ภาคผนวก ฉ

เอกสารสอบเทียบ



CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com

CLC Accredited ISO/IEC 17025

ilac-MRA

ANAB ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	pH METER
MANUFACTURER	:	SMART SENSOR
MODEL / TYPE	:	AS218
SERIAL NO.	:	6766085/TIZZ9744
CLID. NO.	:	272302598
JOB CONTROL NO.	:	230911100491

CUSTOMER : TNP ENVIRONMENT CO., LTD.
332/173 MOO 3 TAMBON BANG RAK PHATTANA,
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 11 September 2023 DATE OF ISSUED : 14 September 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : [redacted]

Approved By : [redacted]

Authorized Signatory
14 September 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23100491

F3-011-04/01-12

@clccalibration

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com

CLC
Accredited
ISO/IEC 17025

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ANSI National Accreditation Board
ACCREDITED
ISO/IEC 17025
CALIBRATION AND DIMENSIONAL MEASUREMENT
ACDM-2814

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	**pH METER**
MANUFACTURER	:	**SMART SENSOR**
MODEL / TYPE	:	**AS218**
SERIAL NO.	:	**6766085/TIZZ9744**
DATE OF CALIBRATION	:	**12 September 2023**

ENVIRONMENT CONDITIONS :

Temperature : **(25 ± 2.5) °C** **Relative Humidity :** **(50 ± 15) % RH**

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPCH-01.** The calibration was performed by direct measurement with Certified Reference Material (CRM).

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664263,11784256, Lot Number CC752722.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand). Lot Number. 040822 , 230822. Due Date 26 April 2024.
2. The measurements are traceable to International System of Units (SI) , through Control Company. Certificate No. 4288-13355261 , Due Date 06 May 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment ( ) adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (± pH)	*k* Factor
4.003	4.02	-	-0.017	0.013	2,15
7.000	7.02	-	-0.020	0.015	2,06
10.003	10.02	-	-0.017	0.016	2,05

Technical Note. Setting function CAL 3 point (4,6.86,9.18).

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 2,3 of 54

This report is valid for the above stated instrument/s only.

End of Certificate

CERTIFICATE OF CALIBRATION

CENTER ON INDUSTRIAL INSTRUMENT CALIBRATION

Classroom Building 4, 2nd Floor
King Mongkut's University of Technology Thonburi
126 Pracha-u-thit Road, Bangmod,Thungkru, Bangkok 10140
Tel : 0 2872 5281-2, 0 2470 8311-2 Fax : 0 2872 5283
E-mail : cic.cal@kmutt.ac.th www.cic.kmutt.ac.th

NSC-TISI-TIS 17025
CALIBRATION 0179

Certificate No. CM230219 Date of Issue 24 March 2023

Customer	:	TNP ENVIRONMENT CO.,LTD.
Address	:	332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
Instrument No.	:	IM230219
Instrument Name	:	Weight
Manufacturer	:	LS
Model	:	Class F1
Serial No.	:	S1K30-23

Issue by Mass Laboratory

Approved Signatory [redacted]

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95%.
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the laboratory.

Certificate No. CM230219

INSTRUMENT DESCRIPTION:

Instrument Name:	Weight	Manufacturer:	LS
Model:	Class F1	Serial No. :	S1K30-23
Environment:	Temperature: (20 ± 2) °C		
	Relative humidity: (44 ± 10)% RH		
	Air pressure: 100.9 kPa		
Received Date:	23 March 2023		
Condition As-Received:	New Item		
Calibrated Date:	24 March 2023		
Calibration Reference:	W0908 : in-house method based on OIML R111-1:2004(E)		

MEASUREMENTS:

Determination of conventional mass value was done by direct comparison with the standard weight class E2 on a Mass Comparator according to the in-house method based on OIML R 111-1: 2004(E) at ambient conditions.

All reference standards are traceable to recognized National standards which realize the unit of measurement according to the International System of Units (SI).

TRACEABILITY OF CERTIFICATE:

National Institute of Metrology Thailand (NIMT) through

1. NIMT Certificate Number MM-0194-18 for Standard Weight Serial No. 90332845

REFERENCE STANDARDS:

1. Standard Weight Model YCS 01- 652 - 02 Serial No. 90332845 Due. Date 29 October 2024

MEASUREMENT RESULTS:

Nominal Value	Marking	Conventional Mass Value	Measurement Uncertainty	Maximum permissible error
1 kg	None	1 kg + 1.4 mg	± 1.6 mg	± 5.0 mg

End of Certificate

Approved Signatory [redacted]

METROLOGY SYSTEM (THAILAND) CO.,LTD.

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR23100181-1 Page : 1 of 3

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

Equipment Name : Digital Thermometer

Manufacturer : Extech

Model : 39240

Serial Number : 0721B

ID. Number : TNP.LAB.34-2564

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-06

Received Date : 12 Oct 2023

Calibration Date : 13 Oct 2023

Recommend Due Date : 13 Oct 2024

Date of Issue : 14 Oct 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received.Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full,without written approval of SP Metrology System (Thailand).

[redacted]

Authorized Signatory

Calibration Report

Certificate Number : SPR23100181-1

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Super Thermometer with PRT	1575/3850-40-392	58087/100288	PSL-T 0400/66	15 Feb 2024

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

METROLOGY SYSTEM (THAILAND) CO.,LTD.

Result of Calibration

Certificate No. : SPR23100181-1

Unit : °C

Setting Value	Standard Reading	UUC Reading	Error	Uncertainty (±)
0.0	0.006	0.2	0.194	0.070
20.0	20.007	20.0	-0.007	0.070
30.0	30.011	30.0	-0.011	0.070
50.0	50.013	49.9	-0.113	0.070

Note:

The result of calibration was found accurate as show on date and place of calibration only. This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

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

- End of Certificate -

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบเครื่องมือวัด.com

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 FAX. 0-2719-9484

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	Horiba
Model :	LAQUA-DO210
Serial No. :	HE0G0013
ID No. :	-
Received Date :	20 January 2023
Test Date :	23 January 2023
Reference :	2301-0699WN-1
Submitted by :	TNP ENVIRONMENT CO.,LTD 332/173 Moo 3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method

[redacted]

Issue Date : 24 January 2023

Condition of this result of calibration

1. Reference Standard Instruments :
   This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center,Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	22MM50	20 Sep 2023

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : **Dissolved Oxygen Meter Adjustment With Air 100 %**

Dissolved Oxygen Probe No.: 9K0E0106

Titration Method (Azide Modification Method) (mg/L)	**DO Meter Reading** (mg/L)	**Standard Deviation** (mg/L)
8.14	8.15	0.000

This report was certified only for the instrument we tested.It is allowable to use for study the system efficiency,The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited.This report may not be reproduced other in full,without written approval of the laboratory

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[redacted]

ENTECH
Where Solutions Begin

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

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

[redacted]

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

ENTECH
Where Solutions Begin

Calibration Certificate

NSC-TISI-TIS 17025
CALIBRATION 0157

Certificate No. : T/O 660071

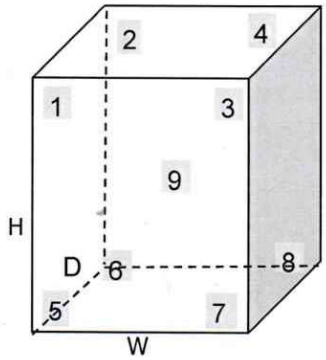
The Reference Standard Instrument :-

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

Measured room conditions

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

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

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
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

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th
Tax ID : 0105536035591 www.entech.co.th

Calibration Certificate

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

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

Calibrated by : [redacted]

Calibrated Date : 20 January 2023

Ref. Job No. : SO6601-00020

Cert. prepare by : [redacted]

Approved by : [redacted]

Calibration Place : ห้องปฏิบัติการ2

Environment Condition : Temperature 28.5 ± 2.7 (°c) , Humidity 57.5 ± 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.

[redacted]

44 Soi ChokChai 4 Soi 40 ,LadPrao ,Bangkok ,Tel.: 0-2538-9205 ,0-2935-7096 ,Fax. : 0-2931-4015 ,Email : contact@mtec.co.th , www.mtec.co.th

Certificate No. : CT-23-01-23295

Calibration Result :

Condition of UUC :

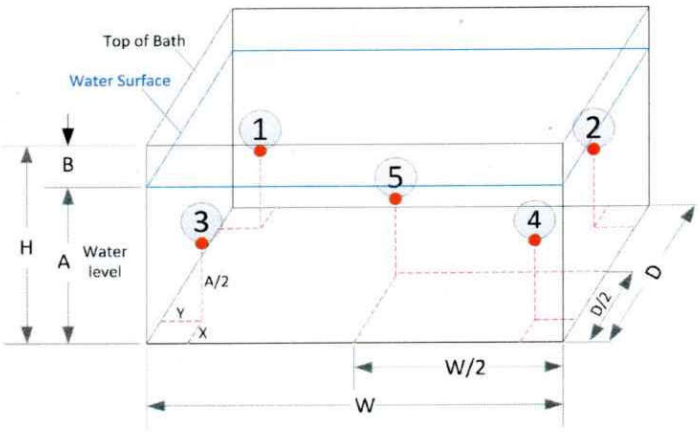
1) Adjust Condition : Without Adjustment
2) Lid Cover : Flat Sheet (Plastic , from
3) Circulation : without circulation
4) X ,Y = 5 cm. , B ~ 3 cm.

(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 througout observation time.



Pic 1 : Position of each sensor No.

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 : ...

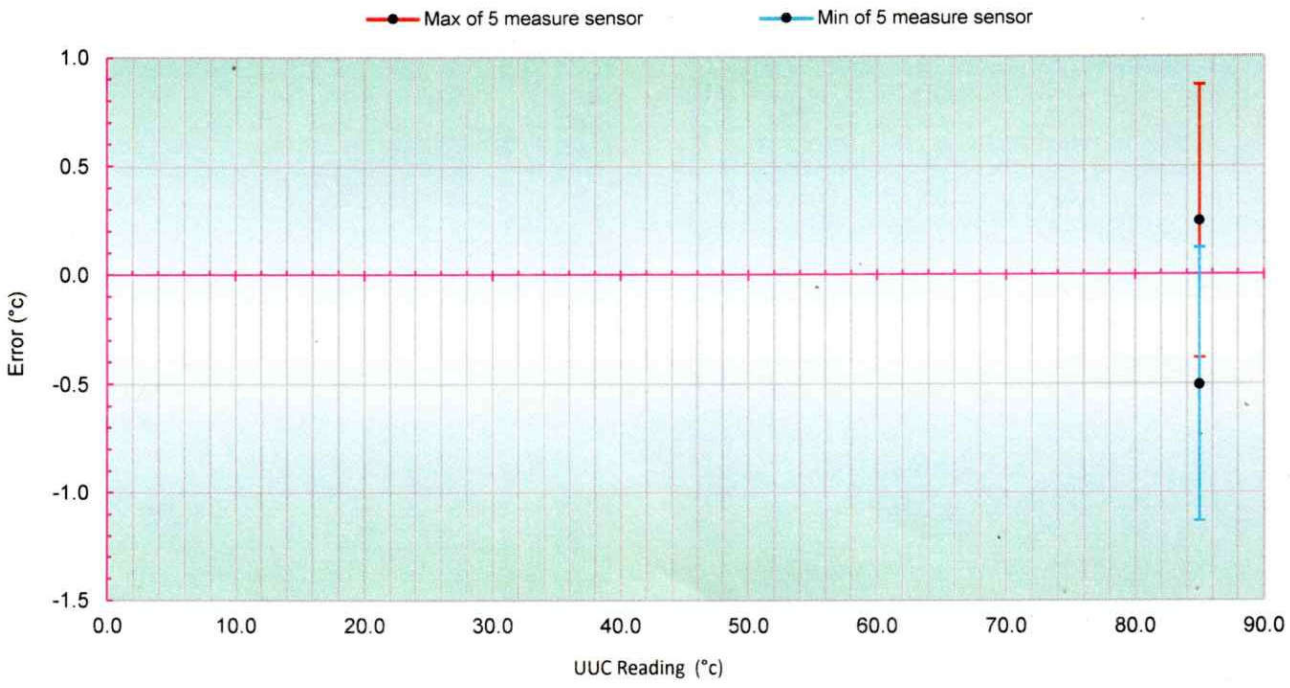
Section 3 : Possible of temperature in chamber. Show minimium and maximum of the average values and Include with uncertainty of measurement. , The average values is average of each position standard sensor througout observation time.

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

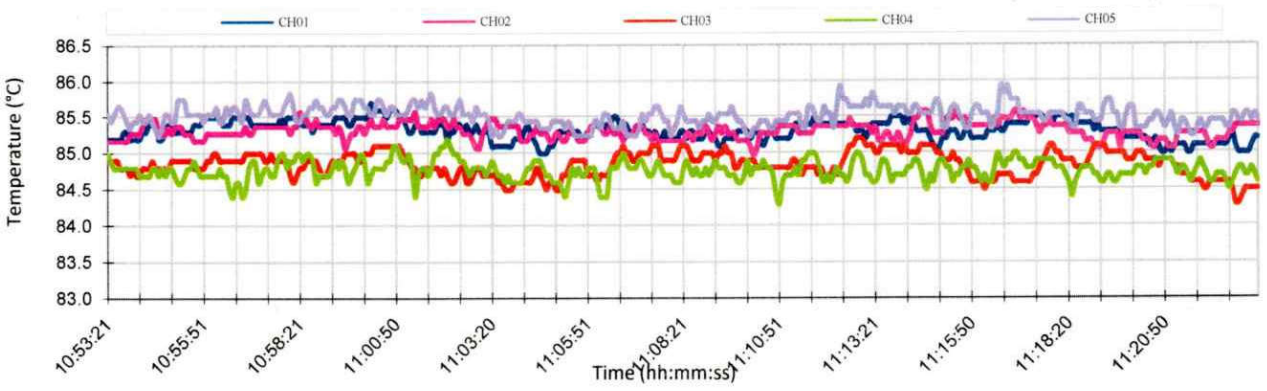
Section 4 : Trend of acuuracy



Approved Signato [redacted]

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

(5.1) Temperature Distribution at UUC Reading 85.0 °c



Approved Signatory : [redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

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
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.

Submitted by: TNP ENVIRONMENT CO.,LTD
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 instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
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)

[redacted]

B 0307331

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 ± 0.16 °C

UUC* Reading (°C)	Standard Temperature (°C)	Error (°C)	Uncertainty of Measurement (± °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%.

-o0o-

[redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

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 ± 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)

[redacted]

Issue Date : 31 January 2023

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 0050390

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
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)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor *k*
pH Electrode	4.008	4.01	N/A	0.0085	2.05
S/N.: 1328	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 %

-o0o-

[redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

Certificate of Calibration

Certificate No. : 23H486
Page : 1 of 2

Equipment :	Digital Thermo-Hygrometer
Manufacturer:	EXTECH
Model :	448515
Serial No.:	PONPE5899554
ID No.:	TNP.LAB.21
Condition As-Received:	Used Item
Received Date:	02 March 2023
Calibration Date:	07 March 2023
Reference:	2303-0104WN
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.

Submitted by: TNP ENVIRONMENT CO.,LTD.

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 instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
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)

[redacted]

B 0310047

Result of Calibration:- Without Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	50.1	48	-2.1	1.6

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.06	19.7	-0.36	0.46
24.99	24.9	-0.09	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%.

-o0o-

[redacted]

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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NSC-TISI-TIS17025
CALIBRATION 0008

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
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.

Submitted by: TNP ENVIRONMENT CO.,LTD.

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 instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
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)

[redacted]

B 0310048

Result of Calibration:- Without Adjustment
Function: Humidity Measurement

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

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°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%.

-o0o-

[redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

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
Ambient Temperature:	(23 ± 2) °C
Relative Humidity:	(50 ± 15) %
Atmospheric Pressure:	1015.25 mbar

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Submitted by: TNP ENVIRONMENT CO.,LTD.

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/m³ and a temperature of 23.4 °C material density of weight is 8000 kg/m³.

Condition of this result of calibration

1.Reference standards instuments :

Instrument	Model	Serial No.	Certificate No.	Due Date
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)

[redacted]

B 0309848

Result of calibration

Nominal Value	Conventional mass		Uncertainty of Measurement (±)	Maximum Permissible error (±)
	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 %.

-o0o-

[redacted]

THAI CALIBRATION SERVICES CO., LTD.
19/8 Moo 9 Soi Raiking 30 Puttamonton 5 Rd., Sampran, Nakornpatom 73210
Tel. 0-3439-7682-5 Fax: 0-3439-7687
www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

Certificate No.S2306518S

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

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer :	Shimadzu	**Order No. :**	66S2523-1
Model :	AP225WD	**Ambient temperature :**	(26.9 ± 5.0) °C
Accuracy class :	-	**Relative humidity :**	(52.0 ± 10.0) %
Capacity :	10 g / 220 g	**Received date :**	21-Jun-2023
Resolution :	0.00001 g / 0.0001 g	**Date of calibration :**	21-Jun-2023
Serial No. :	D316301848	**Date of issue :**	24-Jun-2023
ID No. :	TNP.LAB.30	**Condition of the balance :**	Good working conditions
Place of calibration :	ห้อง LAB		

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

	Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m^3)
1	Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

[redacted]

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NO. 17067

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www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

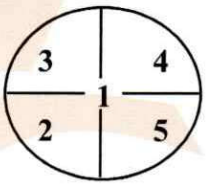
Certificate No.S2306518S

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between suscessive reading (g)	n
100	0.000005	0.00001	5
200	0.00005	0.0001	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0002
Point 3	100.0001
Point 4	100.0000
Point 5	100.0001
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	*k*
Unload	0.00000	0.00000	0.00000	0.000016	2.32
0.1	0.10000	0.10003	-0.00003	0.000019	2.10
0.5	0.50000	0.50001	-0.00001	0.000023	2.04
1	1.00001	1.00000	+0.00001	0.000026	2.00
5	5.00000	5.00001	-0.00001	0.000038	2.00
10	9.99999	10.00001	-0.00002	0.000046	2.00
20	20.0000	20.0000	0.0000	0.000085	2.00
50	50.0000	50.0001	-0.0001	0.00011	2.00
100	100.0000	100.0000	0.0000	0.00018	2.00
200	200.0000	200.0004	-0.0004	0.00034	2.00

Remark : Adjustment, External weight nominal value 100 g, Standard weight of Lab

Uncertainty of measurement

The reported expanded 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% (confidence level).

This report will certify of the calibrated equipment only.

--End--

NO. 14851

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www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

Certificate No.S2306519S

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

Equipment : Non-automatic weighing instrument (Electronic instrument)

Manufacturer :	Sartorius	**Order No. :**	66S2523-2
Model :	SECURA224-1S	**Ambient temperature :**	(26.8 ± 5.0) °C
Accuracy class :	-	**Relative humidity :**	(52.0 ± 10.0) %
Capacity :	220 g	**Received date :**	21-Jun-2023
Resolution :	0.0001 g	**Date of calibration :**	21-Jun-2023
Serial No. :	0041305301	**Date of issue :**	24-Jun-2023
ID No. :	TNP.LAB.31	**Condition of the balance :**	Good working conditions
Place of calibration :	ห้อง LAB		

Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m^3)
1 Standard weight set	1 mg to 2 kg	15885+15849	M2210001S	8-Oct-2023	7950

Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

[redacted]

**This calibration certificate may not be reproduced other than in full,
except with the prior written approval of the head of TCS calibration laboratory.**

NO. 17068

THAI CALIBRATION SERVICES CO., LTD.
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Tel. 0-3439-7682-5 Fax: 0-3439-7687
www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com

NSC-TISI-TIS 17025
CALIBRATION 0189

CALIBRATION CERTIFICATE

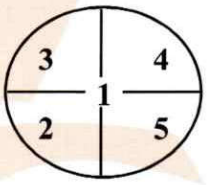
Certificate No.S2306519S

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between sucessive reading (g)	n
200	0.00000	0.0000	5

The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading (g)
Point 1	100.0000
Point 2	100.0000
Point 3	100.0000
Point 4	99.9998
Point 5	99.9998
Eccentric Value	0.0002



The error of indication

Nominal Value (g)	Value of Reference Standard Weight (g)	Balance Reading (g)	Correction (g)	Uncertainty (±) (g)	*k*
Unload	0.0000	0.0000	0.0000	0.000082	2.00
0.1	0.1000	0.1000	0.0000	0.000083	2.00
0.5	0.5000	0.5000	0.0000	0.000084	2.00
1	1.0000	0.9999	+0.0001	0.000085	2.00
5	5.0000	5.0000	0.0000	0.000090	2.00
10	10.0000	10.0000	0.0000	0.000094	2.00
20	20.0000	20.0001	-0.0001	0.00011	2.00
50	50.0000	50.0001	-0.0001	0.00013	2.00
100	100.0000	100.0000	0.0000	0.00019	2.00
200	200.0000	199.9998	+0.0002	0.00033	2.00

Remark : Without adjustment

Uncertainty of measurement

The reported expanded 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% (confidence level).

This report will certify of the calibrated equipment only.

--End--

NO. 14853

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

CERT.No.: HS-U039F

Certificate of Calibration

Calibration Date : 20 Jun 23

Submitted by : TNP ENVIRONMENT COMPANY LIMITED.
332/173 Moo. 3, Tambon Bang Rak Phatthana,
Amphoe Bang Bua Thong, Nonthaburi 11110

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)	9.04	(PASS)	-	-
Measurement 4 (mg/l)	9.03	(PASS)	-	-
Measurement 5 (mg/l)	9.04	(PASS)	-	-
Measurement 6 (mg/l)	9.04	(PASS)	-	-
Measurement 7 (mg/l)	9.04	(PASS)	-	-
Measurement 8 (mg/l)	9.03	(PASS)	-	-
Measurement 9 (mg/l)	9.03	(PASS)		-
Measurement 10 (mg/l)	9.03	(PASS)	-	-
Mean Measurement	9.04	mg/l	-	-
Inaccuracy	0.05	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.

[redacted]

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Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-019

Issue Date : 30 June 2023

Work Order No. : 23/0879

Customer Name : BUREAU VERITAS AQ LAB (THAILAND) COMPANY LIMITED
111 Thailand Science Park, Moo 9 Paholyotin Road,
Klong Nueng, Klong Luang, Pathumthani 12120, Thailand

Date of Received : 28 June 2023

Date of Calibration : 28 June 2023

Instrument Details :

Description	:	Water Bath
Manufacturer	:	ThremoFisher
Model	:	N/A
Serial No.	:	0152187501160414
ID No.	:	CHM000205
Resolution	:	0.1 °C
Location	:	Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the liquid bath according to calibration procedure CWI-T-11 in-house methods based on ASTM E715-80 (Reapproved 2006)

Environmental Conditions :

Temperature	:	Area Monitoring between 15°C to 40°C
Humidity	:	Area Monitoring between 30%RH to 85%RH
Line Voltage	:	Area Monitoring 220 VAC ± 10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

[redacted]

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-019

Issue Date : 30 June 2023

Work Order No. : 23/0879

Details of calibration

1. Reference Standards Instrument

Instrument	Model	Serial No. / ID No.	Certificate No.	Due Date
Data Acquisition unit ·	34972A	MY59002085	22-1146-021	22 November 2023
Sensor type	RTD	Channel 101 to 106	22-1146-021	22 November 2023

2. Certificate traceble : This certificate traceable to The International System of Unit refer to Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration site : On-site

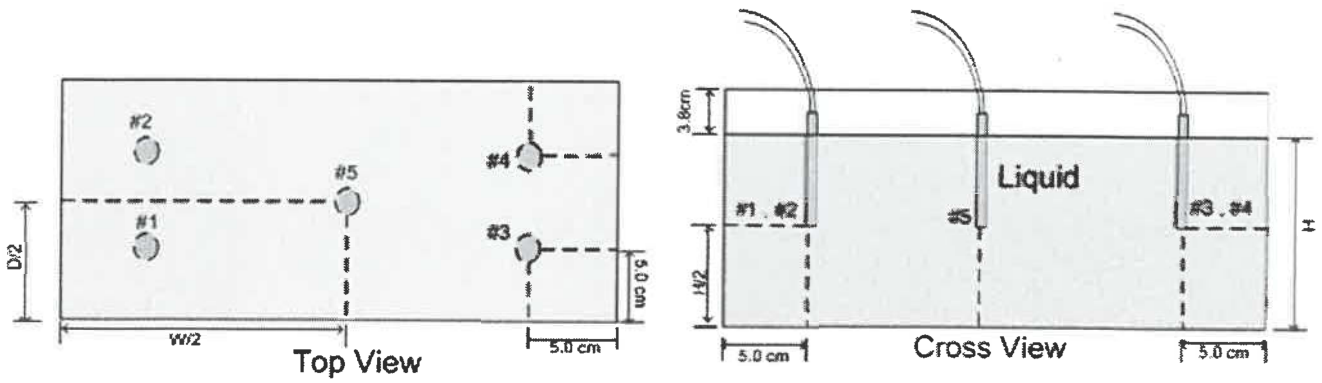
5. Result of Calibration : Without Adjustment

6. Evaluate Condition : **Time Constant** : - Hour 33 Minute At Cal. point 44.5 °C
Type of Control : PID Control

Testing liquid bath use media is Water

7. Calibration note : The results reported in this certificate refer to the condition of instrument on the process into the standy state of Liquid Bath

8. Sensors Installation Diagram :



Position Diagrams

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Salathammasop, Thawewatthana, Bangkok 10170 Thailand
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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-019

Issue Date : 30 June 2023

Work Order No. : 23/0879

Result of Temperature Distribution and Performance Check

Table 1 : Reporting of Temperature

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.5 is REF)					Uncertainty ± (°C)
	#1	#2	#3	#4	#5	
44.5	44.50	44.50	44.50	44.50	44.51	0.13

Table 2 : Reporting of Characterization Result

Indicator Set point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
44.4	44.4	44.4	44.4	0.04	0.07	0.07

Note :

Calibrate items it good condition and this report customer request and accepted in certificate

The reference sensor is preferably located of the center of bath

The measured temperature data readout by software "Benchlink Datalogger 3"

The quoted uncertainty include " Stability " and exclude" Loading effect (20% of Temp Uniformity) "

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

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 bath under steady state conditions.

Overall Variation - The difference of the maximum and minimum measured temperatures througout observation time.

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

[redacted]

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

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%.

--END--

CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.
45/48 Soi Salathammasop31, Salathammasop Rd.,
Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-008

Issue Date : 30 June 2023

Work Order No. : 23/0879

Customer Name : BUREAU VERITAS AQ LAB (THAILAND) COMPANY LIMITED
111 Thailand Science Park, Moo 9 Paholyotin Road,
Klong Nueng, Klong Luang, Pathumthani 12120, Thailand

Date of Received : 26 June 2023

Date of Calibration : 26 June 2023

Instrument Details :

Description	:	Temperature Controlled Enclosures [Incubator]
Manufacturer	:	memmert
Model	:	INE 500
Serial No.	:	E512.0738
ID No.	:	CHM000151
Resolution	:	0.1 °C
Location	:	Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08 (E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.

Environmental Conditions :

Temperature	:	Area Monitoring between 15°C to 40°C
Humidity	:	Area Monitoring between 30%RH to 85%RH
Line Voltage	:	Area Monitoring 220 VAC ± 10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990.

[redacted]

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Salathammasop, Thawewatthana, Bangkok 10170 Thailand
Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com

NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-008

Issue Date : 30 June 2023

Work Order No. : 23/0879

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY59002085	22-1146-021	22 November 2023
Sensor type	RTD	RTD# 101-109	22-1146-021	22 November 2023

2. Certificate traceble : This certificate traceable to The International System of Unit refer to Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration site : On - Site

5. Result of Calibration : Without adjustment

6. Evaluate Condition : **Time Constant** : - Hour 33 Minute At cal. point 41.5 °C

Air vent : Off

Fan speed status : None Fan Speed

7. Calibration note : The results reported in this certificate refer to the condition of instrument on the process into the steady state of chamber

8. Sensors Installation Diagram : When ; Sensor installation location in Chamber @ Working Space

A = Distance between sensor and wall of chamber is 5 cm

9. Dimensions of chamber : W = 0.56 m ; D = 0.4 m ; H = 0.48 m

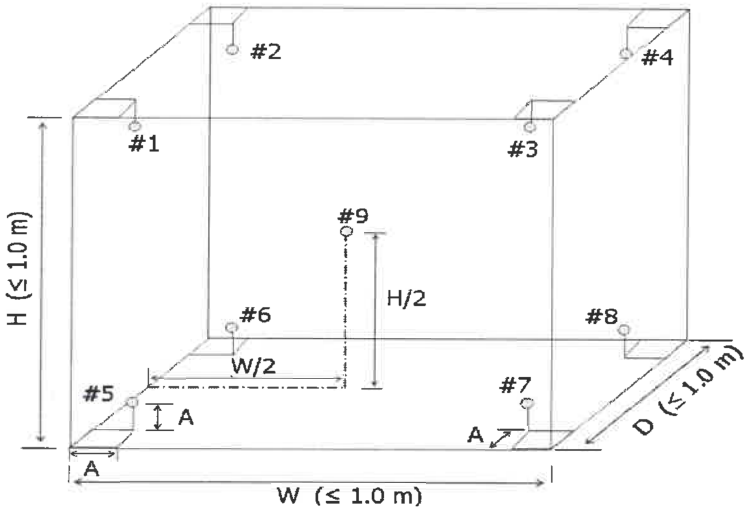


Diagram of Chamber

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NSC-TISI-TIS 17025
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Certificate No. : 23-0879-008

Issue Date : 30 June 2023

Work Order No. : 23/0879

Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
41.5	41.91	41.99	41.77	41.86	41.62	42.18	41.66	41.76	41.80	0.29
42.0	42.46	42.52	42.29	42.39	42.16	42.66	42.19	42.27	42.33	0.26

Table 2 : Reporting of Performance check

Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
41.5	41.5	41.5	41.5	0.14	0.51	0.74
42.0	42.0	42.0	42.0	0.10	0.44	0.64

Note

Calibrate items it good condition and this report customer request and accepted in certificate

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchlink Datalogger 3"

The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

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

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 througout observation time.

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

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

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%.

--END--

CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.
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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-010

Issue Date : 30 June 2023

Work Order No. : 23/0879

Customer Name : BUREAU VERITAS AQ LAB (THAILAND) COMPANY LIMITED
111 Thailand Science Park, Moo 9 Paholyotin Road,
Klong Nueng, Klong Luang, Pathumthani 12120, Thailand

Date of Received : 26 June 2023

Date of Calibration : 26 June 2023

Instrument Details :

Description	:	Temperature Controlled Enclosures [Incubator]
Manufacturer	:	memmert
Model	:	IN110
Serial No.	:	D415.0797
ID No.	:	CHM000181
Resolution	:	0.1 °C
Location	:	Laboratory

Calibration Method : This instrument was calibrated by insert standard thermometer into the chamber according to calibration procedure no. CWI-T-10 follow up to TLAS G-20-1/02-08 (E) : Guidelines for Calibration and Checks of Temperature Controlled Enclosures.

Environmental Conditions :

Temperature	:	Area Monitoring between 15°C to 40°C
Humidity	:	Area Monitoring between 30%RH to 85%RH
Line Voltage	:	Area Monitoring 220 VAC ± 10%

Traceability of Measurement :

This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI) and The temperature scale in use at this laboratory is The International Temperature scale of 1990

[redacted]

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-010

Issue Date : 30 June 2023

Work Order No. : 23/0879

Details of Calibration

1. Reference Standards Instrument

Instrument	Model	Serial No./Ins No.	Certificate No.	Due Date
Data Acquisition unit	34972A	MY49024826	22-1485-003	20 November 2023
Sensor type	RTD	RTD# 301-308, 310	22-1485-003	20 November 2023

2. Certificate traceble : This certificate traceable to The International System of Unit refer to Crystal Calibration Sales and Service Co., Ltd. , NAC Calibration No. 0260

3. Condition of item : Used

4. Calibration site : On - Site

5. Result of Calibration : Without adjustment

6. Evaluate Condition : Time Constant : - Hour 33 Minute At cal. point 35 °C
Air vent : Off
Fan speed status : None Fan Speed

7. Calibration note : The results reported in this certificate refer to the condition of instrument on the process into the steady state of chamber

8. Sensors Installation Diagram : When ; Sensor installation location in Chamber @ Working Space
A = Distance between sensor and wall of chamber is 5 cm

9. Dimensions of chamber : W = 0.56 m ; D = 0.4 m ; H = 0.48 m

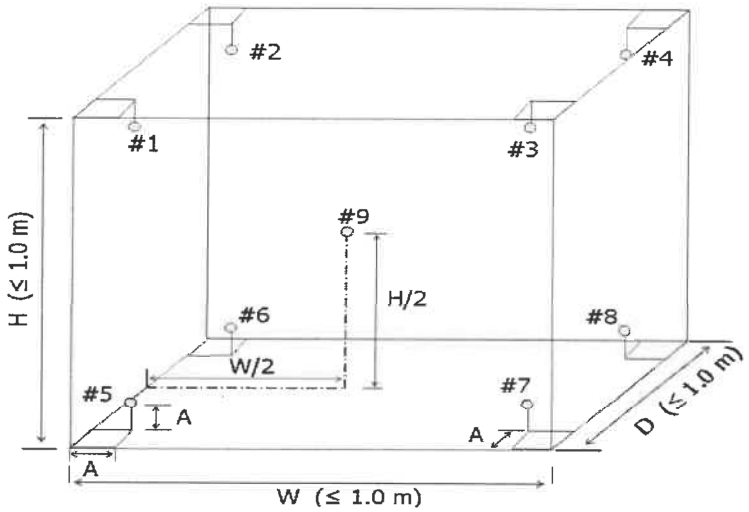


Diagram of Chamber

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NSC-TISI-TIS 17025
CALIBRATION 0260

CERTIFICATE OF CALIBRATION

Certificate No. : 23-0879-010

Issue Date : 30 June 2023

Work Order No. : 23/0879

Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature Distribution

Calibration point (°C)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.05	35.03	35.04	35.07	34.80	34.87	34.78	34.86	35.07	0.26

Table 2 : Reporting of Performance check

Indicator Set Point (°C)	Indicator Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average			
34.8	34.8	34.8	34.8	0.11	0.33	0.48

Note

Calibrate items it good condition and this report customer request and accepted in certificate

The reference sensor is preferably located of the geometric center of chamber

The measured temperature data readout by software "Benchlink Datalogger 3"

The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

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

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 througout observation time.

Indicating Temperature - the average reading of indicating device that forms the integral part of the enclosure.

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

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%.

--END--

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance



บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0 2 639 7000 E-mail: service.tec.th@dksh.com

ฝ่ายขายและการตลาด

โทร 0 2 639 7000 E-Mail : marketing.tec.th@dksh.com

Website : www.dksh.co.th/technology/scientific-thailand

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักขัตฤกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

ช่องทางการติดต่อ

DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)

LINE: @dkshscientific

Call center 0 2 639 7000

DKSH Scientific

www.dksh.com/scientific-thailand

marketing.tec.th@dksh.com

@dkshscientific

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ....1.... ครั้ง ต่อ ปี
ครั้งที่ ...1...วันที่ ..... **17/08/2023** .....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท บูโร เวอริทัส เอคิว แล็บ (ประเทศไทย) จำกัด		
ที่อยู่	อุทยานวิทยาศาสตร์ประเทศไทย 111 หมู่9 ถนนพหลโยธิน ตำบลคลองหนึ่ง คลองหลวง จังหวัดปทุมธานี 12120		
โทรศัพท์		แฟกซ์	

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณ ปัฐฐามาภรณ์ ทองสาย				
ตำแหน่ง					
โทรศัพท์	**084 337 6271**	**เบอร์ต่อ**		**แฟกซ์**	
E-mail	patthathamaporn.thongsai@bvaq.com				

รายละเอียดผู้ให้บริการ

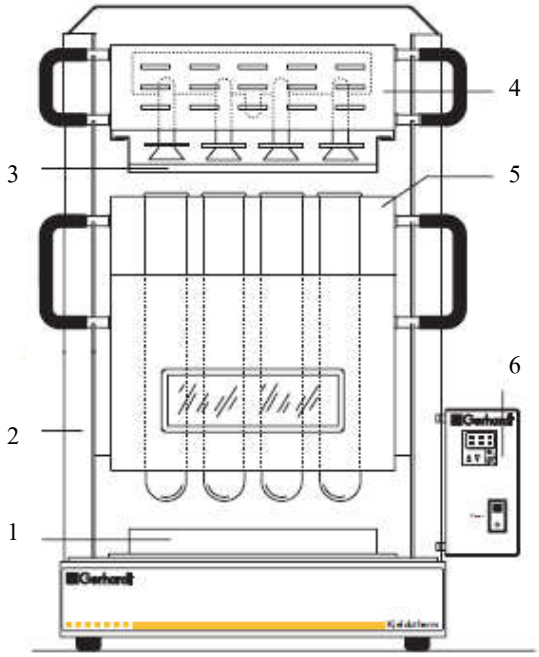
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260 โทรศัพท์ 0 2 693 7000 Email: siriporn.sy@dksh.com Line ID : siripon3007 เจ้าหน้าที่ประสานงาน : คุณศิริพร อยู่ทองจุ้ย โทรศัพท์ 090 678 6924 ,02 301 7467			
เจ้าหน้าที่ผู้ให้บริการ	นาย เมฆินทร์ วังซ้าย		
ตำแหน่ง	Specialist,Technical Services		
โทรศัพท์		แฟกซ์	-
E-mail	mekin.mw@dksh.com		

ลงนามผู้รับบริการ		ลงนามผู้ให้บริการ	
ตัวบรรจง	(.....)	ตัวบรรจง	(นาย เมฆินทร์ วังซ้าย)
ตำแหน่ง		ตำแหน่ง	Specialist,Technical Services
วันที่ / ประทับตราบริษัท		วันที่ / ประทับตราบริษัท	17/08/2023

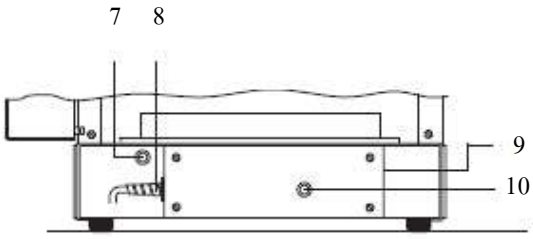
JOB No: ..... LSPR2309932..... MODEL: .....KB 20s..... S/N: 7020 16 0087 / 7210 16 0009

Part 1: ตรวจเช็คสภาพเครื่อง

Digestion Unit



Front



Real

No.		PASS	Fail	Remark
1	KJALDATHEAM –Digestion Block	☑	☐	
2	Two tier console	☑	☐	
3	Drip tray	☑	☐	
4	Exhaust system	☑	☐	
5	Insert rack	☑	☐	
6	Control unit	☑	☐	
7	Inner for PT-100	☑	☐	
8	Connection cable	☑	☐	
9	Excess current switch	☑	☐	
10	Excess temperature	☑	☐	

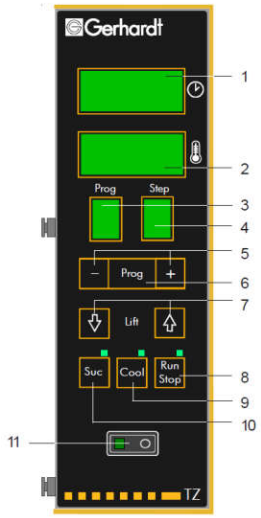
Part 2: รายละเอียดและรายงานผลการให้บริการ Preventive Maintenance

2.1 ตรวจเช็คระบบไฟฟ้า

	Pass	Fail	N/A	Remark
ใช้ไฟ 220 V50 Hz	☑	☐	☐	……..
กระแสไฟฟ้าตามพิกัดเครื่อง	☑	☐	☐	……..

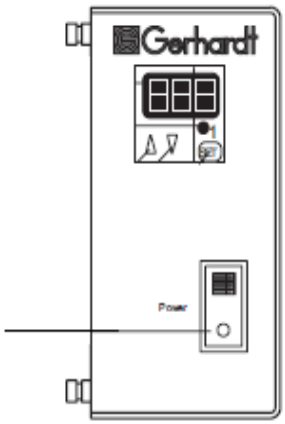
2.2 ตรวจอุปกรณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของเครื่อง	☑	☐	☐	……..
ท่อแก้วรวมไอกรด	☑	☐	☐	……..
สายยางต่อกับท่อแก้วรวมไอกรด	☑	☐	☐	……..
สภาพของ Aluminum block	☑	☐	☐	เริ่มเสื่อมสภาพเล็กน้อย



☑

TZ control



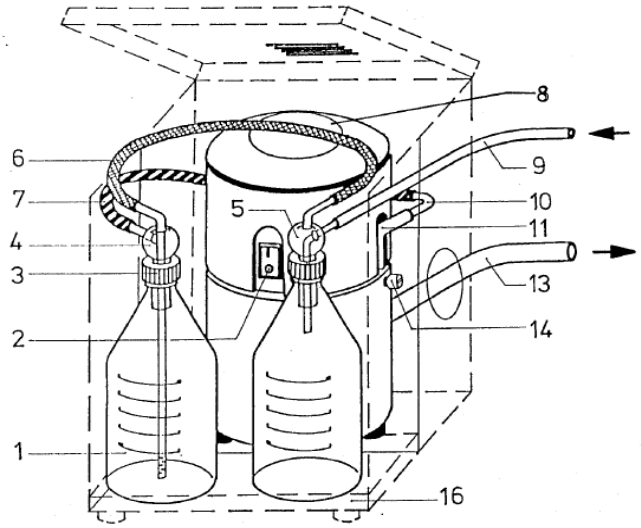
☐

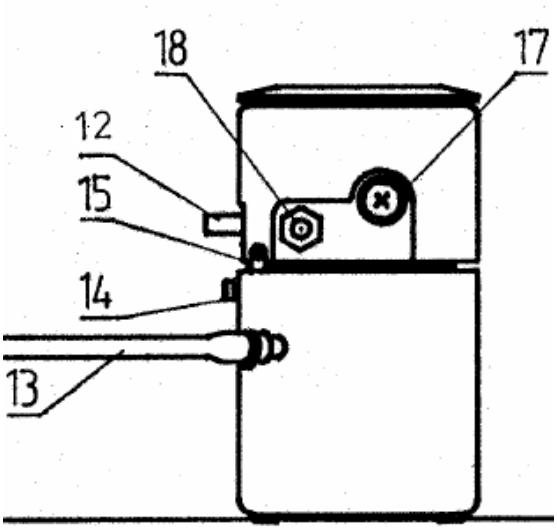
TR control

2.3ตรวจเช็คระบบการทำงาน	Pass	Fail	N/A	Remark
สวิทช์เปิด-ปิดหลัก (1)TR control (11)TZ control	☑	☐	☐	……..
จอแสดงผลของ Control	☑	☐	☐	……..
ปุ่มกด ตั้งค่า โปรแกรม TZ control (5,6)	☑	☐	☐	……..
ปุ่มกด ขึ้น ลง ลิฟท์ TZ control (7)	☑	☐	☐	……..
ปุ่มกด ตั้งค่า Suction TZ Control (10)	☑	☐	☐	……..
ปุ่มกดตั้งค่า Cool Trap TZ Control (9)	☑	☐	☐	……..
ปุ่มกด เริ่ม / หยุดการทำงาน TZ Control (8)	☑	☐	☐	……..
การขึ้นของอุณหภูมิมากกว่า10องศาต่อนาทีที่250องศา	☑	☐	☐	……..
การทำงานของตัวป้องกันอุณหภูมิสูงเกิน	☑	☐	☐	……..
การทำงานของระบบควบคุมอุณหภูมิ	☑	☐	☐	……..

JOB No: LSPR2305476 **MODEL:** TUR/K **S/N:** 6300 15 0026

☑ **TUR/K**





No.		PASS	Fail	N/A	Remark
1	Glass-Bottle	☑	☐	☐	
2	Power switch green	☑	☐	☐	
3	Screw cap With Silicone seal GL45	☑	☐	☐	เริ่มเสื่อมสภาพ ควรเปลี่ยนพร้อม Seal
4	Down pipe long	☑	☐	☐	
5	Down pipe Short	☑	☐	☐	
6	Isoversinic tubing 12/17	☑	☐	☐	
7	Isoversinic tubing 12/17	☑	☐	☐	
8	Turbosog	☑	☐	☐	
9	Isoversinic tubing 12/17 maniflod	☑	☐	☐	
10	Glass elbow	☑	☐	☐	
11	Isoversinic tubing 12/17	☑	☐	☐	
12	Inlet from maniflod	☑	☐	☐	
13	Cooling water outlet	☑	☐	☐	
14	Screw for suction capacity	☑	☐	☐	
15	Gas outlet pipe	☑	☐	☐	
16	Drip tray	☑	☐	☐	
17	Water inlet	☑	☐	☐	
18	Connection cable	☑	☐	☐	

การบำรุงรักษาทั่วไป (Basic maintenance)

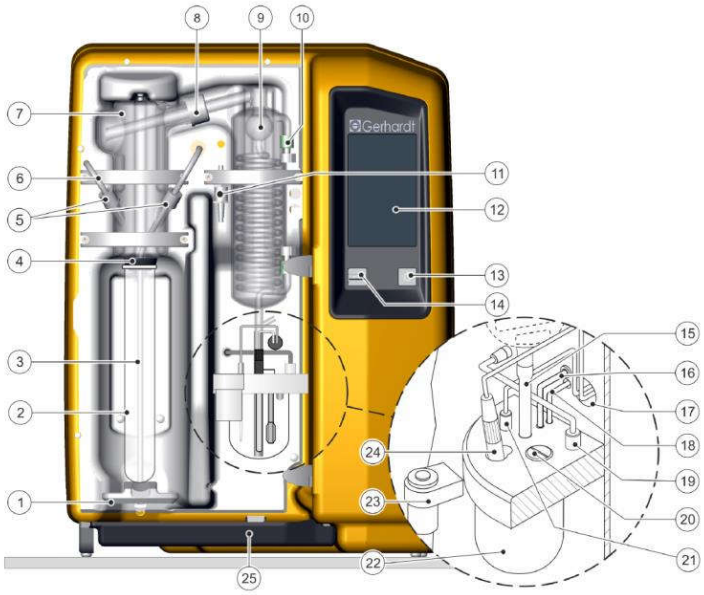
1. การย่อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
2. เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำถาดลองไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดหยดลงมาติดอยู่ในหลุม เพื่อป้องกันไม่ให้คราบดังกล่าวไปกั้นการแผ่อุณหภูมิ

JOB No: LSPR2309931 **MODEL:** VAP 400 **S/N:** 5400 15 0006

Part 1: Operational Qualification (OQ)

1.1 ตรวจสอบสภาพเครื่อง

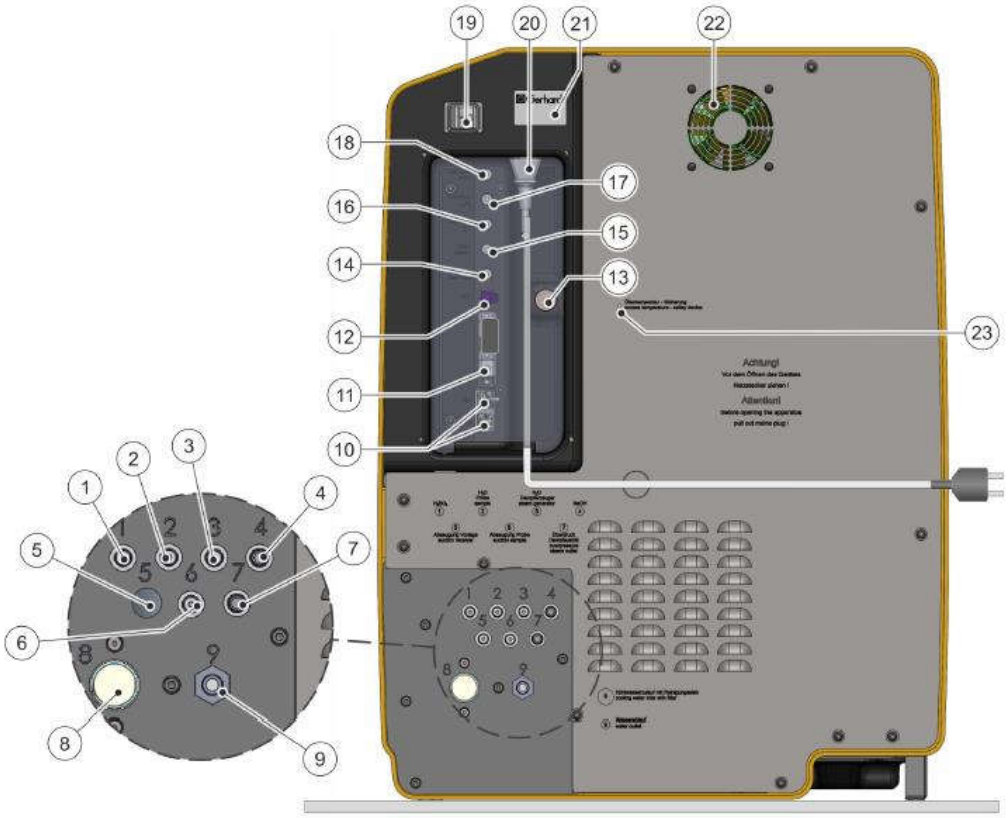
FRONT



No		PASS	FAIL	N/A
1	Quick clamping device with clamping block	☑	☐	☐
2	Digestion tube 250/300 ml	☑	☐	☐
3	PTFE steam inlet tubing	☑	☐	☐
4	Connection stopper , Viton	☑	☐	☐
5	Screw cap GL18	☑	☐	☐
6	PTFE-inlet tubing NaOH	☑	☐	☐
7	Distribution head made of glass	☑	☐	☐
8	Screw cap GL32	☑	☐	☐
9	Distillation condenser made of glass	☑	☐	☐
10	Screw cap GL14	☑	☐	☐
11	Ventilation valve	☑	☐	☐
12	Control panel	☑	☐	☐
13	Operating Button	☑	☐	☐
14	USB interface (with protective cap)	☑	☐	☐
15	Silicone tubing 8/10 for distillate discharge **	☐	☐	☑
16	Verprene tubing 4/8 , receiver suction **	☐	☐	☑
17	Cable duct for electrode cable + titration tube**	☐	☐	☑
18	Silicone tubing 4/7 , boric acid inlet**	☐	☐	☑
19	Sensor for level monitoring including connector**	☐	☐	☑
20	Agitator motor with propeller**	☐	☐	☑
21	Titration acid inlet tube **	☐	☐	☑
22	Receiver glass**	☐	☐	☑
23	Holder for pH electrode , removable**	☐	☐	☑
24	pH electrode (combined electrode)**	☐	☐	☑
25	Drip tray PP	☑	☐	☐

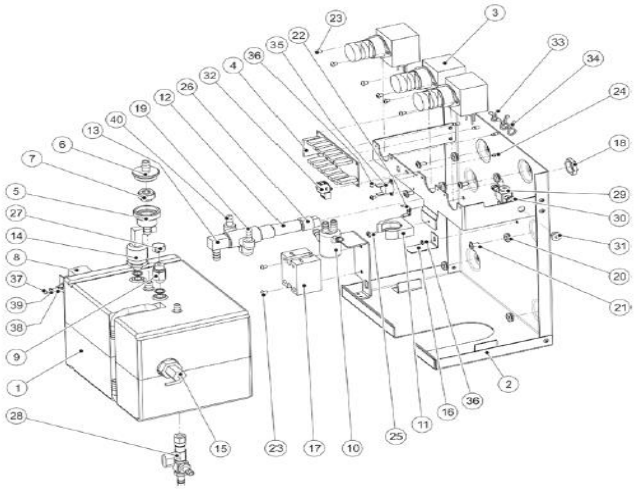
** only VAP 450

REAR



No		PASS	FAIL	N/A
1	Tube connection for sample H3BO3 supply	☑	☐	☐
2	Tube connection for sample H2O supply	☑	☐	☐
3	Tube connection for steam generator H2O supply	☑	☐	☐
4	Tube connection for NaOH supply	☑	☐	☐
5	Tube connection for receiver glass extraction	☑	☐	☐
6	Tube connection for sample waste extraction	☑	☐	☐
7	Tube connection, overpressure steam outlet	☑	☐	☐
8	Connection for cooling water supply (with cleaning sieve)	☑	☐	☐
9	Tube connection for cooling water outlet	☑	☐	☐
10	4 X USB interface	☑	☐	☐
11	1 X RS-232 Interface	☑	☐	☐
12	LAN Interface	☑	☐	☐
13	Screw cap for Perspex cover	☑	☐	☐
14	Connection socket for sample waste tank level monitoring	☑	☐	☐
15	Connection (not used)	☑	☐	☐
16	Connection socket for H2O tank level monitoring	☑	☐	☐
17	Connection socket for H3BO3 tank level monitoring	☑	☐	☐
18	Connection socket for NaOH tank level monitoring	☑	☐	☐
19	Overcurrent circuit breaker	☑	☐	☐
20	Apparatus socket (mains cable connection)	☑	☐	☐
21	Rating plate with serial number	☑	☐	☐
22	Exhaust air fan	☑	☐	☐
23	Excess temperature switch	☑	☐	☐

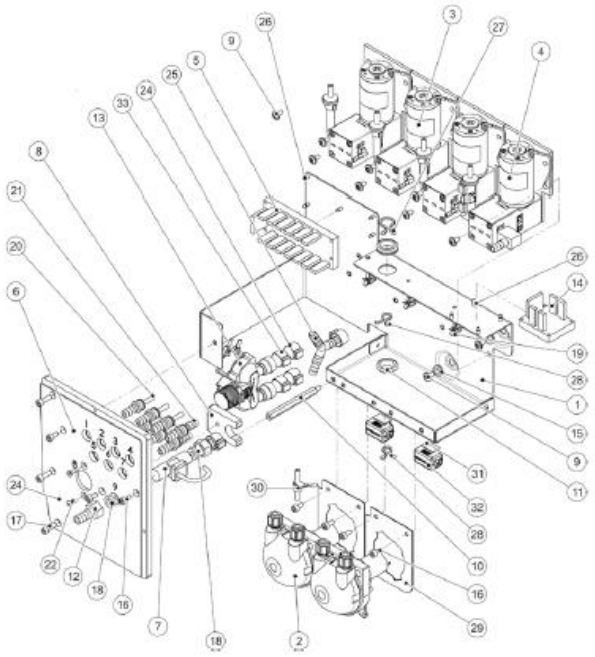
Inside Steam generator



No		PASS	FAIL	N/A
1	Steam generator	☑	☐	☐
2	Steam generator traverse	☑	☐	☐
3	Pinch valve	☑	☐	☐
4	Circuit board distributor	☑	☐	☐
5	Valve tubing connection	☑	☐	☐
6	Housing safety valve	☑	☐	☐
7	Safety valve SKT	☑	☐	☐
8	Excess temperature protection , steam generator	☑	☐	☐
9	Safety valve G 1/8 0,5 bar	☑	☐	☐
10	Ventilation glass pinch valve VAPODEST	☑	☐	☐
11	Hose clamp for ventilation clamp	☑	☐	☐
12	Distributor PP	☑	☐	☐
13	Angle connection PP	☑	☐	☐
14	Pressure transmitter	☑	☐	☐
15	Level switch	☑	☐	☐
16	Fixing bracket steam generator	☑	☐	☐
17	Relay HT+	☑	☐	☐
18	VA Hexagon nut ½“	☑	☐	☐
19	Angle connection 1/8“	☑	☐	☐
20	Bushing nipple 6-10-14	☑	☐	☐
21	VA Lens head screw M5 X 10	☑	☐	☐
22	Grounding connection , 2-pole	☑	☐	☐
23	VA Lens head screw M4 X 6	☑	☐	☐
24	Spacer bolt 5 mm	☑	☐	☐
25	VA Lens head screw M4 X 10	☑	☐	☐
26	Tubing connection	☑	☐	☐
27	Hose clamp 14.5 mm	☑	☐	☐
28	Module ball valve with nozzles	☑	☐	☐
29	Cross manifold with spout	☑	☐	☐
30	Seal copper G 1/8	☑	☐	☐
31	Locking screw 1/8”	☑	☐	☐
32	Pin strip	☑	☐	☐
33	Bundle clamp 12 H 4500	☑	☐	☐
34	Bundle clamp 12 H 4502	☑	☐	☐
35	Temperature switch 80°C	☑	☐	☐
36	VA Lens head screw M3 X 6	☑	☐	☐
37	VA Hexagon nut M4	☑	☐	☐
38	Lins head screw M4 X 8	☑	☐	☐

39	VA Spring washer	☑	☐	☐
40	Angle connection, reduced , 1/8" PP	☑	☐	☐

☑ Inside Pump holder VAP200 - 450 V1-V2



No		PASS	FAIL	N/A
1	Pump holding plate	☑	☐	☐
2	Peristaltic pump for sample suction	☑	☐	☐
3	Diaphragm pump for H2O (Com[plete incl angle connection piece)	☑	☐	☐
4	Diaphragm pump for NaOH (Com[plete incl angle connection piece)	☑	☐	☐
5	PC board distributor PT	☑	☐	☐
6	Tubing connection module VAP	☑	☐	☐
7	Water pressure control FT110	☑	☐	☐
8	Bracket for tubing connection module	☑	☐	☐
9	VA Lens head screw with flange M5X10	☑	☐	☐
10	Spacer bolt M5X80	☑	☐	☐
11	Bushing nozzle 18-22-27-1,5	☑	☐	☐
12	Screw-in socket G3-8 LW10	☑	☐	☐
13	Magnetic valve R2v 2/2 way	☑	☐	☐
14	PC board distributor REVAP 450	☑	☐	☐
15	Bushing nozzle 6-10-14-1,5	☑	☐	☐
16	VA Cylinder screw M5X10	☑	☐	☐
17	VA Cylinder screw M5X16	☑	☐	☐
18	Seal EPDM 15 X 4	☑	☐	☐
19	Cable clip	☑	☐	☐
20	Tubing connection piece 51X10X5	☑	☐	☐
21	Tubing connection piece 51 X 10 X 10	☑	☐	☐
22	VA-Countersunk screw M4X10	☑	☐	☐
23	Hose clamp S8-7	☑	☐	☐
24	Clamp	☑	☐	☐

25	Y-tube connector	☑	☐	☐
26	Spacer bolt 5 mm	☑	☐	☐
27	Bundle clamp 12 H 6506	☑	☐	☐
28	Bundle clamp 12 H 4502	☑	☐	☐
29	Holder for peristaltic pump	☑	☐	☐
30	Kit grounding pump	☑	☐	☐
31	Adhesive tape	☑	☐	☐
32	Snap ferrite VAP300-450	☑	☐	☐
33	Clamp	☑	☐	☐

Control panel



No		PASS	FAIL
1	Title bar	☑	☐
2	Status bar	☑	☐
3	Navigation button	☑	☐
4	Smart switch with multiple functions	☑	☐
5	USB interface	☑	☐

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2 รายละเอียดการตรวจสอบ

2.1 ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distribution Head
- Condensor
- Steam generator
- Tubing
- Viton cone

ตรวจสอบ Function การทำงาน (The FunctionTest)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H3BO3

2.2 รายงานผลการให้บริการ

1. TECHNICAL DATA	Pass	Fail	N/A	Remark
Main Supply 220 volt + 10% 50 Hz with ground	☑	☐	☐	……..
Norminal current	☑	☐	☐	……..

1.1 COOLING WATER BATH	Pass	Fail	N/A	Remark
Temperature 15-20 °C	☑	☐	☐	……..
Cooling Water Outlet	☑	☐	☐	……..
Control Temperature	☑	☐	☐	……..

1.2 OPTICAL TEST VAP....400...	Pass	Fail	N/A	Remark
Screw cap GL14	☑	☐	☐	……..
Screw cap GL18	☑	☐	☐	……..
Screw cap GL32	☐	☑	☐	……..
Distillation Head	☐	☑	☐	……..
Condensor	☐	☑	☐	……..
Viton Cone	☐	☑	☐	……..
Ventilation Valve BV	☑	☐	☐	……..
Micro Switch Sample	☑	☐	☐	……..
Agitator motor for propeller	☑	☐	☐	……..

2. SYSTEM COOLING WATER INLET	Pass	Fail	N/A	Remark
Cooling Water Inlet	☑	☐	☐	……..
Cooling Water Outlet	☑	☐	☐	……..
Flow control valve	☑	☐	☐	……..

3.SYSTEM CONTROL	Pass	Fail	N/A	Remark
Display	☑	☐	☐	……..
Program	☑	☐	☐	……..
Adding NaOH	☑	☐	☐	……..
Adding H2O	☑	☐	☐	…….
Adding H3BO3	☑	☐	☐	…….
Suction Sample	☑	☐	☐	…….
Suction Reciver	☑	☐	☐	.....

4.SYSTEM DISTILLATION	Pass	Fail	N/A	Remark
Boiler	☑	☐	☐	…….
Level Sensor	☑	☐	☐	…….
Novopren	☐	☑	☐	…….
Solenoid Valve Shut-Off	☑	☐	☐	…….
Solenoid Valve Steam	☑	☐	☐	…….
Solenoild Valve soft steam	☑	☐	☐	…….
Ventilation Valve Premount	☐	☑	☐	…….
Excess Pressure Detector	☑	☐	☐	…….
Heating Element	☑	☐	☐	…….

5. PUMP	Pass	Fail	N/A	Remark
Pump H_2O Steam	☑	☐	☐	……..
- Non-Return Valve	☑	☐	☐	……..
Pump H_2O Sample	☑	☐	☐	……..
- Non-Return Valve	☑	☐	☐	……..
Pump NaOH	☑	☐	☐	……..
- Non-Ruturn Valve	☑	☐	☐	……..
Pump H3BO3	☑	☐	☐	…….
- Non-Ruturn Valve	☑	☐	☐	…….
Pump suction	☑	☐	☐	…….
Pump suction receiver	☑	☐	☐	…….

6. The Following Program Run :		Pass	Fail	N/A	Remark
Addition H2O	0-999 ml.	☑	☐	☐	……
Addition NaOH	0-999 ml.	☑	☐	☐	……
Addition H3BO3	0-999 ml.	☑	☐	☐	……
Reaction Time	0-108 min	☑	☐	☐	…….
Distillation Time	0-108 min	☑	☐	☐	…….
Steam Capacity	10%-100%	☑	☐	☐	……
Suction Sampe		☑	☐	☐	……
Suction Receiver		☑	☐	☐	……

7. Measured pumps		**Remark**
Pump NaOH	Volume : .....15.00.....ml	……..
Pump H2O	Volume : .....15.90.....ml	……..
Pump H3BO3	Volume : .....18.00.....ml	……..

Remark : ……จากการ PM พบว่ามีอะไหล่เสื่อมสภาพหลายรายการ ได้แก่ หัวกลัน ,ปลาย condensor บาง ทำให้มีคราบสารออกมาที่ Screw cap gl32 ,screw cap gl32 เสื่อม,สายNovoprene ควรเปลี่ยน, ventilation valve รั่วเล็กน้อย,viton cone ควรเปลี่ยน

Part 3: ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

3.1 การบำรุงรักษาทั่วไป (Basic maintenance)

Cleaning program

Glass parts and tubes must be rinsed daily before starting analysis in order to prevent clogging by crystallising chemicals.

The following settings are recommended for this:

parameters	Value
H_2O addition	150 ml
NaOH addition	0 ml
Distillation time	7 min
Steam power	100 %
Reaction time	0 s
Suction sample	30 s

→ Insert a digestion tube (without sample) and start the program.

➡ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

3.2 General error message

Fault description	Cause	Remedy
'Cooling water flow volume too low'	Cooling water pressure under 1 bar	■ Open water tap. ■ Check coolant pressure. ■ Check coolant tube. Program continues automatically once error has been fixed.
'Sample tube missing'	Sample tube missing.	■ Insert sample tube. Continue program or restart.
'Distillation room protective door open'	Protection door not closed	■ Close protection door. Program continues automatically once error has been fixed.
'Reagent storage/ waste'	One or more storage tanks are empty	■ Fill storage tank. ■ Check correct seating of the universal sensors. The running program can be continued after rectification of the error.
	The sample waste tank is full.	■ Empty sample waste tank. ■ Check correct seating of the universal sensors. The running program can be continued after rectification of the error.

Analytical errors

Fault description	Cause	Remedy
Analysis results too high	The chemicals used are contaminated with nitrogen compounds.	■ Detailed checking of the chemicals. ■ Determination of a blank value. ■ Replace the chemicals if necessary.
	Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.	■ Increase of the water addition amount.
	Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	■ Replacement of the glass condenser.
	Glass cleaning agents in the digestion tube.	■ Clean digestion tube in advance with distilled water.
	Entrainment of ammonia from the previous sample.	■ Increase distillation time. ■ Check whether the sample was previously sufficiently alkalised.
Analysis result too low or no result	Incomplete distillation; distillation time too short.	■ No quantitative expulsion of the ammonia content. ■ The distillation amount should be 100 ml.
	Ammonia escapes at leaking places.	■ Soiled or defective Viton plugs; clean or replace. ■ Check seals (GL screw connections) on the distribution head; replace if necessary. ■ Check valve at the condenser is gummed up; clean or replace. ■ Digestion tube is damaged at the neck extension. ■ Distribution head glass leaks; replace.
	Addition amount of the sodium hydroxide too little; no ammonia development.	■ Check the constant flow rate of the NaOH pump (see Technical Data).
	Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.	■ Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	■ Increase of the acid amount.
	Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.	■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.

Technology

DKSH

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	< 350	V	253	V	PASS
Photometric Noise	-		-		
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 0.49 Abs	± 0.02	Abs	0.489	Abs	PASS
BC mode with gauze			0.0007	Abs	
BC mode without gauze			0.0009	Abs	
* Difference between With gauze and without gauze	< 0.02	Abs	-0.0002	Abs	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 speccifications

***Your satisfaction is our promise* @ SPCRT**

[redacted]

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2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260
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Job No. LSPR2208846
☐ Service contract Basic Plan
☐ Service contract Performance Plan

DKSH
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

PREVENTIVE MAINTENANCE AND PERFORMANCE VERIFICATION REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

Issued Date: 10/10/22

Customer :	บริษัท เอ็นไวรอนเม้นท์ แอนด์ แลบอราตอรี่ จำกัด	Manufactuer :	GBC Scientific Equipment Pty Ltd.
Address :	53/3 หมู่ 3 ถนนเรวดี ตำบลตลาดขวัญ อำเภอเมืองนนทบุรี จังหวัดนนทบุรี 11000	Model :	SavantAA
		Serial No :	A8631
Contract :	[redacted]	Location :	Laboratory

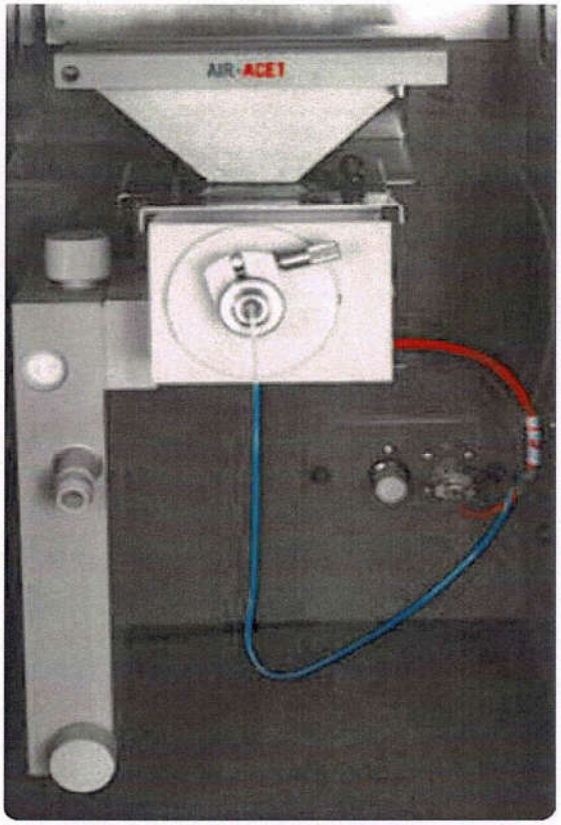
Power on switch and initial status

Instrument Ready สถานะเครื่องพร้อมใช้งาน

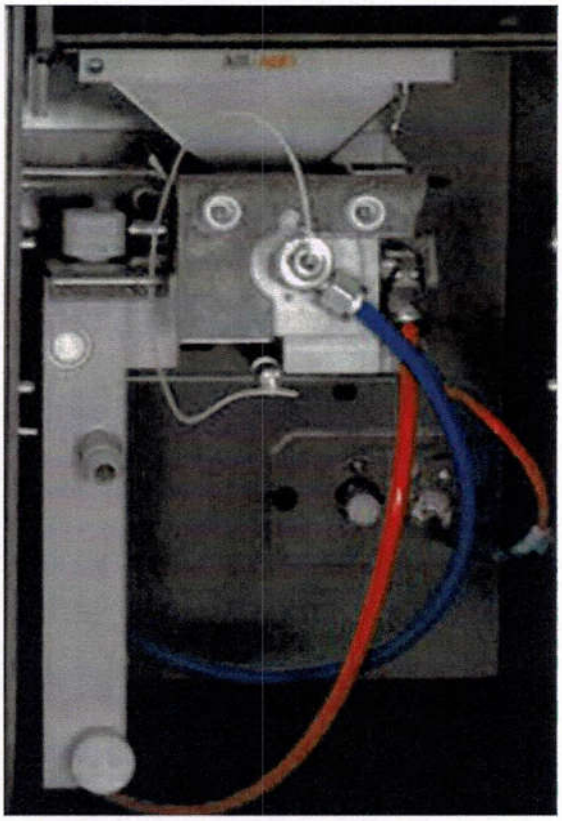
Preventive Maintenance	Pass	Fail	Remarks
Electrical Voltage			
- **Main voltage** (power supply check 220V ±10V).	☑	☐	236.5 VAC
- **Power indicator light** (Replace if faulty).	☑	☐	N/A
- **Power core** (Clean or replace as appropriate).	☑	☐	N/A
- **Fan** (Clean or replace filter element as appropriate).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

Spray Chamber Type

☐ ABR Spray Chamber



☑ Standard Spray Chamber



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

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

Note:

Signature	
Customer ..... (.....)	Date :
Service Engineer [redacted] ([redacted])	Maintenance Date : 10/Oct/2022

Job No. LSPR2208846
☐ Service contract Basic Plan
☐ Service contract Performance Plan

DKSH
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

Performance Verification	Specification	Actual Value	Pass	Failed	Remarks
1. **Wavelength accuracy** (optic calibration check).	Cu 324.75 nm ±0.2 nm	324.80 nm	☑	☐	N/A
	Cs 852.10 nm ±0.2 nm	852.17 nm	☑	☐	N/A
2. **Slit width accuracy** (0.2 nm ,0.5 nm,1.0 nm)	0.2 nm ±0.02 nm	0.22 nm	☑	☐	N/A
	0.5 nm ±0.05 nm	0.52 nm	☑	☐	N/A
	1.0 nm ±0.10 nm	1.05 nm	☑	☐	N/A
3. **EHT**	<350V	253 V	☑	☐	N/A
4. **Absorbance accuracy** (absorbance calibration check). ➢ Gauze 0.49 A.U.	Reading ±10% of calibrated value.	0.4891 Abs.	☑	☐	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.	☑	☐	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.	☑	☐	N/A
	<0.5% RSD	0.19 %	☑	☐	N/A

Note:

Signature	
Customer ..... (.....)	Date :
Service Engineer [redacted] ( )	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

NSC-TISI-TIS17025
CALIBRATION 0008

Cert. No.: 22TM1185

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) %

[redacted]

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.

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

Cert. No.: 22TM1185

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	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**

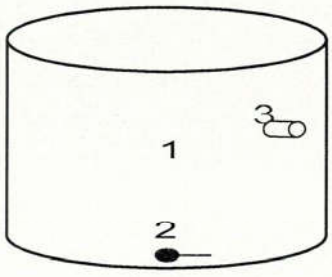
(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

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 directry concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



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

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

[redacted]

Equipment : Autoclave

Condition As-Received : Used Item

Reference : 2207-0250OC-7

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/cm²)	Uncertainty (± °C)	Coverage Factor *k*
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 %.

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[redacted]

PerkinElmer

MAINTENANCE AND IPV TEST CERTIFICATE MODEL

Avio 200

Customer :	Environment & Laboratory	**Date Tested:**	September 9, 2022
		Recommendation Recertification	
Address :	40 Soi Liangmueangnon 13	**Period**	12 Months
	Talad Kwan, Mueang	**Recertification Due:**	September 9, 2023
	Nonthaburi 11000	**Date Last Certified:**	January 14, 2021
User Name:	[redacted]	**Visit Number:**	1 of 1
Phone:		**PerkinElmer Phone:**	02-719-6420 ext 206
E - Mail :		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
Avio 200	079S16062402	

TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Method		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	Jun 30,2023
Instrument Cal. STD4	N930-0221	Nov 30, 2023

CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		

PerkinElmer

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 reqiured, check and replace all purgebfilters.	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

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

PerkinElmer

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

PerkinElmer Ltd. 290 Soi 17 Rama 9 Road, Khwang Bangkapi, Khet Huay Kwang, Bangkok 10310, Thailand

PerkinElmer

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 perfomed 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: [redacted]

( )

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

NSC-TISI-TIS17025
CALIBRATION 0008

Cert. No.: 22TM1184

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 ± 10) °C
Relative Humidity :	(50 ± 30) %

[redacted]

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.

Equipment : Incubator
Condition As-Received : Used Item
Reference : 2207-0250OC-4

Cert. No.: 22TM1184

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

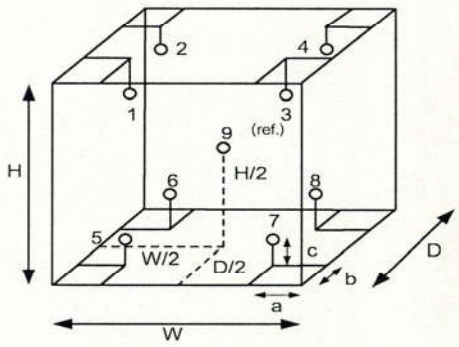
1. Reference standard instrument:-

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



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^3

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

[redacted]

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

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

Calibration Point	Measured Temperature (°C)								
	Position								
(°C)	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 %.

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[redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

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

[redacted]

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.

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
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

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor *k*
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

[redacted]

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (±Abs)	Coverage Factor *k*
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 %.

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[redacted]

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

NSC-TISI-TIS17025
CALIBRATION 0008

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) %

[redacted]

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.

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

Cert. No.: 22TM1183

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

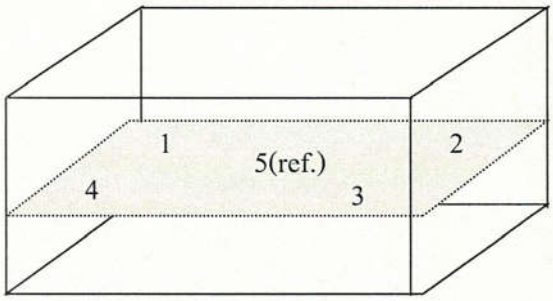
Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44073381	22LM78/1	12 May 2023

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

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



Front

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

[redacted]

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

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 *k*
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 %.

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[redacted]