

## เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



# QUALITY CALIBRATION CO.,LTD.

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



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235 Pothkasem 63/2 Road, Laksoeng, Bangkok 10160  
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CERTIFICATE No : 22E0980

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CERTIFICATE No : 22E0980  
REFERENCE No : 63904-1

PAGE : 1 OF 2

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : DKK-TOA  
ID No : EQL-183  
RECEIVED DATE : 02-Feb-22  
AMBIENT TEMPERATURE : 25°C ± 1°C  
MODEL : HM-23R  
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 W1-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/ LOT 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	7314008	21E1392	29-Apr-22
5) BATH	260014	124748074	2119121	10-Sep-22
6) THERMOMETER WITH PROBE	421504	55000379	2119129	14-Sep-22
7) STANDARD THERMOMETER	2560	AL4546	PSL-T0049/64	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 S/N: 002E035MK

STANDARD pH BUFFER SOLUTION	UUC READING (pH)	CORRECTION (pH)	ACTUAL READING (mV)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.01	-0.003	174	0.013	2.0
7.003	7.00	0.003	0.0	0.013	2.0
10.014	10.01	0.004	-172	0.014	2.0

2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE:

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (± °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

*[Signature]*

F-G010 REV.02

## Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : DKK-TOA  
MODEL : HM-23R  
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 : *[Signature]*  
PONGSAK J.

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.

F-G010 REV.02



# QUALITY CALIBRATION CO., LTD.

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

CERTIFICATE No : 21E11277

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## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : TOA DKK  
ID No : EQL-199  
RECEIVED DATE : 15-Oct-21  
AMBIENT TEMPERATURE : 25°C ± 1°C  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH  
MODEL : HM-41X  
SERIAL NUMBER : 784787  
CALIBRATION DATE : 15-Oct-21

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON VLTQ-062. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER SOLUTION.  
2. REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT	MODEL	SERIAL No/ LOT 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	21T9121	10-Sep-22
6) THERMOMETER WITH PROBE	421504	55000379	21T9129	14-Sep-22
7) STANDARD THERMOMETER	2560	A14546	PSL-T0049/64	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 : ADJUSTMENT

1. DISPLAY UNIT WITH pH ELECTRODE SN: 903F0008MK

STANDARD pH BUFFER SOLUTION (pH)	UUC* READING (pH)	CORRECTION (pH)	ACTUAL READING (mV)	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.007	4.01	-0.003	177	0.013	2.00
7.003	7.00	0.003	0	0.013	2.00
10.014	10.01	0.004	-177	0.014	2.00

2. DISPLAY UNIT MEASUREMENT TEMPERATURE WITH PROBE

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (± °C)
25.008	25.0	80	0.008	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

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



CERTIFICATE No : 22T1730

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : HIRAYAMA  
ID NUMBER : HQL-155  
RECEIVED DATE : 21-Feb-22  
AMBIENT TEMPERATURE : 30°C ± 1°C  
RELATIVE HUMIDITY : 50%RH ± 10%RH

## CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON IS 7646 : Part 5 : 1993 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. TWO PROBES WERE PLACED NEAR TOP AND BOTTOM WALL AND EACH PROBE WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE THIRD PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE INSTRUMENT CHAMBER. PROBE NUMBER 4 WAS ATTACHED TO THE LOAD TEMPERATURE PROBE, IF FITTED, WITHIN 20 mm OF ITS TIP. PROBE NUMBER 5 WAS PLACED IN THE CHAMBER DRAIN OR VENT WITHIN 100 mm OF ITS CONNECTION TO THE CHAMBER. REFERENCE STANDARD INSTRUMENTS :

## INSTRUMENT

1) DATA LOGGER

MODEL VALPROBE

SERIAL No S350, DV35, DN94

CERTIFICATE No 2210541

DUE DATE 31-Jan-23

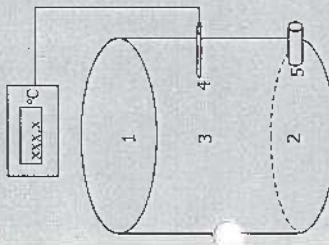
2. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

4. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT :

NATIONAL INSTITUTE OF METROLOGY (THAI) AND THROUGH QUALITY CALIBRATION CO., LTD.

## RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



## 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 Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
116	116.48	0.09	0.10	0.27	0.090	15	60
122	122.43	0.09	0.13	0.27	0.130	15	60

## TEMPERATURE MEASUREMENT ACCURACY TEST(°C)

Cont Temp		Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
116	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 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

F-G010 REV : 0



CERTIFICATE No : 22T1730

REFERENCE No : 64109-6

## Certificate of Calibration

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : HIRAYAMA  
MODEL : HVE-50  
SERIAL No : 30612085166  
D No : HQL-155  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD.,  
SAMAEDAM, BANGKHUNTHAN, BANGKOK  
10150

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 21-Feb-22

APPROVED BY : PONGSAK J.

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



CERTIFICATE No : 21M9564

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE : MODEL : BP210S  
MANUFACTURER : SARTORIUS : SN : S0736477  
ID No : EQL-008 : RECEIVED DATE : 23-Sep-21  
AIR PRESSURE : 101(hmbar ± 1mmbar) : CALIBRATION DATE : 23-Sep-21  
AMBIENT TEMPERATURE : 23° 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 62019 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 3 REFERENCE STANDARD INSTRUMENTS :-

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	EXPIRY DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-1-349	M2103235S	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.

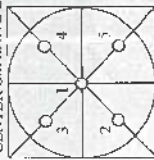
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS & MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (±g)
0.000	0.0000	0.0000	0.000078
0.100	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
1.0	1.0000	0.0000	0.000079
2.0	2.0000	0.0000	0.000080
20.0	19.9999	0.0001	0.000089
45.0	44.9999	0.0001	0.000114
65.0	64.9999	0.0001	0.00016
80.0	79.9999	0.0001	0.00019
100.0	99.9998	0.0002	0.00022
120.0	119.9998	0.0002	0.00025
140.0	139.9998	0.0002	0.00027
160.0	159.9998	0.0002	0.00030
180.0	179.9999	0.0001	0.00030
200.0	199.9995	0.0005	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9997
2	99.9996
3	99.9994
4	99.9998
5	99.9997
OFF-CENTER LOADING	0.0003

6. INTERNAL WEIGHT ERROR 0.0000000000013279 g  
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

F-G010 REV 02

CERTIFICATE No : 21M9564  
REFERENCE No : 62575-2

## 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.  
30,32 RAMA II SOI 63, RAMA II RD.,  
SAMAEDAM, BANGKUNTHIAN, BANGKOK  
10150

CALIBRATED BY : PRASERT P.  
CALIBRATION DATE : 23-Sep-21  
APPROVED BY :   
PONGSAK J.  
ISSUED DATE : 27-Sep-21  
RECEIVED DATE : 23-Sep-21

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



CERTIFICATE No : 21T9567/1

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : 1101 AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UTE 500  
ID No : EQ1-161  
RECEIVED DATE : 23-Sep-21  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
S/N : G 512.2005  
CALIBRATION DATE : 23-Sep-21  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO T1AS G-20 BY COMPARISON WITH CALIBRATED RTD P100 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 : HYDRA 263SA  
2) REFERENCE TEMPERATURE : 21T6765  
3) REFERENCE TEMPERATURE : 10-Jul-22

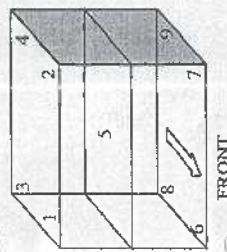
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDES 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 (THAI AND) 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 : 9  
Instrument Condition : Normal  
Chamber Size (W\*H): 56\*40\*48 cm; Vent =50%

### CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.5	104.5	104.12	0.16	0.62	0.76
120.0	120.5	120.5	120.10	0.17	0.70	0.84
140.0	140.5	140.5	140.10	0.22	0.80	1.04
150.0	150.5	150.5	150.03	0.25	0.96	1.20

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.5	104.00	104.30	104.25	103.92	103.97	103.92	103.98	104.23	104.48	0.38
120.5	119.92	120.33	120.24	119.88	119.91	119.83	120.04	120.21	120.51	0.38
140.5	139.90	140.32	140.27	139.79	139.79	139.93	139.79	140.29	140.63	0.46
150.5	149.84	150.24	150.13	149.81	149.85	149.72	149.78	150.25	150.68	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

F-G010 REV : 02

CERTIFICATE No : 21T9567/1  
REFERENCE No : 62575-5

PAGE : 1 OF 2

## Certificate of Calibration

THIS CALIBRATION CERTIFICATE WAS ISSUED TO SUPPLEMENT CALIBRATION CERTIFICATE NO.21T9567  
EQUIPMENT : 1101 AIR OVEN

MANUFACTURER : MEMMERT

MODEL : UTE 500

SERIAL No : G 512.2005

ID No : EQ1-161

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 : 23-Sep-21

APPROVED BY : PONGMAK J.

ISSUED DATE : 05-Oct-21

RECEIVED DATE : 23-Sep-21

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

F-43010 REV : 02



CERTIFICATE No : 21T9568

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UF 110  
ID No : KQL-169  
RECEIVED DATE : 23-Sep-21  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
SN : B414.0764  
CALIBRATION DATE : 23-Sep-21  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

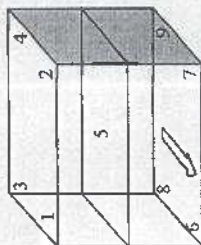
### CONDITION OF THIS RESULTS OF CALIBRATION

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 THIRDMETER 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 : DATA LOGGER WITH RTD  
MODEL : HYDRA 2635A  
SERIAL No : 7301307  
CERTIFICATE No : 21T6764  
DUE DATE : 10-Jul-22  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION.  
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

### CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	104.0	103.89	0.21	0.91	0.93
180.0	180.0	180.0	179.74	0.56	1.82	2.11

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.32	104.08	103.67	103.89	103.58	103.73	104.04	103.73	103.93	0.38
180.0	180.38	179.92	179.16	179.40	179.25	179.24	180.76	179.13	180.37	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

Signature

CERTIFICATE No : 21T9568  
REFERENCE No : 62575-6

## 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., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 23-Sep-21

APPROVED BY : PONGSAK J.  
ISSUED DATE : 27-Sep-21  
RECEIVED DATE : 23-Sep-21



# QUALITY CALIBRATION CO.,LTD.

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



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CERTIFICATE No : 21T9566

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
ID No : EQL-128  
RECEIVED DATE : 23-Sep-21  
AMBIENT TEMPERATURE : 25 °C ± 1 °C  
SN : G508.0791  
CALIBRATION DATE : 23-Sep-21  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 60730 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 :-

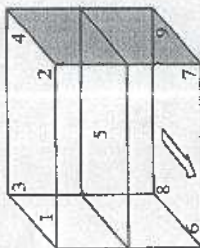
INSTRUMENT : MODEL : SERIAL No : CERTIFICATE No : DUE DATE :  
1) DATA LOGGER WITH RTD : HYDRA 2635A : 6635300 : 21T9765 : 10-Jul-22  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

### CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
104.0	104.0	104.0	104.09	0.19	0.98	1.23
180.0	180.0	180.0	180.10	0.42	1.68	2.30

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.03	103.61	104.24	103.79	103.77	104.04	104.45	104.56	104.34	0.38
180.0	179.70	179.20	180.24	179.24	179.57	180.43	180.86	180.89	180.73	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

*[Signature]*

F-G010 REV : 02

CERTIFICATE No : 21T9566  
REFERENCE No : 62575-4

## 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., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 23-Sep-21

APPROVED BY : *[Signature]*  
ISSUED DATE : 27-Sep-21  
RECEIVED DATE : 23-Sep-21

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



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235 Petchkasem 63/2 Road, Laksoong, Bangkok, Bangkok 10160  
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www.qcalibration.com



CERTIFICATE No : 21T8205

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : ---  
ID No : ---  
RECEIVED DATE : 24-Aug-21  
AMBIENT TEMPERATURE : 24 °C ± 1 °C

MODEL : ---  
SERIAL NUMBER : ---  
CALIBRATION DATE : 24-Aug-21  
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLA5 G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 13 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm, AND PLACED THE SEVENTH 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 7903007 21T8205 05-Jul-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 THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

#### GENERAL INFORMATION

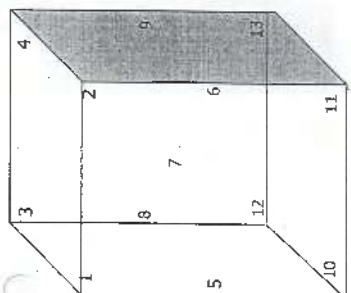
Overall Ambient Temperature around the Chamber (°C) variation : 0  
Overall Line Voltage (V) variation : 3  
Instrument Condition : Normal  
Chamber Size (W\*H) : 190\*70\*170 cm

#### CHAMBER PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Indicating Temperature (°C)	Average All Locations (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
20.0	20.0	20.0	19.8	0.0	0.4	0.5

#### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller temperature (°C)		Indicating Temperature		Measured Temperature (°C) at Spread Locations		Uncertainty of Measurement (± °C)	
20.0		20.0		1		20.0	
				2		19.7	
				3		20.0	
				4		19.8	
				5		19.9	
				6		19.6	
				7 Ref.		19.6	
				8		19.6	
				9		19.6	
				10		19.6	
				11		19.9	
				12		19.9	
				13		19.9	
						0.48	



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

NOTE 2 : LOCATION 7 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

P-G010 REV

CERTIFICATE No : 21T8205  
REFERENCE No : 62206-1

## Certificate of Calibration

EQUIPMENT : INCUBATOR

MANUFACTURER : ---

MODEL : ---

SERIAL No : ---

ID No : EQ1-166

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 : TETINITHI W.

CALIBRATION DATE : 24-Aug-21

APPROVED BY : PONGK J.

ISSUED DATE : 24-Aug-21

RECEIVED DATE : 24-Aug-21

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

P-G010 REV : 02



CERTIFICATE No : 22T1725

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 110  
ID No : EQL-190  
RECEIVED DATE : 21-Feb-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
SN : D415-0802  
CALIBRATION DATE : 21-Feb-22  
RELATIVE HUMIDITY : 50 %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.

### REFERENCE STANDARD INSTRUMENTS :-

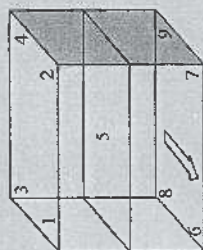
INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE  
1) DATA LOGGER WITH RTD HYDRA 2635A 7408027 21T6766 10-Jul-22  
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

5. THIS CERTIFICATE IS TRACIBLE 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 : 5

Overall Line Voltage (V) variation : 8

Instrument Condition : Normal

Chamber Size (W\*H\*H): 56\*40\*48 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)
37.0	37.0	37.0	36.91	0.07	0.22	0.28
44.0	44.0	44.0	44.17	0.07	0.22	0.27

### 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	
37.0	37.0	36.97	36.95	36.84	36.96	36.94	36.92	36.91	36.90	36.84	0.25
44.0	44.0	44.21	44.23	44.09	44.25	44.23	44.13	44.21	44.15	44.07	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

*[Signature]*

P-C010 REV : 02

CERTIFICATE No : 22T1725  
REFERENCE No : 64109-1

## Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 110  
SERIAL No : D415-0802  
ID No : EQL-190  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
3032 RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 21-Feb-22

APPROVED BY :

PONGKAK J.

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.

P-C010 REV : 02



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CERTIFICATE No : 22T1726

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : EQL-205  
ID No : D518.0082  
RECEIVED DATE : 21-Feb-22  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
RELATIVE HUMIDITY : 50 %RH ± 10 %RH

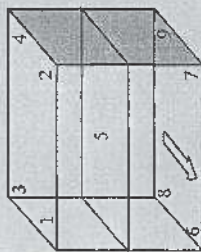
### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD PH100 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 6635300 21T6765 10-Jul-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 TRACABLE 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 : 2  
Overall Line Voltage (V) variation : 9  
Instrument Condition : Normal  
Chamber Size (W\*H\*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	34.98	35.03	35.08	35.01	35.08	0.25
36.0	35.93	35.95	35.95	35.94	36.00	36.05	36.10	36.01	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 MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT

CERTIFICATE No : 22T1726

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IP 160  
SERIAL No : D518.0082  
ID No : EQL-205  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
3032 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKOKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CHIL  
CALIBRATION DATE : 21-Feb-22

APPROVED BY : PONGKRAK J.  
ISSUED DATE : 22-Feb-22  
RECEIVED DATE : 21-Feb-22



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235 Pachkasem 63/2 Road, Laksoeng, Bangkok 10160  
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CERTIFICATE No : 2117075

PAGE : 2 OF 2

## Calibration Report

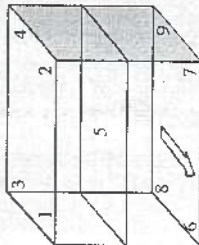
EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : INB 400  
ID No : HQI-087  
RECEIVED DATE : 20-Jul-21  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
S/N : 16405.0946  
CALIBRATION DATE : 20-Jul-21  
RELATIVE HUMIDITY : 50 %RH = 10 %kH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO CLASS 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 :

- 1) DATA LOGGER WITH RTD  
MODEL : HYDRA 2635A  
SERIAL No : 7301307  
CERTIFICATE No : 2116764  
DUE DATE : 10-Jul-22
2. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION.
3. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
4. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.
5. **RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**



### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 9
Instrument Condition : Normal
Chamber Size (W*H): 40*33*40 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)
44.0	43.5	43.5	44.15	0.17	1.25	1.27
55.0	54.5	54.5	55.06	0.27	1.47	1.50

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	Uncertainty (± °C)
43.5	43.5	43.75	43.82	43.87	43.82	43.62	44.62	44.52	44.61	44.68	0.36
54.5	54.5	54.63	54.67	54.77	54.68	54.46	55.47	55.64	55.52	55.67	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 1.92, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

P-0010 REV - 03

CERTIFICATE No : 2117075  
REFERENCE No : 61873-3

## Certificate of Calibration

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : INB 400  
SERIAL No : E405.0946  
ID No : HQI-087  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30.32 RAMA II SOI 63, RAMA II RD., SAMMAJUDAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAI CHANN CH.  
CALIBRATION DATE : 20-Jul-21

APPROVED BY :   
PONGSAVAI J.  
ISSUED DATE : 21-Jul-21  
RECEIVED DATE : 20-Jul-21

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

P-0010 REV - 03



Bara Scientific Co., Ltd.  
968 U Chu Liang Building Floor 7 Rama 4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



# Certificate of Calibration

Certificate No. BSCC-UV-170/21 Number of Page(s) 2 of 3

## Calibration Results:

### 1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
279.44	279.07	-0.37	0.18
418.53	418.41	-0.12	0.18
536.52	536.48	-0.04	0.18
684.50	684.53	0.03	0.18
879.41	879.37	-0.04	0.18

### 2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (A)
235	CNR	CNR	CNR	CNR
257	0.0000	0.0000	0.0000	0.0075
	0.8871	0.8825	-0.0046	0.0075
313	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6443	0.6406	-0.0037	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 this 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 Floor 7 Rama 4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6375496-7  
www.barscientific.com



# Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-170/21  
Equipment UV-Vis Spectrophotometer  
Model UV-1900i  
Manufacturer Shimadzu  
Serial No. A12535780311ML  
ID No. EQL-233  
Date of receipt 7 June 2021  
Date of calibration 11 June 2021  
Date of issue 11 June 2021  
Customer name Test Tech Co., Ltd.  
Address 30,32 Rama II Sor 63, Rama II Rd., Sametdham, Bangkhunthian Bangkok 10150

Temperature (23.8 - 25.2) °C (On site)  
Humidity (48.6 - 53.6) %RH (On site)

Equipment condition Good Operation

Calibration Location Water Room

Calibration Procedure In-house method WIJUV-702-01 based on ASTM E275-01

Traceability  
Wavelength Accuracy is traceable to certificate No. 80172 and 78888  
Photometric Accuracy is traceable to certificate No. 80182 and 78888  
Spectral Light is traceable to certificate No. 78900  
The above certificate are traceable to SI unit through Sigma Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Wanchana Janloey

Approved by

Mr. Kanchit Choothep  
Technical 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 this 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	418.9	-0.29	0.13
536.66	536.9	-0.24	0.13
637.98	637.9	0.08	0.13
748.46	748.7	-0.22	0.13
807.03	807.4	-0.37	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
	0.0000	0.000	0.0000	0.0015
420 nm	0.2878	0.288	-0.0002	0.0045
	0.5157	0.517	-0.0013	0.0045
	1.0258	1.028	-0.0022	0.0045
	0.0000	0.000	0.0000	0.0045
440 nm	0.2816	0.282	-0.0004	0.0045
	0.5059	0.507	-0.0011	0.0045
	1.0044	1.005	-0.0006	0.0045
	0.0000	0.000	0.0000	0.0045
465 nm	0.2467	0.248	-0.0013	0.0045
	0.4579	0.459	-0.0011	0.0045
	0.9301	0.931	-0.0009	0.0045
	0.0000	0.000	0.0000	0.0045
546.1 nm	0.2419	0.243	-0.0011	0.0045
	0.4646	0.465	-0.0004	0.0015
	0.9453	0.944	0.0013	0.0045
	0.0000	0.000	0.0000	0.0045
590 nm	0.2560	0.257	-0.0010	0.0045
	0.5036	0.503	0.0006	0.0045
	1.0022	1.001	0.0012	0.0045
	0.0000	0.000	0.0000	0.0045
635 nm	0.2553	0.256	-0.0007	0.0045
	0.4871	0.496	0.0011	0.0045
	0.9717	0.969	0.0027	0.0045

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
	0.7342	0.736	-0.0018	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8569	0.857	-0.0001	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2859	0.288	-0.0021	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6379	0.636	0.0019	0.0080

Stray light \*

Standard: out-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.73 +/- 0.11 nm	260.7	0.9	2.046
391.86 +/- 0.11 nm	392.0	1.1	1.959

The stray light transmission reference is less than 1.0 T(%) and absorbance is greater than 2.0 (A)

Spectral Resolution \*

Nominal Concentration 0.02 % w/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.77	266.84	1.37	2.00
UUC: Wavelength (nm)	268.7	268.7		
Std Absorbance (A)	0.4200	0.2484		
Absorbance (A)	0.380	0.278		

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

The End of Certificate



Cert No.: 22M196  
Page: 2 of 2

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( $\pm$ )	Maximum Permissible error ( $\pm$ )
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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a 1092727



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SIHANUKONG, BANGKOK 10250  
TEL. 0-27173-3000-24 FAX. 0-2719-9484



MSC-TS16949  
CALIBRATION 9001

## 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

Reference: 2202-01100N

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

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

Atmospheric Pressure: 1011 mbar

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

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

Procedure used:

Calibration were conducted using in-house calibration procedure CP-M01 according to comparison method against standard weights on the basis of weighings at an average air density of  $1.2 \text{ kg/m}^3$  and a temperature of  $23 ^\circ\text{C}$  material density of weight is  $8000 \text{ kg/m}^3$ .

Condition of this result of calibration

1. Reference standards instruments:

Instrument

1) Standard weight Set (E2)

Model

Serial No.

Certificate No.

Due Date

YCS31-712-00

50202065

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 Prabpaijal  
[x] Sura Suwanmasri  
[ ] Chaowalit Ritirak

S. S.

R 0280632



Cert No.: 21M1550  
Page: 2 of 2

Result of calibration Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( $\pm$ )	Maximum Permissible error ( $\pm$ )
2 g	2.000024 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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
514/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3400-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 21M1550  
Page: 1 of 2

Equipment:

Standard Weight

Manufacturer:

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.

Model:

Serial No.:

M 0030/11

ID No.:

ECL-139

Condition As-Received:

Used Item

Received Date:

28 August 2021

Calibration Date:

01 September 2021

Reference:

2108-0772WN

Ambient Temperature:

(  $23 \pm 2$  ) °C

Relative Humidity:

(  $50 \pm 15$  ) %

Atmospheric Pressure:

1008 mbar

Procedure used:

Calibration was 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

1) Standard weight Set (E2)

Model

YCS31-712-00

Serial No.

50202965

Certificate No.

MM-0102-20

Due Date

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 Certificate is traceable to the International System of Unit maintained at-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Chaowalit Ritirak  
Issue Date: 02 September 2021

Approved Signatory:

[Signature] Phaihee Prabpaijal

[ ] Sura Suwanasri

[ ] Chaowalit Ritirak

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Cert No.: 21M1549  
Page: 2 of 2

#### Result of calibration

Without adjustment

Nominal Value	Conventional mass	Uncertainty of Measurement ( $\pm$ )	Maximum Permissible error ( $\pm$ )
20 g	20.000018 g	0.080 mg	0.25 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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL: 0-2717-3000-34 FAX: 0-2719-5484



NSC-TSA-TIS 17025  
CALIBRATION 0008

## Certificate of Calibration

Certificate No.: 21M1549  
Page: 1 of 2

Equipment: Standard Weight

Manufacturer: Mettler Toledo

Model: -

Serial No.: 11119453

ID No.: EQL-149

Condition As-Received: Used Item

Received Date: 25 August 2021

Calibration Date: 01 September 2021

Reference: 2108-0772WN

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

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

Atmospheric Pressure: 1005 mbar

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

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

Procedure used:

Calibration were conducted using in-house calibration procedure CP-MD1 according to comparison method against standard weights on the basis of weighings at an average air density of  $1.2 \text{ kg/m}^3$  and a temperature of  $23.0 ^\circ\text{C}$  material density of weight is  $8000 \text{ kg/m}^3$ .

#### Condition of this result of calibration

1. Reference standards instruments:

#### Instrument

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: Chaowalit Ritirak  
Issue Date: 02 September 2021

Approved Signatory:

[ ] Phairinee Prabpalai

[ ] Sura Suwannasri

[ ] Chaowalit Ritirak

B 0268025



Cert. No.: 217805  
Page: 2 of 2

## Certificate of Calibration

Certificate No.: 217805  
Page: 1 of 2

### Result of Calibration:-

Function: Without Adjustment

Temperature measurement

This equipment was connected with Thermocouple Type T

ID No. EQL-058

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
150	3.9975	3.9	-0.0975	0.24
150	20.0005	19.9	-0.1005	0.24
150	34.9956	34.9	-0.0956	0.24
150	35.9978	36.0	0.0022	0.26
150	55.0023	54.7	-0.3023	0.25
150	100.0048	99.6	-0.4048	0.35
150	103.9978	103.8	-0.1978	0.36
150	119.9973	119.7	-0.2973	0.42
150	139.9975	139.7	-0.2975	0.47
150	150.0029	149.7	-0.3029	0.49
150	170.0037	169.6	-0.4037	0.55
150	179.9975	179.4	-0.5975	0.58

### Result of Calibration:-

Without Adjustment

Temperature measurement

This equipment was connected with Thermocouple Type T

ID No. EQL-058 Water Proof

Dimension of probe : Diameter 5 mm., Length 112 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
90	40.9967	40.9	-0.0967	0.24
90	44.9988	44.9	-0.0988	0.24
90	50.0006	49.9	-0.1006	0.24
90	83.0026	82.8	-0.2026	0.31
90	91.9953	91.7	-0.2953	0.33
90	95.0009	94.7	-0.3009	0.34
90	149.9951	149.5	-0.4951	0.49

UUC\* : Unit Under Calibration

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

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Equipment : Digital Thermometer With Sensor

Manufacturer: Testo

Model : 926

Serial No.: 5609280110250914

ID No.: EQL-058

Condition As-Received: Used Item

Received Date: 26 April 2021

Calibration Date: 28 April 2021 to 11 May 2021

Reference: 2104-0645WN

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, Bangkokthuan, Bangkok 10150

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.  
The temperature scale used was based on ITS-90

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Black Stack Thermometer	1560	8C454	201581	20 May 2021
2) PRT Scanner Module	2562	A01303	201581	20 May 2021
3) Industrial PRT Probe	5627A	679442	201581	20 May 2021
4) Digital Thermometer	1529	A68176	201303	07 Nov 2021
5) Industrial Platinum Resistance Thermometer	5627	739435	201303	07 Nov 2021

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 Metrology Thailand (NIMT)

Calibrated by : Pitak Srongkol

Issue Date : 13 May 2021

Approved Signatory :

[ ] Phalines Prabpai

[x] Chatchawan Khunpluck

[ ] Wanlop Larprum

1053951

0260224



CERTIFICATE No : 21T8009

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : PRECISION  
MODEL : ...  
ID No : EQL-103  
RESOLUTION : 0.1 °C  
RECEIVED DATE : 18-Aug-21  
AMBIENT TEMPERATURE : 23 °C ± 3 °C  
SERIAL NUMBER : 8925  
TYPE : TOTAL IMMERSION  
CALIBRATION DATE : 25-Aug-21  
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E771/992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1529	A22167	20T12169	10-Dec-21
2) SPRT PROBE	5612	587312	20T12169	10-Dec-21
3) PRECISION BATH	7320	A21105	20T12163	16-Dec-21
4) PRECISION BATH	CTR-40	A68155	20T12164	22-Dec-21

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).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (°C)
19.9958	20.0	140	-0.0042	N/A	0.079
25.0038	25.0	160	0.0038	N/A	0.079
41.5059	41.5	225	0.0059	N/A	0.079
44.5075	44.5	235	0.0075	N/A	0.079
45.0125	45.0	240	0.0125	N/A	0.079
50.0154	50.0	260	0.0154	N/A	0.084

UUC\* : UNIT UNDER CALIBRATION

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 : 21T8009

REFERENCE No : 62147-2

## Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : PRECISION  
MODEL : ...  
SERIAL No : 8925  
ID No : EQL-103  
RESOLUTION : 0.1 °C  
TYPE : TOTAL IMMERSION  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD. SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

ALIBRATED BY : CHARUKIT L.  
CALIBRATION DATE : 25-Aug-21  
APPROVED BY : PONGSAK J.  
ISSUED DATE : 25-Aug-21  
RECEIVED DATE : 18-Aug-21

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



CERTIFICATE No : 21T8008

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : PRECISION  
MODEL : G13004  
ID No : EQL-111  
SERIAL NUMBER : ---  
TYPE : TOTAL IMMERSION  
RESOLUTION : 1 °C  
CALIBRATION DATE : 25-Aug-21  
RECEIVED DATE : 18-Aug-21  
AMBIENT TEMPERATURE : 23 °C ± 3 °C  
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77-1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.

### 2. REFERENCE STANDARD INSTRUMENTS :

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1529	A22167	20T12169	10-Dec-21
2) SPRT PROBE	5612	587312	20T12169	10-Dec-21
3) PRECISION BATH	7320	A21105	20T12169	16-Dec-21

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).

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (°C)
114.9054	115.0	110	-0.0946	N/A	0.14
120.9149	121.0	120	-0.0851	N/A	0.14

### \* UNIT UNDER CALIBRATION

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 : 21T8008  
REFERENCE No : 62147-1

## Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER  
MANUFACTURER : PRECISION  
MODEL : G13004  
SERIAL No : ---  
ID No : EQL-111  
RESOLUTION : 1 °C  
TYPE : TOTAL IMMERSION  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUINHIAN, BANGKOK 10150

ALIBRATED BY : CHIRUKIT L.  
CALIBRATION DATE : 25-Aug-21  
APPROVED BY : PONGSAK J.  
ISSUED DATE : 25-Aug-21  
RECEIVED DATE : 18-Aug-21

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 BATTANAKARN ROAD SOI 18, SIAMLIANG, SUANLIANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-2484



Cert. No.: 21H2269

Page.: 2 of 2

**Result of Calibration:-**  
**Function:**

Humidity measurement  
Without Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	30.1	30.0	-0.1	1.5
25.0	40.1	40.0	-0.1	1.5
25.0	50.1	51.0	0.9	1.7
25.0	60.0	61.0	1.0	1.7
25.0	75.2	76.0	0.8	1.7

**Result of Calibration:-**  
**Function:**

Temperature measurement  
Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
15.00	15.0	0.00	0.72
20.00	20.0	0.00	0.72
25.01	25.0	-0.01	0.72
30.01	30.0	-0.01	0.72

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

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*Signature*

B 1079790

**Certificate of Calibration**

Certificate No.: 21H2269  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer

Manufacturer: Barigo

Model :

Serial No.:

ID No.: EOL-064

Condition As-Received: Used Item

Received Date: 25 October 2021

Calibration Date: 27 October 2021

Reference: 2110-0738DN

Ambient Temperature: ( 25 ± 3 ) °C

Relative Humidity: ( 50 ± 20 ) %

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

30,32 Rama II Soi 63, Rama II Rd., Samaedam,  
Bangkhunthian, 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) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31853	19714	20 Sep 2022
2) Standard Humidity/Temperature Meter	400	10240757	TH-0076-20	07 Dec 2021

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 : Viporn Tantiyawuttl  
Issue Date : 04 November 2021

Approved Signatory :

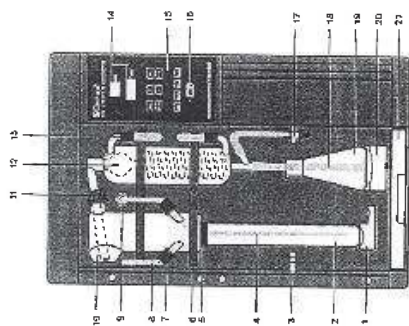
*Signature*  
[ ] Chakrit Waewarajua  
[ ] Ponthippa Tameyavul  
[ ] Plak Srimongkol

B 0273563

# Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

FRONT



## ข้อมูลพื้นฐานของเครื่อง

ผลิตภัณฑ์ : เครื่องกลั่นให้ไดรเจน

ยี่ห้อ : Gerhardt

รุ่น : VAP30s

หมายเลขเครื่อง : GER003718

## REMARK

PASS FAIL N/A

1. Quick clamping device with wedge	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Kjeldstern digestion tube	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Header for steam inlet tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. PTFE-Inlet tubing, steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Vion-cone	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Clamping for glassware	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Screw cap GL18 with silicone seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. PTFE-Inlet tubing, NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. PP-Distributor with PP-threaded joint	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Distribution head, glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Screw cap GL32 with silicone seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Distillation condenser	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Screw cap GL14 with plastic screw connection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14. Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. Keyboard, chemical resistant	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Main switch, green	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Distillate outlet tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Erlenmeyer flask	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20. Platform	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21. Drip tray	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

# REAR

PASS	FAIL	N/A	REMARK
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	22. Tubing reduction
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	23. Silicone tubing 6x10 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	24. PP-distributor with PP-thread
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	25. SKT-valve (built in with brass fitting)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	26. Silicone tubing 8x16x80 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	27. Steam generator
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	28. PTFE-inlet tubing NaOH
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	29. Silicone tubing 8x16 for cooling water inlet
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	30. Silicone tubing 8x16 for cooling water outlet
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	31. Viton tubing 6x12x50 mm.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	32. Silicone tubing 4x7 mm.

## รายละเอียดการตรวจสอบ

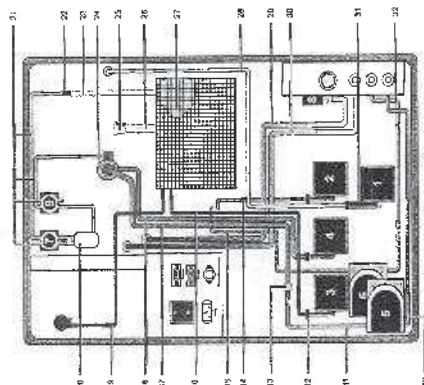
### ขั้นตอนการบริการ

#### ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ตรวจสอบการทำงานของไฟฟ้าของเครื่องจักร
- ตรวจสอบไฟฟ้าที่ใช้งาน

#### ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distillation Head
- Condensor
- Steam generator
- Tubing
- Viton cone
- ตรวจสอบ Function การทำงาน (The Function Test)
- ตรวจสอบแรงและความดันของ Steam
- ตรวจสอบการเดินน้ำเข้า Sample Tube
- ตรวจสอบการเดิน Na OH
- ตรวจสอบการ Suction ทั้ง Sample Tube และ Receiver



# REMARK

PASS	FAIL	N/A	REMARK
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1. Diaphragm pump NaOH
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2. Diaphragm pump $H_2O$
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3. Diaphragm pump $H_2O$ for steam generator
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4. Diaphragm pump $H_2O$ for sample
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5. Peristaltic pump for suction sample
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	6. Peristaltic pump for suction receiver
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7. Pinch-solenoid valve, steam
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8. Magnetic valve with pressure control
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9. Pinch-solenoid valve, shut-off
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10. Verprene-tubing 4x8 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11. Verprene-tubing 4x8 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12. Non-return valve for diaphragm pumps
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13. Tubing reduction PT 51x10x5 mm.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14. Silicone tubing 4x7 mm.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	15. Silicone tubing 4x7 mm.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	16. Silicone tubing 6x12 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17. Verprene-tubing 4x8 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18. Verprene tubing 4x7 mm
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19. Silicone tubing 4x7 mm.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20. Ventilation glass
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21. Nonreturn-tubing 4.8x8 mm.



## 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
No sample tube	Insert tube
Check chemicals	Check set of tanks
Low water Press Enter	Check the water inlet distilled H <sub>2</sub> O
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 vol. > 1 ml Continue=Enter	Check programming Enter=continue of interrupted program Reset=Standby-mode
Program undefined	Check programming
Excess steam pressure	Switch the system off and call service
Sensor error	Switch the system off and call service

## ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

### การบำรุงรักษาทั่วไป (Basic maintenance)

#### Cleaning

Glass parts and suction pump should be cleaned before long periods of non-usage (i.e. holidays). This way blockages caused by crystalline deposits are avoided.

The following program should be run:

Addition H <sub>3</sub> BO <sub>3</sub>	0	s
Addition H <sub>2</sub> O:	13	s
Addition NaOH:	0	s
Reaction time:	0	s
Distillation time:	7	min.
Steam capacity:	100	%
Suction time:	20	s

Place an empty digestion tube and an Erlenmeyer flask into position, and start the program.

In case of extreme deposits in the glassware you can clean the system by putting about 10 ml of sulphuric acid into the digestion tube.

## Preventive Maintenance

วันที่ 10 มีนาคม 2564 (ครั้งที่ 1/1)

บริษัท เอสพีซี จำกัด

# GERHARDT

Distillation Unit VAPODEST VAP20

(S/N GER004730/EQ1-090)

# S&P

บริษัท เอสพีซี จำกัด

ฝ่ายบริการหลังการขาย

โทร 0-2185-4333 ต่อ 3004-3008 Fax 0-2332-1236, 0-2332-9138 E-mail: service.spc@spc-t.com

ฝ่ายขายและการตลาด

โทร 0-2185-4333 ต่อ 2133-2134 Fax 0-2332-8809, 0-2332-6216 E-mail: marketing.spc@spc-t.com

Website: www.spc-t.com

เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งช่างผู้ชำนาญ เพื่อให้บริการซ่อมแซมของเหลวและบริการเฉพาะ ในปริมาณและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด บักชญาญ) บริษัทฯ จะคิดค่าบริการเพิ่มตามอัตราที่ผู้ดูแลของเหลวของหน่วยงานกำหนดไว้

ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานของถังต่าง ๆ ของเครื่องเมื่อ
- ทดสอบประสิทธิภาพการไหลของเครื่องเมื่อ
- รางการถ่ายเทของเหลวของเครื่องเมื่อ

หมายเหตุ

- หากไม่พร้อมแจ้งการบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้ให้บริการอยู่ตามเขตพื้นที่ให้บริการ บริษัทฯ ถ้าไม่สะดวกค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัทฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

Preventive Maintenance Contract

สัญญาบริการเลขที่ .....  
วันที่เริ่มสัญญา ..... / ..... / .....  
จำนวนในการที่สัญญาบริการ ..... ครั้ง  
ครั้งที่ ..... / วันที่ ..... 10 มีนาคม 2564

รายละเอียดผู้รับบริการ

รหัส	19878	บริษัท / หน่วยงาน	บริษัท เทสท์ เฮลท์ จำกัด
ที่อยู่	30,32 ซอยพระรามที่ 2 ซอย 63 แขวงแสมดำ เขตบางขุนเทียน กรุงเทพมหานคร 10150		
โทรศัพท์	0-2893-4211-7		
E-mail	0-2893-4218		

ผู้ติดต่อ

ชื่อ - นามสกุล	คุณ ณัฐวิภา ล่อนจั่น		
ตำแหน่ง			
โทรศัพท์	02-893-4211-7	มือถือ	แฟกซ์
E-mail	pru_bonon@hotmail.com		

รายละเอียดผู้ให้บริการ

บริษัท เอสพีซี อาร์ท จำกัด (ฝ่ายบริการหลังการขาย)  
1759 ซอยพระรามที่ 57 ถนน สุขุมวิท 101/1 แขวงบางนา เขตพระโขนง กรุงเทพมหานคร 10260  
โทรศัพท์ 02-185-4333 เบอร์โทรภายใน 3004-3007 แฟกซ์ 02-332-9158 Email: service.spc@spc-art.com  
เจ้าหน้าที่ประสานงาน : คุณสุภาพร พันธุ์ชัยสิทธิ์ โทรศัพท์ 02-185-4333 มือถือภายใน 3008

เจ้าหน้าที่ผู้ให้บริการ	คุณสุภาพร พันธุ์ชัยสิทธิ์		
ตำแหน่ง	วิศวกรซ่อม		
โทรศัพท์	0-2185-4333	มือถือ	0-2332-9158, 0-2333-1236
E-mail			

ลายเซ็นผู้รับบริการ

(คุณ ณัฐวิภา ล่อนจั่น)  
ลายเซ็นผู้รับบริการ  
ลายเซ็นผู้ให้บริการ  
SART ( นามบริษัท เอสอาร์ที )  
บริษัท เอสพีซี อาร์ท จำกัด  
ตัวแทน SPC RT Co., Ltd.  
วันที่ / ประทับตราบริษัท  
10 มีนาคม 2564  
10 มีนาคม 2564

ช่องทางติดต่อ

บริการหลังการขาย



บริการลูกค้าสัมพันธ์



บริการรับเรื่องร้องเรียน (CSI-Center)



ลูกค้าสามารถร้องเรียนผ่านเว็บไซต์-จดแจ้งกับศูนย์รับแจ้งการร้องเรียน หรือเรื่องอื่นใดของบริษัทฯ

โทรศัพท์ : 02-185-4333 ต่อ 2150, 6801

E-mail :

ขอรับเทียบเครื่องมีด



สอบถามข้อมูลเกี่ยวกับบริการขอเทียบ

โทรศัพท์ : 02-185-4333 ต่อ 3301-3305

โทรสาร : 02-185-4474

E-mail :

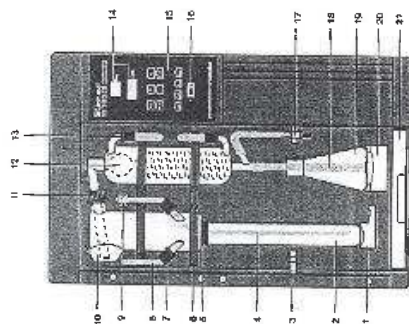
## สิทธิพิเศษ

- ในกรณีที่เครื่องมือเกิดการขัดข้อง บริษัทฯ จะทำการตรวจสอบและดำเนินการตรวจสอบให้โดยไม่มีค่าใช้จ่ายในการตรวจสอบ
- เครื่องมือที่มีการที่ค่า Precision Maintenance มากกว่า 2 ครั้งเป็นระยะเวลาติดต่อกัน จะได้รับส่วนลด ค่าบริการซ่อม และค่าอะไหล่ 10 % โดยบริษัทฯ จะส่งวิศวกรผู้ชำนาญการไปตรวจสอบและดำเนินการซ่อมแซม
- ในกรณีที่ลูกค้าสัญญาเป็นระยะเวลาสัญญา จะได้รับสิทธิพิเศษ หากเงินลงทุนสัญญา โดยทางบริษัทฯ จะไม่คิดค่าใช้ จ่ายเพิ่มเติมในกรณีที่มีการปรับราคาขึ้น

# Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

FRONT



อนุมัติงานของเครื่อง

ผลิตภัณฑ์

ชื่อ

รุ่น

หมายเลขเครื่อง

เครื่องกลั่นในโดม

Cerhardt

VAP20

GER004730

REMARK

PASS FAIL N/A

1. Quick clamping device with wedge	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Kjeldahl digestion tube	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Holder for steam inlet tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. PTFE-Inlet tubing, steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Viton-cone	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Clamping for glassware	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Screw cap GL18 with silicone seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. PTFE-Inlet tubing, NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. PP-Distributor with PP-threaded joint	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Distribution head, glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Screw cap GL32 with silicone seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1. ไม่เห็น Condenser บนบน region
12. Distillation condenser	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Screw cap GL14 with plastic screw connection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14. Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. Keyboard, chemical-resistant	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Main switch, green	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Distillate outlet tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Erlenmeyer flask	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20. Platform	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21. Drop tray	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

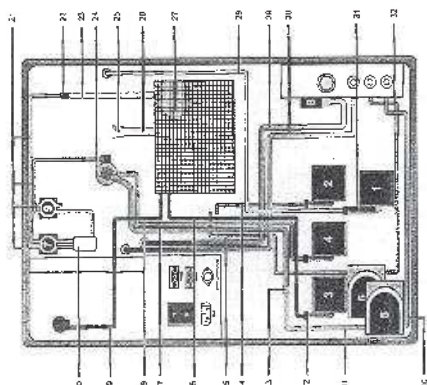
6

15-18

15-17

5

REAR



REMARK

N/A

FAIL

PASS

22. Tubing reduction	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
23. Silicone tubing 6x10 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
24. PP-distributor with PP-tread	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
25. SKT-valve (built in with brass fitting)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
26. Silicone tubing 8x16x80 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
27. Steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
28. PTFE-inlet tubing NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
29. Silicone tubing 8x16 for cooling water inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
30. Silicone tubing 8x16 for cooling water outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
31. Viton-tubing 6x12x50 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
32. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

รายละเอียดการตรวจสอบ

ขั้นตอนการบริการ

ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความดันทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

ตรวจสอบระบบท่อ (Optical Test)

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

ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบเครื่องและหลอดความดันความสูง Steam
- ระบบการเดินน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการดูด Sample ทั้ง Sample tube และ Receiver

REMARK

N/A

FAIL

PASS

1. Diaphragm pump N-OH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2. Diaphragm pump H <sub>3</sub> BO <sub>3</sub>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Diaphragm pump H <sub>2</sub> O for steam generator	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4. Diaphragm pump H <sub>2</sub> O for sample	<input type="checkbox"/>	<input type="checkbox"/>	
5. Peristaltic pump for suction sample	<input type="checkbox"/>	<input type="checkbox"/>	
6. Peristaltic pump for suction receiver	<input type="checkbox"/>	<input type="checkbox"/>	Option
7. Pinch-solenoid valve, steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8. Magnetic valve with pressure control	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9. Pinch-solenoid valve, shut-off	<input type="checkbox"/>	<input type="checkbox"/>	
10. Verprene-tubing 4x8 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
11. Verprene-tubing 4x8 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
12. Non-return valve for diaphragm pumps	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
13. Tubing reduction PP 51x10x5 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
14. Silicone tubing 4x7 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
15. Silicone tubing 4x7 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
16. Silicone-tubing 8x12 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
17. Verprene-tubing 4x8 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
18. Verprene tubing 4x7 mm.	<input type="checkbox"/>	<input type="checkbox"/>	
19. Silicone tubing 4x7 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
20. Ventilation glass	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
21. Novoprene-tubing 4.8x8 mm.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

รายงานผลการให้บริการ

	PASS	FAIL	N/A	REMARK
<b>1. TECHNICAL DATA</b>				
Main Supply 220 volt + 10% 50 Hz with ground	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nominal current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.1 COOLING WATER BATH</b>				
Temperature 15-20 °C	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Control Temperature	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>1.2 OPTICAL TEST VAP. 20</b>				
Screw cap GL14	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Screw cap GL18	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Screw cap GL32	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Distillation Hends	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Viton Core	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ventilation Valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Micro Switch Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Condensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2. SYSTEM COOLING WATER INLET</b>				
Cooling Water Inlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Cooling Water Outlet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Magnetic valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3. SYSTEM CONTROL</b>				
Key Board	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Adding H <sub>2</sub> O	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Adding NaOH	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Adding Li <sub>2</sub> HPO <sub>3</sub>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Suction Sample	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. SYSTEM DISTILLATION</b>				
Boiler	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Level Sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Nonyrene-Tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Solenoid Valve Shut-Off	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Solenoid Valve Steam	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Excess Pressure Detector	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## 5. PUMP

[illegible]

**Remark :**

## 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
No sample tube	Insert tube
Check chemicals	Check set of tanks
Low water Press Enter	Check the water inlet distilled H <sub>2</sub> O
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. > 1mln Continue=Enter	Check programming Enter=continue of interrupted program Reset=Standby-mode
Program undefined	Check programming
Excess steam pressure	Switch the system off and call service
Sensor error	Switch the system off and call service

## ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

### การบำรุงรักษาทั่วไป (Basic maintenance)

#### Cleaning

Glass parts and suction pump should be cleaned before long periods of non-usage (i.e. holidays). This way blockages caused by crystalline deposits are avoided.

The following program should be run:

Addition H <sub>2</sub> BO <sub>3</sub>	0	s
Addition H <sub>2</sub> O:	13	s
Addition NaOH:	0	s
Reaction time:	0	s
Distillation time:	7	min.
Steam capacity:	100	%
Suction time:	20	s

Place an empty digestion tube and an Erlenmeyer flask into position, and start the program.

In case of extreme deposits in the glassware you can clean the system by putting about 10 ml of sulphuric acid into the digestion tube.