
DK-3400 Hillerød  
Denmark

Tel +45 7010 3370  
Fax +45 7010 3371  
E-mail support@foss.dk  
Web www.foss.dk

**FOSS Analytical AB**  
Box 70  
SE-263 21 Höganäs  
Sweden

Tel +46 42 361500  
Fax +46 42 340349  
E-mail support@foss.dk  
Web www.foss.dk

## 4 Control of Received Equipment

### 4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write “Y” in the right column of the table immediately following.

Packing List Item	Acceptance Criteria	Pass/Y/N)
Kjeltec 8100 Distillation Unit	No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Accessory kit, according to packing list	Included. No visible damage, received in undamaged FOSS Analytical's standard shipping container	Y
Handling device for digestion tube	Included. No visible damage.	Y
Tanks with level sensors for Waste, Alkali and Water	Included. No visible damage.	Y
Receiver flask	Included. No visible damage.	Y
One digestion tube 250ml One digestion tube 100 ml	Included. No visible damage.	Y
Tube adapter	Included. No visible damage.	Y
User manual	Kjeltec 8100 Distillation Unit	Y
Owners guide	Kjeltec 8100 Distillation Unit	Y
Quick guide	Kjeltec 8100 Distillation Unit	Y
Spare parts manual	Kjeltec 8100 Distillation Unit	Y
Application notes	AN 300 included AN 303 included	Y

## 5 Installation

### 5.1 The equipment must be installed in a suitable location with power, water and draining available

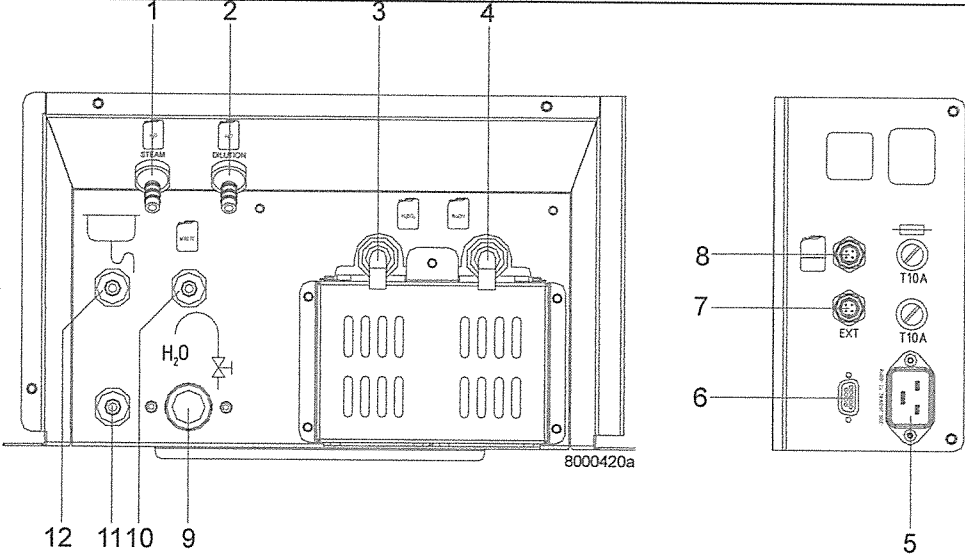
Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write “Y” in the right column of the table immediately following.

Location Requirements	Acceptance Criteria	Pass (Y/N)
Adequate space for instrument	Dimensions 48x58x69 cm	Y
AC supply available for instrument	200-240 V 50/60Hz	Y
Current	10 A	Y
Cold water supply available	2 L/min at 30°C	Y
Drain	For cooling water and waste (depending on local waste disposal legislation)	Y
Ambient temperature	Max. 40°C	Y
Ambient humidity	Max. 80% relative	Y
Internal fuses	T10A AH	Y



## 5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write “Y” in the right column of the table immediately following.

Instrument Tubing Connections	Acceptance Criteria	Pass (Y/N)
 <p>1. Deionised water in (steam generator)</p> <p>2. Deionised water in (dilution water)</p> <p>3. *) Receiver solution in</p> <p>4. Alkali in</p> <p>5. Power</p> <p>6. Not used</p> <p>7. External titration module</p> <p>8. Level sensors</p> <p>9. Cooling water in (tap water)</p> <p>10. Waste water out (tube drain vessel)</p> <p>11. Drain</p> <p>12. Cooling water out (tap water)</p> <p>*) Only on Kjelttec 8200</p>	<p>Visual verification by installer</p>	<p>Y</p>

### 5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start up procedure and check that the expected response is obtained. If so, write “Y” in the right column of the table immediately following.

Action	Expected Response	Pass (Y/N)
Switch on the power	The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software.	Y
	After start-up, Program 1 is loaded and the Analyse menu is displayed.	Y
Turn on the cold water tap	No visible reaction	Y
Press the <b>“Manual”</b> view	The Manual menu is opened	Y
Open the door with the handle, place the test tube and receiver flask in position. Close the door.		Y
Select <b>Dilution</b> and press <b>Start</b>	Water is added to the tube	Y
Select <b>Alkali</b> and press <b>Start</b>	Alkali is added to the tube	Y
Select <b>Steam</b> and press start	After heating up, steam is entering the tube	Y
Select <b>Drain</b> and press <b>Start</b>	The tube is drained	Y

## 6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below.  
If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Installed By: Pannipa Onnom

Company: Foss SEA

Customer Name: United Analyst and Engineering

Company: United Analyst and Engineering

Date completed: July 25, 2022



## Kjeltec™ 8100 Distillation Unit

**This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.**

### 1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical Application Notes.

### 2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

### 3 Identification

Description	Serial Number
Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz	91889052

#### Dedicated Analytical Solutions

**FOSS Analytical A/S**  
69 Slangerupgade  
DK-3400 Hillerød  
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Tel +45 7010 3370  
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E-mail [support@foss.dk](mailto:support@foss.dk)  
Web [www.foss.dk](http://www.foss.dk)

**FOSS Analytical AB**  
Box 70  
SE-263 21 Höganäs  
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Tel +46 42 361500  
Fax +46 42 340349  
E-mail [support@foss.dk](mailto:support@foss.dk)  
Web [www.foss.dk](http://www.foss.dk)

## 4 Performance

### 4.1 Verify the dispensed volumes of reagents

**Note!** To verify the dispensed volumes of reagents a triple test should be done to be statistic correct. Then calculate a mean value.

1. Choose “Manual” in the menu. (When starting up the instrument Program 1 is loaded)
2. Open the safety door by pressing **Open** and place a tube in the instrument. Close the safety door.

#### Water

1. Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

**Note!** If the water volume needs to be calibrated, go to 4.8.5 Dilution Pump Calibration in the User Manual.

#### Alkali

1. Press **Alkali** and then press **Start**. 50 ml of alkali will be filled into the tube.
2. Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Table 1 Volume control

Test	Result	Expected result	Passed (Y/N)
Water volume	<u>83</u> ml <u>83</u> ml <u>82</u> ml Mean <u>82.67</u> ml	76- 84 ml	Y
Alkali volume	<u>52</u> ml <u>52</u> ml <u>53</u> ml Mean <u>52.33</u> ml	47- 54 ml	Y

## 4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium ( $\text{NH}_4^+$ ) into ammonia ( $\text{NH}_3$ ) by using an alkali ( $\text{NaOH}$ ) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following.

### Chemical Check

Use ammonium sulphate ( $(\text{NH}_4)_2\text{SO}_4$ , purity > 99.5 % \*)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (99.5 %) = 21.09% \*)

### Analysis conditions according to AN 300

Water	80 ml
Alkali	50 ml $\text{NaOH}$ (40%w/w)
Receiver solution	30 ml boric acid (4%)
Distillation time	5 minutes
SAfE	5 seconds
Titrant	0.2N $\text{HCl}$

### For reagent preparation see Appendix A

1. Start the instrument and run two blanks without chemicals according to above analysis conditions, distil into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0,2 ml continue with the recovery tests:
2. Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
3. Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
4. Calculate the recovery according to below equations. Expected results of recovery should be  $100\% \pm 1\%$ .

Recovery test	Result	Expected result	Passed (Y/N)
Blank value (water blank)	1. <u>0.08</u> ml 2. <u>0.14</u> ml	0.05-0.20 ml	Y
Recovery	1. <u>100.20</u> % 2. <u>100.30</u> % 3. <u>100.63</u> % 4. <u>99.01</u> % 5. <u>99.97</u> % 6. <u>100.09</u> %		
Accuracy	Mean Value: <u>100.03</u>	99-101%	Y
Precision	SD: <u>0.557</u>	SD <1%	Y



\*) **Note!** Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available

Purity	Nitrogen content
99,5%	21.09%
99,6%	21.12%
99,7%	21.14%
99,8%	21.16%
99,9%	21.18%

$$\% \text{ Nitrogen} = \frac{(ml_{\text{sample}} - ml_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} \nearrow 0.1005 \\ 21.72 \end{matrix}$$

$N$  = Normality of titrant to 4 places of decimal.

$$\% \text{ Recovery} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

mg sample

- ① ~~0.1592~~ 23.56
- ②
- ③
- ④
- ⑤
- ⑥

## 5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

Deviation	Action	Comment

## 6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: \_\_\_\_\_

Company: \_\_\_\_\_

Customer Name: \_\_\_\_\_

Company: \_\_\_\_\_

Date completed: \_\_\_\_\_

## 7 Appendix A

### 7.1 Preparation of Reagents

#### 7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

#### 7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

- **Standard substance**

Weigh approx. 10 g of anhydrous sodium carbonate ( $\text{Na}_2\text{CO}_3$ ). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.

- **Indicator solutions**

Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1g bromocresol green in 100 ml methanol.

- **Procedure**

Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight ( $W_1$ ). Transfer the sodium carbonate to a receiver flask and add 40 ml of  $\text{H}_2\text{O}$  (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used ( $A_1$ ). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume

( $A_2$ ). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume ( $A_3$ )

**Note!** Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)



## 7.2 Calculation

$$\text{Molarity (M)} = \frac{18,870 \times W_1}{(A_1 + A_2 + A_3)}$$

**Note!** Concentration must be accurate to four digits, i.e. 0.2000 M.

**Note!** The colour change of this official procedure (AOAC 936.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

## 7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05-0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5-6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

**Note!** The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 - 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

1. Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant x 40
2. Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
3. To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might create irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.