

ภาคผนวก ซ

เอกสารสอบเทียบเครื่องมือ



S K SALES AND SERVICE CO.,LTD.

194/56, 194/57 Thakham Rd. Samae Dam

Bang Khun Thian Bangkok 10150

Tel. : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : 2745/2006-059 Certificate No. : S2008-1560
Customer : OKLA TESTING & CONSULTING SERVICE CO.,LTD Page 1 of 2
: 67/35-36, 3rd Floor, Soi Phetjasem 7/1 ,
: Watthapra, Bankokyai, Bangkok, Thailand 10600
Equipment : Freezer
Manufacturer : SHIMAX
Model : MAC3D
Serial No. : -
ID No. : 011/190118
Received Date : 10 August 2020
Calibrated Date : 10 August 2020
Issued Date : 15 August 2020
Environment

	Minimum Value	Maximum Value
Ambient Temperature (°C)	30.1	31.0
Relative Humidity (% RH)	54	56
AC Line Voltage (VAC)	224	226

Place Of Calibration : LABORATORY
Calibrated by : Mr. Rattanachai Charoenngam

Calibration Method

In-house method : WI-23 base on ASTM E145-94 (Reapproved 2001).

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Model	Serial No.	Certificate No.	Due Date
1)	Data acquisition/Switch unit	34970A	MY44021731	L2006-017	1 Dec 20
2)	Multiplexer Module	34901A	MY41085938	L2006-017	1 Dec 20

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by : _____

☐ Mr.Suphachai Saksri

☒ Mr.Phayak Tootit

☐ Miss Tantaraporn Pettong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,providing a level of confidence level of approximately 95 %

Table1 General Information

Working Area (W*L*H)	50 *38 *125 cm
Fresh Air	OFF

Table2 Chamber Performance

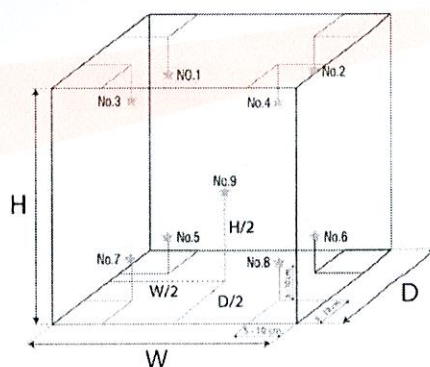
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
2.0	2.0	0.44	1.2	2.2
4.0	4.0	0.31	1.0	1.8
6.0	6.0	0.39	1.1	1.8

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)									Uncertainty (± °C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
2.0	1.30	0.26	1.33	0.53	0.92	0.54	0.83	-0.06	0.55	0.48
4.0	3.30	2.36	3.36	2.59	2.91	2.57	2.93	2.08	2.59	0.42
6.0	5.31	4.42	5.36	4.65	4.89	4.56	5.02	4.24	4.65	0.47

Resolution : 0.1 (°C)

* Probe No. 9 is Reference Probe



- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **



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194/56, 194/57 Thakham Rd. Samae Dam

Bang Khun Thian Bangkok 10150

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Certificate of Calibration

Reference No. : 2745/2006-059 Certificate No. : S2008-1562
Customer : OKLA TESTING & CONSULTING SERVICE CO.,LTD Page 1 of 2
: 67/35-36, 3rd Floor, Soi Phetjasem 7/1 ,
: Watthapra, Bankokyai, Bangkok, Thailand 10600
Equipment : Incubator
Manufacturer : SHIMAX
Model : MAC3D
Serial No. : -
ID No. : 012/190118
Received Date : 10 August 2020
Calibrated Date : 10 August 2020
Issued Date : 15 August 2020
Environment

	Minimum Value	Maximum Value
Ambient Temperature (°C)	29.5	31.7
Relative Humidity (% RH)	53	55
AC Line Voltage (VAC)	224	226

Place Of Calibration : LABORATORY
Calibrated by : Mr. Rattanachai Charoenngam

Calibration Method

In-house method : WI-23 base on ASTM E145-94 (Reapproved 2001).

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Model	Serial No.	Certificate No.	Due Date
1)	Data acquisition/Switch unit	34970A	MY44021731	L2006-017	1 Dec 20
2)	Multiplexer Module	34901A	MY41085938	L2006-017	1 Dec 20

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by : _____

☐ Mr.Suphachai Saksri ☒ Mr.Phayak Tootit ☐ Miss Tantaraporn Pettong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,providing a level of confidence level of approximately 95 %

Table1 General Information

Working Area (W*L*H)	50 *38 *125 cm
Fresh Air	OFF

Table2 Chamber Performance

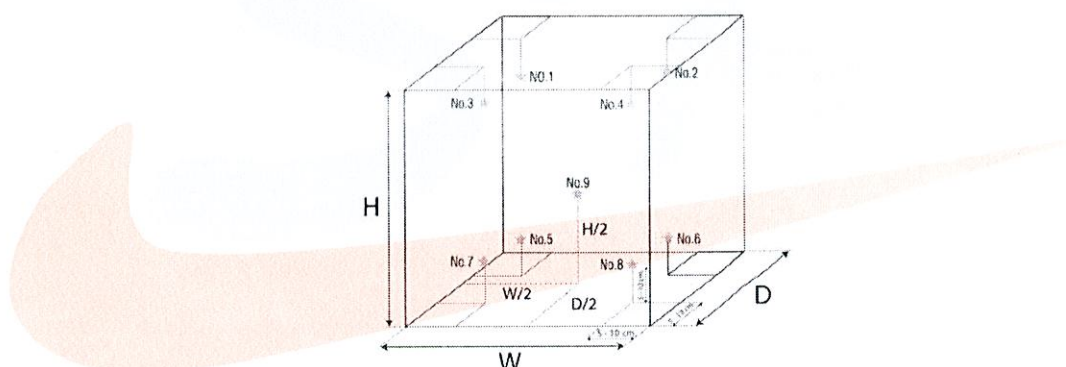
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.25	0.83	1.6

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)									Uncertainty (± °C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
20.0	18.69	18.34	19.14	18.69	19.47	18.54	19.23	18.74	19.02	0.37

Resolution : 0.1 (°C)

* Probe No. 9 is Reference Probe



- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **



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Certificate of Calibration

Reference No. : 2745/2006-059 Certificate No. : S2008-1561
Customer : OKLA TESTING & CONSULTING SERVICE CO.,LTD
: 67/35-36, 3rd Floor, Soi Phetjasem 7/1 ,
: Watthapra, Bankokyai, Bangkok, Thailand 10600
Equipment : Water Bath
Manufacturer : LABTECH
Model : LWB-222A
Serial No. : BCCLJ23001C
ID No. : OKLA-LAB-008/122011
Received Date : 10 August 2020
Calibrated Date : 10 August 2020
Issued Date : 15 August 2020
Environment

	Minimum Value	Maximum Value
Ambient Temperature (°C)	29.6	31.3
Relative Humidity (% RH)	54	56
AC Line Voltage (VAC)	224	226

Place Of Calibration : Laboratory
Calibrated by : Mr. Rattanachai Charoenngam

Calibration Method

In-house method : WI-05 base on ASTM E 715-80 (Reapproved 2001)

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Model	Serial No.	Certificate No.	Due Date
1)	Data Acquisition/Switch Unit	34972A	MY49009808	PSL-T 285/63	15 Jan 21
2)	RTD Module	34901A	MY41161398	PSL-T 285/63	15 Jan 21

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

3. This certificate can be traceable to International System of Unit :

-Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by : _____

☐ Mr.Suphachai Saksri ☒ Mr.Phayak Tootit ☐ Miss Tantaraporn Pettong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,providing a level of confidence level of approximately 95 %

Table 1 General Information

Chamber Size (W*L*H)	49.5 *29 *11.5 cm
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Table 2 Chamber Performance

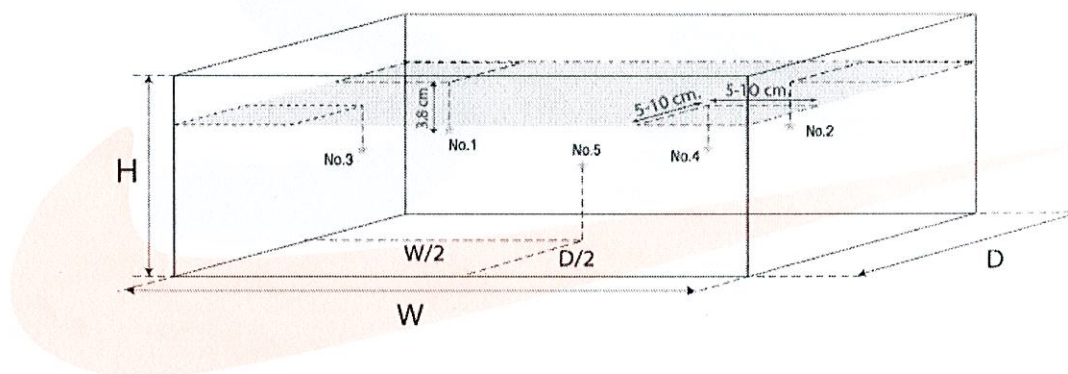
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (±°C)	Measured Uniformity (°C)	Overall Variation (°C)
60	-	0.22	0.65	0.71

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)					Uncertainty (±°C)
	No. 1	No. 2	No. 3	No. 4	No. 5	
60	61.32	60.96	61.14	61.07	60.97	0.62

Resolution : - (°C)

* Probe No. 5 is Reference Probe



- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **



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Certificate of Calibration

Reference No. : 2745/2006-059 Certificate No. : S2008-1559
Customer : OKLA TESTING & CONSULTING SERVICE CO.,LTD Page 1 of 2
: 67/35-36, 3rd Floor, Soi Phetjaseem 7/1 ,
: Watthapra, Bankokyai, Bangkok, Thailand 10600
Equipment : Hot Air Oven
Manufacturer : Lab Tech
Model : LDO-060E
Serial No. : DLCCCL0513C
ID No. : OKLA-LAB-007/122011
Received Date : 10 August 2020
Calibrated Date : 10 August 2020
Issued Date : 15 August 2020
Environment

	Minimum Value	Maximum Value
Ambient Temperature (°C)	30.1	31.5
Relative Humidity (% RH)	55	57
AC Line Voltage (VAC)	224	226

Place Of Calibration : LABORATORY
Calibrated by : Mr. Rattanachai Charoenngam

Calibration Method

In-house method : WI-23 base on ASTM E145-94 (Reapproved 2001).

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Model	Serial No.	Certificate No.	Due Date
1)	Data acquisition/Switch unit	34972A	MY49003278	L2006-022	1 Dec 20
2)	Multiplexer Module	34901A	MY41130428	L2006-022	1 Dec 20

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

3. This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by :

☐ Mr.Suphachai Saksri ☒ Mr.Phayak Tootit ☐ Miss Tantaraporn Pettong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2.00$,providing a level of confidence level of approximately 95 %

Table1 General Information

Working Area (W*L*H)	40 *40 *40 cm
Fresh Air	OFF

Table2 Chamber Performance

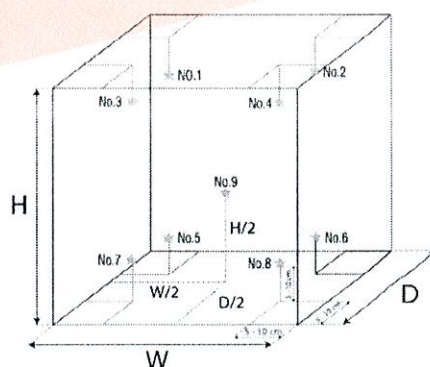
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
104.0	104.0	2.4	7.6	9.8
140.0	140.0	2.9	10.7	13.5
160.0	160.0	5.5	13.7	18.1
180.0	180.0	5.2	16.3	19.5

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)									Uncertainty (± °C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
104.0	104.3	107.8	105.4	105.9	110.0	110.9	103.9	107.7	105.3	2.9
140.0	143.7	148.2	145.3	145.6	151.3	153.3	143.3	148.6	145.1	3.8
160.0	164.8	169.3	166.7	166.8	173.5	176.1	164.7	170.8	166.4	5.3
180.0	186.7	191.3	188.4	188.5	196.4	199.5	186.3	193.0	188.1	5.8

Resolution : 0.1 (°C)

* Probe No. 9 is Reference Probe



- Notes :
1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
 3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 4. The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **



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Bang Khun Thian Bangkok 10150

Tel. : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : 2745/2006-059 Certificate No. : S2008-1556
Customer : OKLA TESTING & CONSULTING SERVICE CO.,LTD Page 1 of 2
: 67/35-36, 3rd Floor, Soi Phetkasem 7/1,
: Watthapra, Bangkokyai, Bangkok, Thailand 10600
Equipment : Electronic Balance
Manufacturer : Sartorius
Model : BSA224S-CW
Serial No. : 35790699
ID No. : -
Received Date : 10 August 2020
Calibrated Date : 10 August 2020
Issued Date : 14 August 2020

Environment	Minimum Value	Maximum Value
Ambient Temperature (°C)	24.9	25.7
Relative Humidity (% RH)	45	48
Atmospheric Pressure (mbar)	1010	1010

Place of Calibration : Laboratory
Calibrated by : Mr. Nawanit Chuntree

Calibration Method


In-house method : WI-08 base on UKAS LAB14 (Calibration and Use of Weighing Machines)

Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Standard Weight Set E2	MASS-WE-01	M1907246S/M1907247S	9 July 2021

Condition of this result of calibration

1. This result of calibration was found accurate as shown on date and place of calibration only
2. This certificate can be traceable to International System of Unit :
 - Through Mass and scale calibration laboratory of Thai scale Co.,Ltd.

Approved by : 

☐ Mr.Suphachai Saksri ☒ Mr.Phayak Tootit ☐ Miss Tantaraporn Pettong

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

Description of UUC

Capacity : 220 g

Resolution : 0.0001 g

Calibration Result

1.Repeatability of reading

Applied weight (g)	Standard Deviation of reading (g)
20	0.000060
200	0.000067

2.Departure from nominal value

Before adjustment

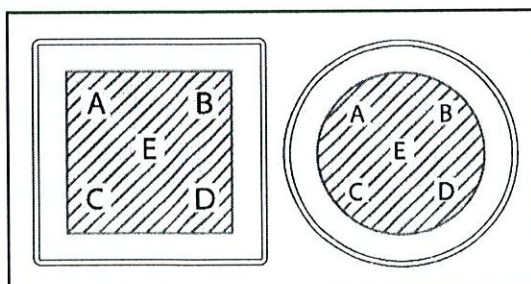
Applied weight (g)	Balance reading (g)	Correction (g)	Uncertainty (\pm g)
20	19.9999	0.0001	0.00011
100	99.9997	0.0003	0.00018
200	199.9995	0.0005	0.00039

After adjustment

Applied weight (g)	Balance reading (g)	Correction (g)	Uncertainty (\pm g)
Zero setting	0.0000	0.0000	0.00011
1	1.0000	0.0000	0.00011
20	20.0000	0.0000	0.00011
40	40.0000	0.0000	0.00013
60	60.0000	0.0000	0.00020
80	80.0000	0.0000	0.00023
100	100.0000	0.0000	0.00018
120	120.0000	0.0000	0.00030
140	140.0000	0.0000	0.00030
160	160.0001	-0.0001	0.00031
180	180.0000	0.0000	0.00034
200	200.0001	-0.0001	0.00039
220	220.0000	0.0000	0.00039

3.Effect of off-center loading : Used weight 50 g was place to various position on the pan

Position	Balance reading (g)
E	50.0000
A	50.0000
B	50.0000
C	50.0000
D	50.0000
Maximum Difference	0.0000



CERTIFICATE OF ANALYSIS

Equipment : Research Grade Bench Meter Dissolved Oxygen and BOD

Meter Model : HI5421-02 **Serial No. :** 04240005101

Probe Model : HI76483 **Serial No. :** KC1A118H

Temp Model : - **Serial No. :** -

Manufacturer : Hanna Instruments

Made in : Romania

Condition As-Received : New Product

Reference : RE191439

Customer name : Okla Testing & Consulting Service Co., Ltd
63/13 Soi Petchakasem 7, Watthapra, Bangkokyai,
Bangkok 10600

Received date : 9 October 2019

Calibrate date : 9 October 2019

Issue date : 11 October 2019

Ambient Temperature : (25 \pm 2)°C

Relative Humidity : (50 \pm 15)% RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by :


Mr. Sawai Promrat

Approved by :


Mr. Anan Suwanchaisakul

Condition of this result of analysis**Standard Dissolved Oxygen Buffer Solution :**

Zero Oxygen Solution	Model No.	Mean Value	Ref. No.	Lot Number	Due Date
HI7040L	HI7040L	0.0 ± 0.1@25°C	23J81	S0086/18	October 2023

Analysis result :

Standard Solution	Applied Value	Before Adj.	After Adj.
0.0 mg/L (HI7040L)	0.0 mg/L	0.09 mg/L	0.00 mg/L
Air Saturate 100%	100%	117.1%	100.0%

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Certificate No. : HIT-1941-0959

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : pH/ORP/ISE and EC/TDS/Resistivity Salinity and Temperature

Meter Model : HI5521-02 **Serial No. :** 04160019101

Probe Model : HI1131B **Serial No. :** 061334CN

Temp Model : - **Serial No. :** -

Resolution (pH) : 0.01 **Resolution (mV) :** 0.1

Manufacturer : Hanna Instruments

Made in : Romania

Condition As-Received : New Product

Reference : RE191439

Customer name : Okla Testing & Consulting Service Co., Ltd
63/13 Soi Petchakasem 7, Watthapra, Bangkokyai,
Bangkok 10600

Received date : 9 October 2019

Calibrate date : 9 October 2019

Issue date : 11 October 2019

Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)% RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrated was conducted by using in-house: work instruction WI-01 by
using standard voltage calibration and certificate reference material (CRM)

Calibrated by :

Mr. Sawai Promrat

Approved by :

Mr. Anan Suwanchaisakul

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceability
Thermometer with sensor	HI98509	OB692A	19T227	Technology Promotion Association (Thailand-Japan)
True RMS Multimeter	Fluke 87	30800044	19E394	
Simulator	Fluke 753	43160061	19E122	

2. Reference Standard Materials : pH calibration standard traceable to Danish Institute of Fundamental

Metrology (DFM).

pH Buffer Solution	Manufacture	Mean Value	Serial No.	Exp. date
pH 4.005	Radiometer	$4.005 \pm 0.005 @ 25^{\circ}\text{C}$	C02497	22 March 2022
pH 7.000	Radiometer	$7.001 \pm 0.005 @ 25^{\circ}\text{C}$	C02488	9 April 2022
pH 10.012	Radiometer	$10.011 \pm 0.005 @ 25^{\circ}\text{C}$	C02494	29 January 2022

3. This certificate was certified only for the instrument we calibrate on date and place of calibration only.

4. Thai certificate is traceability to the International System of Unit (SI)

Calibration Result :

Performing standard curve by Simulator at -177.5,0.0,177.5 mV

(Measurement Electrical Potential)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)
	pH	mV	pH	mV	
pH Meter	10.01	-177.5	10.01	-177.5	0.062
S/N	7.01	0.0	7.01	0.0	0.060
04160019101	4.01	177.5	4.01	177.5	0.062

Performing Three buffer standard curve using buffer nominal : 4,7,10

(Measurement Indication Error of Electrode)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)
pH Electrode S/N 061334CN	4.005	4.01	174.5	0.009
	7.001	7.01	2.4	0.009
	10.011	10.00	-171.7	0.015

The report 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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CERTIFICATE OF CALIBRATION

Equipment : pH/ORP/ISE and EC/TDS/Resistivity Salinity and Temperature

Meter Model : HI5521-02 **Serial No. :** 04160019101

Probe Model : HI76312 **Serial No. :** 0614117M

Temp Model : - **Serial No. :** -

Manufacturer : Hanna Instruments

Made in : Romania

Condition As-Received : New Product

Reference : RE191439

Customer name : Okla Testing & Consulting Service Co., Ltd
63/13 Soi Petchakasem 7, Watthapra, Bangkokyai,
Bangkok 10600

Received date : 9 October 2019

Calibrate date : 9 October 2019


Issue date : 10 October 2019

Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) % RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibrated by :


Mr. Sawai Promrat

Approved by :


Mr. Anan Suwanchaisakul

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	Model	Serial No.	Certificate No.	Traceability
Thermometer with sensor	HI 98509	OB692A	19T227	Technology Promotion Association (Thailand-Japan)

2. Reference Standard Materials : EC calibration standard

EC Buffer Solution	Manufacture	Mean Value	Lot Number	Exp. date
84 $\mu\text{S/cm}$ (HI6033)	Hanna	$84 \pm 0.8 @ 25^{\circ}\text{C}$	2311	November 2020
1413 $\mu\text{S/cm}$ (HI6031)	Hanna	$1413 \pm 4 @ 25^{\circ}\text{C}$	3562	November 2023

3. This certificate was certified only for the instrument we calibrate on date and place of calibration only.

Calibration Result

Calibration result after adjustment at 84 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$

Standard Conductivity Solution	Before Adjustment UUC Reading	After Adjustment UUC Reading	Uncertainty of Measurement (\pm)
84 $\mu\text{S/cm}$	83.3 $\mu\text{S/cm}$	84.2 $\mu\text{S/cm}$	1.59 $\mu\text{S/cm}$
1413 $\mu\text{S/cm}$	1411 $\mu\text{S/cm}$	1413.6 $\mu\text{S/cm}$	10.07 $\mu\text{S/cm}$

The report 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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