

# เอกสารสอบเทียบเครื่องมือวัด

ศูนย์บริการวิชาการ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี  
ศูนย์บริการวิชาการ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี  
ศูนย์บริการวิชาการ มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี



VEHICULAR PROMOTION ASSOCIATION (THAILAND AND JAPAN)  
COMPANIES ASSOCIATION FOR EQUIPMENT'S ASSOCIATION AND TESTING SERVICES  
สมาคมส่งเสริมยานยนต์ (ไทยและญี่ปุ่น) สมาคมผู้ประกอบการเครื่องจักรกลและ  
บริการทดสอบและตรวจสอบคุณภาพ  
112 หมู่ 11/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110



Cert.No.: 20CH534

Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Eutech  
Model : pH510  
Serial No. : 293152  
ID No. : pHM-03  
Condition As-Received: Used Item  
Received Date : 07 April 2020  
Calibration Date : 08 April 2020  
Reference : 2004-0121DC-2  
Submitted by : Environment & Laboratory Co.Ltd.  
40 Soi Liangmuangnonthaburi 13, Talad Kwan,  
Mueang, Nonthaburi 11000  
Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Calibration Procedure : In-house method  
GP-CH5 : based on direct measurement by  
using standard voltage calibrator and  
certified reference material (CRM)

Calibrated by : Uthair Kankawit

Approved by : Wala  
Approved Signatory

( ) Pornthippa Tameyakul

(x) Malee Butkruea

( ) Santhap Meangmae

Issue Date : 10 April 2020

The Uncertainties are for a confidence probability of approximately 95%

ค่าความไม่แน่นอนที่ระบุไว้ข้างบนนี้แสดงถึงระดับความน่าเชื่อถือประมาณ 95%

ค่าความไม่แน่นอนที่ระบุไว้ข้างบนนี้แสดงถึงระดับความน่าเชื่อถือประมาณ 95%



Cert. No.: 20CH534

Page.: 2 of 2

### Condition of this calibration result

#### 1. Reference Standard Instrument

Instrument	Model	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	753	43160068	130RC092	19E1939	21 May 2020

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

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

#### 2. Certified Reference Materials

The measurement results are traceable to SI through CPA chem Ltd.  
ANSI-ASQ National Accreditation Board, Accredited No. AB-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	677227	12 Mar 2022
pH 6.987	CPA chem	679465	12 Mar 2021
pH 10.009	CPA chem	679464	12 Mar 2021

3. This certificate was certified only for the instrument we calibrated

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

### Calibration Results

#### Function : mV Measurement

##### Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter	4.00	177.48	177.5	4.00	0.11	2.52
S/N 293152	7.00	0.00	0.1	7.00	0.11	2.52
	10.00	177.48	177.3	10.00	0.11	2.52

#### Function : pH Measurement

##### Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.01	153.0	0.0086	2.05
S/N 29091	6.987	6.99	-19.9	0.011	2.00
	10.009	10.01	-193.3	0.013	2.00

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

-000-

note




TECHNISHERY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
THAI TECHNICAL SERVICE CO., LTD.  
113/101-113/102, KHAMSAKUL RD., 55/1, KHAMSAKUL, KHAMSAKUL DISTRICT, BANGKOK  
TEL : 0-2517-9240-21 FAX : 0-2517-9240-22



Cert. No.: 20TM1181

Page.: 1 of 3

## Certificate of Calibration

Equipment : Hot Air Oven  
Manufacturer : France Etuves  
Model : XU058  
Serial No. : P427  
ID No. : CHD-003  
Submitted by : Environment & Laboratory Co., Ltd.  
40 Soi Liangmusangnonthaburi 13,  
Talat Kwun, Mueang,  
Nonthaburi 11000  
Location : Room No. 303  
Received Order : 7 July 2020  
Calibration Date : 7 July 2020  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Suwit Injai  
Approved by :   
Approved Signatory  
( ) Pornthappa Tameyakul  
( / ) Malee Butkruea

Issue Date : 20 July 2020

The Uncertainties are for a confidence probability of approximately 95%

.....  
The calibration is performed in accordance with the requirements of the ISO 9001:2015 standard.  
The calibration is performed in accordance with the requirements of the ISO 9001:2015 standard.



Equipment : Hot Air Oven

Cert. No.: 201M1181

Condition As-Received : Used Item

Page: 2 of 3

Reference : 2007-0084QC-1

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ) and Thermocouple Type T

The temperature scale used was based on ITS-90

**Condition of this result of calibration**

**1 Reference standard instrument:-**

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY44067817	19LM4	NIST	13 Jul 2020
2 ) Data Acquisition	MY41021843	20LM1	NIST, NIST	29 Dec 2020

2 This certification is traceable to the SI unit.

3 This certificate is valid only to the item calibrated on date and place of calibration.

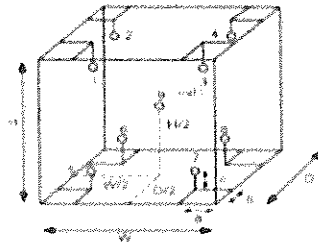
Remark : NIST : National Institute of Standards and Technology, The United State of America

NMT : National Institute of Metrology Thailand

Result of Calibration : ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. ( °C )	32	29
REL Humid. ( % )	45	51
AC Supply ( Volt )	220	220

Probe Installation Details :			Dimension of Chamber :		
a *	50	cm	D *	0.36	m
b *	50	cm	W *	0.40	m
c *	50	cm	H *	0.40	m
			Capacity *	0.058	m <sup>3</sup>

Ref. Std./ID No.: @		
Calibration Point		
Position :	(104) °C	(185) °C
1	19-15RTD-01	18-04TC-01
2	19-15RTD-02	18-04TC-02
3	19-15RTD-10	18-04TC-03
4	19-15RTD-04	18-04TC-04
5	19-15RTD-05	18-04TC-05
6	19-15RTD-06	18-04TC-07
7	19-15RTD-07	18-04TC-08
8	19-15RTD-08	18-04TC-09
9 (ref.)	19-15RTD-09	18-04TC-10

Walu



Equipment : Hot Air Oven  
 Condition As-Received : Used Item  
 Reference : 2007-00540C-1  
 Result of Calibration : ( \* ) Without Adjustment  
 Cert. No. : 201M1181  
 Page : 3 of 3

Function of UUC\* : Temperature Source

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Uncertainty ( ± °C )	Coverage Factor k
104.0	104.0	104.0	0.081	0.74	1.2	0.42	2
180.0	179.0	179.0	0.43	2.5	2.7	1.2	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	103.914	104.144	104.194	103.501	103.476	103.447	104.518	104.040	104.124
180.0	178.857	180.061	179.558	179.686	180.733	179.373	180.327	180.831	178.602

Average\* : The average of 30 values in each position

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity

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

-000-

Wali



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND JAPAN)  
AN INDEPENDENT, NON-PROFIT CALIBRATION AND TESTING SERVICE  
FOR INDUSTRIAL AND COMMERCIAL LABORATORY AND ANALYTICAL INSTRUMENTS  
13/1-13/101 Sukhvit 21, Floor 13, Sukhvit 21  
Bangkok 10110, Thailand




Cert. No.: 20TM1644

Page: 1 of 3

## Certificate of Calibration

**Equipment :** Incubator  
**Manufacturer :** Songseem Intercool  
**Model :** -  
**Serial No. :** -  
**ID No. :** CHI-001  
**Submitted by :** Environment & Laboratory Co., Ltd  
40/501 Liangmueangnonthaburi 13  
Tasat Kwan, Muang,  
Nonthaburi 11000  
**Location :** Room No. 301  
**Received Order :** 19 August 2020  
**Calibration Date :** 19 August 2020  
**Ambient Temperature :**  $(26 \pm 10) ^\circ\text{C}$   
**Relative Humidity :**  $(50 \pm 30) \%$

**Calibrated by :** Kunchit Promprat

**Approved by :**   
Approved Signatory

- ☐ Pongthappa Tameyakul  
☒ Maidee Botkruea  
☐ Suwit Imjai

**Issue Date :** 26 August 2020

The Uncertainties are for a confidence probability of approximately 95%

Uncertainties are not applicable for calibration of instruments used for general service

Report of the calibration is given based on the calibration conditions and test by National

Measurement Institute of Thailand (NMIT) and the results are given in the form of a certificate





Equipment : Incubator Cert. No.: 20TM1644  
 Condition As-Received : Used Item Page: 2 of 3  
 Reference : 2008-04010C-2  
 Procedure Used :

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90

**Condition of this result of calibration**

1. Reference standard instrument :

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY44067817	20LM5	NIST, NIMT	29 Jul 2021

2. This certification is traceable to the SI unit.

3. This certificate is valid only to the item calibrated on date and place of calibration.

Remark : NIST : National Institute of Standards and Technology, The United State of America.

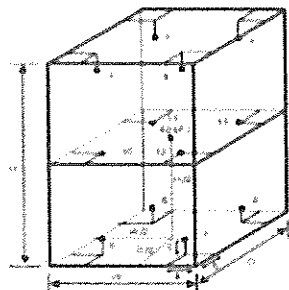
NIMT : National Institute of Metrology Thailand.

Result of Calibration : ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	28	28
REL Humi. ( % )	51	60
AC Supply ( Volt )	220	220



Position :	Ref. Std./D No.:
1	19-15RTD-01
2	19-15RTD-02
3	19-15RTD-03
4	19-15RTD-04
5	19-15RTD-05
6	19-15RTD-06
7	19-15RTD-07
8	19-15RTD-08
9 (ref.)	19-15RTD-09
10	19-15RTD-10
11	15RTD2/11
12	15RTD2/12
13	15RTD2/13

Dimension of Chamber :

D = 0.60 m

W = 0.60 m

H = 1.2 m

Capacity = 0.43 m<sup>3</sup>

Probe Installation Details :

a = 10 cm

b = 10 cm

c = 10 cm

Wala





Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2008-0401OC-2  
 Result of Calibration : ( \* ) Without Adjustment  
 Function of UUC\* : Temperature Source

Cert. No.: 20TM1644  
 Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
20.0	20.0	20.0	0.31	0.40	0.97	0.44	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
20.0	1	2	3	4	5	6	7	8	9 (ref.)
	19.962	19.966	20.292	19.831	20.086	20.032	19.942	19.887	19.975
	10	11	12	13					
	19.956	20.100	19.870	19.899					

**Average\*** : The average of 30 values in each position.

**Temperature stability** : One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature uniformity** : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation** : The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\*** : Unit Under Calibration

**Note** : The reported uncertainty of measurement was included stability and excluded uniformity.

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

รายงานผลการปฏิบัติตามเงื่อนไขของมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND) JAPAN  
CONTRIBUTING TO THE ECONOMIC DEVELOPMENT AND TECHNICAL SERVICES  
FOR THE THAILAND JAPAN ECONOMIC COOPERATION  
THAILAND JAPAN ECONOMIC COOPERATION



## Certificate of Calibration

Cert No.: 20MM439


Page: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AL204  
Serial No. : 1228510730  
ID No. : ANB-002  
Submitted by : Environment & Laboratory Co., Ltd.  
40 Soi Liangmueangnonthaburi 13,  
Talat Kwan, Mueang,  
Nonthaburi 11000

Location : Room No. 304

Received order : 7 July 2020  
Calibration Date : 7 July 2020  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %

Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

☐ Ponthippa Tameyakul  
☒ Malee Butkruea  
☐ Suwit Imjai

Issue Date : 20 July 2020

The Uncertainties are for a confidence probability of approximately 95%

.....  
.....  
.....  
.....



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2007-00840C-9

Cert.No.: 20MM439  
Page: 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-0801 according to direct measurement method against standard weight.

**Condition of this result of calibration**

**1. Reference standard instruments :-**

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	O-72336	G0602134	70RC067	MM-0053-20	27 Apr 2022
2) Standard Weight Set (E2)		B129177491-7	70RC233	MM-0054-20	27 Apr 2022

- This certificate is valid only to the item calibrated on date and place of calibration
- This result of calibration was made on requested at the point specified by customer
- This certificate is not certified for any commercial transaction
- This certification is traceable to the International System of Unit maintained at National Institute of Metrology (Thailand)

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by External Calibration

Range capacity : 0 g to 210 g Resolution 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
100	100.0005	-0.0005	0.20	2.04
200	200.0012	-0.0012	0.30	2.00

**After Adjustment :**

**1. Determination of the standard deviation of weighing machine** ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00008
200	0.00009

*Mulu*



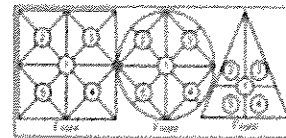
Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2007-00840C-9

Cert.No : 204MM439  
Page : 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan  
The weighing machine reading error obtained is given in the table



Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading
(g)	(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0001	0.0000	+0.0001	+0.0001	0.0002

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unloaded	0.0000	0.0000	0.15	2.13
0.2	0.2000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
2	2.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	9.9999	+0.0001	0.15	2.13
20	19.9999	+0.0001	0.16	2.11
50	49.9999	+0.0001	0.17	2.09
100	99.9997	+0.0003	0.20	2.04
150	149.9998	+0.0002	0.29	2.00
200	199.9998	+0.0002	0.30	2.00

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

*Mulu*