



MAINTENANCE AND IPV TEST CERTIFICATE MODEL  
OPTIMA 8000

Customer : บริษัท เทคโนโลยี จำกัด	Date Tested: May 21, 2021
Address : 30,32 ซอยพระรามที่ 2 ซอย 63 ถนนพระรามที่ 2 แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10150	Recommendation Recertification Period 12 Months Recertification Due: May 20, 2022 Date Last Certified: November 24, 2020 Visit Number: 1 of 1
User Name: คุณณัฐกร สรรค์จันทร์	PerkinElmer Phone: 02-893-4211-17
Phone: 02-893-4211-17	PerkinElmer Fax: 02-318-5597
Email: asorny.999@hotmail.com	

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED
MODEL OPTIMA 8000 N0772045 EQL-180	SERIAL NUMBER 078S1411171C 2F1441085
TESTED EQUIPMENT IPV Methods	WinLab32 Version 5.5.0.0714 PN:6150T21EQ41E
TEST STANDARD USED Mixed standard 1/10 Mixed standard 1/100	EXPIRATION EXPIRATION DATE NOV 30, 2021 JUN 30, 2021
CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3	CALIBRATION NUMBER PART NUMBER N069-1579 N930-0221 CUSTOMER INITIALS
	COMMENTS



MAINTENANCE AND IPV TEST CERTIFICATE MODEL  
OPTIMA 8000

SERIAL NUMBER : 078S1411171C	DATE TESTED : May 21, 2021
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purge filters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every six months.	<input type="checkbox"/> OK
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK



PerkinElmer.

**MAINTENANCE AND IPV TEST CERTIFICATE MODEL**  
**OPTIMA 8000**

**SERIAL NUMBER :** 078S1411171C

DATE TESTED : May 21, 2021

**SERIAL NUMBER: 078S1411171C**

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	0.00702 nm
	Ni 231.604 nm	0.00855 nm
	Ni 341.476 nm	0.01304 nm
	Ba 455.403 nm	0.01682 nm
Spectral Resolution : VIS	≤ 0.020	
Precision	Zn 206.200 nm	% RSD ≤1.0
	Mg 280.271 nm	% RSD ≤1.0
	Mg 285.213 nm	% RSD ≤1.0
	Ba 455.403 nm	% RSD ≤1.0
Detection Limits : Axial	As 193.696 nm	3(SD) ppb ≤ 10.0 ppb
	Se 196.026 nm	3(SD) ppb ≤ 5.0 ppb
	Tl 190.801 nm	3(SD) ppb ≤ 10.0 ppb
	Pb 220.353 nm	3(SD) ppb ≤ 3.0 ppb
Detection Limits : Radial	As 193.696 nm	3(SD) ppb ≤ 60.0 ppb
	Zn 213.857 nm	3(SD) ppb ≤ 2.0 ppb
	Mn 257.610 nm	3(SD) ppb ≤ 1.0 ppb
	La 379.478 nm	3(SD) ppb ≤ 3.0 ppb
BEC : Axial (B X 1000)/(S-IE)	Ba 455.403 nm	3(SD) ppb ≤ 0.3 ppb
	Ba 493.408 nm	3(SD) ppb ≤ 0.6 ppb
	Mn 257.610 nm	≤ 30 ppb
	Mn 257.610 nm	≤ 30 ppb
BEC : Radial (B X 1000)/(S-IB)		15.47 ppb

Page 3 of 4

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



PerkinElmer®

**MAINTENANCE REPORT AND IPV TEST CERTIFICATE**  
**OPTIMA 8000**

**SERIAL NUMBER : 078S1411171C**

**SERIAL NUMBER: 078S1411171C**

DATE TESTED: May 21, 2021

Remarks :

Commissioning follow as commissioning performance sheets.

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

✓

meets

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.

**Authorized Representative :**

( Khwanchai Siangwong )

Senior Customer Support Engineer

Page 4 of 4

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



# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

<b>Customer :</b> บริษัท เทค จำกัด	<b>Date Tested:</b> May 21, 2021
<b>Address :</b> 30,32 ถนนพหลโยธิน 2 ซอย 63 ถนนพหลโยธิน 2 แขวงสามเสน เขตราชเทวี กรุงเทพมหานคร 10150	<b>Recommendation Recertification</b> Period 12 Months May 20, 2022 November 24, 2020 1 of 1
<b>User Name:</b> อรุณรัตน์ ศรีจันทร์	<b>Recertification Due:</b>
<b>Phone:</b> 02-893-4211-17	<b>Date Last Certified:</b>
<b>Email:</b> aornv_999@hotmail.com	<b>Visit Number:</b>
	<b>PerkinElmer Phone:</b>
	<b>PerkinElmer Fax:</b>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
<b>MODEL</b>	<b>SERIAL NUMBER</b>	<b>WinLab32 Version 5.5.0.0714</b>	
OPTIMA 8000	078S1411171C	<b>PN:6150T21E4Q1E</b>	
N0772045	2F1441085		
<b>EQL-180</b>		<b>EXPIRATION</b>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>		
IPV Methods		<b>EXPIRATION DATE</b>	
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	NOV 30, 2021	
Mixed standard 1/10	N069-1579	JUN 30, 2021	
Mixed standard 1/100	N930-0221	<b>CUSTOMER INITIALS</b>	
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>		
2 % HNO3			
10 % HNO3			

<b>SERIAL NUMBER :</b> 078S1411171C	<b>DATE TESTED :</b> May 21, 2021
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every six months.	<input type="checkbox"/> OK
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK





# MAINTENANCE AND IPV TEST CERTIFICATE MODEL OPTIMA 8000

# MAINTENANCE REPORT AND IPV TEST CERTIFICATE OPTIMA 8000

SERIAL NUMBER : 078S141171C		DATE TESTED : May 21, 2021	
PARAMETER	SPECIFICATION	FINAL VALUE	
<b>Spectral Resolution : UV</b>			
As	193.696 nm	≤ 0.009	0.00702
Ni	231.604 nm	≤ 0.011	0.00855
Ni	341.476 nm	≤ 0.015	0.01304
Ba	455.403 nm	≤ 0.020	0.01682
<b>Spectral Resolution : VIS</b>			
<b>Precision</b>			
Zn	206.200 nm	% RSD ≤ 1.0	0.21
Mg	280.271 nm	% RSD ≤ 1.0	0.16
Mg	285.213 nm	% RSD ≤ 1.0	0.39
Ba	455.403 nm	% RSD ≤ 1.0	0.17
<b>Detection Limits : Axial</b>			
As	193.696 nm	3(SD) ppb ≤ 10.0 ppb	2.81
Se	196.026 nm	3(SD) ppb ≤ 5.0 ppb	2.58
Tl	190.801 nm	3(SD) ppb ≤ 10.0 ppb	0.75
Pb	220.353 nm	3(SD) ppb ≤ 3.0 ppb	1.26
<b>Detection Limits : Radial</b>			
As	193.696 nm	3(SD) ppb ≤ 60.0 ppb	7.86
Zn	213.857 nm	3(SD) ppb ≤ 2.0 ppb	0.40
Mn	257.610 nm	3(SD) ppb ≤ 1.0 ppb	0.17
La	379.478 nm	3(SD) ppb ≤ 3.0 ppb	0.17
Ba	455.403 nm	3(SD) ppb ≤ 0.3 ppb	0.14
Ba	493.408 nm	3(SD) ppb ≤ 0.6 ppb	0.11
<b>BEC : Axial (IB X 1000)/(IS-IB)</b>			
Mn	257.610 nm	≤ 30 ppb	7.47
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>			
Mn	257.610 nm	≤ 30 ppb	15.47

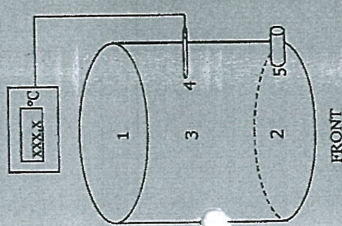
SERIAL NUMBER : 078S141171C		DATE TESTED : May 21, 2021	
Remarks :			
Commissioning follow as commissioning performance sheets.			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets		<input type="checkbox"/> does not meet	
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.			
Authorized Representative :		( Khwanchai Siangwong ) Senior Customer Support Engineer	





RECEIVED DATE : 21-Feb-22

F-G010 REV : 02



TEMPERATURE MEASUREMENT ACCURACY TEST(°C)							Uncertainty (± °C)
		Measured Temperature (°C) at Spread Locations					
	Ind Temp	#1	#2	#3	#4	#5	
Cont Temp	116	116.45	116.50	116.53	116.45	116.45	0.59
122	122	122.40	122.46	122.50	122.39	122.39	0.59

NOTE 1: THE UNCERTAINTY OF MEASUREMENT OF TEMPERATURE MEASUREMENT, ACCURACY TEST EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2: THE STABILITY TERM IN THE UNCERTAINTY

NOTE 3: LOCATION 3 WAS REFERENCE LOCATION.

NOTE 4: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S REQUEST. THE STANDARD UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS APPROXIMATELY 95%.

END OF CALIBRATION REPORT

END OF CATALOGUE

F-GO





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



NIST  
NIST-1815-1815  
CALIBRATION 0000

Cert.No.: 22CH120  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : TOA DKK  
Model : CM-41X  
Serial No. : 842572  
ID No. : EQL-211  
Condition As-Received : Used Item  
Received Date : 24 January 2022  
Calibration Date : 26 January 2022  
Reference : 2201-0646DN-1  
Submitted by : TEST TECH CO.,LTD (HEAD Office)  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkhunthian, Bangkok 10150  
(25 ± 2.5) °C  
(50 ± 15) %  
In-house method :  
- CP-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagitrakul

Approved by :   
Malee Bulkuea  
Sailhip Meangmai  
Warakorn Lemgagitrakul

Issue Date : 3 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0037370



Cert.No.: 22CH120  
Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	21977	17 Sep 2022
2) Ref. Std. Thermometer	4982054	110RC044	211201	26 Oct 2022

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

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 µS/cm	CPA Chem	761020	02 Aug 2022
1.413 mS/cm	CPA Chem	761021	02 Aug 2022
12.8806 mS/cm	CPA Chem	754037	28 June 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C  
3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 147.0, 1413.0, 12880.6 µS/cm

Conductivity Electrode Serial No.: 806F0005

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
147.0 µS/cm	149.1 µS/cm	146.9 µS/cm	0.99 µS/cm	2.00
1.413 mS/cm	1.424 mS/cm	1.413 mS/cm	0.0092 mS/cm	2.00
12.8806 mS/cm	12.81 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00

Remark - UUC\* = Unit Under Calibration

- 147.0 µS/cm Adjustment Cell constant = 98.4m<sup>-1</sup>  
- 1.413 mS/cm Adjustment Cell constant = 99.2m<sup>-1</sup>  
- 12.8806 mS/cm Adjustment Cell constant = 100.7m<sup>-1</sup>

A 1092322



Cert.No.: 22CH120  
Page.: 3 of 3

#### Calibration Results

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : CT-58101B  
- Serial No. : 806F0005

Dimension of probe;

- Length : 114 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement ( $\pm$ °C)	Coverage factor $k$
25.0	25.003	25.1	0.097	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

-o0o-



**Metrological Center**  
SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.  
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100  
Bangkok Tel : +668 9205 8851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220242

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )  
Manufacturer : -  
Model : -  
Serial No. : -  
Customer Code : EQL-181  
ID No. : T0399A5  
Customer : Test Tech Co.,Ltd

30, 32 Rama II Soi 63, Rama II Rd., Samaedam,  
Bangkhunthian Bangkok 10150

Customer Location : LABORATORY FLOOR 4

Date of Receipt : 3 February 2022

Calibrated By : Watcharasak Puttarat (Technician )

Approved By : [Redacted] / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 7 FEB 2022

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

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

PM-L14 117/01-02-64

a 1092321





**Metrological Center**  
SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhohi, Saraburi 18110, Thailand.



NSC-TIS-TIS 17025  
CALIBRATION 0244

Certificate No. T220242

Page 2 of 4

## Calibration Report

Equipment : Chamber (Cooling Room )  
Date of Calibration : 7 February 2022  
Environment : Temperature : 16.4-17.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 15 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001) and AS2853-1986 ) .

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN141-TN150	T210743	21 April 2022
TC	TYPE T	TN151-TN160	T210743	21 April 2022
DATA LOGGER	34970A	T150	T210743	21 April 2022

### 3. This certificate is traceable to :

National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TIS-TIS 17025 CALIBRATION 0244.)

### 4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour  
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close ☒ Not Available

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

Approved By \_\_\_\_\_

FM-L15 117/15-05-63



**Metrological Center**  
SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhohi, Saraburi 18110, Thailand.

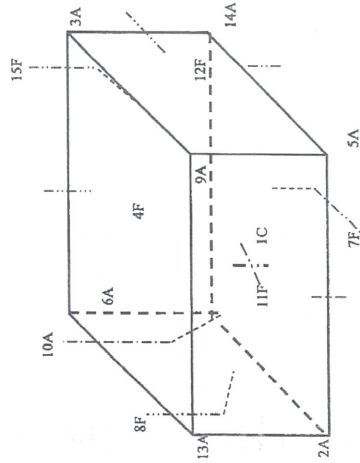


NSC-TIS-TIS 17025  
CALIBRATION 0244

Certificate No. T220242

Page 3 of 4

## Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C =	TN141
2A =	TN142
3A =	TN143
4F =	TN144
5A =	TN145
6A =	TN146
7F =	TN147
8F =	TN148
9A =	TN149
10A =	TN150
11F =	TN151
12F =	TN152
13A =	TN153
14A =	TN154
15F =	TN155

Approved By \_\_\_\_\_

FM-L15 117/15-05-63



Metrological Center  
SCIECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhro, Saraburi 18110, Thailand.



NSC-TIS-1715-1725  
CALIBRATION 024

Page 4 of 4

Certificate No. T220242

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN141	TN142	TN143	TN144	TN145	TN146	TN147	TN148	TN149	TN150
3.0	3.03	2.89	2.89	3.39	2.90	3.05	3.02	3.00	2.89	3.13
	3.23	3.20	3.25	2.93	3.17					

Chamber (Cooling Room)		Temperature Distribution				
		Setting (°C)	Average (°C)	Stability (±°C)	Uniformity (°C)	Coverage Factor k
3.0	Min, Max	2.7, 3.3	3.0	1.09	1.30	2.00
	Average		3.07			

\* The Acquired uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k$  which for a  $t$ -distribution, providing a level of confidence of approximately 95 %.

Approved By: \_\_\_\_\_



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-5484



NSC-TIS-1715-1725  
CALIBRATION 008

## Certificate of Calibration

Certificate No. : 22H2187

Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model :

Serial No.:

ID No.: EQL-064

Condition As-Received: Used Item

Received Date: 17 October 2022

Calibration Date: 25 October 2022  
to 28 October 2022  
2210-0461DN

Reference:

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

Submitted by: TEST TECH CO.,LTD. (HEAD Office)

30, 32 Rama II Sol 63, Rama II Rd.,  
Samaedam, Banghuthian, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

#### Instrument

	Model	Serial No.	Certificate No.	Due Date
1) Chilled-Mirror Hygrometer	Dew Master	41292	19848	03 Nov 2022
2) Handheld Thermometer With Sensor	1523	3240076	22049	02 Mar 2023

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Surasit Phansudnoi  
Issue Date : 01 November 2022

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

[ V ] Chakrit Waewanjua

[ ] Ponthippa Tameyayakul

[ ] Viporn Tantiyawutti



Result of Calibration:-			
Function:			
Humidity measurement			
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)
25.0	30.1	29.0	-1.1
25.0	40.1	39.0	-1.1
25.0	50.1	50.0	-0.1
25.0	60.0	61.0	1.0
25.0	75.2	76.5	1.3
			Uncertainty of Measurement (±%R.H.)
			1.5
			1.5
			1.7
			1.7
			1.7

Result of Calibration:-			
Function:			
Temperature measurement			
Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)
25.0	15.013	15.0	-0.013
25.0	20.023	20.0	-0.023
25.0	25.019	25.0	-0.019
25.0	30.009	30.0	-0.009
			Uncertainty of Measurement (±°C)
			0.72
			0.72
			0.72
			0.72

UUC\* : Unit Under Calibration  
The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

-00-

CERTIFICATE No: 22M9915  
REFERENCE No: 66549-2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BP210S  
SERIAL No : S0736477  
ID No : EQL-008  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
3032 RAMA II SOI 63, RAMA II RD.,  
SAMAEDAM, BANGKHUNTHIAN, BANGKOK  
10150

CALIBRATED BY : PRASERT P.

CALIBRATION DATE : 15-Sep-22

APPROVED BY :

ISSUED DATE : 21-Sep-22

RECEIVED DATE : 15-Sep-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.





QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Lalong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



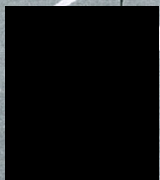
PAGE : 1 OF 2

CERTIFICATE No : 2219917  
REFERENCE No : 66549-4

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
SERIAL No : G508.0791  
ID No : EQL-128  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 15-Sep-22

APPROVED BY :   
ISSUED DATE : 21-Sep-22  
RECEIVED DATE : 15-Sep-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-C010 REV : 02

## Calibration Report

QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Lalong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com

CERTIFICATE No : 22M0915

PAGE : 2 OF 2

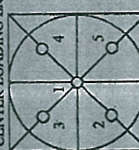
EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
ID No : EQL-008  
AIR PRESSURE : 101 mmbar ± 1 mmbar  
AMBIENT TEMPERATURE : 21° C ± 1° C  
RELATIVE HUMIDITY : 51 %RH ± 10 % RH  
CONDITION OF THIS RESULTS OF CALIBRATION  
1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6/2019 BY USING KNOWN WEIGHT  
STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO  
ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY  
WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE  
PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED  
ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING  
2. REFERENCE STANDARD INSTRUMENTS :-  
INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE  
1) STANDARD WEIGHT SET E2 OK-1-151 C02210415 09-Feb-23  
2) STANDARD WEIGHT E2 15843 C02210419 10-Feb-23  
3) STANDARD WEIGHT E2 OK-1-549 AC102735S 26-Mar-23  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS & MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000063 g
4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.0000	0.0000	0.000090
0.10	0.1000	0.0000	0.000090
0.20	0.2000	0.0000	0.000090
0.50	0.5000	0.0000	0.000091
1.00	1.0000	0.0000	0.000091
2.00	2.0000	0.0000	0.000092
5.00	5.0000	0.0000	0.000093
10.00	10.0000	0.0000	0.000095
20.00	19.9999	0.0001	0.00010
50.00	49.9998	0.0002	0.00012
100.00	99.9998	0.0002	0.00019
200.00	199.9993	0.0007	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9997
2	99.9996
3	99.9995
4	99.9997
5	99.9998
OFF-CENTER LOADING	0.0002

6. INTERNAL WEIGHT ERROR: 0.00066666666666667 g  
NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION AREA  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY M  
COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT



CERTIFICATE No : 22T9917

PAGE: 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : EQL-128  
ID No :  
RECEIVED DATE : 15-Sep-22  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
SN : G508.0791  
CALIBRATION DATE : 15-Sep-22  
RELATIVE HUMIDITY : 51%RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm, AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

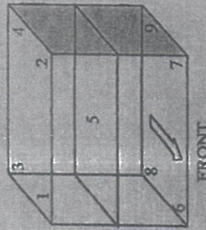
### 2. REFERENCE STANDARD INSTRUMENTS :-

1) DATA LOGGER WITH RTD : HYDRA 2635A  
2) REFERENCE STANDARD INSTRUMENTS :  
MODEL : SERIAL No : CERTIFICATE No : DUE DATE :  
EQL-128 : 6635800 : 22T9917 : 10-Jul-23

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : ± 1  
Overall Line Voltage (V) variation : ± 3  
Instrument Condition : Normal  
Chamber Size (W\*H) : 56\*40\*48 cm



#### CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.32	0.15	0.62	1.02
180.0	180.09	0.29	1.23	1.86

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Indicating		Measured Temperature (°C) at Spread Locations									Uncertainty
Temp (°C)	Temp (°C)	#1	#2	#3	#4	#5	#6	#7	#8	#9	(± °C)
104.0	104.0	104.23	103.89	104.54	104.02	104.33	104.63	104.42	104.48	104.39	0.38
180.0	180.0	180.16	179.13	180.46	179.35	179.79	180.66	180.36	180.29	180.61	1.1

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA. THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



CERTIFICATE No : 22T9918  
REFERENCE No : 66549-5

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
SERIAL No : G512.2005  
ID No : EQL-161  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30.32 RAMA II SOI 63, RAMA II RD., SAMAEBAUM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 15-Sep-22

APPROVED BY :

ISSUED DATE : 21-Sep-22

RECEIVED DATE : 15-Sep-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.





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www.qcalibration.com



PAGE : 1 OF 2

CERTIFICATE No : 22T1726  
REFERENCE No : 64109-2

## Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 160  
SERIAL No : D518.0082  
ID No : EQL-205  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA IIRD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 21-Feb-22

APPROVED BY :  
ISSUED DATE : 22-Feb-22  
RECEIVED DATE : 21-Feb-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 02

## Calibration Report

235 Petchkasem 63/2 Road, Laksoeng, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T19918

PAGE : 2 OF 2

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
ID No : EQL-161  
RECEIVED DATE : 15-Sep-22  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
SN : G512.2005  
CALIBRATION DATE : 15-Sep-22  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD PH00 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

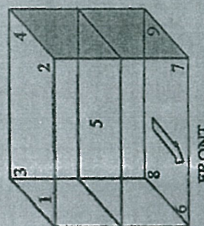
REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD  
2) REFERENCE TEMPERATURE POINTS  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1  
Overall Line Voltage (V) variation : 8  
Instrument Condition : Normal  
Chamber Size (W\*H\*±H): 56\*40\*48 cm



CHAMBER PERFORMANCE			
Calibrate Point	Average All Position Temp. (°C)	Temperature Stability (°C)	Temperature Uniformity (°C)
104.0	103.98	0.12	0.91
120.0	119.98	0.13	1.06
140.0	140.09	0.13	1.35
150.0	150.03	0.14	1.38
			Overall Variation (°C)
			1.49

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Indicating		Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
Temp (°C)	Temp (°C)	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
104.0	104.0	104.07	104.09	104.21	103.58	103.58	103.79	103.99	103.78	104.36	0.38
120.0	120.0	120.03	120.13	120.34	119.94	119.94	119.69	119.71	120.48	0.38	0.38
140.5	140.5	140.15	140.30	140.44	140.10	139.56	139.74	140.03	139.80	140.72	0.46
150.5	150.5	150.04	150.25	150.54	150.35	149.46	149.55	149.83	149.60	150.67	0.46

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMERS PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR K=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT

F-G01





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235 Petchkasem 63/2 Road, Laksong, Bangkok 10160  
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CERTIFICATE No : 22T1726

PAGE : 2 OF 2

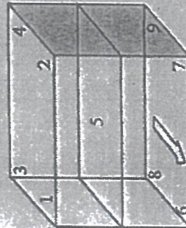
## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 160  
ID No : BCL-205  
RECEIVED DATE : 21-Feb-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
S/N : D518.0082  
CALIBRATION DATE : 21-Feb-22  
RELATIVE HUMIDITY : 50 % RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION  
THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ILAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT : MODEL : HYDRA 2635A  
SERIAL No : 6635300  
CERTIFICATE No : 21T8765  
DUE DATE : 10-Jul-22  
1) DATA LOGGER WITH RTD  
3) THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4) THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5) THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.  
RESULT OF CALIBRATION : WITHOUT ADJUSTMENT



FRONT

### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 2  
Overall Line Voltage (V) variation : 9  
Instrument Condition : Normal  
Chamber Size (W\*D\*H) : 56\*40\*72 cm

### CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	35.0	34.99	0.02	0.14	0.20
36.0	36.0	36.0	36.00	0.03	0.14	0.22
41.5	41.5	41.5	41.46	0.05	0.10	0.19

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (±°C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	34.91	34.94	34.93	34.93	35.03	35.08	35.01	35.01	35.08	0.25
36.0	35.93	35.95	35.95	35.94	36.00	36.05	36.01	36.10	36.10	0.25
41.5	41.46	41.47	41.41	41.47	41.50	41.47	41.45	41.43	41.49	0.36

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.  
NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.  
NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY M COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT



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CERTIFICATE No : 22E0980  
REFERENCE No : 63904-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : DKK-TOA  
MODEL : HM-25R  
SERIAL No : 760205  
ID No : EQL-183  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30/32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.

CALIBRATION DATE : 02-Feb-22

APPROVED BY :

ISSUED DATE : 02-Feb-22

RECEIVED DATE : 02-Feb-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.





## QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4384

CERTIFICATE No.: 22D0980

PAGE: 2 OF 2

### Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : DEK-TOA  
ID No : EQL-183  
RECEIVED DATE : 02-Feb-22  
AMBIENT TEMPERATURE : 25°C ± 1°C

MODEL : HM-25R  
SERIAL NUMBER : 760205  
CALIBRATION DATE : 02-Feb-22  
RELATIVE HUMIDITY : 57%RH ± 10% RH

#### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.

#### 2. REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATE No.	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	744	7514008	21E1392	29-Apr-22
5) BATH	260014	1247 48074	21T1921	10-Sep-22
6) THERMOMETER WITH PROBE	421504	53000379	21T1929	14-Sep-22
7) STANDARD THERMOMETER	2360	A14546	PSL-T049164	23-Nov-22

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :

- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

#### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. DISPLAY UNIT WITH pH ELECTRODE SN: 002F0035MK				
STANDARD pH BUFFER SOLUTION	UUC READING	CORRECTION	ACTUAL READING	UNCERTAINTY OF MEASUREMENT
(pH)	(pH)	(pH)	(mV)	(± pH)
4.007	4.01	-0.003	174	0.013
7.003	7.00	0.003	0.0	0.013
10.014	10.01	0.004	-172	0.014
				2.0

#### 2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING	UUC* READING	IMMERSION DEPTH	CORRECTION	UNCERTAINTY OF MEASUREMENT
(°C)	(°C)	(mm)	(°C)	(± °C)
25.003	25.1	80	-0.097	0.21

UUC : UNIT UNDER CALIBRATION

THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A

COVERAGE FACTOR k, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



Bara Scientific Co., Ltd.  
988 U Chu Liang Building Floor 7 Ramad Road  
Siam Bangkok Thailand 10500  
Tel : 02-6243000 Fax : 02-6375496-7  
www.barascientific.com



## Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-17322  
Equipment UVMa Spectrophotometer  
Model UV-1900i  
Manufacturer Shimadzu  
Serial No. A12535780311 ML  
ID No. EQL-233  
Date of receipt 19 May 2022  
Date of calibration 19 May 2022  
Date of issue 26 May 2022  
Customer name Test Tech Co., Ltd.  
Address 30, 32 Rama II Soi 63, Rama II RD., Samaedam, Bangkokthian, Bangkok 10150.  
Temperature (23.7-24.3) °C (On site)  
Humidity (47.5-48.3) %RH (On site)  
Equipment condition Good Operation  
Calibration Location Water Room  
Calibration Procedure In-house method WI-UV-702.01 based on ASTM E275-01  
Traceability Wavelength Accuracy is traceable to certificate No. 99367 and 99366  
Photometric Accuracy is traceable to certificate No. 99925 and 100147  
Stray Light is traceable to certificate No. 99385  
The above certificate are traceable to SI unit through Siama Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)  
Calibrated by Mr.Kanchit Choothep

Approved by

Mr.Kanchit Choothep  
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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Bara Scientific Co., Ltd.  
988 U Chu Liang Building Floor 7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



# Certificate of Calibration

Certificate No.

BSCC-UV-173/22

Number of Page(s)

2 of 3

Calibration Results:

## 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
279.44	279.06	-0.38	0.18
418.53	418.35	-0.18	0.18
536.52	536.47	-0.06	0.18
684.50	684.50	0.00	0.18
879.41	879.24	-0.17	0.18

## 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	CNR	CNR	CNR	CNR
257	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
350	CNR	CNR	CNR	CNR

\*CNR = Customer not request

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988 U Chu Liang Building Floor 7 Rama4 Road  
Siam Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



# Certificate of Calibration

Certificate No.

BSCC-UV-173/22

Number of Page(s)

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Calibration Results:

## 3.Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5472	0.5481	0.0009	0.0042
	0.7637	0.7626	-0.0011	0.0042
	1.0480	1.0484	0.0004	0.0042
	0.0000	0.0000	0.0000	0.0042
	0.5371	0.5381	0.0010	0.0042
	0.7457	0.7450	-0.0008	0.0042
	1.0233	1.0243	0.0010	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5906	0.5912	0.0006	0.0042
	0.6961	0.6946	-0.0015	0.0042
	0.9563	0.9556	-0.0005	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5137	0.5143	0.0006	0.0042
	0.6897	0.6892	-0.0015	0.0042
	0.9633	0.9627	-0.0006	0.0042

\*CNR = Customer not request

## 4.Stray Light\*

Standard cut-off wavelength (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.98±0.1nm	200.85	0.9120	2.0401

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

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.  
\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate. Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
33/44 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250

TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 22M196  
Page : 1 of 2

Equipment : Standard Weight  
Manufacturer : LS  
Model : -  
Serial No. : -  
ID No. : EQL-121  
Condition As-Received: Used Item  
Received Date: 03 February 2022  
Calibration Date: 08 February 2022

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.

Reference: 2202-0110DN  
Submitted by: TEST TECH CO.,LTD (HEAD Office)  
30,32 Rama II Soi 63, Rama II Rd., Samaedam,  
Bangkhunthian, Bangkok 10150  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1011 mbar

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method  
against standard weights on the basis of weightings at an average air density of 1.2 kg/m<sup>3</sup> and a temperature  
of 23 °C material density of weight is 8000 kg/m<sup>3</sup>.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0102-20	13 Jul 2022

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 : Suwat Wuthicharnmongkol  
Issue Date : 08 February 2022  
Approved Signatory :   
[ ] Phalinee Prabpalai  
[x] Sura Suwanasri  
[ ] Chaowalit Ritirak



Cert No.: 22M196  
Page: 2 of 2

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( ± )	Maximum Permissible error ( ± )
50 g	50.00008 g	0.10 mg	0.30 mg

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

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B 0280632

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 13, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



REC-TB-11817325  
CALIBRATION 0005

## Certificate of Calibration

Certificate No. : 22M1563  
Page : 1 of 2

Cart No.: 22M1563  
Page: 2 of 2

Equipment : Standard Weight  
Manufacturer :  
Model :  
Serial No.: M 003011  
ID No.: EQL-139  
Condition As-Received: Used Item  
Received Date: 11 August 2022  
Calibration Date: 24 August 2022

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

Submitted by: TEST TECH CO.,LTD. (HEAD Office)  
30, 32 Rama II Rd 63, Rama II Rd.,  
Samaedam, Bangkokhuan, Bangkok 10150  
Reference: 2208-0438DN  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1008 mbar

Procedure used: Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method  
against standard weights on the basis of weightings at an average air density of 1.2 kg/m<sup>3</sup> and a temperature  
of 23.0 °C material density of weight is 8000 kg/m<sup>3</sup>.

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard weight Set (E2)	YCS31-712-00	50202965	MM-0109-22	11 Jul 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)

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( ± )	Maximum Permissible error ( ± )
2 g	2.000020 g	0.040 mg	0.12 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-

Calibrated by : Chaowalit Ritirak  
Issue Date : 25 August 2022

Approved Signatory :  
[ ] Phalinee Prabpalpal  
[x] Sura Suwanmasri  
[ ] Chaowalit Ritirak

B 0295804

a 1122451





## Certificate of Calibration

**Equipment:** TURBIDIMETER  
**Model:** 2100N  
**Serial No. (or ID.):** 970400003415 (EQL-024)  
**Manufacturer:** HACH  
**Condition:** In Condition

**Customer:** TEST TECH CO., LTD.  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkokthunien Bangkok 10150 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

**Calibration Place:** Environment Laboratory, DKSH Technology Limited.  
1194 Soi Wachirathaisathit 57, Sukhumvit 101/1 Rd.,  
Bangchak, Prakhnang, Bangkok 10260 Thailand

**Calibration By:** Mr. Wasan Nuchraee  
**Calibration Date:** 21 September 2022  
**The Method used:** In house method, CAL-WI-23, base on Hach Manufacturer Method 8195  
**Traceability:** This certificate is traceable to Primary standard Fromazin and StabCal accepted by  
United States Environmental Protection Agency (EPA) through Hach Company  
Certificate No. A1075, A1074, A1081, A1074, A1074

**Person in charge**  
(Mr. Wasan Nuchraee)  
Authorized signatory

**Person in charge**  
(Mr. Thelengkeat Pongngam)  
Authorized signatory

This certificate is issued in the units of measurement according to the International System of Units (SI). It provides traceability of measurement to International or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ( $k=2$ ) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. This results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

DKSH Technology Limited  
2333 Rattana Road, Bangkok, Thailand 10260  
Phone: +66 2029 7000 Email: info@dksh.com Website: www.dksh.com/en/thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-008-08; 20 Jul 2022



Certificate No.: C08220157 Page 2 of 2

### Calibration Results:

#### Before Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.048	0.012	0.0004	0.070
20.40	20.1	0.30	0.05	1.0
208.0	204	2.0	0.5	10
1020.0	1013	7.0	1.2	50
4086.0	3875	190.0	1.8	200

#### After Adjustment

Std Turbidity (NTU)	UUC Reading	Correction	Deviation	Uncertainty
0.060	0.057	0.003	0.0015	0.070
20.40	20.5	-0.10	0.04	1.0
208.0	206	0.0	0.5	10
1020.0	1018	2.0	0.5	50
4086.0	4084	1.0	0.5	200

The End of Certificate

DKSH Technology Limited  
2333 Rattana Road, Bangkok, Thailand 10260  
Phone: +66 2029 7000 Email: info@dksh.com Website: www.dksh.com/en/thailand

Delivering Growth – In Asia and Beyond.

CAL-FM-008-08; 20 Jul 2022



Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WPE 45  
SERIAL No : L711.0024  
ID No : EQL-147  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150  
CALIBRATED BY : PRASERT P.  
CALIBRATION DATE : 14-Jul-22

APPROVED BY :  
ISSUED DATE : 15-Jul-22  
RECEIVED DATE : 14-Jul-22

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF QUALITY CALIBRATION CO., LTD.



Calibration Report

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
ID NUMBER : EQL-147  
RECEIVED DATE : 14-Jul-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
MODEL : WPE 45  
SERIAL NUMBER : L711.0024  
CALIBRATION DATE : 14-Jul-22  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

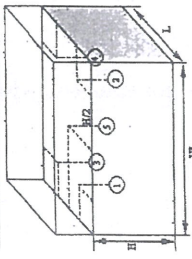
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.

2. REFERENCE STANDARD INSTRUMENTS :-

- INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE
- 1) DATA LOGGER WITH RTD 2625A 660614 22T7514 05-Jul-23
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.9
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*42*24 cm

BATH PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
41.5	41.5	41.5	41.54	0.05	0.03	0.12
44.5	44.5	44.5	44.50	0.07	0.02	0.15

TEMPERATURE MEASUREMENT ACCURACY TEST

Measured Temperature (°C) at Spread Locations						Uncertainty (± °C)
Controller Temp (°C)	Indicating Temp (°C)	#1	#2	#3	#4	
41.5	41.5	41.54	41.52	41.55	41.55	0.14
44.5	44.5	44.48	44.51	44.50	44.51	0.15

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT QC LABORATORY AREA. THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT