

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือการตรวจวัด



CRYSTAL CALIBRATION SALES AND SERVICE CO., LTD.

45/48 Soi Salathammassop31, Salathammassop Rd.,  
Salathammassop, Thawewatthana, Bangkok 10170 Thailand

Tel : 0-2408-8474-5 Fax : 0-2408-8477 Email : info@crystalcal.com www.crystalcal.com



## CERTIFICATE OF CALIBRATION

Certificate No. : 20-1244-002

Issue Date : 5 December 2020

Work Order No. : 20/1244

Customer Name : Faculty of Science and Technology  
Suan Sunandha Rajabhat University  
1 U-Thong nok Road, Dusit, Bangkok 10300 Thailand

Date of Received : 1 December 2020

Date of Calibration : 1 December 2020

Instrument Details : Description : pH meter  
Manufacturer : OHAUS  
Model : ST5000  
Serial No. : 17460012  
ID No. : N/A  
Resolution : 0.001 pH  
Location : Faculty of Science and Technology

Calibration Method : This instrument was calibrated by in-house calibration procedure no. CWI-C-02 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)


### Environmental Condition

Temperature : Area Monitoring  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$   
Humidity : Area Monitoring  $55\%\text{RH} \pm 30\%\text{RH}$

### Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Kritsada Kaewwangpa  
Calibration Engineer

Approved by :   
( Mr. Anuwat Yaklermjit )  
Laboratory Manager

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Crystal Calibration Sales and Service Co., Ltd.

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



**CERTIFICATE OF CALIBRATION**

Issue Date : 5 December 2020

Certificate No. : 20-1244-002

Work Order No. : 20/1244

**Details of Calibration****1. Certified Reference Material / Certified of Instrument**

Certified Reference Material	Certificate no.	CRM Code	Lot no.	Expire Date
1.1 Buffer Solution pH 4.00	180619	TRM-S-2027	180619	25 August 2021
1.2 Buffer Solution pH 7.00	020719	TRM-S-2034	020719	25 August 2021
1.3 Buffer Solution pH 10.00	190619	TRMS-2031	190619	25 August 2021

Instrument	Certificate no.	Serial No.	Due Date
1.4 Voltage Calibrator	20E2357	9791008	10 July 2021
1.5 Digital Thermometer	QR20-0189	316A14010055	13 February 2021

**2. This certificate traceable to the international unit (SI)**

Buffer solution no. 1.1 traceable to : Nation Institute of Metrology (Thailand)  
 Buffer solution no. 1.2 traceable to : Nation Institute of Metrology (Thailand)  
 Buffer solution no. 1.3 traceable to : Nation Institute of Metrology (Thailand)  
 Instrument no. 1.4 traceable to : Technology Promotion Association (Thailand-Japan) NAC Calibration No. 0008  
 Instrument no. 1.5 traceable to : Quality Reborn Co., Ltd., NAC Calibration No. 0292

**3. Condition of Item** : Used**4. Calibration location** : On-site**Result of Calibration**

Measurement Function : mV Measurement

Performing : Standard curve by Voltage calibrator at pH ( 4, 7, 10 )

Nominal value	Applied DC voltage	Average Indicator reading		Uncertainty ( $\pm$ )	Coverage Factor
		mV	pH		
pH	mV			mV	k
0	414.1	413.96	0.024	0.060	2.00
4	177.5	177.37	4.010	0.060	2.00
7	0.0	-0.09	7.000	0.060	2.00
10	-177.5	-177.56	10.010	0.060	2.00
14	-414.1	-414.15	14.023	0.059	2.00



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## CERTIFICATE OF CALIBRATION

Issue Date : 5 December 2020

Certificate No. : 20-1244-002

Work Order No. : 20/1244

### Result of calibration

Measurement Function : pH Measurement with electrode  
Performing : Three buffer standard curve using buffer nominal pH (4, 7, 10)

STD buffer solution pH @ 25°C	Average indicator reading		Uncertainty (±) pH	Coverage factor k
	pH	mV		
4.01	3.999	170.28	0.011	2.00
7.00	7.014	-6.77	0.011	2.00
10.02	10.017	-181.30	0.012	2.00

### Descriptions of electrode :

Electrode Type : Combination Electrode  
Manufacturer : OHAUS  
Serial no. : 2936028  
Model : ST310  
ID No. : N/A

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

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

—END—

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## CERTIFICATE OF CALIBRATION

Certificate No. : 20-1244-001

Issue Date : 5 December 2020

Work Order No. : 20/1244

Customer Name : Faculty of Science and Technology  
Suan Sunandha Rajabhat University  
1 U-Thong nok Road, Dusit, Bangkok 10300 Thailand

Date of Received : 1 December 2020

Date of Calibration : 1 December 2020

Instrument Details : Description : Electronic Balance  
Manufacturer : METTLER TOLEDO  
Model : ME204  
Serial No. : B354348442  
ID No. : สส.07.14.02.0003/59  
Resolution : 0.0001 g  
Capacity : 220 g  
Location : Balance and Pressure Calibration Laboratory

Calibration Method : This calibration was conducted by using in-house method according to calibration procedure no. CWI-B-01 based on UKAS LAB14 edition 6, October 2019


### Environmental Condition

Temperature : Laboratory Control at  $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$   
Humidity : Laboratory Control at  $50\%\text{RH} \pm 20\%\text{RH}$   
Air Pressure : Laboratory Monitoring between 980 hPa to 1040 hPa

### Traceability of Measurement

: This certificate of calibration documents the traceability to national standard, which realize the unit of measurement according to the International system of Units (SI)

Calibrated by : Mr. Wuttinun Yindeepot  
Calibration Engineer

Approved by :   
( Mr. Anuwat Yaklermjit )  
Laboratory Manager

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## CERTIFICATE OF CALIBRATION

Certificate No. : 20-1244-001

Issue Date : 5 December 2020

Work Order No. : 20/1244

### Details of Calibration

#### 1. Reference Standards Instrument

Instrument	Capacity of Weight	Serial No. / ID No.	Certificate No.	Due date
Weight Set E2	1mg to 200g	B744909236	19-095084	10 November 2021

2. Certificate traceable : This certificate traceable to The International System of Unit refer to  
Asia Medical and Agricultural Laboratory and Research center Co., Ltd. , NAC Calibration No.  
0152
3. Condition of item : Used
4. Calibration site : Permanent

### Result of Calibration

#### 1. Calibration result : Check performance before calibration

Applied Weight	Balance Reading	Correction Value	Uncertainty	Coverage Factor
g	g	g	( $\pm$ ) g	(k)
100.0000	99.9988	0.0013	0.00017	2.00
200.0001	199.9974	0.0027	0.00030	2.00

#### 2. The result of check performance in first step has to Reset span

#### 3. Calibration result : After set span by Internal Calibration

3.1 Repeatability number of repeatability is 10 times

Normal Value ( g )	Standard Deviation of Reading ( g )
100	0.0000422
200	0.0000699

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

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





## CERTIFICATE OF CALIBRATION

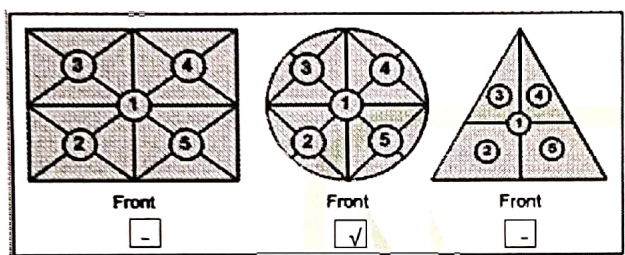
Certificate No. : 20-1244-001

Issue Date : 5 December 2020

Work Order No. : 20/1244

### 3. Calibration result : After set span by Internal Calibration (continued)

3.2 Eccentric or Off-center Error A mass of 100 g was placed and moved to various position on pan.



Result of Eccentric Error		
Position 1	100.0000	g
Position 2	100.0000	g
Position 3	99.9999	g
Position 4	99.9999	g
Position 5	100.0000	g
(Maximum Difference)	0.0002	g

### 3.3 Departure of indication from nominal value

Applied Weight g	Balance Reading g	Correction Value g	Uncertainty (±) g	Coverage Factor (k)
Unload	0.0000	0.0000	0.00012	2.00
0.0010	0.0010	0.0000	0.00012	2.00
0.0500	0.0500	0.0000	0.00012	2.00
0.1000	0.1000	0.0000	0.00012	2.00
1.0000	1.0000	0.0000	0.00012	2.00
2.0000	2.0000	0.0000	0.00012	2.00
5.0000	5.0000	0.0000	0.00012	2.00
10.0000	10.0000	0.0000	0.00012	2.00
20.0000	20.0000	0.0000	0.00012	2.00
50.0001	50.0000	0.0001	0.00012	2.00
100.0000	99.9999	0.0001	0.00017	2.00
150.0001	149.9999	0.0002	0.00030	2.00
200.0001	199.9999	0.0002	0.00030	2.00

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

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



## Certificate of Calibration

Certificate Number : SPR20110028-3

Page : 1 of 3

Customer : O.K Environmental Consultant & Research Co.,Ltd

89/213 , Hatairat Road., Bangchan, khlongsamwa, Bangkok 10510

Equipment Name : Oven

Manufacturer : Memmert

Model : UNB500

Serial Number : C507.1009

ID. Number : N/A

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Received Date : 03 Nov 2020

Relative Humidity :  $60\% \pm 20\%$

Calibration Date : 06 Nov 2020

Location of Calibration : On-Site

Recommend Due Date : N/A

Calibration Procedure : SP-CPT-04-01

Date of Issue : 07 Nov 2020

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item fails calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Prayoon Topart

Calibration Officer

Approved by :

( Mr. Worapong Sinthusopa )

Authorized Signatory





## Calibration Report

Certificate Number : SPR20110028-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY41025374	SPR20070032-5	07 Jul 2021

### Traceability

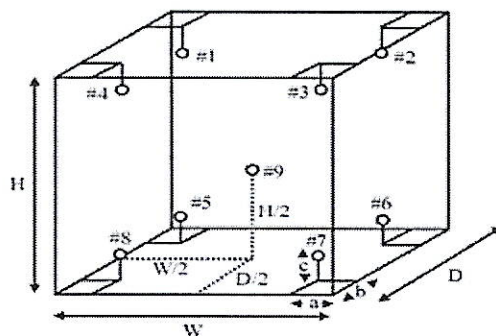
This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.



## Result of Calibration

Certificate No. : SPR20110028-3

Page : 3 of 3



Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No. (Probe No. 9 is REF.)									Uncertainty (±)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
103.0	103.37	103.65	103.66	103.62	103.62	103.31	103.45	103.28	103.26	0.35
104.0	104.39	104.68	104.80	104.66	104.63	104.33	104.50	104.27	104.23	0.43
105.0	105.42	105.68	105.79	105.69	105.60	105.40	105.52	105.35	105.33	0.43
150.0	150.42	150.73	150.86	150.66	150.62	150.46	150.54	150.44	150.34	0.43
180.0	180.48	180.71	180.81	180.73	180.68	180.43	180.56	180.41	180.32	0.43

Temperature Uniformity, Stability, Overall Variation

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity	Overall Variation
103.0	103.0	0.16	0.70	0.72
104.0	104.0	0.26	0.82	0.87
105.0	105.0	0.26	0.86	0.93
150.0	150.0	0.27	0.86	0.95
180.0	180.0	0.27	0.90	0.96

### Measurement Uncertainty

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

- End of Certificate -



CERTIFICATE No : 19T2243  
REFERENCE No : 51989-6

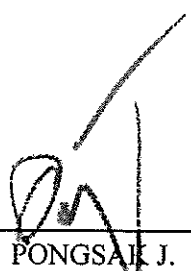
PAGE : 1 OF 2

## Certificate of Calibration

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 12-Mar-19

APPROVED BY :   
PONGSAK J.

ISSUED DATE : 20-Mar-19

RECEIVED DATE : 12-Mar-19

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





# QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 19T2243

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : AUTOCLAVE  
MANUFACTURER : HIRAYAMA  
ID NUMBER : EQL-155  
RECEIVED DATE : 12-Mar-19  
AMBIENT TEMPERATURE : 25° C ± 1° C  
MODEL : HVE-50  
SERIAL NUMBER : 30612085166  
CALIBRATION DATE : 12-Mar-19  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

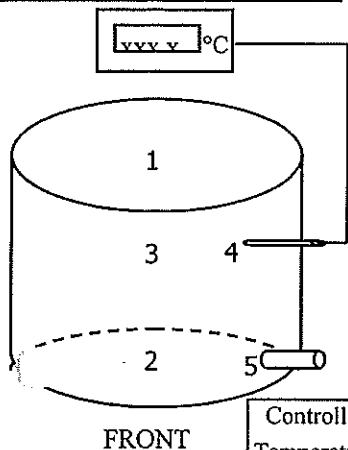
1. THIS INSTRUMENT WAS CALIBRATED BASED ON BS 2646 : Part 5 : 1993 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON FIVE LOCATIONS AS SHOWN IN THE PICTURE. TWO PROBES WERE PLACES NEAR TOP AND BOTTOM WALL AND EACH PROBE WAS AWAY FROM THE EACH 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.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	18T7389	14-Jul-19

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 variation : 2.5 °C

Autoclave Condition : Normal

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

### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	All Locations Average (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)	Pressure (MPa)	Holding time (min)	Operating Cycle time (min)
116	116	116.11	0.10	0.20	0.40	0.090	15	60
122	122	122.15	0.12	0.47	0.47	0.125	15	60

### TEMPERATURE MEASUREMENT ACCURACY TEST(° C)

Cont Temp	Ind Temp	Measured Temperature ( °C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	#5	
116	116	116.08	116.06	116.21	116.11	116.07	0.80
122	122	122.17	122.09	122.17	122.16	122.15	0.87

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 5 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 : 02

**QUALITY CALIBRATION CO.,LTD.**

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

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CERTIFICATE No : 19T2239

REFERENCE No : 51989-2

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : INCUBATOR

**MANUFACTURER** : MEMMERT

**MODEL** : IF 160

**SERIAL No** : D518.0082

**ID No** : EQL-205

**CONDITION AS RECEIVED** : USED ITEM

**SUBMITTED BY** : TEST TECH CO.,LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 12-Mar-19

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 20-Mar-19

**RECEIVED DATE** : 12-Mar-19



# 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 : 19T2239

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : IF 160  
ID No : EQL-205  
RECEIVED DATE : 12-Mar-19  
AMBIENT TEMPERATURE : 24 °C ± 1 °C

S/N : D518.0082  
CALIBRATION DATE : 12-Mar-19  
RELATIVE HUMIDITY : 48 %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 :-

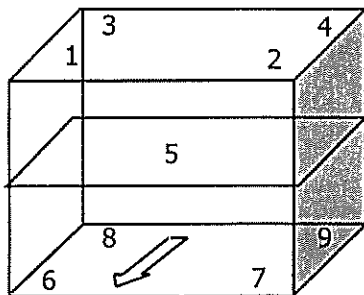
INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	HYDRA 2635A	6635300	18T7389	14-Jul-19

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



FRONT

### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1
Overall Line Voltage (V) variation : 4
Instrument Condition : Normal
Chamber Size (W*L*H): 56*40*72 cm

### CHAMBER PERFORMANCE

Controller Temperature (°C)	Indicating Temperature (°C)	All Locations Average (°C)	Temperature Stability (±°C)	Temperature Uniformity (°C)	Overall Variation (°C)
35.0	35.0	34.99	0.02	0.16	0.23
36.0	36.0	36.04	0.05	0.17	0.30

### TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations									Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	#6	#7	#8	#9	
35.0	35.0	34.88	34.92	34.85	34.96	35.06	35.05	35.06	35.12	35.04	0.25
36.0	36.0	35.93	35.97	35.89	36.00	36.11	36.11	36.13	36.17	36.10	0.25

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. T190164

Page 1 of 4

## Certificate of Calibration

**Equipment** : Chamber ( Cooling Room )**Manufacturer** : -**Model** : -**Serial No.** : -**Customer Code** : EQL-167**ID No.** : T1447A1**Customer** : Test Tech Co.,Ltd30, 32 Rama II Soi 63, Rama II Rd., Samaedam,  
Bangkhunthian Bangkok 10150**Customer Location** : LABORATORY FLOOR 3**Date of Receipt** : 24 January 2019**Calibrated By** : Wanchai Puttarat (Technician )**Approved By** :  / Sujjar Naknakred (Site Calibration Manager)**Date of Issue** : 05 FEB 2019

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

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



**SCG**  
CEMENT-BUILDING MATERIALS

# Metrological Center

## SCI ECO Services Company Limited

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

Saraburi Tel : +66 3627 3096

Fax : +66 3627 3100

Bangkok Tel : +66 2586 5792-4

Fax : +66 2586 5109

Website : www.scieco.co.th

E-Mail : [calibrate@scg.co.th](mailto:calibrate@scg.co.th)



Certificate No. T190164

Page 2 of 4

## Calibration Report

Equipment : Chamber ( Cooling Room )  
Date of Calibration : 30 January 2019  
Environment : Temperature : 25.5-28.5 °C  
Line Voltage : 221.4-225.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

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

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN121-TN130	T182699	16 October 2019
TC	TYPE T	TN131-TN140	T182699	16 October 2019
DATA LOGGER	34970A	T63	T182699	16 October 2019

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour - Minute At 4 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Adjustment :

( X ) without adjustment

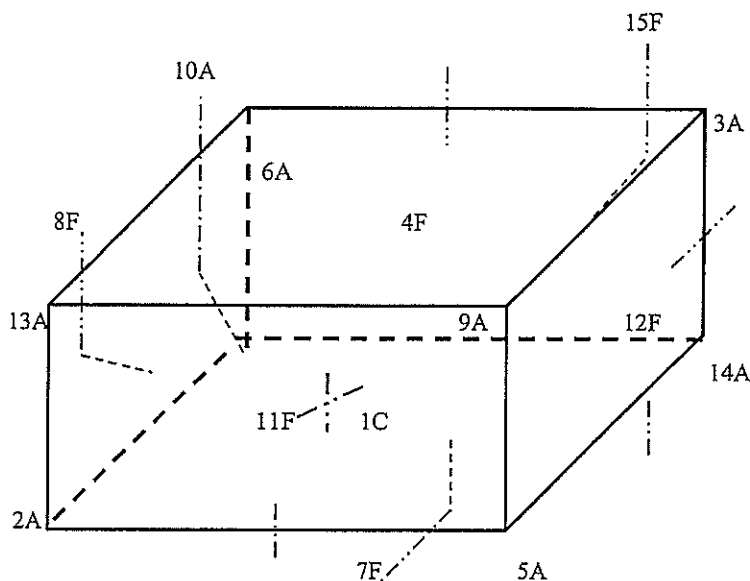
( ) after adjustment

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

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## Calibration Report



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

1C	=	TN121
2A	=	TN122
3A	=	TN123
4F	=	TN124
5A	=	TN125
6A	=	TN126
7F	=	TN127
8F	=	TN128
9A	=	TN129
10A	=	TN130
11F	=	TN131

12F	=	TN132
13A	=	TN133
14A	=	TN134
15F	=	TN135

Approved By.





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## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
4.0	3.66	3.60	4.17	3.92	3.79	4.20	3.89	4.23	3.92	3.92
	TN131	TN132	TN133	TN134	TN135					
	4.03	3.74	4.40	3.91	4.24					

Chamber ( Cooling Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor <i>k</i>
	Min , Max	Average					
4.0	4 , 4.1	4.0	3.97	0.40	1.30	1.23	2.00

\* The Acuoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

Approved By. 