

รายงานผลการให้บริการ

1. TECHNICAL DATA

Main Supply 220 volt + 10% 50 Hz with ground
Nominal current

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>8a.....

1.1 COOLING WATER BATH

Temperature 15-20 °C

Cooling Water Outlet

Control Temperature

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1.2 OPTICAL TEST

Screw cap GL14

Screw cap GL18

Screw cap GL32

Distillation Head

Condensor

Viton Cone

Ventilation Valve BV

Micro Switch Sample

Agitator motor for propeller

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

2. SYSTEM COOLING WATER INLET

Cooling Water Inlet

Cooling Water Outlet

Flow control valve

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3.SYSTEM CONTROL

Display

Program

Adding NaOH

Adding H2O

Adding H3BO3

Suction Sample

Suction Receiver

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

4.SYSTEM DISTILLATION

Boiler

Level Sensor

Novopren

Solenoid Valve Shut-Off

Solenoid Valve Steam

Solenoid Valve soft steam

Ventilation Valve Premount

Excess Pressure Detector

Heating Element

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. PUMP

Pump H₂O Steam

- Non-Return Valve

Pump H₂O Sample

- Non-Return Valve

Pump NaOH

- Non-Return Valve

Pump H3BO3

- Non-Return Valve

Pump suction

Pump suction receiver

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

6. The Following Program Run :

Addition H2O 0-999 ml.

Addition NaOH 0-999 ml.

Addition H3BO3 0-999 ml.

Reaction Time 0-108 min

Distillation Time 0-108 min

Steam Capacity 10%-100%

Suction Sample

Suction Receiver

Pass	Fail	N/A	Remark
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

7. Measured pumps

Pump NaOH

Volume :20.40.....ml

Pump H2O

Volume :10.00.....ml

Pump H3BO3

Volume :ml

Remark

Remark :
.....

ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

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
Sleep 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.

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	<p>The chemicals used are contaminated with nitrogen compounds.</p> <p>Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.</p> <p>Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver.</p> <p>Glass cleaning agents in the digestion tube.</p> <p>Entrainment of ammonia from the previous sample.</p>	<ul style="list-style-type: none"> Defatted checking of the chemicals. Determination of a blank value. Replace the chemicals if necessary. Increase of the water addition amount. Replacement of the glass condenser. Clean digestion tube in advance with distilled water. Increase distillation time. Check whether the sample was previously sufficiently alkalised.
Analysis result too low or no result	<p>Incomplete distillation; distillation time too short.</p> <p>Ammonia escapes at leaking places.</p>	<ul style="list-style-type: none"> No quantitative expulsion of the ammonia content. The distillation amount should be 100 ml. Solided 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. Check the constant flow rate of the NaOH pump (see Technical Data).
	<p>Addition amount of the sodium hydroxide too little; no ammonia development.</p> <p>Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.</p> <p>Tube not completely immersed in the acid receiver.</p> <p>Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.</p>	<ul style="list-style-type: none"> Increase of the boric acid amount. Increase of the acid amount. This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.



CERTIFICATE No : 23T8796
REFERENCE No : 70515-4

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
MODEL : WNE 45
SERIAL No : L720.0266
ID No : EQL-241
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 : 
CALIBRATION DATE : 16-Aug-23

APPROVED BY : 
ISSUED DATE : 16-Aug-23
RECEIVED DATE : 16-Aug-23

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



CERTIFICATE No : 23T8796

PAGE : 2 OF 2

Calibration Report

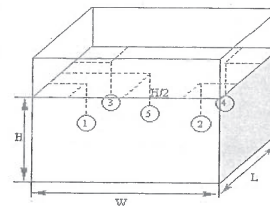
EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : EQL-241
RECEIVED DATE : 16-Aug-23
AMBIENT TEMPERATURE : 25 °C ± 1 °C
MODEL : WNE 45
SERIAL NUMBER : L720.0266
CALIBRATION DATE : 16-Aug-23
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	23T6642	19-Jul-24
- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- 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) : 0.6
Overall Variation of Line Voltage (V) : 3
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 59*35*20 cm

BATH PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (±°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
83.0	83.09	0.05	0.07	0.05	0.16
92.0	92.13	0.11	0.06	0.06	0.28

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
83.0	83.0	83.08	83.09	83.06	83.11	83.12	0.15
92.0	92.0	92.11	92.13	92.10	92.16	92.16	0.19

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 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 : 24T1185
REFERENCE No : 72116-3

PAGE : 1 OF 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 II RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : 
CALIBRATION DATE : 09-Feb-24

APPROVED BY : 

ISSUED DATE : 12-Feb-24

RECEIVED DATE : 09-Feb-24



CERTIFICATE No : 24T1185

PAGE : 2 OF 2

Calibration Report

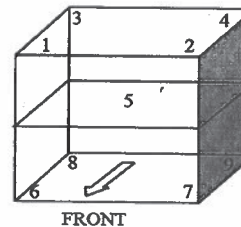
EQUIPMENT : INCUBATOR
MANUFACTURER : MEMMERT
MODEL : IF 160
ID No : EQL-205
RECEIVED DATE : 09-Feb-24
AMBIENT TEMPERATURE : 25 °C ± 1 °C
S/N : D518.0082
CALIBRATION DATE : 09-Feb-24
RELATIVE HUMIDITY : 53 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS 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	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	23T6636	10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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 : 3
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average All Position Temp. (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.03	0.05	0.09	0.16
36.0	36.05	0.07	0.08	0.19
41.5	41.45	0.08	0.13	0.20

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	34.98	35.01	35.00	35.00	35.02	35.08	35.07	35.04	35.10	0.25
36.0	36.0	36.00	36.03	36.03	36.02	36.04	36.09	36.10	36.04	36.12	0.25
41.5	41.5	41.45	41.45	41.39	41.46	41.46	41.47	41.43	41.44	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 MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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

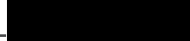


CERTIFICATE No : 24T1189
REFERENCE No : 72116-7

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
MODEL : HVE-50
SERIAL No : 30612085166
ID No : EQL-155
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 : 
CALIBRATION DATE : 09-Feb-24

APPROVED BY : 

ISSUED DATE : 12-Feb-24

RECEIVED DATE : 09-Feb-24

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

F-G010 REV : 03



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

CERTIFICATE No : 24T1189

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
ID NUMBER : EQL-155
RECEIVED DATE : 09-Feb-24
AMBIENT TEMPERATURE : 30° C ± 1° C
MODEL : HVE-50
SERIAL NUMBER : 30612085166
CALIBRATION DATE : 09-Feb-24
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

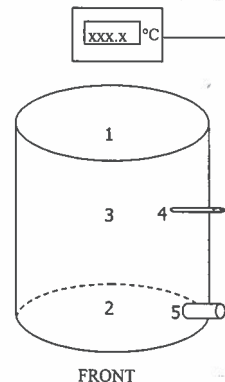
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. THE THIRD SENSOR WAS PLACED WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT CHAMBER. SENSOR NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 15 mm OF ITS TIP. SENSOR NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER	VALPROBE	S350,S367,DV35,DN94	24T0890	26-Jan-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE 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 variation : 0.5 °C
Autoclave Condition : Normal
Chamber Size (Diameter*H): 30 * 71 cm

CHAMBER PERFORMANCE

Calibrate Point (°C)	Average all Position (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
115	115.74	0.09	0.11	0.25	0.090	20	60
121	121.59	0.06	0.21	0.28	0.125	20	60

TEMPERATURE MEASUREMENT ACCURACY TEST(° C)

Cont Temp	Ind Temp	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
115	115.	115.72	115.74	115.79	115.71	115.71	0.59
121	121	121.59	121.62	121.56	121.58	121.59	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 BUDGET WAS REPLACED BY THE STANDARD REPEATABILITY.

NOTE 3 : LOCATION 3 WAS REFERENCE LOCATION.

NOTE 4 : 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



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-166/24
Equipment UV/Vis Spectrophotometer
Model UV-1900i
Manufacturer Shimadzu
Serial No. A12535780311 ML
ID No. EQL-233
Date of receipt 26 April 2024
Date of calibration 26 April 2024
Date of issue 30 April 2024

Customer name Test Tech Co., Ltd.

Address 30,32 Rama II Soi 63, Rama II Road, Samae Dam, Bang Khun Thian, Bangkok 10150

Temperature (24.9 - 25.4) °C (On site)
Humidity (49.4 - 51.1) %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. 106372 and 106371
Photometric Accuracy is traceable to certificate No. 106364 and 111398
Stray Light is traceable to certificate No. 106377
The above certificate are traceable to SI unit through Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by

Approved by

Service Manager

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.



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Certificate No. BSCC-UV-166/24

Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (\pm nm)
279.44	279.18	-0.26	0.18
418.53	418.46	-0.07	0.18
536.52	536.54	0.02	0.18
684.50	684.63	0.13	0.18
879.41	879.43	0.02	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (\pm A)
235	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
257	0.0000	0.0000	0.0000	0.0075
	0.8354	0.8333	-0.0021	0.0075
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	-0.0001	-0.0001	0.0075
	0.6199	0.6190	-0.0009	0.0075

*CNR = Customer not request

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.

Certificate of Calibration



Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1693421 (EQL-197)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06240153
Issued Date: 18 April 2024
Job No.: WO-00024683
Page: 1 of 3

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

Environment Condition: Temperature 29.8 °C ± 0.1 °C
Humidity 45.7 %RH ± 6.9 %RH

Calibration Place: TEST TECH CO., LTD. (แผนกน้ำดี)
30,32 Rama II Soi 63, Rama II Rd.,
Samaedam, Bangkhuntien Bangkok 10150 Thailand

Calibration By: [Redacted]
Calibration Date: 18 April 2024
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.
The standard for Wavelength Certificate No. 118106 and 118118
The standard for Photometric Certificate No. 118123 and 118113
The standard for Stray light Certificate No. 118110 and 118112
The standard for Spectral resolution Certificate No. 118104

Person in charge [Redacted]
Authorized signatory [Redacted]

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

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DKSH Technology Limited
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Delivering Growth - in Asia and Beyond.

CAL-FM-C06-16: 11 Mar 2024



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Certificate No. BSCC-UV-166/24 Number of Page(s) 3 of 3

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
	0.5761	0.5791	0.0030	0.0042
	0.7119	0.7132	0.0013	0.0042
	1.0189	1.0221	0.0032	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5610	0.5636	0.0026	0.0042
	0.7001	0.7012	0.0011	0.0042
	1.0026	1.0052	0.0026	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
	0.5249	0.5260	0.0011	0.0042
	0.6975	0.6971	-0.0004	0.0042
	1.0009	1.0012	0.0003	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
	0.5666	0.5673	0.0007	0.0042
	0.7620	0.7611	-0.0009	0.0042
	1.0982	1.0976	-0.0006	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.85±0.11nm	200.76	0.9795	2.0091

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.

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	637.9	0.08	0.13
748.48	748.6	-0.12	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5772	0.576	0.0012	0.0045
	0.7198	0.719	0.0008	0.0045
	1.0394	1.039	0.0004	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5608	0.560	0.0008	0.0045
	0.7062	0.705	0.0012	0.0045
	1.0189	1.018	0.0009	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5214	0.521	0.0004	0.0045
	0.6652	0.664	0.0012	0.0045
	0.9577	0.957	0.0007	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5192	0.518	0.0012	0.0045
	0.6907	0.689	0.0017	0.0045
	0.9949	0.993	0.0019	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5530	0.551	0.0020	0.0045
	0.7555	0.753	0.0025	0.0045
	1.0761	1.073	0.0031	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5604	0.559	0.0014	0.0045
	0.7418	0.739	0.0028	0.0045
	1.0467	1.044	0.0027	0.0045

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Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7533	0.748	0.0053	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8745	0.869	0.0055	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2926	0.293	-0.0004	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6486	0.644	0.0046	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.95 +/- 0.11 nm	261.0	0.9	2.046
392.04 +/- 0.11 nm	392.0	1.3	1.886

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.74	266.81	1.29	2.00
UUC: Wavelength (nm)	268.6	266.6		
Std Absorbance (A)	0.5137	0.3473		
UUC: Absorbance (A)	0.463	0.359		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

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บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

ATOMIC ABSORPTION SPECTROMETER TEST CERTIFICATE

Certificate No : SV2310/21414

Instrument Type : Atomic Absorption Spectrometer

Model : AA240FS

Serial Number : EL08043418

Organization : Test Tech Co., Ltd.

Address : 30,32 Soi 66 Rama II Rd., Samaedam Bangkhuntien, Bangkok 10150

Date : 25 Oct 2023

Hollow cathode lamps used

Element	Lamp number	Comments
Arsenic	56-101003-00	
Copper	56-101014-00	
Potassium	56-101042-00	
Iron	56-101027-00	
Manganese	56-101337-00	

Test description	Specification	Result	Comments
Light throughput (%Gain) or (EHT)			
Cu at 324.8 nm	≤ 64 % or 380 V	32 %	Pass
As at 193.7 nm	≤ 80 % or 540 V	55 %	Pass
K at 766.5 nm*	≤ 84 % or 540 V	64 %	Pass
Fe at 248.3 nm	≤ 80 % or 540 V	59 %	Pass
Mn at 279.5 nm	≤ 64 % or 380 V	46 %	Pass
Photometric noise Cu BGC off			
STDV @ 0 Abs	≤ 0.0001	0.0001	Pass



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THAI UNIQUE CO., LTD.

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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Wavelength accuracy			
Cu at 324.8 nm	323.0 nm – 326.0 nm	324.8 nm	Pass
As 193.7 nm	192.0 nm – 195.0 nm	193.7 nm	Pass
K at 766.5 nm*	765.0 nm – 768.0 nm	766.6 nm	Pass
Fe at 248.3 nm	246.8 nm – 249.8 nm	248.3 nm	Pass
Mn at 279.5 nm	278.0 nm – 281.0 nm	279.5 nm	Pass
High solids nebulizer setting**			
Uptake rate	7.2 – 10.6 ml / min	9.8 ml/min	Pass
Max Abs	≥ 0.75 Abs	0.81 Abs	Pass
Precision(%RSD)	≤ 0.5 %	0.2 %	Pass
Zeeman Background Correction Accuracy (%)***			
BCA @ Au 242.8 nm	< 3.7 %	***	***
Zeeman Magnetic Sensitivity Ratio (%)***			
MSR @ Cu 324.7 nm	> 70 %	***	***
Characteristic mass and sensitivity ****			
Sensitivity	≥ 0.21 Abs	****	****
Precision (%RSD)	≤ 4.0 %	****	****

* for Wideband PMT (Wavelength 190nm – 900nm)

** for Flame system

*** for Zeeman system

**** for Graphite furnace system

CALIBRATED BY :

Signature :

Engineer :

Date : 25 / Oct / 2023



APPROVED BY :

Signature :

Engineer :

Date : 25 / Oct / 2023



ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 8000

Customer : บริษัท เทสท์ เทคโนโลยี จำกัด
Address : 30, 32 ซอยพระรามที่ 2 ซอย 63
ถนนพระรามที่ 2 แขวงสามต้น
เขตบางขุนเทียน กรุงเทพฯ 10150
User Name :
Phone :
Fax :
Date Tested: May 18, 2023
Recommendation Recertification
Period 12
Recertification Due: May 17, 2024
Date Last Certified: May 19, 2022
Visit Number: 1 of 1
PerkinElmer Phone: 02-719-6420 ext 206
PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL SERIAL NUMBER
OPTIMA 8000 078S1411171C
N0772045 2F1441085
EQL-180

TESTED EQUIPMENT CALIBRATION NUMBER
IPV Methods

TEST STANDARD USED PART NUMBER
Mixed standard 1/10 N069-1579
Mixed standard 1/100 N930-0221

CUSTOMER SUPPLIED COMMENTS
2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT
NOT INCLUDED

WinLab32 Version 5.5.0.0714
PN:6150T21E4Q1E

EXPIRATION

EXPIRATION DATE
NOV 30, 2023
NOV 30, 2023

CUSTOMER INITIALS

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ICP02329207

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 8000

SERIAL NUMBER : 078S1411171C

DATE TESTED : May 18, 2023

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 six months. ☐

4. PERFORMANCE CHECKS

- A. Torch View Alignment. ☐
- B. Wavelength Calibration. ☐

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