

ภาคผนวกที่ 4

สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ



CERTIFICATE No : 25E0617
REFERENCE No : 75885-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : TOA DKK
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 D.

CALIBRATION DATE : 20-Jan-25

APPROVED BY :

ISSUED DATE : 21-Jan-25

RECEIVED DATE : 20-Jan-25



CERTIFICATE No : 24T8053
REFERENCE No : 74209-2

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : BOD INCUBATOR
MANUFACTURER : N/A
MODEL : N/A
SERIAL No : N/A
ID No : EQL-166
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 : CHAICHARN CH.

CALIBRATION DATE : 13-Aug-24

APPROVED BY :

ISSUED DATE : 19-Aug-24

RECEIVED DATE : 13-Aug-24



Calibration Report

EQUIPMENT : BOD INCUBATOR
MANUFACTURER : N/A
ID NUMBER : EQL-166
RECEIVED DATE : 13-Aug-24
AMBIENT TEMPERATURE : 25° C ± 1° C
MODEL : N/A
SERIAL NUMBER : N/A
CALIBRATION DATE : 13-Aug-24
RELATIVE HUMIDITY : 54 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 19 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE TENTH THERMOCOUPLE 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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	7286308	24T6471	24-Jun-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.

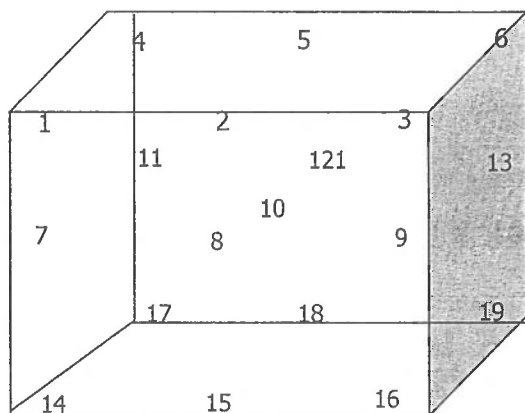
RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 0
Overall Line Voltage (V) variation : 11
Instrument Condition : Normal
Chamber Size (W*L*H): 190*70*174 cm

CHAMBER PERFORMANCE

Calibrate Point (° C)	Average all Located Temp. (° C)	Temperature Stability (±° C)	Temperature Uniformity (° C)	Overall Variation (° C)
20.0	20.09	0.41	0.47	1.0



FRONT



QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T8053

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):-

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller temperature (°C)		20.0
Indicating Temperature		20.0
Measured Temperature (°C) at Spread Locations	1	20.00
	2	20.15
	3	20.16
	4	20.17
	5	20.18
	6	20.12
	7	20.21
	8	20.10
	9	20.09
	10 Ref.	19.92
	11	19.97
	12	20.22
	13	20.16
	14	20.11
	15	20.16
	16	20.06
	17	20.01
	18	19.94
	19	20.04
Uncertainty of Measurement(± °C)		0.62

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

NOTE 2 : LOCATION 10 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



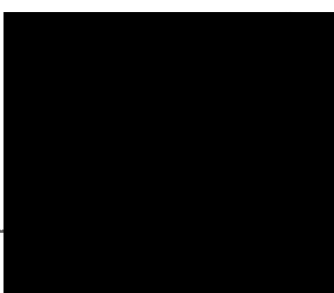
CERTIFICATE No : 24T8913
REFERENCE No : 74483-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH
MANUFACTURER : N/A
MODEL : SUP IV
SERIAL No : N/A
ID No : EQL-056
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 : 05-Sep-24

APPROVED BY : 
ISSUED DATE : 09-Sep-24
RECEIVED DATE : 05-Sep-24





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 : 24T8913

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : WATER BATH
MANUFACTURER : N/A
ID NUMBER : EQL-056
RECEIVED DATE : 05-Sep-24
AMBIENT TEMPERATURE : 24 °C ± 1 °C
MODEL : SUP IV
SERIAL NUMBER : N/A
CALIBRATION DATE : 05-Sep-24
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

1) DATA LOGGER WITH RTD

MODEL

2625A

SERIAL No

6603614

CERTIFICATE No

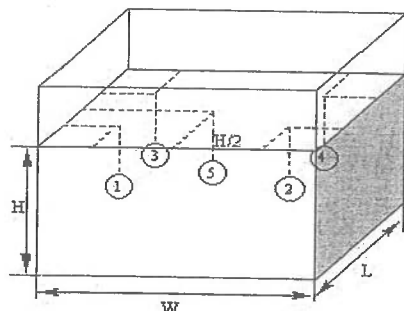
24T6473

DUE DATE

01-Jul-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



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.3
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 (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
83.0	82.95	0.17	0.06	0.01	0.41

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	82.92	82.96	82.96	82.97	82.93	0.24

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 : 25T0975
REFERENCE No : 76012-7

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 RD., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.
CALIBRATION DATE : 04-Feb-25

APPROVED BY : 
ISSUED DATE : 12-Feb-25
RECEIVED DATE : 04-Feb-25





QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

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CERTIFICATE No : 25T0975

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : AUTOCLAVE
MANUFACTURER : HIRAYAMA
ID NUMBER : EQL-155
RECEIVED DATE : 04-Feb-25
AMBIENT TEMPERATURE : 29° C ± 1° C
MODEL : HVE-50
SERIAL NUMBER : 30612085166
CALIBRATION DATE : 04-Feb-25
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

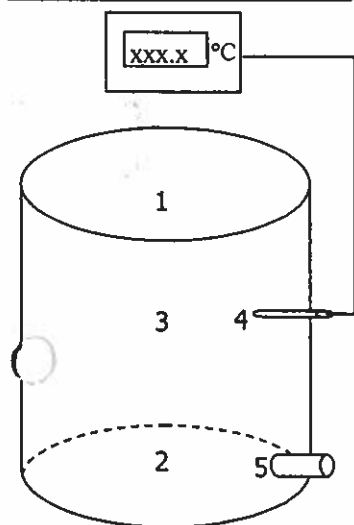
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646-1:2021 BY COMPARISON WITH CALIBRATED RTD DATA LOGGERS UNDER NO LOAD CONDITION. THE SENSORS WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. THE SENSOR ON LOCATION 1 AND 2 WERE PLACED IN THE UPPER HALF AND LOWER HALF OF CHAMBER FREE SPACE RESPECTIVELY. 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.

REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER	VALPROBE	S350,S367,DV35,DN94	25T0777	24-Jan-26

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



FRONT

GENERAL INFORMATION

Overall Ambient Temperature around the Chamber variation : 1.2 °C

Autoclave Condition : Normal

Chamber Size (Diameter*H): 30 * 71 cm

CHAMBER PERFORMANCE

Controller Temperature (°C)	Average All Position (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
115	115.71	0.10	0.20	0.20	0.090	15	60
121	121.65	0.10	0.20	0.20	0.125	15	60

TEMPERATURE MEASUREMENT ACCURACY TEST(° C)

Calibration Point	Controller Temp.	Indicating Temp.	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
			#1	#2	#3	#4	#5	
115	115	115	115.66	115.65	115.76	115.76	115.70	0.63
121	121	121	121.59	121.60	121.71	121.71	121.66	0.64

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 FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



F-C



CERTIFICATE No : 25M6069

REFERENCE No : 77517-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BCA224I-1S

SERIAL No : 0043402017

ID No : EQL-268

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 : SUCHART S.

CALIBRATION DATE : 23-Jun-25

APPROVED BY : 

ISSUED DATE : 24-Jun-25

RECEIVED DATE : 23-Jun-25





CERTIFICATE No : 25M6069

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BCA224I-1S
MANUFACTURER : SARTORIUS S/N : 0043402017
ID No : EQL-268 RECEIVED DATE : 23-Jun-25
AIR PRESSURE : 1007mbar $\pm$ 1mbar CALIBRATION DATE : 23-Jun-25
AMBIENT TEMPERATURE : 27°C $\pm$ 1°C RELATIVE HUMIDITY : 64 %RH $\pm$ 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 NOT ADJUSTED BEFORE CALIBRATION. 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.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

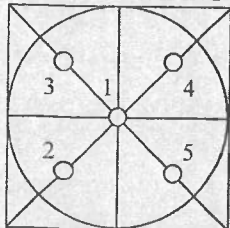
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ($\pm$ g)
0.0	0.0000	0.0000	0.00010
0.1	0.1000	0.0000	0.00010
0.5	0.5000	0.0000	0.00010
1.0	1.0000	0.0000	0.00010
2.0	2.0000	0.0000	0.00010
20.0	20.0001	-0.0001	0.00011
45.0	45.0001	-0.0001	0.00015
50.0	50.0000	0.0000	0.00012
80.0	80.0001	-0.0001	0.00018
100.0	100.0001	-0.0001	0.00019
120.0	120.0001	-0.0001	0.00022
140.0	140.0001	-0.0001	0.00025
160.0	160.0001	-0.0001	0.00027
180.0	180.0001	-0.0001	0.00030
200.0	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	99.9999
3	100.0000
4	100.0000
5	100.0001
OFF-CENTER LOADING	0.0001

NOTE: 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 : 24T8915
REFERENCE No : 74483-5

PAGE : 1 OF 2

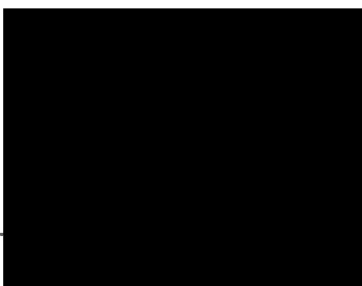
Certificate of Calibration

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., SAMAEDAM,
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 05-Sep-24

APPROVED BY :



ISSUED DATE : 09-Sep-24

RECEIVED DATE : 05-Sep-24





Calibration Report

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UFE 500
ID No : EQL-128
RECEIVED DATE : 05-Sep-24
AMBIENT TEMPERATURE : 24 °C ± 1 °C

S/N : G508.0791
CALIBRATION DATE : 05-Sep-24
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

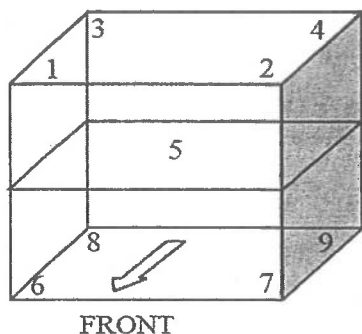
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND 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.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	6635300	24T6468	26-Jun-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 (°C) variation : 4
Overall Line Voltage (V) variation : 6
Instrument Condition : Normal
Chamber Size (W*L*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	104.09	0.24	0.72	1.03
180.0	179.88	0.20	1.00	1.24

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	
104.0	104.0	104.13	103.69	104.30	103.76	103.78	104.35	104.38	104.13	104.31	0.38
180.0	180.0	180.05	179.34	180.20	179.29	179.51	180.23	180.27	179.92	180.11	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 : 24T8916
REFERENCE No : 74483-6

PAGE : 1 OF 2

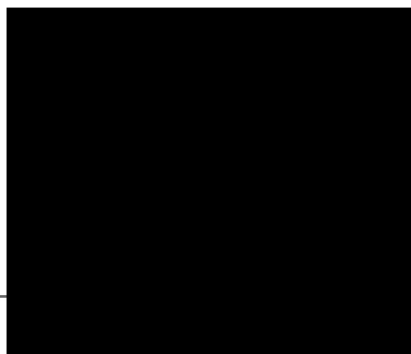
Certificate of Calibration

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UF 110
SERIAL No : B414.0764
ID No : EQL-169
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 : CHAICHARN CH.

CALIBRATION DATE : 05-Sep-24

APPROVED BY :



ISSUED DATE : 09-Sep-24

RECEIVED DATE : 05-Sep-24





QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkai, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T8916

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : HOT AIR OVEN
MANUFACTURER : MEMMERT
MODEL : UF 110
ID No : EQL-169
RECEIVED DATE : 05-Sep-24
AMBIENT TEMPERATURE : 24 °C ± 1 °C
S/N : B414.0764
CALIBRATION DATE : 05-Sep-24
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

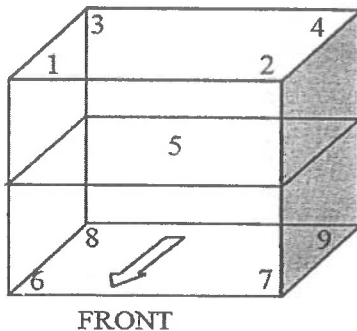
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND 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.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	7301307	24T6467	26-Jun-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 (°C) variation : 3
Overall Line Voltage (V) variation : 8
Instrument Condition : Normal
Chamber Size (W*L*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	104.11	0.06	0.43	0.55
120.0	120.18	0.04	0.58	0.67
140.0	140.24	0.09	0.71	0.91
150.0	150.20	0.10	0.79	0.98

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	
104.0	104.0	104.37	104.10	104.39	104.07	104.01	104.25	103.95	103.92	103.97	0.38
120.0	120.0	120.54	120.25	120.45	120.23	120.00	120.33	119.94	119.90	120.00	0.46
140.0	140.0	140.64	140.33	140.53	140.28	139.98	140.48	139.92	139.88	140.09	0.46
150.0	150.0	150.66	150.29	150.55	150.23	149.90	150.47	149.85	149.80	150.06	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 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





บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

การดูแลบำรุงรักษาเชิงป้องกัน

Preventive Maintenance

Customer Name: บริษัท เทสท์ เทค จำกัด
Product : Distillation Unit
Brand : GERHARDT
Model : Vapodest 30
Serial number : GER003718



บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

- Part 1: สัญญาการให้บริการ (Service Contact)
- Part 2: ข้อมูลพื้นฐานของเครื่องมือ (Details of Instrument)
- Part 3: ตรวจเช็คสภาพเครื่อง
- Part 4: รายละเอียดและรายงานผลการให้บริการ Preventive Maintenance
 - 4.1 ขั้นตอนการบริการ
 - 4.2 รายงานผลการให้บริการ
- Part 5: ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)
 - 5.1 Care and Maintenance
 - 5.1.1 การบำรุงรักษาทั่วไป (Basic maintenance)
 - 5.1.2 General error message



1. สัญญาการให้บริการ (Service Contact)

หน่วยงานลูกค้า :	บริษัท เทสท์ เทค จำกัด
ที่อยู่ :	30,32 ซอยพระรามที่ 2 ซอย 63 แขวงสามเต่า เขตบางขุนเทียน กรุงเทพมหานคร 10150
โทรศัพท์ :	
อีเมล :	
บุคคลติดต่อ :	
ชื่อ-นามสกุล :	คุณ กรรณก ขุนพิทักษ์
ตำแหน่ง :	
โทรศัพท์ :	02-893-4211-17
อีเมล :	lab_center@testtech.co.th

สัญญาการบริการจำนวน 1 ครั้ง ต่อ ปี

ครั้งที่ 1 วันที่ :	19 มีนาคม 2568
ครั้งที่ 2 วันที่ :	
ครั้งที่ 3 วันที่ :	

2. ข้อมูลพื้นฐานของเครื่องมือ (Details of Instrument)

2.1 รายละเอียดเครื่องมือ (Instrument Description)

ประเภทเครื่องมือ :	Distillation Unit
ผลิตภัณฑ์ :	GERHARDT
รุ่น :	Vapodest 30
หมายเลขเครื่อง :	GER003718
หมายเลขครุภัณฑ์ :	EQL-062

2.2 ผู้ดำเนินการ

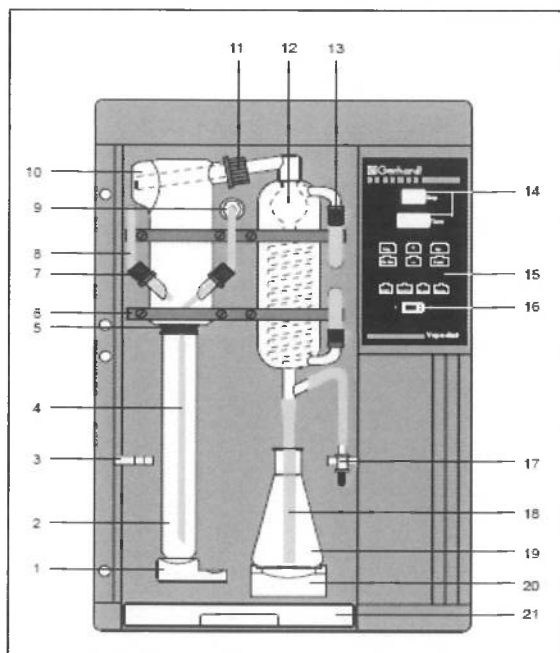
ดำเนินการทำ PM โดย

ชื่อ-นามสกุล :	คุณธนฤทธิ์ เดชนวรัตน์
ตำแหน่ง :	วิศวกร
แผนก :	บริการหลังการขาย
ฝ่าย :	บริการหลังการขาย

Part 3: Operational Qualification (OQ)

3.1 ตรวจสอบสภาพเครื่อง

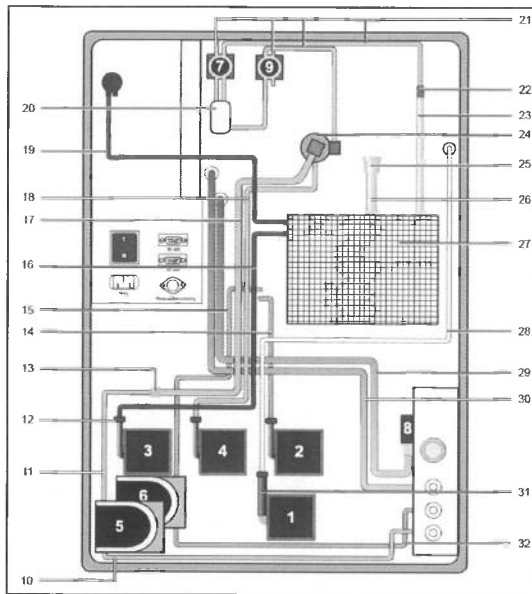
FRONT



No	Description	PASS	FAIL	N/A
1.	Quick clamping device with wedge	☒	☐	☐
2.	Kjeldatherm digestion tube	☒	☐	☐
3.	Holder for steam inlet tubing	☒	☐	☐
4.	PTFP-Inlet tubing, steam	☒	☐	☐
5.	Viton-cone	☒	☐	☐
6.	Clamping for glassware	☒	☐	☐
7.	Screw cap GL18 with silicone seal	☒	☐	☐
8.	PTFP-Inlet tubing, NaOH	☒	☐	☐
9.	PP-Distributor with PP-threaded joint	☒	☐	☐
10.	Distribution head, PP	☒	☐	☐
11.	Screw cap GL32 with silicone seal	☒	☐	☐
12.	Distillation condenser	☒	☐	☐
13.	Screw cap GL14 with plastic screw connection	☒	☐	☐
14.	Display	☒	☐	☐
15.	Keyboard, chemical-resistant	☒	☐	☐
16.	Main switch, green	☒	☐	☐
17.	Ventilation valve	☒	☐	☐
18.	Distillate outlet tubing	☒	☐	☐
19.	Erlenmeyer flask	☒	☐	☐
20.	Platform	☒	☐	☐
21.	Drip tray	☒	☐	☐



REAR



No	Description	PASS	FAIL	N/A
1.	Diaphragm pump NaOH	☒	☐	☐
2.	Diaphragm pump H ₃ BO ₃	☐	☐	☒ *Vap40
3.	Diaphragm pump H ₂ O for steam generator	☒	☐	☐
4.	Diaphragm pump H ₂ O for sample	☒	☐	☐ *Vap30,40
5.	Peristaltic pump for suction sample	☒	☐	☐ *Vap30, 40
6.	Peristaltic pump for suction receiver	☐	☐	☒ Option
7.	Pinch-solenoid valve, steam	☒	☐	☐
8.	Magnetic valve with pressure control	☒	☐	☐
9.	Pinch-solenoid valve, shut-off	☒	☐	☐
10.	Verprene-tubing 4x8 mm.	☒	☐	☐
11.	Verprene-tubing 4x8 mm.	☒	☐	☐ *Vap30,40
12.	Non-return valve for diaphragm pumps	☒	☐	☐
13.	Tubing reduction PP 51x10x5 mm.	☒	☐	☐ *Vap30,40
14.	Silicone tubing 4x7 mm.	☐	☐	☒ *Vap40
15.	Silicone tubing 4x7 mm.	☐	☐	☒ Option
16.	Silicone -tubing 4x7 mm.	☒	☐	☐
17.	Verprene-tubing 8x12 mm.	☒	☐	☐ *Vap30,40
18.	Verprene tubing 4x7 mm.	☒	☐	☐ *Vap30,40
19.	Silicone tubing 4x7 mm.	☒	☐	☐
20.	Ventilation glass	☒	☐	☐
21.	Novoprene-tubing 4.8x8 mm.	☒	☐	☐
22.	Tubing reduction	☒	☐	☐
23.	Silicone tubing 6x10 mm.	☒	☐	☐
24.	PP-distributor with PP-thread	☒	☐	☐
25.	SKT-valve (built in with brass fitting)	☒	☐	☐
26.	Silicone tubing 8x16x80 mm.	☒	☐	☐
27.	Steam generator	☒	☐	☐
28.	PTFE-inlet tubing NaOH	☒	☐	☐
29.	Silicone tubing 8x16 for cooling water inlet	☒	☐	☐
30.	Silicone tubing 8x16 for cooling water outlet	☒	☐	☐
31.	Viton-tubing 6x12*50 mm.	☒	☐	☐
32.	Silicone tubing 4x7 mm.	☐	☐	☒ Option



Part 4: รายละเอียดการตรวจสอบ

4.1 ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

PASS	FAIL	Remark
☒	☐	
☒	☐	

ตรวจสอบสภาพเครื่อง (Optical Test)

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

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม NaOH
- ระบบการ Suction ตั้ง Sample Tube และ Receiver

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	

4.2 รายงานผลการให้บริการ

1. TECHNICAL DATA

Main Supply 220 volt + 10% 50 Hz
Normal current

PASS	FAIL	Remark
☒	☐	
☒	☐	

1.1 COOLING WATER BATH

Temperature 15-20 °C
Cooling Water Outlet
Control Temperature

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	

1.2 OPTICAL TEST VAP 30

Screw cap GL14
Screw cap GL18
Screw cap GL32
Distillation Head
Condensor
Viton Cone
Ventilation Valve
Micro Switch Sample

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	
☒	☐	

2. SYSTEM COOLING WATER INLET

Cooling Water Inlet
Cooling Water Outlet
Flow control valve

PASS	FAIL	Remark
☒	☐	
☒	☐	
☒	☐	



3. SYSTEM CONTROL

	PASS	FAIL	Remark
Key Board	☒	☐	
Display	☒	☐	
Program□	☒	☐	
Adding H ₂ O	☒	☐	*Vap30,40
Adding NaOH	☒	☐	
Adding H ₃ BO ₃	☐	☐	*Vap40
Suction Sample	☒	☐	*Vap30,40

4. SYSTEM DISTILLATION

	PASS	FAIL	Remark
Boiler	☒	☐	
Level Sensor	☒	☐	
Neoprene-Tubing	☒	☐	
Solenoid Valve Shut-Off	☒	☐	
Solenoid Valve Steam	☒	☐	
Excess Pressure Detector	☒	☐	
Ventilation Valve	☒	☐	
Heater	☒	☐	

5. PUMP□

	PASS	FAIL	Remark
Pump H ₂ O Steam			
- Non-Return Valve	☒	☐	
Pump H ₂ O Sample			
- Non-Return Valve	☒	☐	
Pump NaOH			
- Non-Return Valve	☒	☐	
Pump H ₃ BO ₃			
- Non-Return Valve	☐	☐	N/A
Pump suction	☒	☐	

6. THE FOLLOWING PROGRAM RUN

	PASS	FAIL	Remark
Addition H ₂ O 0-99 sec.	☒	☐	
Addition NaOH 0-99 sec.	☒	☐	
Addition H ₃ BO ₃ 0-99 sec.	☐	☐	N/A
Reaction Time 0-99 min	☒	☐	
Distillation Time 0-99 min	☒	☐	
Steam Capacity 30%-100%	☒	☐	
Suction Time 0-99 sec.	☒	☐	
The Instrument is in perfect technical shape	☒	☐	

Remark :

4.2 Error Code

The micro-processor continually surveys all the functions of the distillation system. As soon as an error arises it is shown on the display and accompanied by an acoustic signal.

Error message	Measures
No tap water	Check cooling water inlet for blockages. Ensure the tap is turned on → Enter
No sample tube	Insert tube → Enter
Check chemicals	Check set of tanks → Enter
Low water Press Enter	Check the water inlet distilled H ₂ O → Enter
↓ Filling Steam generator	This message disappears as soon as steam generator is filled

After the above mentioned errors are corrected, the following message is displayed.

Error message	Measures
Stop Prog.No. x continue=Enter	Enter = continue of interrupted program Reset = Standby-mode

Other error messages

Error message	Measures
Wait for steam	Message disappears as soon as stand-by is reached
Add sol. > 1min Continue=Enter	Check programming Enter=continue of interrupted program Reset=Standby-mode
Program undefined	Check programming → Reset
Excess steam pressure	Switch the system off and call service
Sensor error	Switch the system off and call service