

ภาคผนวก จ

เอกสารสอบเทียบ



Certificate No.: T/O 660198

Date of issue : 11-Oct-2023

Equipment Description : Refrigerator
Equipment Model : P1010
Equipment Serial No. : P1010-1020-0005
I.D. No. or Control No. : TNP.LAB.01
Manufacturer : Entech Industrial Solution Co.,Ltd.
Customer Name : TNP ENVIRONMENT CO.,LTD.
Customer Address : 332/173 Moo. 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong,
Nonthaburi 11110
Total pages of certificate : 2 pages
Instrument Receiving Date : 9-Oct-2023
Receiving No. : O-230230
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%

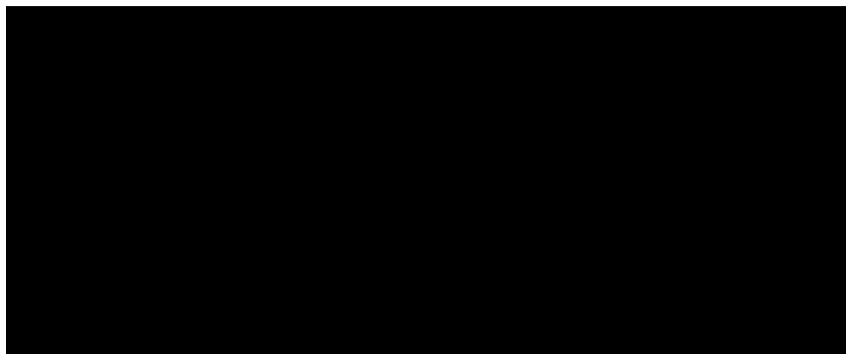
*The standard uncertainty of measurement has been determined in accordance with M 3003
The expression uncertainty and confidence in measurement.*

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.*

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 : 9-Oct-2023



Certificate No. : T/O 660198

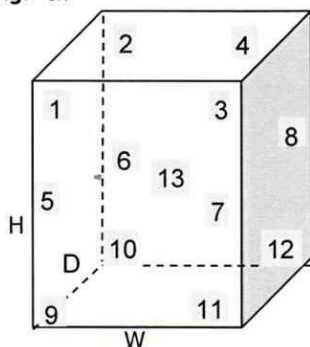
The Reference Standard Instrument :-

Instrument	Model	Serial No.	Cert No.	
1) Data logger with RTD Probe	Agilent 34972A	MY41187730	PSL-T 0651-1/66	21-Apr-2024
		MY60008352	PSL-T 0651-3/66	21-Apr-2024

Measured room conditions

Temperature :	Minimum: 30.8 °C	Maximum: 31.9 °C
Humidity :	Minimum: 50.7 %RH	Maximum: 57.2 %RH
Voltage :	Minimum: 219.8 VAC	Maximum: 223.4 VAC
Fresh Air Setting:	off	

Sensor Position :



Working Space of chamber :

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

Sensor Installation Details :

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

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

(*) Without adjustment

() After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
(°C)	(°C)	Sensor Position								
		1	2	3	4	5	6	7	8	9
		4.02	4.35	4.01	4.20	4.37	4.22	4.17	4.39	4.05
		Sensor Position								
		10	11	12	13					
		4.29	4.30	4.28	4.19					

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
(°C)	(°C)	(°C)	(± °C)	(°C)	(± °C)	K
4.0	4.1	1.19	1.08	2.47	1.5	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

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HORIBA
MODEL / TYPE : LAQUA-PH1100/9615S
SERIAL NO. : B80A0042/9X0B0575
CLID. NO. : 272001452
JOB CONTROL NO. : 230911100397

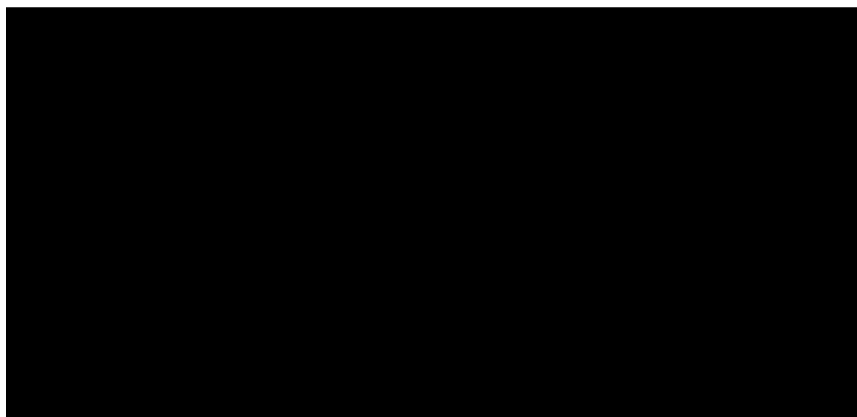
CUSTOMER : TNP ENVIRONMENT CO., LTD.
332/173 MOO 3 TAMBON BANG RAK PHATTANA,
AMPHOE BANG BUA THONG, NONTABURI 11110

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 :



Approved By :

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. Q23100397

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HORIBA
MODEL / TYPE : LAQUA-PH1100/9615S
SERIAL NO. : B80A0042/9X0B0575
DATE OF CALIBRATION : 12 September 2023

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \% \text{ RH}$

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)"

Certificate No. Q23100397

F3-011-04/01-12

page 2 of 3



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 (\pm pH)	k Factor
4.003	4.01	150.2	-0.007	0.010	2,00
7.000	7.00	-26.1	0.000	0.015	2,06
10.003	10.01	-187.1	-0.007	0.016	2,05

Technical Note. Setting function CAL 3 point (4,7,10).

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 No. Q23100397

F3-011-04/01-12

page 3 of 3



@clccalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMO-HYGROMETER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 445814
SERIAL NO. : PONPE5816745
CLID. NO. : 232303263
JOB CONTROL NO. : 230911100396

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

DATE OF RECEIVED : 11 September 2023

DATE OF ISSUED : 15 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 :

Approved By :

15 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. Q23100396

F3-011-04/01-12

page 1 of 3



REPORT OF CALIBRATION

FOR

NOMENCLATURE : **DIGITAL THERMO-HYGROMETER**
MANUFACTURER : **EXTECH INSTRUMENTS**
MODEL / TYPE : **445814**
SERIAL NO. : **PONPE5816745**
DATE OF CALIBRATION : **13 September 2023**

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPTH-11**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.

Certificate No. 21028, Due Date 09 December 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ 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)"

Certificate No. Q23100396

F3-011-04/01-12

page 2 of 3



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 the measuring digital thermo-hygrometer.

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty \pm (° C)
20.0	20.01	19.9	+0.11	0.27
25.0	25.01	25.2	-0.19	

2. CORRECTION OF HUMIDITY

STD Temperature (° C)	STD Reading (%RH)	DUC Reading (%RH)	Correction (%RH)	Uncertainty \pm (%RH)
25	50.0	47	+3.0	0.8

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 49 of 54

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

End of Certificate

Certificate No. Q23100396

F3-011-04/01-12

page 3 of 3



@clccalibration

Certificate of Calibration

Certificate No. : 67-400049-1

Page : 1 of 2

Submitted by : TNP Environment Co., Ltd.

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 200 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TNP.LAB.12

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 26 January 2024

Date of Calibration : 01 February to 02 February 2024

Date of Issue : 02 February 2024

Calibrated by :

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 67-400049-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 ° C Standard reading 0.8789 ° C

Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
21.2064	20	1.2	0.31
31.3084	30	1.3	0.31

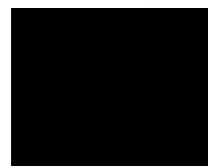
Remark

UUC : Unit Under Calibration

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

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

- oOo -



Certificate no: H/T 670338

Date of issue : 21-Mar-24

Instrument description : Thermo-Hygrometer
Instrument model : Extech 445815
Instrument serial no. : PONPE5899554
ID no. or control no. : TNP.LAB.21
Manufacturer : Extech Instruments
Probe description : -
Probe model : -
Probe serial : -
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
Receiving no. : L-241004-1
Receiving date. : 08-Mar-24
Parameter of calibration : Temperature Calibration
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison of indication with the Standard Thermo- hygrometer according to calibration Work Instruction no .WI-CL-11-C

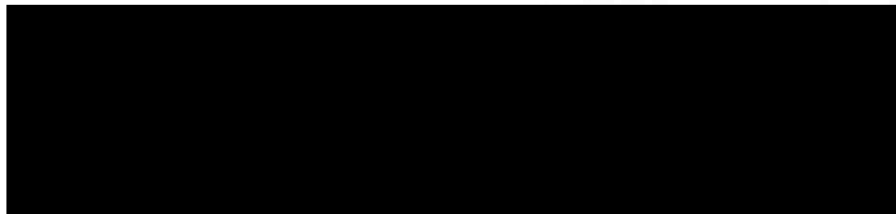
The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.

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

Date of calibration : 20-Mar-24



Certificate no: H/T 670338

Standard references

Standard	Reference No.	Vendor	Due Date
ARALAB 300ECP,Fitoclima	S2023070040-001	MIT	07-Jul-24
Thermo HygroPalm HP 23-A	SG-H-00579/66	Success Gateway	16-Aug-24

Measured room conditions

Temperature : 22.1 °C

Humidity : 55.9 %RH

Pressure : 1019.3 mbar

Calibration results (Without Adjustment)

Reference temperature : - °C

Parameter of standard	Standard values	Mean of UUC.	Error	Uncertainty (±)
Temperature (°C)	19.97	20.1	0.13	0.50
Temperature (°C)	25.02	25.2	0.18	0.50
Temperature (°C)	29.99	30.2	0.21	0.50

Remark : -

End of Report

Certificate no: H 670285

Date of issue : 21-Mar-24

Instrument description : Thermo-Hygrometer
Instrument model : Extech 445815
Instrument serial no. : PONPE5899554
ID no. or control no. : TNP.LAB.21
Manufacturer : Extech Instruments
Probe description : -
Probe model : -
Probe serial : -
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
Receiving no. : L-241004
Receiving date. : 08-Mar-24
Parameter of calibration : Humidity Calibration
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
 Temperature : 23 ± 5 °C
 Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison of indication with the Standard Thermo- hygrometer according to calibration Work Instruction no .WI-CL-11-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.

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

Date of calibration : 19-Mar-24

Certificate no: H 670285

Standard refereces

Standard	Reference No.	Vendor	Due Date
Thermo HygroPalm HP 23-A	SG-H-00579/66	Success Gateway	16-Aug-24
Hygrogen 2-XL	Performance	Entech	24-Mar-24

Measured room conditions

Temperature : 22.7 °C **Humidity :** 56.7 %RH **Pressure :** 1013.3 mbar.

Calibration results (Without Adjustment)

Reference temperature : 25.0 °C

Parameter of standard	Standard values	Mean of UUC.	Error	Uncertainty (±)
Humidity (%RH)	35.09	31	-4.09	1.3
Humidity (%RH)	50.03	48	-2.03	1.5
Humidity (%RH)	64.97	68	3.03	1.5

Remark : -

End of Report



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



Certificate of Calibration

Certificate No. : 23M455

Page : 1 of 2

Equipment : Standard Weight Set

Manufacturer: -

Model : Class:F1

Serial No.: 15022021-01

ID No.: TNP.LAB.25

Condition As-Received: Used Item

Received Date: 02 March 2023

Calibration Date: 04 March 2023

Reference: 2303-0104WN

Submitted by: TNP ENVIRONMENT CO.,LTD.

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1015.25 mbar

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-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 instruments :

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

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

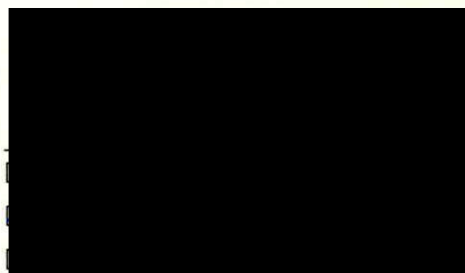
3.The certificate is valid only to the item calibrated on date and place of calibration.

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Thapakorn Thammachai
Issue Date : 07 March 2023

Approved Signatory :



B 0309848



Cert No.: 23M455

Page: 2 of 2

Result of calibration

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

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

-o0o-



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 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



CALIBRATION CERTIFICATE

Certificate No.S2306518S

page 1 of 2

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 :** $(26.9 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity :** $(52.0 \pm 10.0) \%$

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

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m³)</u>
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.

Calibrated By :

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



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raking 30 Puttamonthon 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



CALIBRATION CERTIFICATE

Certificate No.S2306518S

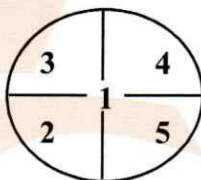
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between susccessive 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--



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



CALIBRATION CERTIFICATE

Certificate No.S2306519S

page 1 of 2

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 :** $(26.8 \pm 5.0) ^\circ\text{C}$

Accuracy class : - **Relative humidity :** $(52.0 \pm 10.0) \%$

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

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m³)</u>
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.

Calibrated By :

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



THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 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



CALIBRATION CERTIFICATE

Certificate No.S2306519S

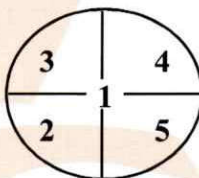
page 2 of 2

The repeatability of indication

Nominal Value (g)	Standard Deviation of reading (g)	Maximum difference between successive 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--

CERT.No.: HS-U039F

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

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

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.

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 757.00 mmHg
 Salinity : 0 ppt

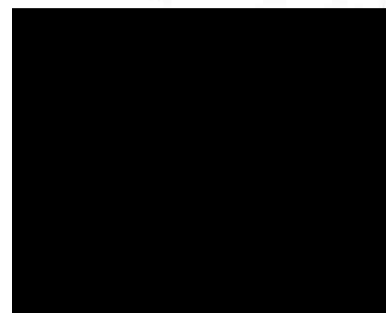
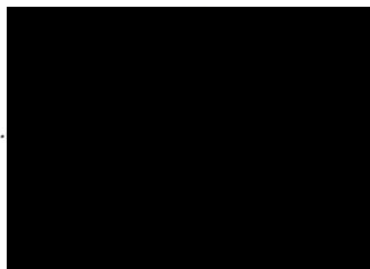
Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(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.



Certificate of Calibration

Certificate No. : 66-400687-1

Page : 1 of 2

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

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

Environment : On site calibration was carried out at the Laboratory, TNP Environment Co., Ltd.
Ambient Temperature : (27.0 to 28.0) °C
Relative Humidity : (45 to 50) %
Line Voltage : (228.0 to 230.0) V

Date of Received : 11 December 2023

Date of Calibration : 11 December 2023

Date of Issue : 14 December 2023

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20
The temperature scale used was based on ITS-90

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

ID No.	Cert. No.	Due Date	Traceability
400046 & 400023	66-400547-1	04 Apr 2024	National Institute of Metrology Thailand (NIMT)

Approved by :



The Uncertainties are for a confidence probability of approximately 95%

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



Certificate of Calibration

Certificate No. : 66-400687-1

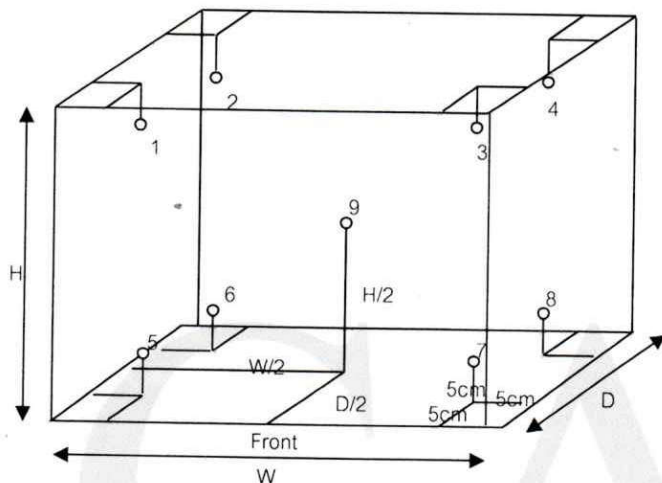
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

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



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.56 m

Capacity = 0.07 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
85.0	85.0	85.0	85.3	85.1	85.2	85.1	85.0	84.8	84.7	84.7	85.0	0.64
104.0	104.0	104.0	104.3	104.2	104.3	104.1	104.0	103.8	103.7	103.7	104.0	0.69
180.0	180.0	180.0	179.5	179.9	180.0	179.8	179.9	179.4	178.9	179.4	180.0	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
85.0	85.0	85.0	0.4	0.1	0.8
104.0	104.0	104.0	0.4	0.1	0.8
180.0	180.0	180.0	1.4	0.3	1.6

Remark The uncertainty is not combine uniformity of the air chamber

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

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

- o0o -





ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR23110535-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

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

Equipment Name : Water Quality Meter

Manufacturer : Digicon

Model : WA-48SD

Serial Number : T.075714

ID. Number : TNP-LAB-46

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPC-04-01,
SP-CPC-04-02,

Method of Calibration : SP-CPC-04-11

Received Date : 30 Nov 2023

Calibration Date : 19 Jan 2024

Recommend Due Date : 19 Jan 2025

Date of Issue : 20 Jan 2024

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)

Calibrated by



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR23110535-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Zero Oxygen Solution	HI7040L	Lot S0027-23 _	21C31	21 Mar 2028
Standard pH Solution	PH016.L5	Lot No.882984	61267077	20 Mar 2024
Standard pH Solution	PH107.L5	Lot No.882985	61275614	13 Apr 2024
Standard pH Solution	PH020.L5	Lot No.882986	61268050	20 Mar 2024
Conductivity Standard 84 uS/cm	CS84M0S.L5	Lot No.882987	61247444	20 Mar 2024
Conductivity Standard 1413 uS/cm	CS1413M0S.L5	Lot No.882988	61267992	20 Mar 2024
Conductivity Standard 12880 uS/cm	CS1288P1S.L5	Lot No.882989	61247253	20 Mar 2024
Sodium Chloride Standard Solution	RM003461L25	Lot No.841770	97756699	23 Sep 2024

Traceability

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

HANNA - Hanna Instruments (Thailand) Ltd.

C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC 17034:2016)



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR23110535-2

Page : 3 of 3

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty (±)
4.008	3.98	-0.028	0.014
6.984	7.01	0.026	0.012
10.011	10.02	0.009	0.018

Conductivity Measurement @ 25 °C

Standard Solution	UUC Reading	Error	Uncertainty (±)
84 µS/cm	84.6 µS/cm	0.6 µS/cm	0.60 µS/cm
1.413 mS/cm	1.415 mS/cm	0.002 mS/cm	0.0082 mS/cm
12.88 mS/cm	12.89 mS/cm	0.01 mS/cm	0.075 mS/cm

* Dissolved Oxygen Permanance Test

Unit : mg/L

Actual Standard	UUC Reading	Error	Uncertainty (±)
0.0	0.0	0.0	0.13
5.0	4.9	-0.1	0.13
8.3	8.2	-0.1	0.13

Salinity Measurement

Unit : % Salinity

Actual Standard	UUC Reading	Error	Uncertainty (±)
5.0269	5.04	0.0131	0.015

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.
 Calibration Marked (*) "Not ANAB Accredited " in this Certificate have been included for completeness.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -

Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Temperature Ver	150±2 °C
Serial No.	000827-A	Model	DB 200/3
Reference Standard	Thermocouple Type K	Certificate No.	21/4272
Calibration Date	10/03/2023	Next Cal. Date	10/03/2024

Left											
Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.1	-0.36	150.7	1	150.6	-0.36	150.2	1	151.4	-0.36	151.0
2	150.8	-0.36	150.4	2	151.7	-0.36	151.3	2	151.3	-0.36	150.9
3	151.2	-0.36	150.8	3	151.1	-0.36	150.7	3	151.7	-0.36	151.3
		Mean	150.67			Mean	150.77			Mean	151.11
		SD	0.208			SD	0.551			SD	0.208
		%RSD	0.138			%RSD	0.365			%RSD	0.138

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.7	-0.36	151.3	1	150.5	-0.36	150.1	1	151.5	-0.36	151.1
2	151.6	-0.36	151.2	2	151.3	-0.36	150.9	2	151.4	-0.36	151.0
3	151.5	-0.36	151.1	3	150.6	-0.36	150.2	3	150.5	-0.36	150.1
		Mean	151.24			Mean	150.44			Mean	150.77
		SD	0.100			SD	0.436			SD	0.551
		%RSD	0.066			%RSD	0.290			%RSD	0.365

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.3	-0.36	150.9	1	151.7	-0.36	151.3	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.5	-0.36	150.1	2	151.2	-0.36	150.8
3	151.3	-0.36	150.9	3	151.4	-0.36	151.0	3	150.8	-0.36	150.4
		Mean	150.84			Mean	150.84			Mean	150.47
		SD	0.173			SD	0.624			SD	0.351
		%RSD	0.115			%RSD	0.414			%RSD	0.233

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.6	-0.36	151.2	1	151.5	-0.36	151.1	1	150.7	-0.36	150.3
2	151.6	-0.36	151.2	2	151.2	-0.36	150.8	2	151.6	-0.36	151.2
3	150.8	-0.36	150.4	3	151.5	-0.36	151.1	3	151.2	-0.36	150.8
		Mean	150.97			Mean	151.04			Mean	150.81
		SD	0.462			SD	0.173			SD	0.451
		%RSD	0.306			%RSD	0.115			%RSD	0.299

Verified By

Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.

Verification COD Reactor

Equipment Name Dri-Block Heater Digital
 Serial No. 000827-A
 Reference Standard Thermocouple Type K
 Calibration Date 10/03/2023

Temperature Ver 150±2 °C
 Model DB 200/3
 Certificate No. 21/4272
 Next Cal. Date 10/03/2024

Middle

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.2	-0.36	150.8	1	150.7	-0.36	150.3	1	151.1	-0.36	150.7
2	151.5	-0.36	151.1	2	151.7	-0.36	151.3	2	151.6	-0.36	151.2
3	151.6	-0.36	151.2	3	150.8	-0.36	150.4	3	150.9	-0.36	150.5
Mean			151.07	Mean			150.71	Mean			150.84
SD			0.208	SD			0.551	SD			0.361
%RSD			0.138	%RSD			0.365	%RSD			0.239

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.6	-0.36	151.2	1	150.5	-0.36	150.1
2	150.7	-0.36	150.3	2	151.2	-0.36	150.8	2	150.6	-0.36	150.2
3	151.6	-0.36	151.2	3	151.2	-0.36	150.8	3	151.2	-0.36	150.8
Mean			150.91	Mean			150.97	Mean			150.41
SD			0.493	SD			0.231	SD			0.379
%RSD			0.327	%RSD			0.153	%RSD			0.252

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.5	-0.36	150.1	2	151.7	-0.36	151.3	2	150.9	-0.36	150.5
3	150.8	-0.36	150.4	3	151.1	-0.36	150.7	3	151.4	-0.36	151.0
Mean			150.57	Mean			151.07	Mean			150.81
SD			0.513	SD			0.306	SD			0.252
%RSD			0.341	%RSD			0.202	%RSD			0.167

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151	-0.36	150.6	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.6	-0.36	150.2	2	150.6	-0.36	150.2	2	150.5	-0.36	150.1
3	151.5	-0.36	151.1	3	151.0	-0.36	150.6	3	151.1	-0.36	150.7
Mean			150.67	Mean			150.67	Mean			150.57
SD			0.451	SD			0.451	SD			0.379
%RSD			0.299	%RSD			0.299	%RSD			0.251

Verified By

Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.

Verification COD Reactor

Equipment Name Dri-Block Heater Digital
 Serial No. 000827/A
 Reference Standard Thermocouple Type K
 Calibration Date 10/03/2023

Temperature Ver 150±2 °C
 Model DB 200/3
 Certificate No. 21/4272
 Next Cal. Date 10/03/2024

Right

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	149.9	-0.36	149.5	1	150.3	-0.36	149.9	1	151.0	-0.36	150.6
2	151.1	-0.36	150.7	2	151.0	-0.36	150.6	2	151.0	-0.36	150.6
3	150.9	-0.36	150.5	3	149.9	-0.36	149.5	3	150.4	-0.36	150.0
		Mean	150.27			Mean	150.04			Mean	150.44
		SD	0.643			SD	0.557			SD	0.346
		%RSD	0.428			%RSD	0.371			%RSD	0.230

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	150.0	-0.36	149.6	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.0	-0.36	149.6	2	150.8	-0.36	150.4
3	150.9	-0.36	150.5	3	150.7	-0.36	150.3	3	149.8	-0.36	149.4
		Mean	150.54			Mean	149.87			Mean	150.01
		SD	0.100			SD	0.404			SD	0.513
		%RSD	0.066			%RSD	0.270			%RSD	0.342

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	151.1	-0.36	150.7	1	150.2	-0.36	149.8
2	150.9	-0.36	150.5	2	150.7	-0.36	150.3	2	150.2	-0.36	149.8
3	151.0	-0.36	150.6	3	151.1	-0.36	150.7	3	149.9	-0.36	149.5
		Mean	150.54			Mean	150.61			Mean	149.74
		SD	0.100			SD	0.231			SD	0.173
		%RSD	0.066			%RSD	0.153			%RSD	0.116

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.6	-0.36	150.2	1	150.5	-0.36	150.1	1	150.9	-0.36	150.5
2	150.5	-0.36	150.1	2	150.9	-0.36	150.5	2	150.0	-0.36	149.6
3	149.9	-0.36	149.5	3	151.1	-0.36	150.7	3	150.5	-0.36	150.1
		Mean	149.97			Mean	150.47			Mean	150.11
		SD	0.379			SD	0.306			SD	0.451
		%RSD	0.252			%RSD	0.203			%RSD	0.300

Verified By

Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.

สรุปผลการ Verify

ปรับอุณหภูมิ 154.0 °C แต่ค่าควบคุมมีอุณหภูมิ 150 ± 2 °C ทุกครั้ง

Verified By



Confidential - Not to be photocopied except by permission of the Laboratory Quality Manager or nominee.



MAINTENANCE AND TEST CERTIFICATE MODEL

Avio220 Max

Customer : <u>SGS(Thailand)Limited</u>	Date Tested: <u>January 10, 2024</u>
<u>Rayong Branch</u>	Recommendation Recertification
Address : <u>1/209 , 1/211 Moo 1,</u>	Period <u>6</u> Months
<u>T. Banchang, A. Banchang</u>	Recertification Due: <u>July 10, 2024</u>
<u>Rayong 21130</u>	Date Last Certified: <u>N/A</u>
User Name <u>Khun Saijai Ruangsawat</u>	Visit Number: <u>1OF2 W</u>
Phone: <u>[REDACTED]</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
Email: <u>[REDACTED]</u>	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
<u>AVIO200 MAX</u>	<u>M79S2304111</u>	<u>Syngristix V5</u>
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>30-Dec-24</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>30-Nov-24</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

**MAINTENANCE AND TEST CERTIFICATE MODEL****Avio220 Max****SERIAL NUMBER** M79S2304111**DATE TESTED**January 10, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

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

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

D. Adjust water and gas pressure regulator settings.

E. Inspect and leak check pneumatics drawers.

F. Clean the exterior of the instrument.

2. OPTICAL CHECKS

A. Inspect and clean all optical components.

B. As required, check and replace all purgefilters.

C. Recheck optical alignment.

3. COOLING SYSTEM CHECKS

A. Perform preventive maintenance on chiller.

B. Flush out the chiller every year.

4. PERFORMANCE CHECKS

A. Torch View Alignment.

B. Wavelength Calibration.



MAINTENANCE AND TEST CERTIFICATE MODEL
Avio220 Max

SERIAL NUMBER <u>M79S2304111</u>		DATE TESTED <u>January 10, 2024</u>	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV			
As 193.696 nm	≤ 0.009 nm	<u>0.00864</u>	nm
Ni 231.604 nm	≤ 0.011 nm	<u>0.01009</u>	nm
Ni 341.476 nm	≤ 0.015 nm	<u>0.01169</u>	nm
Spectral Resolution : VIS			
Ba 455.403 nm	≤ 0.020 nm	<u>0.01776</u>	nm
Precision			
Zn 206.200 nm	% RSD ≤ 1.0 %	<u>0.28</u>	%
Mg 280.271 nm	% RSD ≤ 1.0 %	<u>0.73</u>	%
Mg 285.213 nm	% RSD ≤ 1.0 %	<u>0.61</u>	%
Ba 455.403 nm	% RSD ≤ 1.0 %	<u>0.54</u>	%
Detection Limits : Axial			
Tl 190.801 nm	3(sd)	<u>1.52</u>	ppb
As 193.696 nm	3(sd)	<u>1.4</u>	ppb
Se 196.026 nm	3(sd)	<u>1.53</u>	ppb
Pb 220.353 nm	3(sd)	<u>1.72</u>	ppb
Detection Limits : Radial			
As 193.696 nm	3(sd)	<u>1.69</u>	ppb
Zn 213.857 nm	3(sd)	<u>0.42</u>	ppb
Mn 257.610 nm	3(sd)	<u>0.1</u>	ppb
La 379.478 nm	3(sd)	<u>0.61</u>	ppb
Ba 455.403 nm	3(sd)	<u>0.13</u>	ppb
Ba 493.408 nm	3(sd)	<u>0.1</u>	ppb
BEC : Axial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>7.83</u>	ppb
BEC : Radial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>17.57</u>	ppb



MAINTENANCE AND TEST CERTIFICATE MODEL
Avio220 Max

SERIAL NUMBER M79S2304111DATE TESTED January 10, 2024**Remarks :**Commissioning follow as commissioning performance sheets.

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



meets

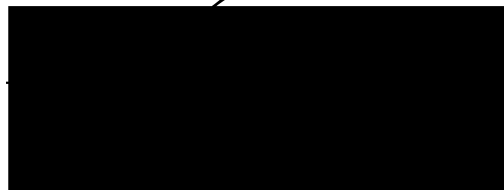


does not meet

the PerkinElmer Specifications listed on this certificate.

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

Customer Service Engineer:





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



Cert.No.: 23CHO565

Page.: 1 of 3

Certificate of Calibration

Equipment :	Spectrophotometer
Manufacturer :	Merck
Model :	Prove 100
Serial No. :	1904113676
ID No. :	S2019025
Condition As-Received:	Used Item
Received Date :	21 September 2023
Calibration Date :	21 September 2023
Reference :	2309-0483OC-2
Submitted by :	SGS (Thailand) Limited 1/209, 1/211 Moo 1, Ban Chang, Ban Chang, Rayong 21130
Calibration Place :	Spectrophotometry Lab
Ambient Temperature :	(23.8 - 20.9) °C (On-Site)
Relative Humidity :	(50.1 - 50.2) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-01
Calibrated by :	Kunchit Promprat

Issue Date :

26 September 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 0058836



Cert. No. : 23CHO565

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	39130	106269	10 Oct 2024
2. Wavelength Standard set	36730	98330	19 Jan 2024
3. Wavelength Standard set	36730	98331	19 Jan 2024

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 through :
- Starna Scientific Ltd.

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

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
418.48	418.5	0.15	2.00
513.70	513.1	0.14	2.00
536.90	536.3	0.14	2.00
637.94	637.6	0.14	2.00
879.70	878.8	0.15	2.00



Cert. No. : 23CHO565

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5645	0.563	0.0028	2.00
	0.6988	0.698	0.0028	2.00
	1.0017	1.001	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5281	0.527	0.0028	2.00
	0.6962	0.696	0.0028	2.00
	0.9984	0.998	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5699	0.569	0.0028	2.00
	0.7606	0.760	0.0028	2.00
	1.0927	1.092	0.0028	2.00

Remark

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

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

-o0o-



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

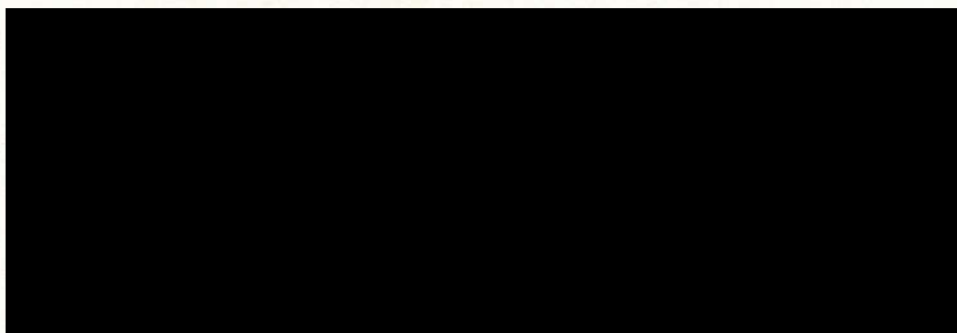


Cert. No.: 23TM1099

Page : 1 of 3

Certificate of Calibration

Equipment :	Autoclave
Manufacturer :	Rexall
Model :	LS-2D
Serial No. :	04131
ID No. :	AUT-01
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 205
Received Order :	12 July 2023
Calibration Date :	12 July 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %



Issue Date : 24 July 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 0056477



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2307-0094OC-7

Cert. No.: 23TM1099

Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Data Acquisition	MY41021843	22LM172	TPA	27 Dec 2023

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

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

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

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

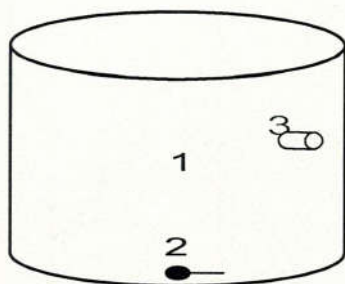
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

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

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	30	55	220
Finished of Calibration	30	57	220

<u>Position</u>	<u>Description</u>	<u>Ref. Std. ID No.:</u>
1 =	Center of chamber	21-04TC-01
2 =	Temperature sensor	21-04TC-02
3 =	Exhaust port	21-04TC-03



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2307-0094OC-7
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM1099

Page : 3 of 3

Operating parameter Set : Temperature = 121 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (kg/cm ²)	Uncertainty (± °C)	Coverage Factor <i>k</i>
121	-	1	121.837	0.89	1.2	1.3	2
		2	121.869				
		3	121.875				

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

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

UUC* : Unit Under Calibration

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

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

-o0o-



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

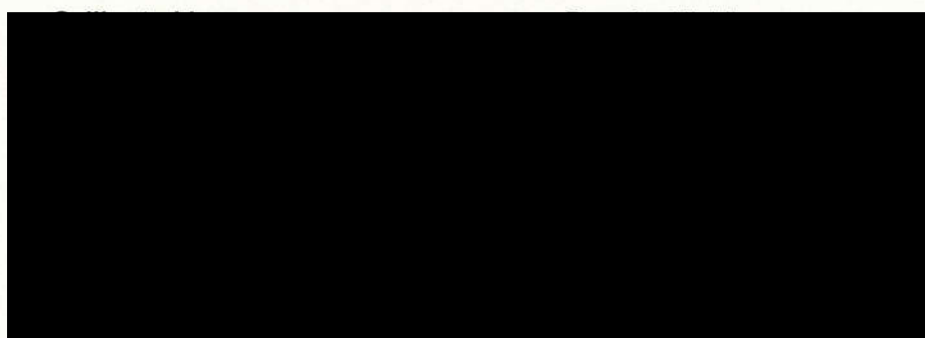


Cert. No.: 23TM1100

Page : 1 of 3

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	BM 500
Serial No. :	D593.0342
ID No. :	CHI-002
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 204
Received Order :	12 July 2023
Calibration Date :	12 July 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %



Issue Date : 24 July 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 0056478



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2307-0094OC-4

Cert. No.: 23TM1100

Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY41021843	22LM172	TPA	27 Dec 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.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

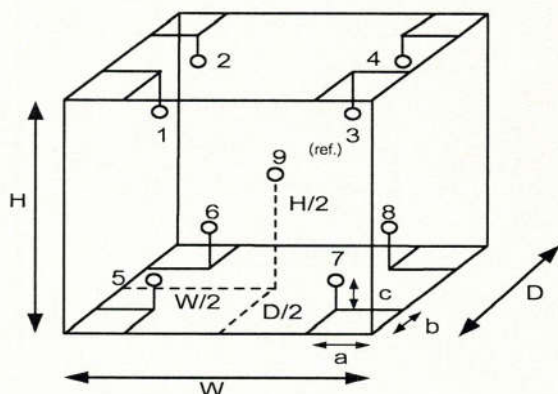
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration

	Beginning	Finished
Temp. (°C)	22	22
REL.Humid. (%)	64	66
AC Supply (Volt)	222	221



Position :	Ref. Std. ID No.:
1	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

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 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2307-0094OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1100

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.040	0.27	0.48	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.021	34.900	35.010	35.284	34.853	34.919	34.945	34.964	35.089	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-



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

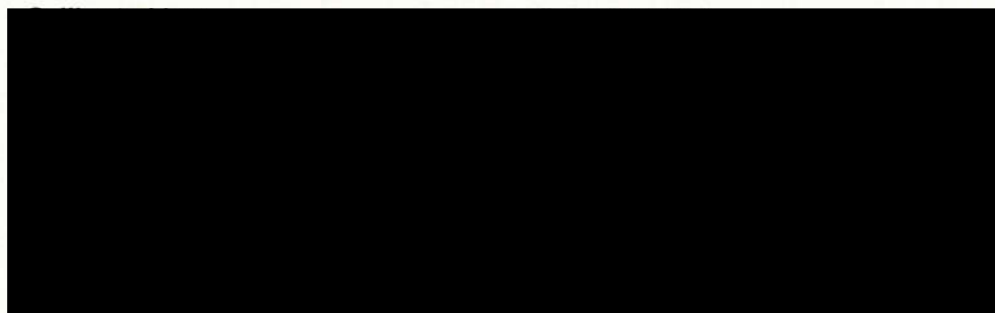


Cert. No.: 23TM1273

Page : 1 of 3

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Envilab-Intiligent
Model :	-
Serial No. :	-
ID No. :	CHI-005
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13, Talad Kwan, Mueang, Nonthaburi 11000
Location :	Room No. 204
Received Order :	24 August 2023
Calibration Date :	24 August 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %



Issue Date :

29 August 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 0057741



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2308-0600OC-1

Cert. No.: 23TM1273
 Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44035217	22LM170	TPA	16 Dec 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.

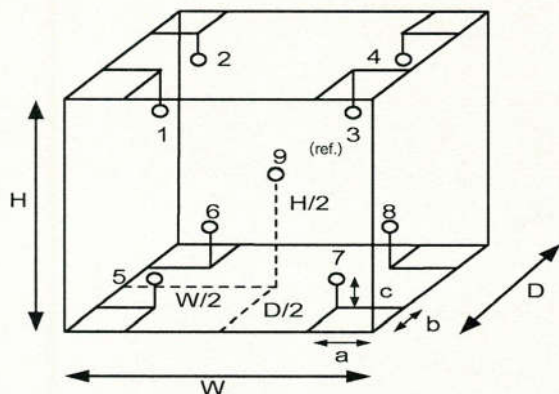
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	23
REL.Humid. (%)	50	54
AC Supply (Volt)	220	220



Position :	Ref. Std. ID No.:
1	18-10RTD-01
2	18-10RTD-02
3	18-10RTD-03
4	18-10RTD-04
5	18-10RTD-05
6	18-10RTD-06
7	18-10RTD-07
8	18-10RTD-08
9 (ref.)	18-10RTD-09

Probe Installation Details :

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

Dimension of Chamber :

D = 0.40 m
 W = 0.70 m
 H = 1.0 m
 Capacity = 0.28 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2308-0600OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1273

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.47	1.2	1.8	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.805	34.737	34.701	34.435	34.724	34.783	35.228	35.604	34.816	0.71

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-



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

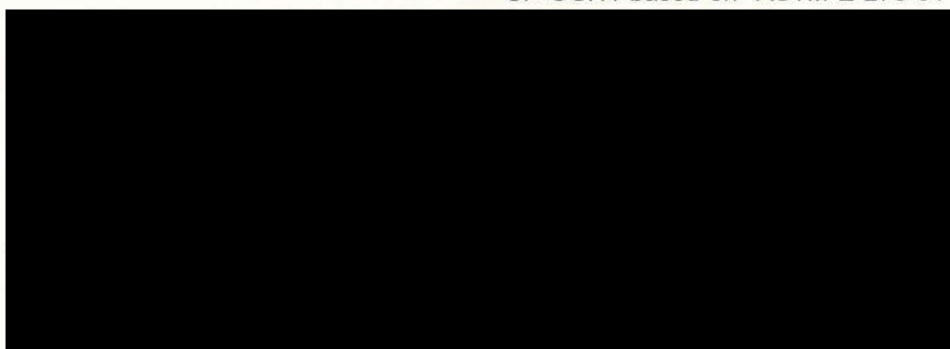


Cert.No.: 23CHO420

Page.: 1 of 3

Certificate of Calibration

Equipment :	Spectrophotometer
Manufacturer :	Hach
Model :	DR 3900
Serial No. :	1988383
ID No. :	SPE-002
Condition As-Received:	Used Item
Received Date :	12 July 2023
Calibration Date :	12 July 2023
Reference :	2307-0094OC-11
Submitted by :	Environment & Laboratory Co.,Ltd. 40 Soi Liangmueangnonthaburi 13 Talad Kwan, Mueang, Nonthaburi 11000
Calibration Place :	Room No. 304
Ambient Temperature :	(26.7 - 26.9) °C (On-Site)
Relative Humidity :	(57.2 - 51.2) % (On-Site)
Calibration Procedure :	In - house method : CP-OCH4 based on ASTM E 275-01



Issue Date : 24 July 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 0056486



Cert. No. : 23CHO420

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	32587	100509	28 Mar 2024
2. Absorbance Standard set	32590	100508	28 Mar 2024
3. Absorbance Standard set	8331	105939	28 Sep 2024
4. Wavelength Standard set	29829	94776	02 Sep 2023
5. Wavelength Standard set	29829	94777	02 Sep 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
361.40	361	0.59	2.00
447.20	446	0.59	2.00
537.00	536	0.59	2.00
638.00	637	0.59	2.00
740.51	741	0.59	2.00
807.04	807	0.59	2.00



Cert. No. : 23CHO420

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
350.0	Zero	0.000	0.0046	2.00
	0.4246	0.423	0.0061	2.00
	Zero	0.000	0.0050	2.00
	0.6385	0.633	0.0055	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5607	0.560	0.0030	2.00
	0.7336	0.733	0.0030	2.00
	1.0636	1.063	0.0030	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5224	0.522	0.0028	2.00
	0.6856	0.684	0.0029	2.00
	0.9937	0.992	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5397	0.538	0.0028	2.00
	0.6832	0.680	0.0028	2.00
	0.9886	0.985	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.

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-



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

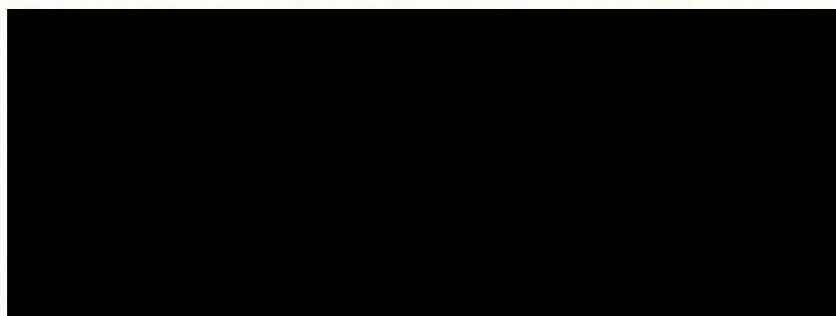


Cert. No.: 23TM1173

Page : 1 of 3

Certificate of Calibration

Equipment :	Water Bath
Manufacturer :	Memmert
Model :	WB 22
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 :	12 July 2023
Calibration Date :	12 - 13 July 2023
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %



Issue Date : 24 July 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 0056487



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2307-0094OC-3

Cert. No.: 23TM1173

Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Data Acquisition	MY44073381	23LM95	TPA	19 May 2024

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.

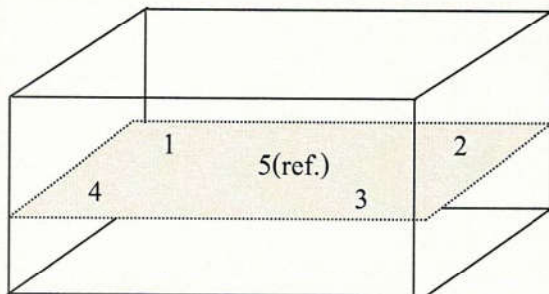
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	30	47	220
Finished of Calibration	31	50	221



Front

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



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2307-0094OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM1173

Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.507	44.503	44.498	44.509	44.502	0.15
60.0	60.0	60.0	59.914	59.928	59.912	59.899	59.894	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor <i>k</i>
44.5	0.039	0.023	2
60.0	0.098	0.042	2

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-





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



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)

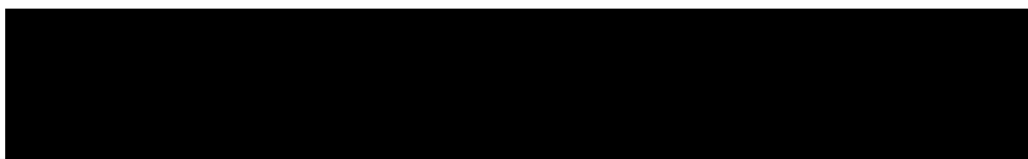
Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C
Humidity : Area Monitoring between 30%RH to 85%RH
Line Voltage : Area Monitoring 220 VAC \pm 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.

Calibrated by :



This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.

Crystal Calibration Sales and Service Co., Ltd.

PAGE 1/3

45/48 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com





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



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

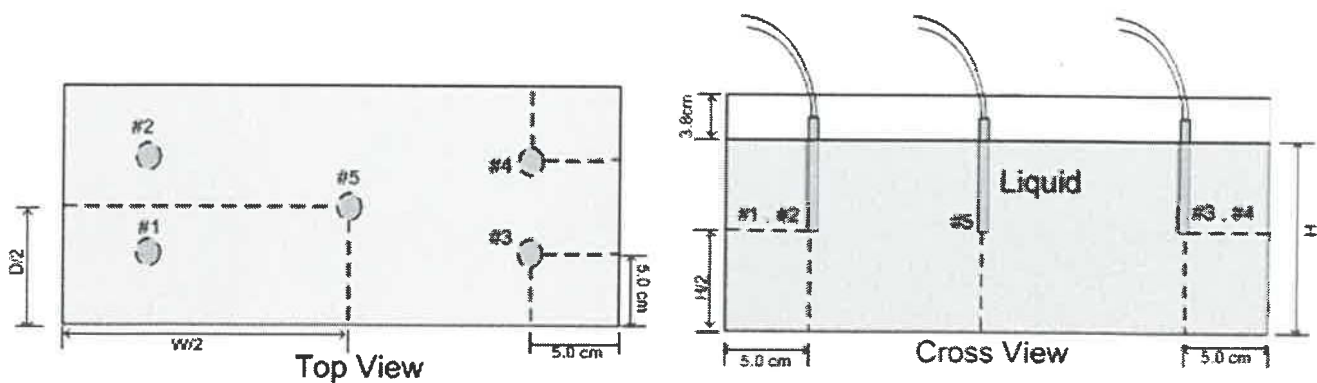
: Time Constant : - Hour 33 Minute At Cal. point 44.5 °C
Type of Control : PID Control

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 standby state of Liquid Bath

8. Sensors Installation Diagram



Position Diagrams



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



CERTIFICATE OF CALIBRATION

Issue Date : 30 June 2023

Certificate No. : 23-0879-019

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 in good condition and this report customer request and accepted in certificate

The reference sensor is preferably located at the center of bath

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

The quoted uncertainty includes "Stability" and excludes "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 throughout 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%.



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



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.

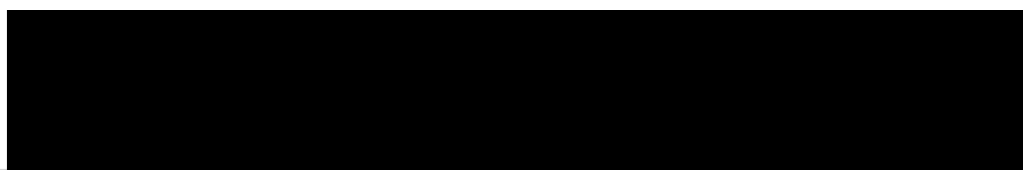
Environmental Conditions :

Temperature : Area Monitoring between 15°C to 40°C
Humidity : Area Monitoring between 30%RH to 85%RH
Line Voltage : Area Monitoring 220 VAC \pm 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.

Calibrated by :



This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.

Crystal Calibration Sales and Service Co., Ltd.

PAGE 1/3

45/48 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com





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



CERTIFICATE OF CALIBRATION

Issue Date : 30 June 2023

Certificate No. : 23-0879-008

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 traceable : 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

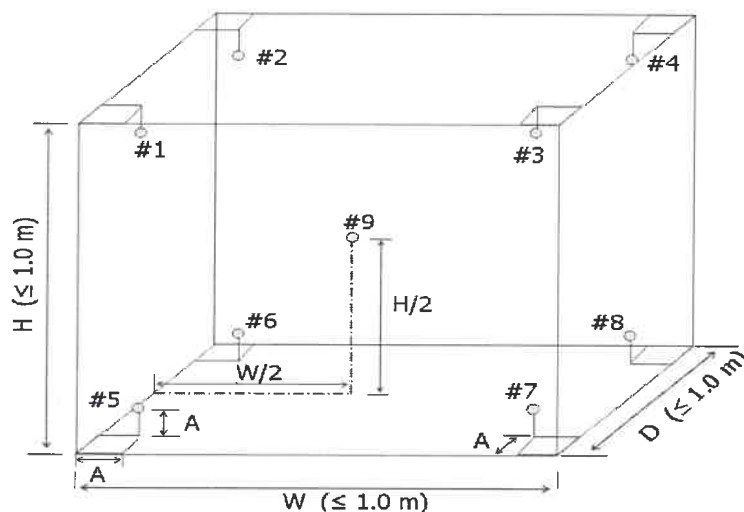


Diagram of Chamber



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



CERTIFICATE OF CALIBRATION

Issue Date : 30 June 2023

Certificate No. : 23-0879-008

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%.



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



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.

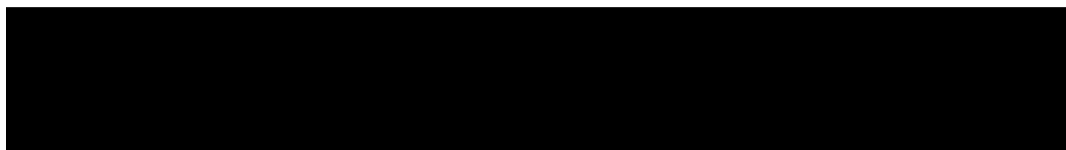
Environmental Conditions :

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.

Calibrated by :



This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.

Crystal Calibration Sales and Service Co., Ltd.

PAGE 1/3

45/48 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com





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



CERTIFICATE OF CALIBRATION

Issue Date : 30 June 2023

Certificate No. : 23-0879-010

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 traceable

: 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

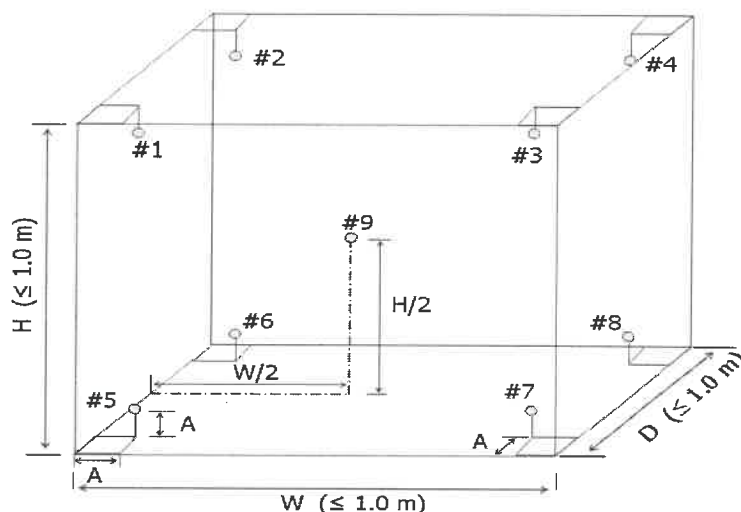


Diagram of Chamber

**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



CERTIFICATE OF CALIBRATION

Issue Date : 30 June 2023

Certificate No. : 23-0879-010

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.									Uncertainty
	(Sensor No.9 is REF)									
	#1	#2	#3	#4	#5	#6	#7	#8	#9	± (°C)
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 throughtout 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%.



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



CERTIFICATE OF CALIBRATION

Certificate No. : 23-0420-001

Issue Date : 21 March 2023

Work Order no.: 23/0420

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 : 21 March 2023

Date of Calibration : 21 March 2023

Instrument Details : Description : Autoclave
Manufacturer : HIRAYAMA
Model : HV-110 II
Serial No. : 34819080032
ID No. : CHM000199
Resolution : 0.1 °C
Location : Laboratory

Calibration Method : This instrument was calibrated by insert Temperature data logger into the chamber of autoclave according to calibration procedure CWI-T-12 in-house methods based on BS 2646 : 1993 part 5 clause 3.1

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 \pm 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.

Calibrated by :

This certificate may not be reproduced other than in full except with the prior written approval of Crystal Calibration Sales and Service co., Ltd.

Crystal Calibration Sales and Service Co., Ltd.

PAGE 1/3

45/48 Salathammasop 31, Salathammasop Rd., Salathammasop, Thawewatthana, Bangkok 10170

Phone : 0-2408-8474 Fax : 0-2408-8477 <http://www.crystalcal.com> Email : info@crystalcal.com





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



CERTIFICATE OF CALIBRATION

Certificate No. : 23-0420-001

Work Order No. : 23/0420

Issue Date : 21 March 2023

Details of Calibration

1. Reference Standards Instrument

Instrument	Serial No.	Certificate No.	Due Date
Temperature Data Logger Type RTD	R14466	22-1388-001	11 October 2023
	R14467	22-1388-001	11 October 2023
	R14469	22-1388-001	11 October 2023

2. Certificate traceable : 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

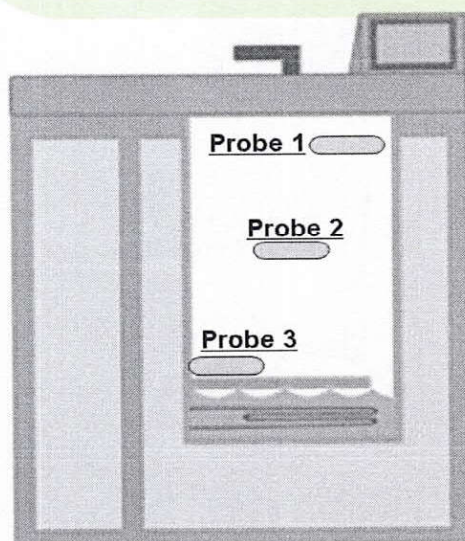
4. Calibration site : On-site

5. Result of Calibration : Without Adjustment

6. Evaluate Condition : Time Constant : 20 Minutes At cal. point 115 °C
Calibration process record temperature data at sterilization time

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

8. Sensors Installation Diagram : Probe 1 : Installation Attached to the load temperature probe, within 20 mm
Probe 2 : Installation in the half of upper the Chamber autoclave
Probe 3 : Installation in the Chamber drain, within 100 mm



Position Diagrams



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



CERTIFICATE OF CALIBRATION

Certificate No. : 23-0420-001

Work Order No. : 23/0420

Issue Date : 21 March 2023

Result of Temperature Distribution and Performance Check

Table1 : Reporting of Temperature within chamber autoclaves

Calibration point (°C)	Sterilization time (Minutes)	Average Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
		#1	#2	#3	
115.0	20	115.46	115.44	115.49	0.45
118.0	15	118.52	118.51	118.55	0.45
121.0	15	121.55	121.52	121.57	0.45

Table 2 : Reporting of Characterization within chamber autoclaves

Indicator Set point (°C)	Indicator Reading (°C)				Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
	MAX	MIN	Average	MPa			
115.0	115.7	115.6	115.7	0.071	0.29	0.09	0.60
118.0	118.8	118.7	118.8	0.089	0.21	0.06	0.45
121.0	121.8	121.7	121.8	0.108	0.20	0.08	0.45

Note :

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

Temperature Data Logger has setting interval time is 5 seconds per record data

The measured temperature data readout by software "Madgetech Data Logger Software"

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 bath under steady state conditions.

Overall Variation - The difference of the maximum and minimum measured temperatures throughtout 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%.

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 นักชดถุกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

หมายเหตุ

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

ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)

เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260

เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



DKSH Scientific



www.dksh.com/scientific-thailand



marketing.tec.th@dksh.com



[@dkshscientific](https://line.me/tv/@dkshscientific)

Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ1..... ครั้ง ต่อ ปี
ครั้งที่ ...1...วันที่..... 17/08/2023.....

รายละเอียดผู้รับบริการ

หน่วยงาน	บริษัท บุโร เวอร์ทิคัล เอคิวก แล็บ (ประเทศไทย) จำกัด		
ที่อยู่	อุทยานวิทยาศาสตร์ประเทศไทย 111 หมู่9 ถนนพหลโยธิน ตำบลคลองหนึ่ง คลองหลวง จังหวัดปทุมธานี 12120		
โทรศัพท์		แฟกซ์	

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณ ปฐมาภรณ์ ทองสาย				
ตำแหน่ง					
โทรศัพท์		เบอร์ต่อ		แฟกซ์	
E-mail					

รายละเอียดผู้ให้บริการ

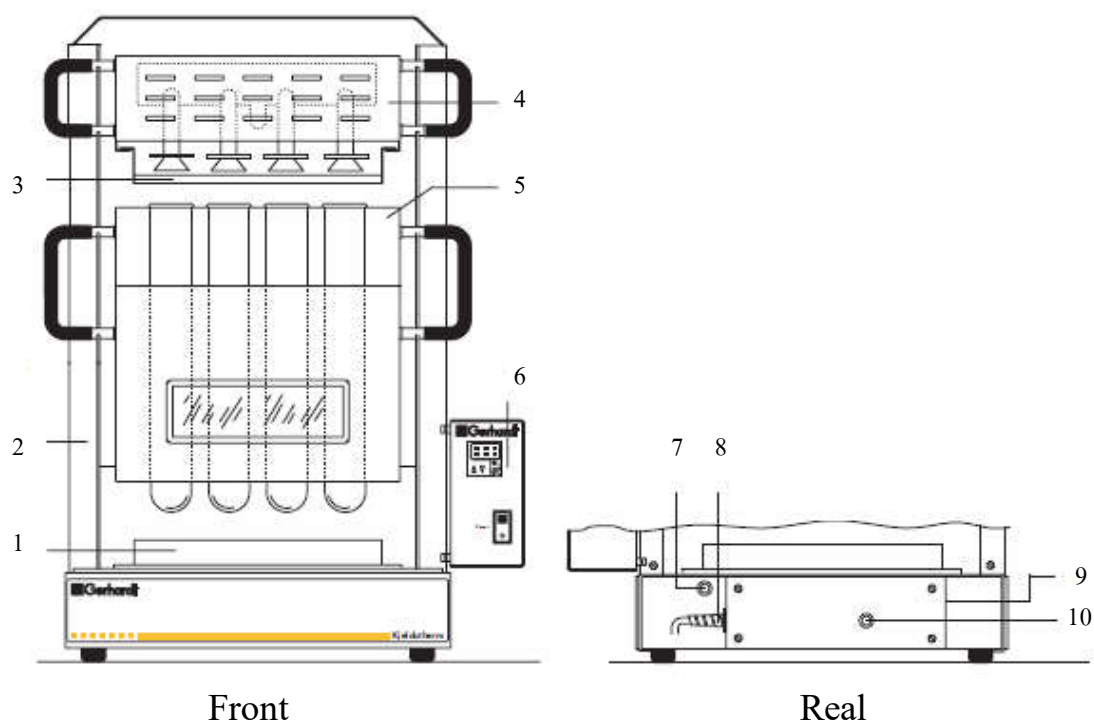
บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)	
เลขที่ [REDACTED]	
โทรศัพท์ [REDACTED] Email [REDACTED]	
เจ้าหน้าที่ประสานงาน : [REDACTED] โทรศัพท์ [REDACTED]	
เจ้าหน้าที่ผู้ให้บริการ	นาย เมฆินทร์ วงษ์ชัย
ตำแหน่ง	Specialist, Technical Services
โทรศัพท์	แฟกซ์ -
E-mail	mekin.mw@dksh.com

ลงนามผู้รับบริการ	
ตัวบรรจง	(.....)
ตำแหน่ง	
วันที่ / ประทับตราบริษัท	

ลงนามผู้ให้บริการ	[REDACTED]
ตัวบรรจง	(.....)
ตำแหน่ง	[REDACTED]
วันที่ / ประทับตราบริษัท	17/08/2023

Part 1: ตรวจสอบเช็คสภาพเครื่อง

Digestion Unit



No.		PASS	Fail	Remark
1	KJALDATHEAM –Digestion Block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Two tier console	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Drip tray	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Exhaust system	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
5	Insert rack	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	Control unit	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
7	Inner for PT-100	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8	Connection cable	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9	Excess current switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
10	Excess temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

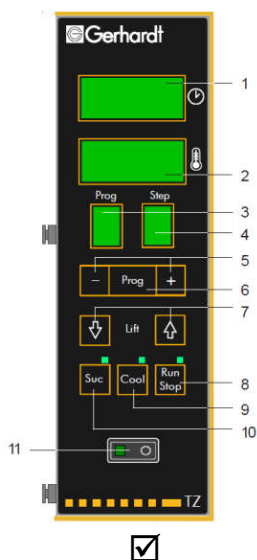
Part 2: รายละเอียดและรายงานผลการให้บริการ Preventive Maintenance

2.1 ตรวจสอบระบบไฟฟ้า

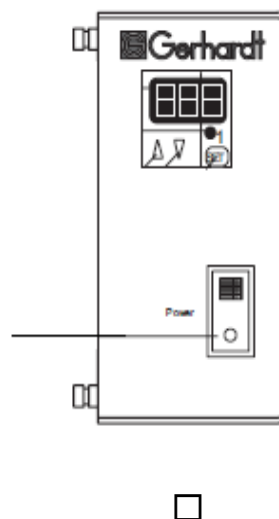
	Pass	Fail	N/A	Remark
ใช้ไฟ 220 V 50 Hz	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
กระแสไฟฟ้าตามพิกัดเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.2 ตรวจสอบอุปกรณ์ภายนอก

	Pass	Fail	N/A	Remark
สายไฟของเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ท่อแก้วรวมไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สายยางต่อกับท่อแก้วรวมไอกรด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
สภาพของ Aluminum block	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	เริ่มเสื่อมสภาพเล็กน้อย



TZ control



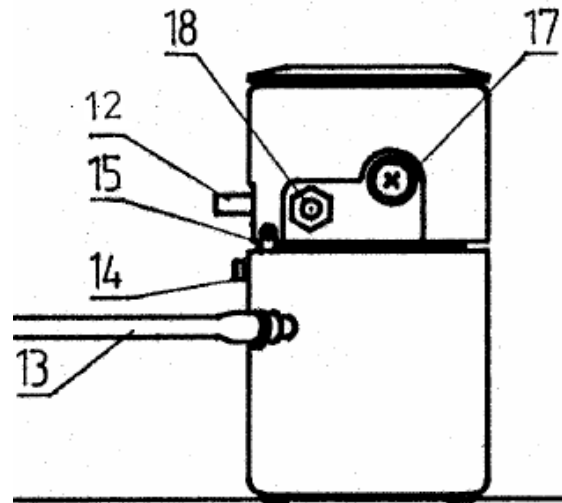
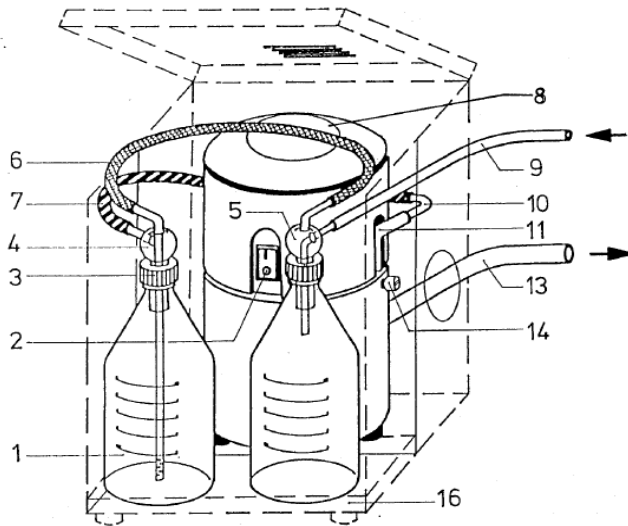
TR control

2.3 ตรวจสอบระบบการทำงาน

	Pass	Fail	N/A	Remark
สวิตช์เปิด-ปิดหลัก (1) TR control (11) TZ control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
จอแสดงผลของ Control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ปุ่มกด ตั้งค่า โปรแกรม TZ control (5,6)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ปุ่มกด ขึ้น ลง ลิฟท์ TZ control (7)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ปุ่มกด ตั้งค่า Suction TZ Control (10)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ปุ่มกด ตั้งค่า Cool Trap TZ Control (9)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ปุ่มกด เริ่ม / หยุดการทำงาน TZ Control (8)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การขึ้นของอุณหภูมิมากกว่า 10 องศาต่อหน้าที่ 250 องศา	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของตัวป้องกันอุณหภูมิสูงเกิน	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
การทำงานของระบบควบคุมอุณหภูมิ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

☒ TUR/K



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

การบำรุงรักษาทั่วไป (Basic maintenance)

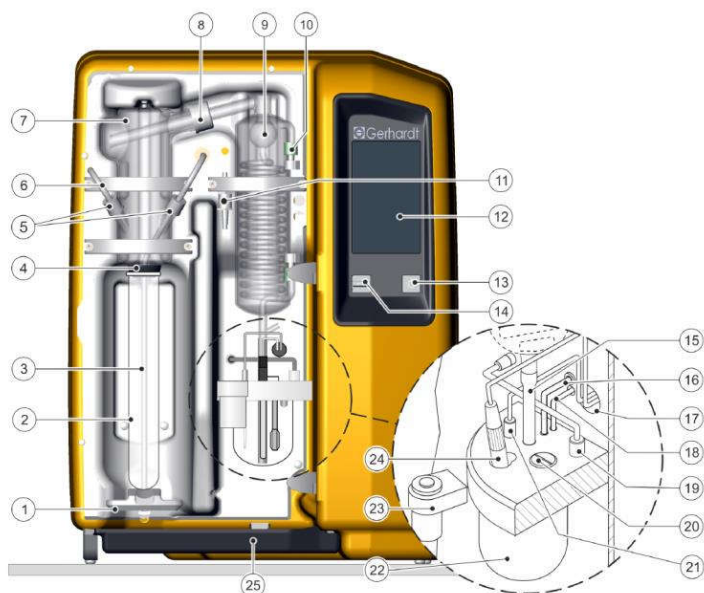
1. การย่อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย่อยที่ระดับอุณหภูมิ 250 C ระยะเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
2. เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำถาดรองไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีการบกรดหยดลงมาติดอยู่ในหลุม เพื่อป้องกันไม่ให้คราบดังกล่าวไปกั้นการแผ่อุณหภูมิ

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

Part 1: Operational Qualification (OQ)

1.1 ตรวจสอบสภาพเครื่อง

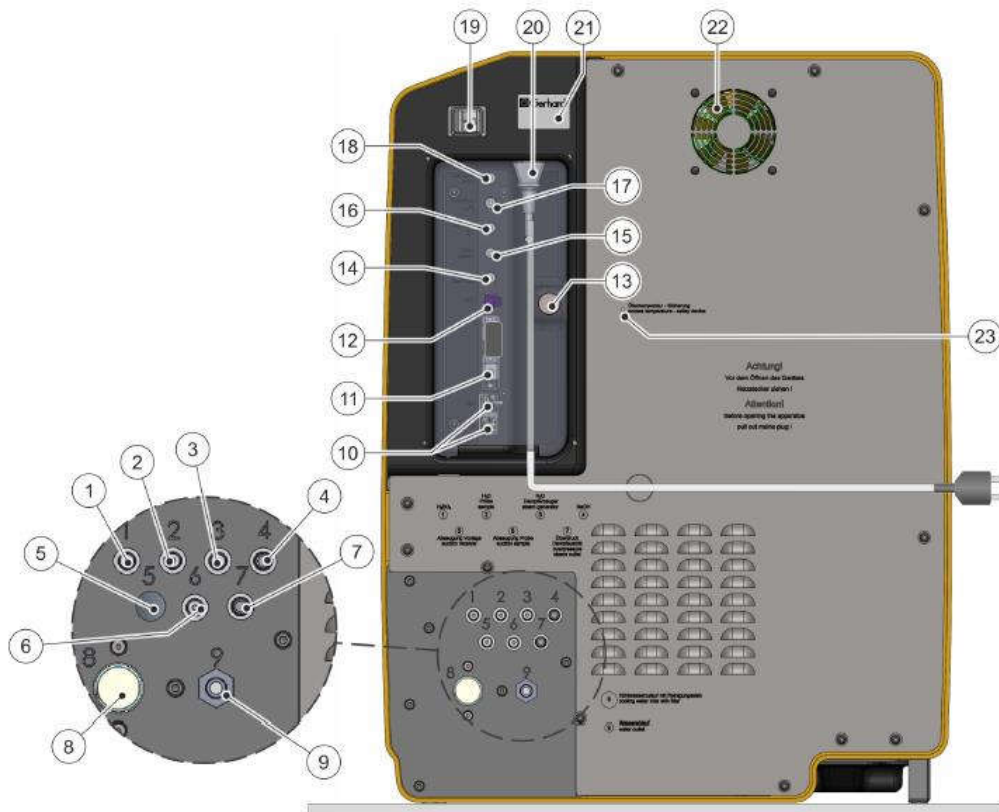
FRONT



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

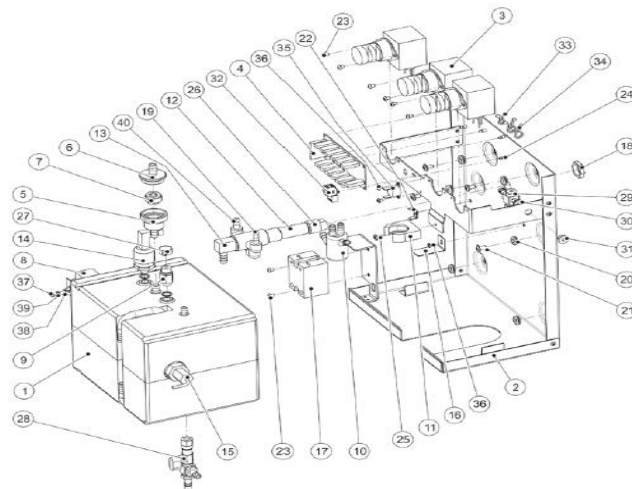
** only VAP 450

REAR



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

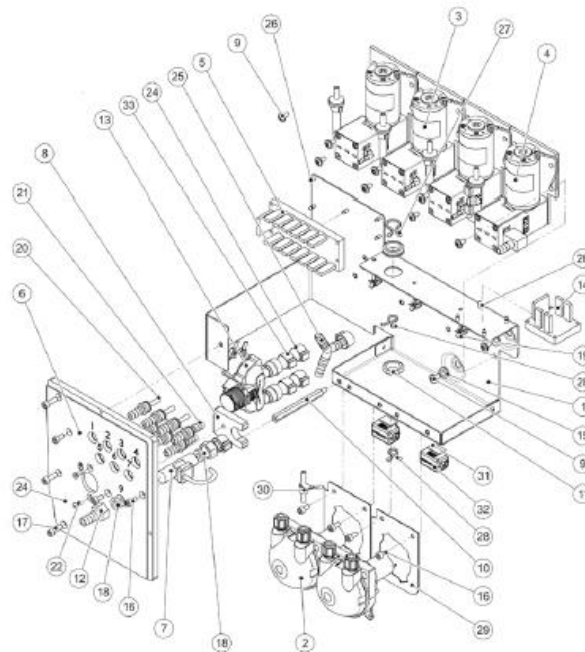
Inside Steam generator



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

39	VA Spring washer	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	Angle connection, reduced , 1/8" PP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☒ Inside Pump holder VAP200 - 450 V1-V2



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

25	Y-tube connector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Spacer bolt 5 mm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Bundle clamp 12 H 6506	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	Bundle clamp 12 H 4502	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Holder for peristaltic pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	Kit grounding pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	Adhesive tape	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	Snap ferrite VAP300-450	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Clamp	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Control panel



No		PASS	FAIL
1	Title bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Status bar	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Navigation button	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Smart switch with multiple functions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	USB interface	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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 Function Test)

- 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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Normal current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1.1 COOLING WATER BATH

	Pass	Fail	N/A	Remark
Temperature 15-20 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control Temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1.2 OPTICAL TEST VAP....400...

	Pass	Fail	N/A	Remark
Screw cap GL14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screw cap GL18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Screw cap GL32	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Distillation Head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Condensor	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Viton Cone	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Ventilation Valve BV	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Micro Switch Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Agitator motor for propeller	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. SYSTEM COOLING WATER INLET

	Pass	Fail	N/A	Remark
Cooling Water Inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flow control valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.SYSTEM CONTROL

	Pass	Fail	N/A	Remark
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding H2O	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding H3BO3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suction Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suction Reciver	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4.SYSTEM DISTILLATION

	Pass	Fail	N/A	Remark
Boiler	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Level Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Novopren	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve Shut-Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Solenoid Valve soft steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ventilation Valve Premount	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Excess Pressure Detector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heating Element	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. PUMP

	Pass	Fail	N/A	Remark
Pump H ₂ O Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Return Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump H ₂ O Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Return Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Ruturn Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump H ₃ BO ₃	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Non-Ruturn Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump suction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pump suction receiver	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. The Following Program Run :

	Pass	Fail	N/A	Remark
Addition H ₂ O 0-999 ml.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Addition NaOH 0-999 ml.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Addition H ₃ BO ₃ 0-999 ml.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reaction Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distillation Time 0-108 min	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steam Capacity 10%-100%	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suction Sampe	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suction Receiver	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Measured pumps

		Remark
Pump NaOH	Volume : 15.00.....ml
Pump H ₂ O	Volume : 15.90.....ml
Pump H ₃ BO ₃	Volume : 18.00.....ml

Remark :จากการ PM พบว่ามีอะไหล่เสื่อมสภาพหลายรายการ ได้แก่ หัวกลั่น ,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 ₂ O 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	<ul style="list-style-type: none"> ■ Open water tap. ■ Check coolant pressure. ■ Check coolant tube. <p>Program continues automatically once error has been fixed.</p>
'Sample tube missing'	Sample tube missing.	<ul style="list-style-type: none"> ■ Insert sample tube. <p>Continue program or restart.</p>
'Distillation room protective door open'	Protection door not closed	<ul style="list-style-type: none"> ■ Close protection door. <p>Program continues automatically once error has been fixed.</p>
'Reagent storage/waste'	One or more storage tanks are empty	<ul style="list-style-type: none"> ■ Fill storage tank. ■ Check correct seating of the universal sensors. <p>The running program can be continued after rectification of the error.</p>
	The sample waste tank is full.	<ul style="list-style-type: none"> ■ Empty sample waste tank. ■ Check correct seating of the universal sensors. <p>The running program can be continued after rectification of the error.</p>

Analytical errors

Fault description	Cause	Remedy
Analysis results too high	The chemicals used are contaminated with nitrogen compounds.	<ul style="list-style-type: none"> ■ 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.	<ul style="list-style-type: none"> ■ Increase of the water addition amount.
	Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.	<ul style="list-style-type: none"> ■ Replacement of the glass condenser.
	Glass cleaning agents in the digestion tube.	<ul style="list-style-type: none"> ■ Clean digestion tube in advance with distilled water.
	Entrainment of ammonia from the previous sample.	<ul style="list-style-type: none"> ■ Increase distillation time. ■ Check whether the sample was previously sufficiently alkalisied.
Analysis result too low or no result	Incomplete distillation; distillation time too short.	<ul style="list-style-type: none"> ■ No quantitative expulsion of the ammonia content. ■ The distillation amount should be 100 ml.
	Ammonia escapes at leaking places.	<ul style="list-style-type: none"> ■ 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.	<ul style="list-style-type: none"> ■ 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.	<ul style="list-style-type: none"> ■ Increase of the boric acid amount.
	Tube not completely immersed in the acid receiver.	<ul style="list-style-type: none"> ■ Increase of the acid amount.
	Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.	<ul style="list-style-type: none"> ■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.