



บริษัท ปตท. น้ำมันและการค้าปลีก จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการทำเทียบเรือน้ำมันและก๊าซของการปิโตรเลียมแห่งประเทศไทย จังหวัดสงขลา

ระหว่างเดือนมกราคม-มิถุนายน พ.ศ. 2565

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Songkhla Lab	BOD (5 days at 20°C)	Incubator	SGK_CL0028	11-Feb-21	12-Aug-22	18
Songkhla Lab	BOD (5 days at 20°C)	DO/BOD Analyser	SGK_CL0073	2-Dec-21	2-Dec-22	12
Songkhla Lab	pH at 25 °C	pH meter	SGK_CL0030	9-Nov-21	10-May-23	18
Songkhla Lab	Oil & Grease	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Oil & Grease	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Oil & Grease	Water Bath	SGK_CL0035	5-Feb-22	6-Aug-23	12
Songkhla Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Total Dissolved Solids 180°C	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Total Suspended Solids	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Total Suspended Solids	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Total Coliform	Autoclave	SGK_ML0001	5-Jul-21	3-Jan-23	18
Songkhla Lab	Total Coliform	Incubator	SGK_ML0013	8-Feb-21	9-Aug-22	18
Songkhla Lab	Total Coliform	pH Meter	SGK_ML0016	5-Jul-21	3-Jan-23	18
Songkhla Lab	Total Coliform	Water Bath	SGK_ML0021	6-Aug-21	4-Feb-23	18
Songkhla Lab	Fecal Coliform	Autoclave	SGK_ML0001	5-Jul-21	3-Jan-23	18
Songkhla Lab	Fecal Coliform	Incubator	SGK_ML0013	8-Feb-21	9-Aug-22	18
Songkhla Lab	Fecal Coliform	pH Meter	SGK_ML0016	5-Jul-21	3-Jan-23	18
Songkhla Lab	Fecal Coliform	Water Bath	SGK_ML0021	6-Aug-21	4-Feb-23	18
Songkhla Lab	Lead	ICP-MS	SGK_CL0048	8-Feb-22	8-Feb-23	12
Songkhla Lab	Lead	Cold Room Water	SGK_CL0065	16-Aug-21	14-Feb-23	18
Songkhla Lab	Total Solids	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Total Solids	Oven	SGK_CL0024	9-Nov-21	10-May-23	18
Songkhla Lab	Cadmium	ICP-MS	SGK_CL0048	8-Feb-22	8-Feb-23	12
Songkhla Lab	Cadmium	Cold Room Water	SGK_CL0065	16-Aug-21	14-Feb-23	18
Songkhla Lab	Temperature	pH meter	SGK_FS0019	20-Jan-22	20-Jan-23	12
Songkhla Lab	Conductivity	Conductivity Meter	SGK_FS0051	21-Sep-21	21-Sep-22	12
Songkhla Lab	Salinity	Conductivity Meter	SGK_FS0051	21-Sep-21	21-Sep-22	12
Songkhla Lab	Turbidity	Turbidity Meter	SGK_FS0045	24-Jun-21	24-Jun-22	12



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BKK_EN0223	1-Feb-22	1-Feb-23	12
Water Lab	Total Kjeldahl Nitrogen	Discrete analyzer	BKK_EN0037	28-Jun-21	28-Jun-22	12
Water Lab	Nitrate	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Water Lab	Phosphate	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Songkhla Lab	COD	COD Reactor	PTC/10/22004	8-Feb-22	8-Feb-23	12
Songkhla Lab	COD	Spectrophotometer	SGK_CL0038	24-Jan-22	24-Jan-23	12
Songkhla Lab	Total Alkalinity	pH meter	SGK_CL0030	9-Nov-21	10-May-23	18
Sediment	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Sediment	Total Petroleum Hydrocarbon	Electronic Top-Loading Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Sediment	pH aqueous phase 50% (w/v)	pH meter	BKK_EN0072	26-Mar-21	24-Sep-22	18



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM331

Page.: 1 of 3

Certificate of Calibration

Equipment :	Incubator
Manufacturer :	Memmert
Model :	ICP 750
Serial No. :	F816.0063
ID No. :	SGK_CL0028
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch 114/1 Moo 8 Kanjanavanij Rd., Banphru, Hatyai, Songkhla 90250 Thailand
Location :	BOD Room
Received Order :	10 February 2021
Calibration Date :	11 February 2021
Ambient Temperature :	(26 ± 10) °C
Relative Humidity :	(50 ± 30) %
Calibrated by :	Khit Ruttanaprapachai
Approved by :	<u>Malee Butkruea</u> Approved Signatory
	() Pornthippa Tameyakul (<input checked="" type="checkbox"/>) Malee Butkruea () Suwit Imjai
Issue Date :	19 February 2021

REVIEW BY	Sutthirak T.
APPROVED BY	Kanitta H.
NEXT CAL. DATE	12/8/22

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0024671



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2102-0248OC-3

Cert. No.: 21TM331

Page.: 2 of 3

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	MY49023932	20LM6	NIST, NIMT	20 Apr 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.

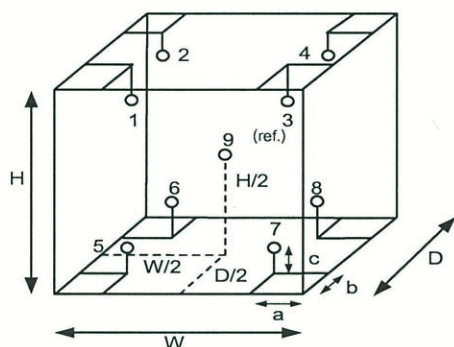
Remark : NIST : National Institute of Standards and Technology, The United State of America.

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)	21	22
REL.Humid. (%)	46	48
AC Supply (Volt)	220	221

Position :	Ref. Std./ID No.:
1	20-16RTD-01
2	20-16RTD-02
3	20-16RTD-03
4	20-16RTD-04
5	20-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	20-16RTD-08
9 (ref.)	20-16RTD-09

Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2102-0248OC-3
Result of Calibration :- (*) Without Adjustment

Cert. No.: 21TM331

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 <i>k</i>
20.0	20.0	20.0	0.10	0.32	0.62	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.294	20.186	20.327	20.313	20.058	20.105	20.008	19.863	20.109

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 %.

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TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 21TW256

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter	<div>REVIEW BY Preetiya P. APPROVED BY Kanitha H. NEXT CAL. DATE 2/12/2022</div>
Manufacturer :	YSI	
Model :	5000	
Serial No. :	17B101473	
ID No. :	SGK_CL0073	
Received Date :	01 December 2021	
Test Date :	02 December 2021	
Reference :	2112-0025DSC-1	
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch. 114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand	
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %	
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method	
Tested by :	Walalak Sirithean	
Approved by :	<div> Approved Signatory</div>	
(/) Malee Butkruea		
() Saithip Meangmai		
() Warakorn Lerngagtrakul		
Issue Date :	6 December 2021	



Cert.No.: 21TW256

Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 17B100103

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.11	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21LM26

Page.: 1 of 2

Certificate of Calibration

Equipment :	DO Meter with Sensor	<div>REVIEW BY <u>Preeiya P.</u> APPROVED BY <u>Kanitta H.</u> NEXT CAL DATE <u>2/8/12/2022</u> <u>512</u></div>
Manufacturer :	YSI	
Model :	5000	
Serial No. :	17B101473	
ID No. :	SGK_CL0073	
Submitted by :	ALS Laboratory Group (Thailand)Co.,Ltd. Songkhla Branch 114/1 Moo 8 Karnchanawanich Rd., T.Ban Phur, A.Hat Yai, Songkhla 90250 Thailand	
Location :	On Site Calibration Service Laboratory	
Received Order :	1 December 2021	
Calibrated Date :	6 December 2021	
Ambient Temperature :	(26 ± 10) °C	
Relative Humidity :	(50 ± 30) %	
AC Line Voltage :	(220 ± 22) V	
Calibrated by :	Man Pattanapongpaiboon	
Approved by :	<u>Malee</u> Approved Signatory	
<input type="checkbox"/> Pornthippa Tameyakul <input checked="" type="checkbox"/> Malee Butkruea <input type="checkbox"/> Suwit Imjai		
Issue Date :	9 December 2021	

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0032821



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2112-0025DSC-1

Cert. No.: 21LM26

Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1502A	A52847	21I1144	20 Oct 2022

2. This 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.

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 17B100103

<u>Calibration Point</u> (°C)	<u>Immersion Depth</u> (mm)	<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty</u> (± °C)	<u>Coverage Factor</u> <i>k</i>
20.00	60	20.001	19.96	-0.041	0.15	2.00

UUC* : Unit Under Calibration

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 %.

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CALIBRATION CERTIFICATE

Issued Date : 12-Nov-2021

Certificate No. : 21PH192

CSR No. : A012/00583

Page. : 1 of 2

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory

Instrument Name : pH meter

Manufacturer : Mettler Toledo

Model : S220

Serial No. : B625631849

ID No. : SGK_CL0030

Electrode No. : 6404000

Received Date : 9-Nov-2021

Calibrated Date : 9-Nov-2021

Ambient Temperature : $(25 \pm 3) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \%$

REVIEW BY	Suttharak T.
APPROVED BY	Kanitta H.
CAL. DATE	10/05/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.008 based on direct measurement by using certified reference Material (CRM)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- HACH : LANGE United For Water Quality
- WK : WK Electric Co., Ltd.
- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Jessadagon Lemhud

Approved by :


Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Solution	4.005	C02840	1617	24-Aug-2022
Standard Solution	7.000	C02841	1618	24-Aug-2022
Standard Solution	10.012	C02843	1619	24-Aug-2022
Temperature/Electrical Calibrator	MC2-MF	23642	WK2102-006-229	21-Feb-2022
Digital Thermometer With Sensor	1529	B4C223	QR21-2009	15-Sep-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration : (✓) Without Adjustment () After Adjustment

1. Electrical Measurement

Applied Voltage (mV)	pH meter Reading (mV)	Correction (mV)	Uncertainty (± mV)
177.48	177.5	-0.02	0.17
0.00	0.0	0.00	0.13
-177.48	-177.5	0.02	0.17

2. Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading (pH)	Correction (pH)	Uncertainty (± pH)
4.007	3.99	0.017	0.011
6.999	7.02	-0.021	0.014
10.011	10.01	0.001	0.036

3. Temperature Measurement

Cal Point (°C)	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
25	24.93	25.0	-0.07	0.11

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%

... End ...



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkhla 90250 Thailand

Tel: 081 599 0417 Fax: 074 805 133 Email: s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 8-Feb-2022

Certificate No. : 22EB149

CSR No. : A023/01123

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory
Instrument Name : Electronic Balance
Manufacturer : Sartorius
Model : MSE224S-100-DU
Serial No. : 34705158
ID No. : SGK_CL0045
Resolution : 0.0001 g
Received Date : 5-Feb-2022
Calibrated Date : 5-Feb-2022
Ambient Temperature : (30 ±10) °C
Relative Humidity : (50 ±20) %

REVIEW BY	Ananta B.
APPROVED BY	Kanitta H.
NEXT CAL. DATE	5/02/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.001 based on UKAS LAB 14 : 2015

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Tcs : Thai Calibration Service Co.,Ltd.

Calibrated by : Imron Rattanaylum

Approved by :

Sakeereen Heemhad / Technical Manager

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Certificate No. : 22EB149

CSR No. : A023/01123

Page. : 2 of 3

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Weight Set	2mg-2kg	11119514/01	M2107051S	6-Jul-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration : (✓) Without Adjustment () After Adjustment

1. Repeatability

Nominal Value (g)	Standard Deviation (g)
200	0.00000

2. Effect of tare

Nominal Value (g)	Standard Value (g)	Balance Reading (g)	Correction (g)
20	20.0000	20.0000	0.0000
40	40.0001	40.0000	0.0001
60	60.0000	60.0001	-0.0001
80	80.0001	80.0001	-0.0001
100	100.0000	100.0000	0.0000

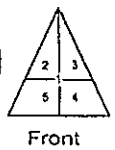
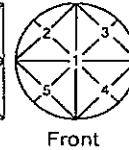
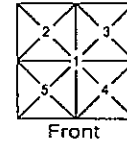
Result of Calibration :.

3. Off-centre loading

A mass approximately 50g was placed on a pan and moved to various position .

The balance reading obtained are given in the table.

Position					Maximum Difference (g)
1	2	3	4	5	
50.0000	50.0000	50.0000	50.0000	50.0000	0.0000



4. Departure from nominal value

Nominal Value (g)	Standard Value (g)	UUC Reading (g)	Correction (g)	Uncertainty (\pm g)	Coverage Factor (k)
0.01	0.0100	0.0100	0.0000	0.00008	2.0
0.1	0.1000	0.1000	0.0000	0.00008	2.0
0.5	0.5000	0.5000	0.0000	0.00008	2.0
1	1.0000	1.0000	0.0000	0.00008	2.0
2	2.0000	2.0000	0.0000	0.00008	2.0
5	5.0000	5.0000	0.0000	0.00009	2.0
10	10.0000	10.0000	0.0000	0.00009	2.0
20	20.0000	20.0000	0.0000	0.00009	2.0
50	50.0000	50.0000	0.0000	0.00011	2.0
100	100.0000	100.0000	0.0000	0.00016	2.0
120	120.0000	120.0000	0.0000	0.00024	2.0
140	140.0001	140.0000	0.0001	0.00024	2.0
160	160.0000	160.0000	0.0000	0.00026	2.0
180	180.0000	180.0000	0.0000	0.00029	2.0
200	200.0000	200.0000	0.0000	0.00030	2.0

- UUC = Unit Under Calibration

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

...End...



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkhla 90250 Thailand

Tel: 081 599 0417 Fax: 074 805 133 Email: s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 12-Nov-2021

Certificate No. : 21OV734

CSR No. : A012/00583

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory

Instrument Name : Hot Air Oven

Manufacturer : Memmert

Model : UF110

Serial No. : B416.3392

ID No. : SGK_CL0025

Resolution : 0.1 °C

Received Date : 9-Nov-2021

Calibrated Date : 9-Nov-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	Sutthirak 9.
APPROVED BY	Kamida H.
NEXT CAL. DATE	10/05/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on G-20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR21-0314	9-Feb-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

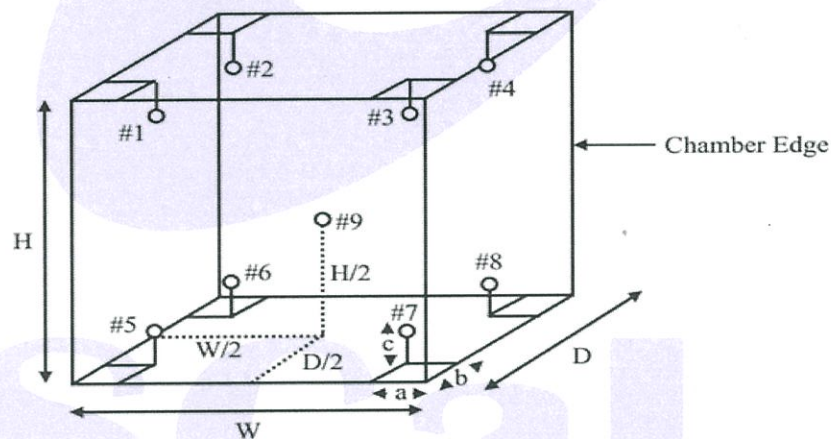
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of the chamber

W = 40.0 cm

H = 40.0 cm

D = 33.0 cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Hot Air Oven and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
40	40.28	40.25	39.80	39.87	40.23	40.19	39.97	40.01	40.09	0.36
70	70.34	70.31	70.08	69.64	69.91	69.89	69.84	69.88	69.84	0.36
103	103.17	103.21	102.75	102.67	103.02	103.06	102.80	102.83	102.94	0.36
104	104.31	104.34	103.85	103.77	104.12	104.19	103.92	103.93	104.05	0.36
105	105.13	105.16	104.64	104.60	104.90	104.96	104.65	104.71	104.82	0.36
180	180.31	180.40	180.22	179.77	180.77	180.40	179.69	180.64	180.47	0.41

3. Performance Result

The performance of the Hot Air Oven are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
40	40.0	40.0	0.10	0.30	0.56
70	70.0	70.0	0.10	0.58	0.72
103	103.0	103.0	0.10	0.37	0.56
104	104.0	104.0	0.10	0.41	0.66
105	105.0	105.0	0.20	0.41	0.68
180	180.0	180.0	0.10	0.63	0.81

- UUC = Unit Under Calibration

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%

... End ...



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkhla 90250 Thailand

Tel: 081 599 0417 Fax: 074 805 133 Email: s.calibration@gmail.com www.scal-lab.com



CALIBRATION CERTIFICATE

Issued Date : 8-Feb-2022

Certificate No. : 22WB004

CSR No. : A0223/01123

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory
Instrument Name : Water Bath
Manufacturer : Memmert
Model : WNE29
Serial No. : L616.0538
ID No. : SGK_CL0035
Resolution : 0.1 °C
Received Date : 5-Feb-2022
Calibrated Date : 5-Feb-2022
Ambient Temperature : (30 ± 10) °C
Relative Humidity : (50 ± 30) %

REVIEW BY	Ananta B.
APPROVED BY	Kanitta H.
NEXT CAL. DATE	6/07/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.W1.014 based on ASTM E 715 : 1980 (reapproved 2001)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Imron Rattanaylum

Approved by :

Sakeereen Heemhad / Technical Manager

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Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR21-0314	9-Feb-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

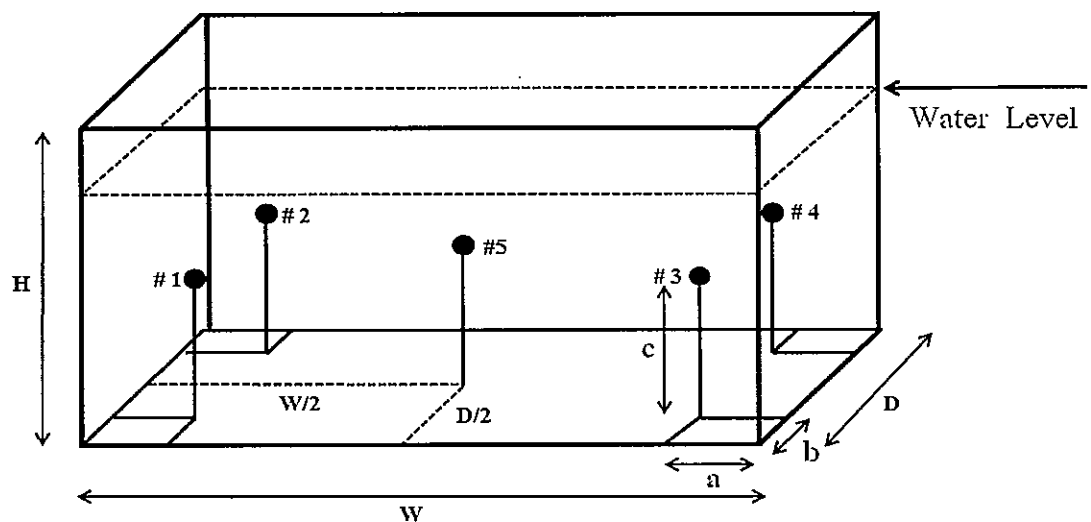
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

$a = 5$ cm
 $b = 5$ cm
 $c = 5$ cm

Dimension of the chamber

$W = 45$ cm
 $H = 30$ cm
 $D = 35$ cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Water Bath and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)					Uncertainty (± °C)
	#1	#2	#3	#4	Ref.5	
80	79.95	80.07	79.95	79.99	80.03	0.14

3. Performance Result

The performance of the Water Bath are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
80	81.0	81.0	0.10	0.19	0.19

- UUC = Unit Under Calibration

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%

... End ...



CALIBRATION CERTIFICATE

Issued Date : 8-Jul-2021

Certificate No. : 21ATC051

CSR No. : A047/2301

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Microbiological Laboratory

Instrument Name : Autoclave

Manufacturer : TOMY

Model : SX-700

Serial No. : 52134079

ID No. : SGK_ML0001

Resolution : 1 °C

Received Date : 5-Jul-2021

Calibrated Date : 5-Jul-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	<i>APD Nattawat P.</i>
APPROVED BY	<i>Kanitta H.</i>
NEXT CAL. DATE	<i>03/07/2023</i>

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.16.013 based on BS 2646 : 1993 (part 5)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- ScaL : Sounthern Calibration Service Co., Ltd.,

Calibrated by : Ibrorhim Saleemin

Approved by :

o.w.
Adull Lemsoh / Laboratory Manager

The uncertainties are for a confidence probability of approximately 95%

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Details of Calibration

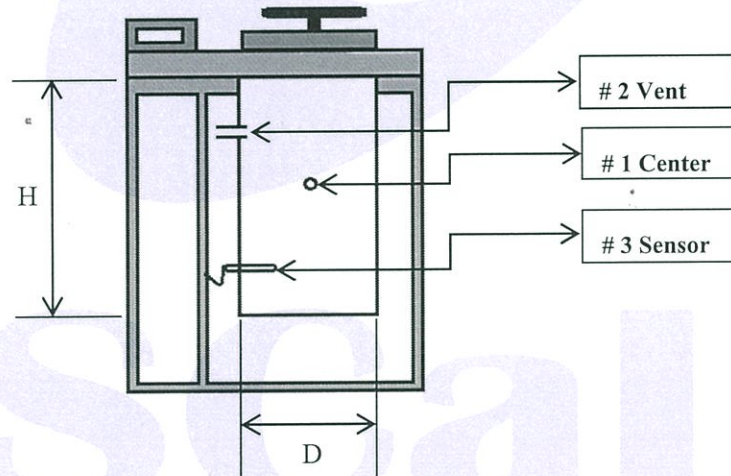
1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	GL220	H11119557	21SDAT001	7-May-2022

- The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.
- This certificate is not certified any commercial transaction
- Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration : (✓) Without Adjustment () After Adjustment

1. Sensor Installation Diagram



Chamber Diameter (D) : 30 cm

Chamber Height (H) : 70 cm

Result of Calibration ::

2. Temperature Measurement Accuracy Test

The measurement results of the Autoclave and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)			Pressure Reading	Operating Time (sec)	Uncertainty (± °C)
	Center #1	Vent #2	Sensor #3			
115	116.2	115.9	116.3	0.8 MPa	1800.18	0.76
118	119.2	118.9	119.3	0.1 MPa	1800.26	0.76
121	121.5	121.2	121.6	0.12 MPa	1800.34	0.76

3. Performance Result

The performance of the Autoclave are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
115	115	115	0.10	0.50	0.50
118	118	118	0.10	0.50	0.50
121	121	121	0.00	0.40	0.40

* UUC = Unit Under Calibration

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%

... End ...



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkhla 90250 Thailand

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CALIBRATION CERTIFICATE

Issued Date : 11-Feb-2021

Certificate No. : 21OV108

CSR No. : A029/1431

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Microbiological Laboratory

Instrument Name : Incubator

Manufacturer : Memmert

Model : ICP750

Serial No. : F816.0061

ID No. : SGK_ML0013

Resolution : 0.1 °C

Received Date : 8-Feb-2021

Calibrated Date : 8-Feb-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	Nattawut P.
APPROVED BY	Kamilla H.
NEXT CAL. DATE	9/8/2022

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on G-20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Laboratory Manager

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Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR20-0166	11-Feb-2021

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

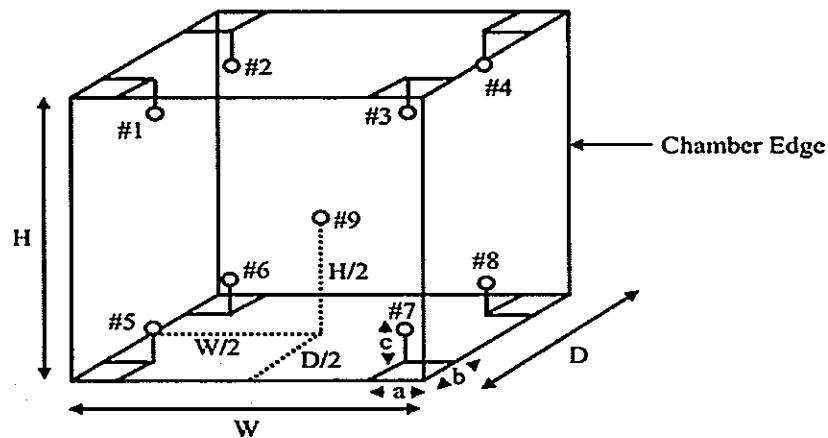
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :.

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of the chamber

W = 104.0 cm

H = 120.0 cm

D = 60.0 cm



Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Incubator and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
35	35.07	35.07	35.00	35.06	35.13	35.06	35.01	35.08	35.09	0.38

3. Performance Result

The performance of the Incubator are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
35	35.0	35.0	0.10	0.14	0.22

* UUC = Unit Under Calibration

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%

... End ...



CALIBRATION CERTIFICATE

Issued Date : 8-Jul-2021

Certificate No. : 21PH098

CSR No. : A047/2301

Page. : 1 of 2

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Microbiological Laboratory

Instrument Name : pH meter

Manufacturer : Sartorius

Model : Basic pH Meter PB-10

Serial No. : C07160695

ID No. : SGK_ML0016

Electrode No. : N/A

Received Date : 5-Jul-2021

Calibrated Date : 5-Jul-2021

Ambient Temperature : $(25 \pm 3) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \%$

REVIEW BY	Nattawut P.
APPROVED BY	Kanida H.
NEXT CAL. DATE	03/01/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.008 based on direct measurement by using certified reference Material (CRM)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- HACH : LANGE United For Water Quality
- WK : WK Electric Co., Ltd.

Calibrated by : Jessadagon Lemhud

Approved by :

Adull Lemsoh / Laboratory Manager

The uncertainties are for a confidence probability of approximately 95%

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Details of Calibration
1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Standard Solution	4.005	C02730	1503	22-May-2022
Standard Solution	7.000	C02775	1551	20-Oct-2022
Standard Solution	10.012	C02770	1545	17-Sep-2022
Temperature/Electrical Calibrator	MC2-MF	23642	WK2102-006-229	21-Feb-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration .: (✓) Without Adjustment () After Adjustment

1. Electrical Measurement

Applied Voltage (mV)	pH meter Reading (mV)	Correction (mV)	Uncertainty (± mV)
177.48	177.4	0.08	0.17
0.00	0.0	0.00	0.13
-177.48	-177.4	-0.08	0.17

2. Sample Test Measurement

Standard Buffer Solutions (pH)	pH meter Reading (pH)	Correction (pH)	Uncertainty (± pH)
4.006	3.99	0.016	0.012
6.997	7.01	-0.013	0.015
10.012	9.98	0.032	0.036

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%

... End ...



Southern Calibration Service Co., Ltd.

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CALIBRATION CERTIFICATE

Issued Date : 9-Aug-2021

Certificate No. : 21WB064

CSR No. : A047/2346

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Microbiological Laboratory

Instrument Name : Water Bath

Manufacturer : Memmert

Model : WPE45

Serial No. : L716.0558

ID No. : SGK_ML0021

Resolution : 0.1 °C

Received Date : 6-Aug-2021

Calibrated Date : 6-Aug-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	Nattawat P.
APPROVED BY	Kanitta H.
NEXT CAL. DATE	4/02/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.014 based on ASTM E 715 : 1980 (reapproved 2001)

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR21-0314	9-Feb-2022

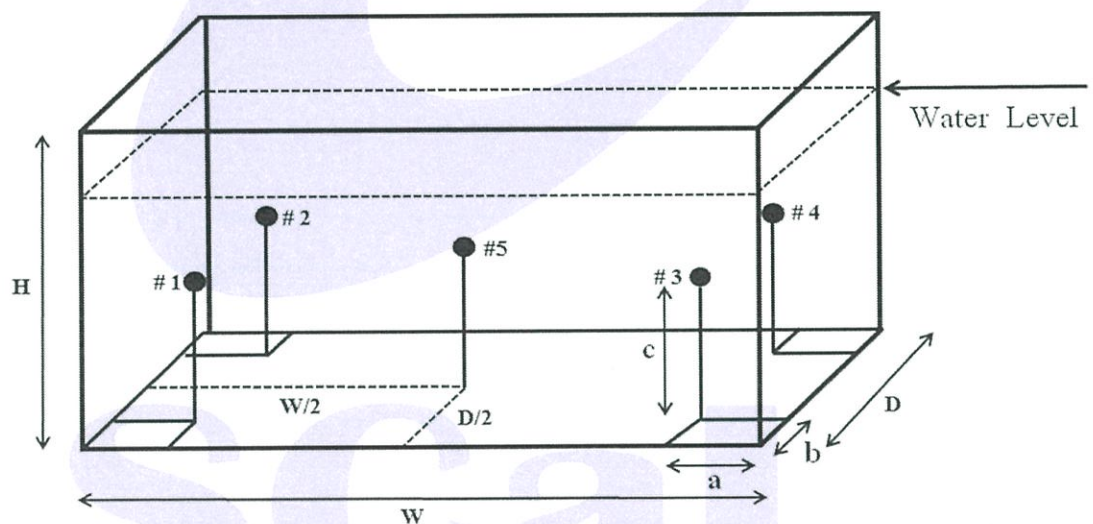
- The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.
- This certificate is not certified any commercial transaction
- Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5 cm
b = 5 cm
c = 5 cm

Dimension of the chamber

W = 45 cm
H = 30 cm
D = 35 cm

Result of Calibration .:

2. Temperature Measurement Accuracy Test

The measurement results of the Water Bath and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)					Uncertainty (± °C)
	#1	#2	#3	#4	Ref.5	
44.5	44.49	44.55	44.48	44.51	44.47	0.14

3. Performance Result

The performance of the Water Bath are reported as shown below

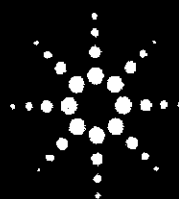
Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
44.5	44.6	44.6	0.20	0.24	0.24

- UUC = Unit Under Calibration

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%

... End ...

SCaL



Agilent CrossLab Compliance Services

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From Insight to Outcome

EQUIPMENT QUALIFICATION REPORT (EQR)

Agilent CrossLab Compliance

Qualification Type: ICPMS-OQ

System ID: JP16511669

EQP Name: AgilentRecommended

EQP Revision: ICPMS.02.50

EQP Publish Date: March 2020

Date: February 8, 2022 11:47:17 AM

Report Type: Report

Org. Name: ALS laboratory Group (Thailand) Co.,Ltd.

Org. Location: 114/1 Moo8, Kanchanawanich Rd., T.Ban Phru,
A.Hatyai, Songkhla 90250

REVIEW BYAnanta B.

APPROVED BYKanitta H.

NEXT CAL. DATE8/2/2023

Date: February 8, 2022 11:47:17 AM
System ID: JP16511669

Certificate of System Qualification

ICPMS-OQ

System ID: JP16511669

Organization Name: ALS laboratory Group (Thailand) Co.,Ltd.

Organization Location: 114/1 Moo8, Kanchanawanich Rd., T.Ban Phru, A.Hatyai, Songkhla 90250

Date: February 8, 2022 11:39:47 AM

EQP Name: AgilentRecommended

EQP Revision: ICPMS.02.50

Overall Qualification Status: Pass

Autosampler Check

Overall Autosampler Check Test Status

Pass

Integrated Sample Introduction System (ISIS) Check

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Autotune

Peakwidth Mass 7	Pass
Peakwidth Mass 89	Pass
Peakwidth Mass 205	Pass
Mass Axis 7	Pass
Mass Axis 89	Pass
Mass Axis 205	Pass
Mass 7 Sensitivity No Gas	Pass
Mass 89 Sensitivity No Gas	Pass
Mass 205 Sensitivity No Gas	Pass
Mass 59 Sensitivity He	Pass
Mass 89 Sensitivity H2	Pass
Oxide Ratio 156/140	Pass
Doubly Charged Species Ratio 70/140	Pass

Date: February 8, 2022 11:39:47 AM

System ID: JP16511669

Overall Autotune Test Status

Pass

Background (No Gas Mode)

Setpoint Status:

Pass

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

	7	89	205		
	6.400	1.800	5.700	cps	
<=	6.9	<=	4.6	<=	11.5
Pass		Pass		Pass	

Overall Background (No Gas Mode) Test Status

Pass

Background (Gas Mode)

Gas Mode:

Helium

Setpoint Status:

Pass

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

	78	
	4.60	cps
<=	115	
Pass		

Gas Mode:

Hydrogen

Setpoint Status:

Pass

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

	78	
	1.45	cps
<=	4.6	
Pass		

Overall Background (Gas Mode) Test Status

Pass

Date: February 8, 2022 11:39:47 AM

System ID: JP16511669

20-Minute Stability (No Gas Mode)

Masses (AMU):

Stability RSD:

Agilent Recommended:

Status:

	7		89		205	
	1.26		0.28		0.43	%
<=	2.3	<=	2.3	<=	2.3	
Pass		Pass		Pass		

Overall 20-Minute Stability (No Gas Mode) Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer	Agilent Technologies
Name	7900
Model Number	G8403A
Installed Options	#100H: Standard Package with Hydrogen option
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP16511669
Firmware Revision	4.00.02

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS3
Model Number	G8411A
Type	Peristaltic pump system
Serial Number	JP16510376

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU16351847

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	701711328

Electronic Signature

Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

Full Name of Signer:	Burin Ngamvijit
Logged On User Name:	Burin_ngamvijit@agilent.com
Signature Creation Date:	February 8, 2022
Reason for Signature:	Published this original version of document

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User Name: burin_ngamvjljt
 Hostname: ASSGKWX019

System Id: JP16511669
 Print Date: February 8, 2022 11:39:48 AM

OQ HW 7900ICPMS ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 8, 2022 9:19:05 AM	Audit	SessionCreated	Session	None
February 8, 2022 9:19:05 AM	Start	Configuration	Session	None
February 8, 2022 9:19:05 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
February 8, 2022 9:23:56 AM	Audit	EqpLoaded	Session	EQP details for primary technique [lcpMs] - File path: [ProtocolPacks/lcpMs/Configurations/02.50/lcpMs.02.50.eqp], EQP File Name: [lcpMs.02.50.eqp], EQP Name: [AgilentRecommended]
February 8, 2022 9:24:02 AM	End	Configuration	Session	None
February 8, 2022 9:24:09 AM	Start	Qualification	Session	OQ
February 8, 2022 9:24:09 AM	Start	Execution	Autosampler Check : SPS4: Autosampler Check	None
February 8, 2022 9:24:54 AM	End	Execution	Autosampler Check : SPS4: Autosampler Check	Run Count : 1
February 8, 2022 9:24:57 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS3: Integrated Sample Introduction System (ISIS) Check	None
February 8, 2022 10:52:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS3: Integrated Sample Introduction System (ISIS) Check	Run Count : 1

User Name: burin_ngamvijit
 Hostname: ASSGKWX019

System Id: JP16511669
 Print Date: February 8, 2022 11:39:48 AM

QQ HW 7900iCPMS ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 8, 2022 10:52:50 AM	Start	Execution	Autotune : G8403A: Autotune 1	None
February 8, 2022 10:55:26 AM	End	Execution	Autotune : G8403A: Autotune 1	Run Count : 1
February 8, 2022 10:55:34 AM	Start	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	None
February 8, 2022 10:55:56 AM	End	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	Run Count : 1
February 8, 2022 10:56:00 AM	Start	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Helium	None
February 8, 2022 10:56:22 AM	End	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Helium	Run Count : 1
February 8, 2022 10:56:24 AM	Start	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Hydrogen	None
February 8, 2022 10:56:40 AM	End	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Hydrogen	Run Count : 1
February 8, 2022 10:56:43 AM	Start	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	None
February 8, 2022 11:01:33 AM	End	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	Run Count : 1
February 8, 2022 11:07:37 AM	End	Qualification	Session	OQ
February 8, 2022 11:07:37 AM	Start	Reporting	Session	None

Page 2 / 3

User Name: burln_ngamvijit

System Id: JP16511669

Hostname: ASSGKWX019

Print Date: February 8, 2022 11:39:48 AM

OQ HW 7900ICPMS ALS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
February 8, 2022 11:38:19 AM	Audit	Reporting	Session	Report Generated : Certificate



Southern Calibration Service Co., Ltd.

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkhla 90250 Thailand

Tel: 081 599 0417 Fax: 074 805 133 Email: s.calibration@gmail.com www.scal-lab.com



NSC-TISI-TIS17025
CALIBRATION 0294

CALIBRATION CERTIFICATE

Issued Date : 19-Aug-2021

Certificate No. : 21OV449

CSR No. : A078/3892

Page : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory

Instrument Name : Cold Room Water

Manufacturer : MODULAR

Model : N/A

Serial No. : N/N

ID No. : SGK_CL0065

Resolution : 0.1 °C

Received Date : 16-Aug-2021

Calibrated Date : 16-Aug-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY Sutthirak T.

APPROVED BY Kanitta H.

NEXT CAL. DATE 14/02/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on G-20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR21-0314	9-Feb-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

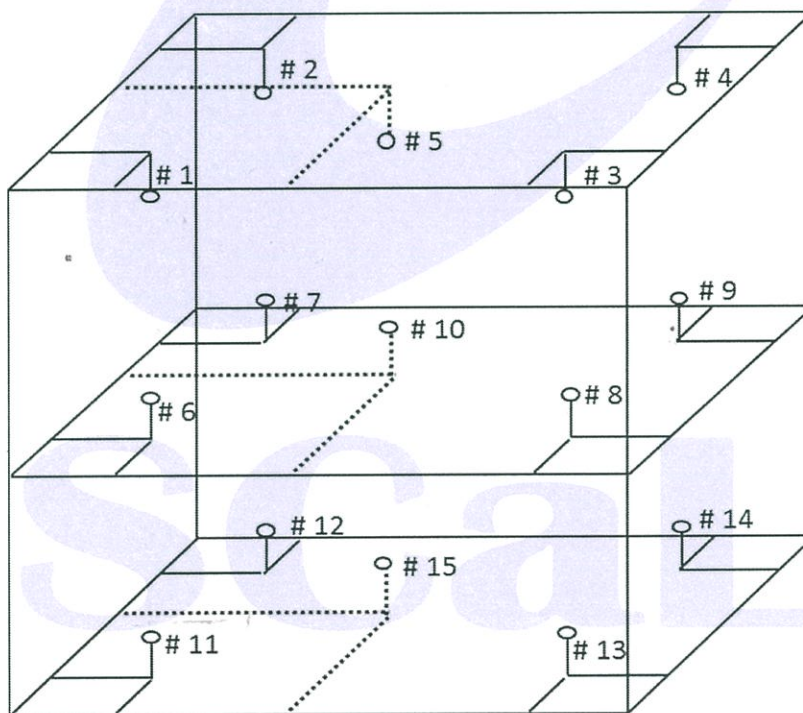
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of the chamber

W = 370.0 cm
H = 250.0 cm
D = 540.0 cm

Result of Calibration :**2. Temperature Measurement Accuracy Test**

The measurement results of the Cold Room Water and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)														
	#1	#2	#3	#4	#5	#6	#7	#8	#9	Ref.10	#11	#12	#13	#14	#15
4	3.63	3.35	3.58	3.80	4.14	3.76	3.77	3.72	3.82	3.80	3.62	3.88	3.67	3.80	3.61

The uncertainty of measurement was ± 0.38 °C

3. Performance Result

The performance of the Cold Room Water are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (\pm °C)	Temperature Uniformity (°C)	Overall Variation (°C)
4	4.0	4.0	1.23	0.69	3.33

* UUC = Unit Under Calibration

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%

... End ...

SCaL



CALIBRATION CERTIFICATE

Issued Date : 12-Nov-2021

Certificate No. : 21OV733

CSR No. : A012/00583

Page. : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd
114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,
A. Hat Yai, Songkhla 90250 TH

Calibration Place : Chemical Laboratory

Instrument Name : Hot Air Oven

Manufacturer : Memmert

Model : UF110

Serial No. : B416.3387

ID No. : SGK_CL0024

Resolution : 0.1 °C

Received Date : 9-Nov-2021

Calibrated Date : 9-Nov-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY Sutthirak O.
APPROVED BY Kanitta H.
NEXT CAL. DATE 10/05/2023

Calibration Method Used :

This instrument was calibrated using the Calibration In - house method : SCAL.WI.012 based on G-20

The Southern Calibration Service Co.,Ltd.calibration control system complies with requirement of ISO/IEC 17025:2017

Traceability of measurement :

This Certificate is traceable to the International and /or national standards which realize the units of measurement according to the International System of Unit (SI) through :

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written approval of Southern Calibration Service Co., Ltd.

Details of Calibration

1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data logger With Sensor	34970A	MY44064411	QR21-0314	9-Feb-2022

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

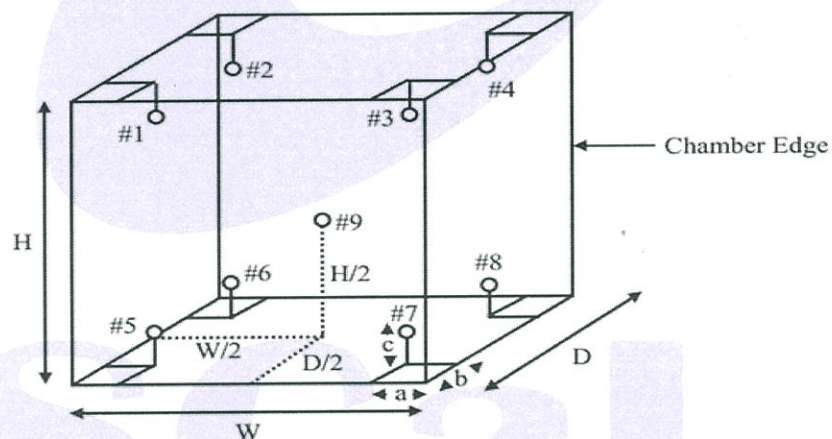
4. Condition of Item : normal condition , no indication for any damage or malfunction

Result of Calibration :.

(✓) Without Adjustment

() After Adjustment

1. Sensor Installation Diagram



Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

Dimension of the chamber

W = 40.0 cm

H = 40.0 cm

D = 33.0 cm

Result of Calibration :

2. Temperature Measurement Accuracy Test

The measurement results of the Hot Air Oven and associates are reported in the manner as shown below

Cal point (°C)	Measured Standard Temperature At Spread Locations (°C)									Uncertainty (± °C)
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
40	39.85	39.81	39.68	39.57	39.94	39.80	39.81	39.93	39.69	0.36
70	70.53	70.23	70.08	69.74	70.51	70.37	70.43	69.79	70.15	0.36
103	103.47	102.96	102.95	102.77	103.40	103.46	103.33	102.73	102.83	0.36
104	104.47	103.92	103.95	103.77	104.33	104.46	104.30	103.73	103.80	0.36
105	105.34	104.85	104.85	104.67	105.16	105.27	105.07	104.81	105.06	0.36
180	180.04	180.03	179.99	179.86	180.11	180.28	180.27	180.16	180.26	0.41

3. Performance Result

The performance of the Hot Air Oven are reported as shown below

Cal point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature Stability (± °C)	Temperature Uniformity (°C)	Overall Variation (°C)
40	40.0	40.0	0.10	0.34	0.47
70	70.0	70.0	0.10	0.48	0.82
103	103.0	103.0	0.10	0.71	0.74
104	104.0	104.0	0.10	0.71	0.74
105	105.0	105.0	0.20	0.39	0.70
180	180.0	180.0	0.20	0.53	0.62

- UUC = Unit Under Calibration

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%

... End ...





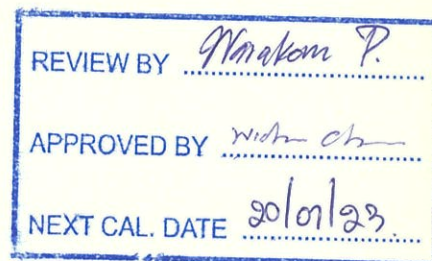
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CH99
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	S2Field Kit
Serial No. :	B731459205
ID No. :	SGK_FS0019
Condition As-Received:	Used Item
Received Date :	19 January 2022
Calibration Date :	20 January 2022
Reference :	2201-0586DSC-3
Submitted by :	ALS Laboratory Group (Thailand)Co.,Ltd. Songkhla Branch. 114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer
Calibrated by :	Warakorn Lerngagtrakul 
Approved by :	 Approved Signatory
() Malee Butkruea	
() Saithip Meangmai	
(<input checked="" type="checkbox"/>) Ponpan Paipim	
Issue Date :	31 January 2022



The Uncertainties are for a confidence probability of approximately 95%

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.



Cert.No.: 22CH99

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	54030049	130RC116	21E2682	25 Aug 2022
2) Ref. Standard Thermometer	4982054	110RC044	21I1201	26 Oct 2022

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. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	766820	23 Sep 2023
pH 6.982	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	766824	04 Sep 2022

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

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 S/N.: B731459205	4.00	177.48	177	4.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.00	0.58	2.00

R2



Cert.No.: 22CH99

Page.: 3 of 3

Calibration Results

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 (\pm)	Coverage factor k
pH Electrode S/N.: 8111906	4.008	4.01	189	0.0079	2.00
	6.982	6.98	15	0.0099	2.00
	10.015	10.02	-160	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLab Expert Go-ISM
- Serial No. : 8111906

Dimension of probe;

- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.002	25.2	0.198	0.13	2.00
45.0	45.002	45.3	0.298	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES


534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250



TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 21CH1267

Page.: 1 of 2

Certificate of Calibration

Equipment :	Conductivity Meter
Manufacturer :	Mettler Toledo
Model :	Seven2GoS3
Serial No. :	B914464504
ID No. :	SGK_FS0051
Condition As-Received:	Used Item
Received Date :	17 September 2021
Calibration Date :	21 September 2021
Reference :	2109-0705DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. Songkhla Branch. 114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru, A.Hat Yai, Songkhla 90250 Thailand
Ambient Temperature :	$(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity :	$(50 \pm 15) \%$
Calibration Procedure:	In -house method : - CP-CH6 : based on direct measurement by using reference material (RM)
Calibrated by :	Walalak Sirithean
Approved by :	 Approved Signatory
(<input checked="" type="checkbox"/>) Malee Butkruea	
() Saithip Meangmai	
() Warakorn Lernagtrakul	
Issue Date :	22 September 2021

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	21/9/22

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

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A 0007589



Cert.No.: 21CH1267

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	9549224	130RC003	21I451	15 Apr 2022

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

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

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835
- Conductivity calibration solution, Thermo Scientific (traceable to NIST)

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
84.001 $\mu\text{S/cm}$	CPA chem	725921	12 Jan 2022
1413 $\mu\text{S/cm}$	Thermo Scientific	081/02	26 Feb 2024
12.88 mS/cm	Thermo Scientific	230/01	07 June 2023

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

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

Calibration results**Function : Conductivity Measurement**(*) After Adjustment at 1413 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5819080541

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
84.001 $\mu\text{S/cm}$	84.78 $\mu\text{S/cm}$	84.97 $\mu\text{S/cm}$	0.58 $\mu\text{S/cm}$	2.00
1413 $\mu\text{S/cm}$	1407 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	15 $\mu\text{S/cm}$	2.00
12.88 mS/cm	12.52 mS/cm	12.71 mS/cm	0.14 mS/cm	2.00

Remark

- UUC* = Unit Under Calibration

- Cell constant = 0.551 cm^{-1}

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 %.

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Internal Calibration

REVIEW BY Sutthirak J.
APPROVED BY Kamitta H.
NEXT CAL. DATE 24/06/2022

Equipment : Turbidity Meter
ID No. : SGK_FS0045
Calibrate Date : 24 Jun 2021

Manufacture : HACH
Model : 2100Q/QIS
Serial No. : 19010C073443

Calibration Point	1st (NTU)	2nd (NTU)	3rd (NTU)	AVG (NTU)	Specifications	Evaluate
Standard 20 NTU	20.2	20.2	20.2	20.2	19 to 21 NTU	Pass
Standard 100 NTU	100	99.9	100	99.97	95 to 105 NTU	Pass
Standard 800 NTU	800	799	793	797.33	760 to 840 NTU	Pass

Calibrated by Somsak J.
(Scientist 2)

Approved by : Kamitta H.
(Supervisor)



Metrological Center

SCI ECO Services Company Limited

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

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220133I01 "Substitute for Calibration Certificate Number T220133" Page 1 of 5

Certificate of Calibration

Equipment : Digestion Unit

Manufacturer : Environmental Express

Model : TKN100

Serial No. : 2017TKNBC142

Customer Code : BKK_EN0223

ID No. : T6773A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab1

Date of Receipt : 26 January 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 20 FEB 2022

REVIEW BY	Sinluk P.
APPROVED BY	KLAL
NEXT CAL. DATE	1/2/23

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.

Certificate No. T220133I01

Page 2 of 5

Calibration Report

Equipment : Digestion Unit
Date of Calibration : 1 February 2022
Environment : Temperature : 23.9 - 26.3 °C
Line Voltage : 221.4 - 225.1 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	Type S	M20A1-(CH17-CH20)	T210011	14 March 2022
DATA LOGGER	34970A	T149	T210011	14 March 2022

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 2 Hour 1 Minute At 380 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

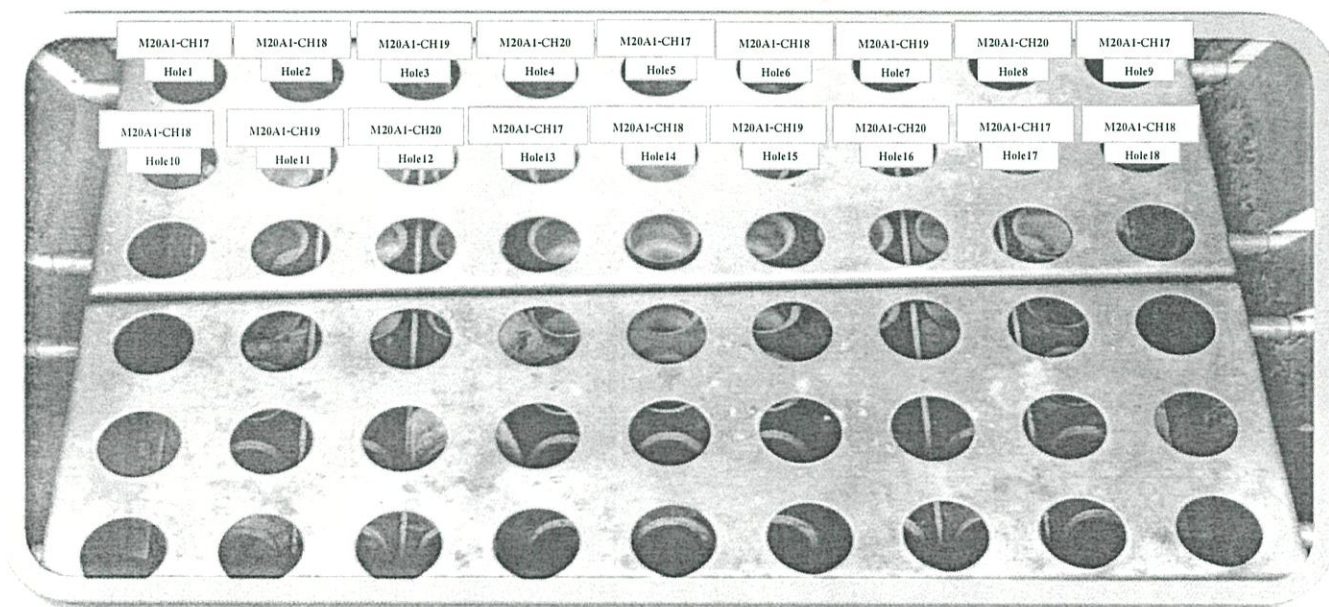
() after adjustment

Approved By. 

Certificate No. T220133I01

Page 3 of 5

Calibration Report




FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole1	Hole2	Hole3	Hole4	Hole5	Hole6	Hole7	Hole8	Hole9
				M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17
380.0	380.0	379.8 - 380.2	Max °C	376.5	377.1	377.3	382.0	383.8	380.9	376.0	377.0	376.3
			Min °C	376.1	376.7	377.0	381.8	383.5	380.6	375.7	376.7	375.9
			Average °C	376.3	376.9	377.1	381.9	383.6	380.8	375.8	376.9	376.1
			Stability ± °C	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole10	Hole11	Hole12	Hole13	Hole14	Hole15	Hole16	Hole17	Hole18
				M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18
380.0	380.0	379.8 - 380.2	Max °C	377.3	378.1	382.6	383.2	381.8	380.8	380.4	376.6	378.2
			Min °C	376.9	377.6	382.2	382.7	381.4	380.5	380.1	375.8	377.4
			Average °C	377.1	377.9	382.4	382.9	381.6	380.6	380.3	376.2	377.8
			Stability ± °C	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.4	0.4

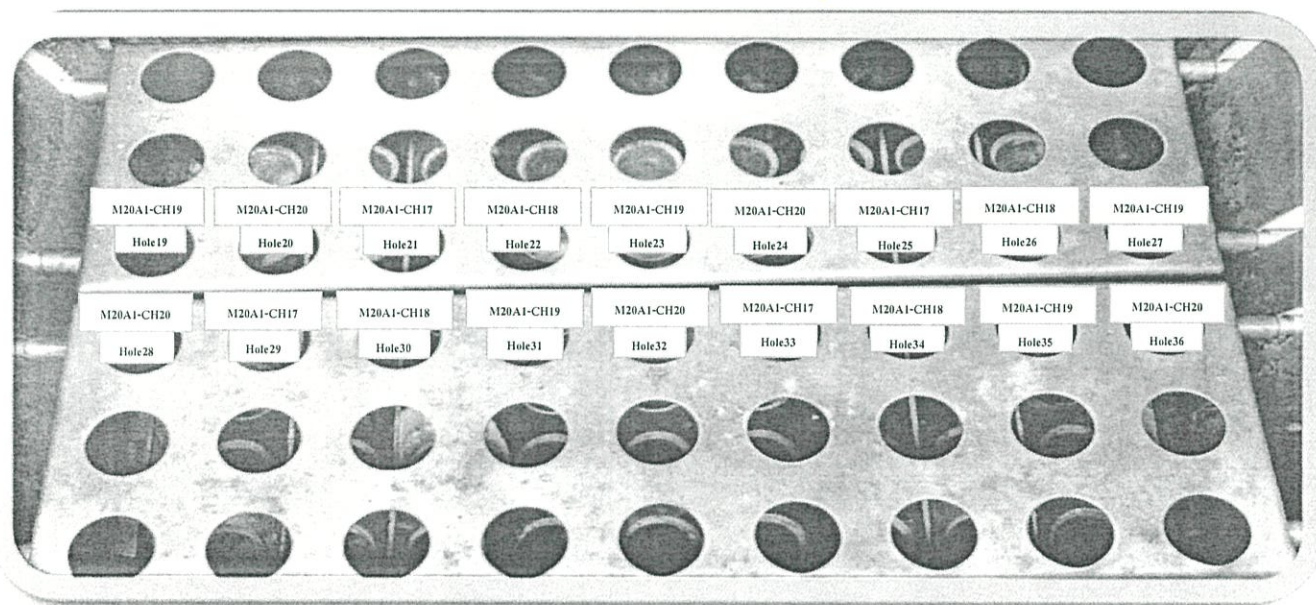
Approved By. _____



Certificate No. T220133I01

Page 4 of 5

Calibration Report



FRONT

Measurement Results

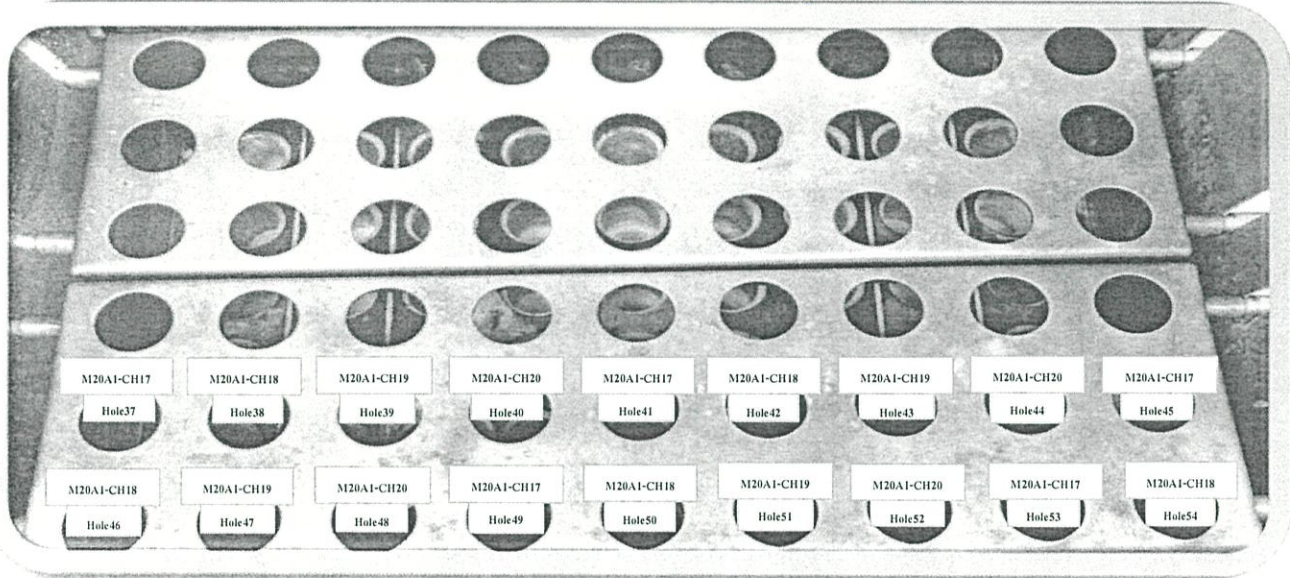
Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole19	Hole20	Hole21	Hole22	Hole23	Hole24	Hole25	Hole26	Hole27
				M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19
380.0	380.0	379.8 - 380.2	Max °C	379.2	383.0	382.8	384.1	383.1	384.1	377.2	377.4	378.4
			Min °C	378.4	382.3	382.2	383.6	382.6	383.7	376.9	377.1	378.0
			Average °C	378.8	382.7	382.5	383.9	382.8	383.9	377.0	377.2	378.2
			Stability ± °C	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole28	Hole29	Hole30	Hole31	Hole32	Hole33	Hole34	Hole35	Hole36
				M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20
380.0	380.0	379.8 - 380.2	Max °C	380.6	381.9	383.9	381.4	382.0	378.3	379.4	380.4	376.2
			Min °C	380.1	381.5	383.5	381.1	381.7	377.9	379.0	379.8	375.8
			Average °C	380.4	381.7	383.7	381.2	381.8	378.1	379.2	380.1	376.0
			Stability ± °C	0.3	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.2

Approved By. _____



Calibration Report



FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole37	Hole38	Hole39	Hole40	Hole41	Hole42	Hole43	Hole44	Hole45
				M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17
380.0	380.0	379.8 - 380.2	Max °C	381.1	383.5	384.2	379.8	381.3	381.4	381.3	380.6	380.7
			Min °C	380.8	383.2	383.9	379.4	380.8	381.0	380.9	380.2	380.4
			Average °C	381.0	383.4	384.1	379.6	381.1	381.2	381.1	380.4	380.6
			Stability ± °C	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Cal. Point	Setting	Reading	STD.	Position of Standards at Block								
(°C)	(°C)	(°C)	Reading	Hole46	Hole47	Hole48	Hole49	Hole50	Hole51	Hole52	Hole53	Hole54
				M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18	M20A1-CH19	M20A1-CH20	M20A1-CH17	M20A1-CH18
380.0	380.0	379.8 - 380.2	Max °C	377.2	377.8	382.8	378.6	379.5	380.4	383.3	383.0	378.1
			Min °C	376.8	377.2	382.2	378.3	379.3	380.1	383.1	382.7	377.8
			Average °C	377.0	377.5	382.5	378.4	379.4	380.2	383.2	382.8	377.9
			Stability ± °C	0.2	0.3	0.3	0.2	0.1	0.2	0.1	0.2	0.2

The expanded uncertainty of temperature measurement was ± 1.63 °C

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=2 , providing a level of confidence of approximately 95 % .

Approved By. 



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด
DOUBLE S DIAGNOSTICS CO., LTD.

4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพฯ 10260 โทรศัพท์: (02) 747-7009 โทรสาร: (02) 747-7008
4 Soi Udomsuk 14, Bangna, Bangkok 10260 Tel. (02) 747-7009 Fax: (02) 747-7008

Maintenance Plan YEAR : 2021

เดือน	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
รวม						10/10/21 OK						10/10/21 OK

Periodical maintenance check list for Konelab

	6M	12M	Note!
1.Diluent-wash tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.ISE tubing change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3.Syringe check/change		<input checked="" type="checkbox"/>	
4.Dispensing check/ change		<input checked="" type="checkbox"/>	
5.Waste tubing change when necessary		<input checked="" type="checkbox"/>	
6.Lamp check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
7.Mixer paddle/paddle change(not Konelab20)		<input checked="" type="checkbox"/>	
8.ISE needles check/change		<input checked="" type="checkbox"/>	
9.Pump tubing check/ chance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
10.Broken/worn out part check /change		<input checked="" type="checkbox"/>	
11.Peristaltic pump check /cleaning/ lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
12.Heating check		<input checked="" type="checkbox"/>	
13.Cooling check		<input checked="" type="checkbox"/>	
14.Dispenser mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15.Cuvette transfer mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
16.Dispenser movement check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
17.Sample/reagent register check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
18.Dispensing tubing tightness check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
19.Photometer and optics cleaning/check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
20.Workstation PC cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
21.Mechanic cleaning/lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
22.Instrument cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
23.Complete analyzer testing with waterblank/QC or sample	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
24.Test parameters/Adjustment/config. Save to USB key	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
25.UPS Test	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Place: ALS Lab Instrument: Aquakem 950
Date/Time: 28-06-21 Serial no: 22781
Service done by: [Signature] Install date:
Signature of customer: [Signature] Date/Time: 28/6/21



REVIEW BY	Autcharawan S.
APPROVED BY	Sarasat M.
NEXT CAL. DATE	12 / Jan / 23
	12 / Jan / 22

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.



Operator Signature: _____

Date: Jan 12, 2022

(Mr.Thitipong Piromkripuk)

Applications Chemist



Certificate of Calibration

Certificate No.:	PTC/10/22004	Page:	1 of 4
Equipment:	Cod Reactor	Condition:	New
Manufacturer:	Hach	Serial No. :	21120C1313
Model:	DRB200	ID No. :	-
Covers:	None	Holes:	30

Environment Condition:	Temperature:	25.2	°C	±	0.1	°C
	Humidity:	49.5	%RH	±	1.1	%RH
	Voltage:	221.8	VAC	±	0.6	VAC

Customer: ALS LABORATORY GROUP (THAILAND)
114/1 Moo.8, Karnchanawanich Rd., T.Ban Phru,
A.Hat Yai, Songkhla 90250 Thailand.

Calibration Place: Penta Calibration Co., Ltd. (Temperature Laboratory)
66/124 The connect 34 Village, Kanchanaphisek Road,
Dokmai, Prawet Bangkok 10250 Thailand

The Method used: In house method, PTC-WI-10, based on Compare with Standard Thermometer

Traceability: This certificate is traceable to the SI Units through Quality Reborn Co.,Ltd ,
NSC-ONSC Accreditation No.: Calibration 0292

Date Received: February 08, 2022
Date Calibrated: February 08, 2022
Date Issued: February 08, 2022
Calibrated By: Mr. Todsapol Moolsuang

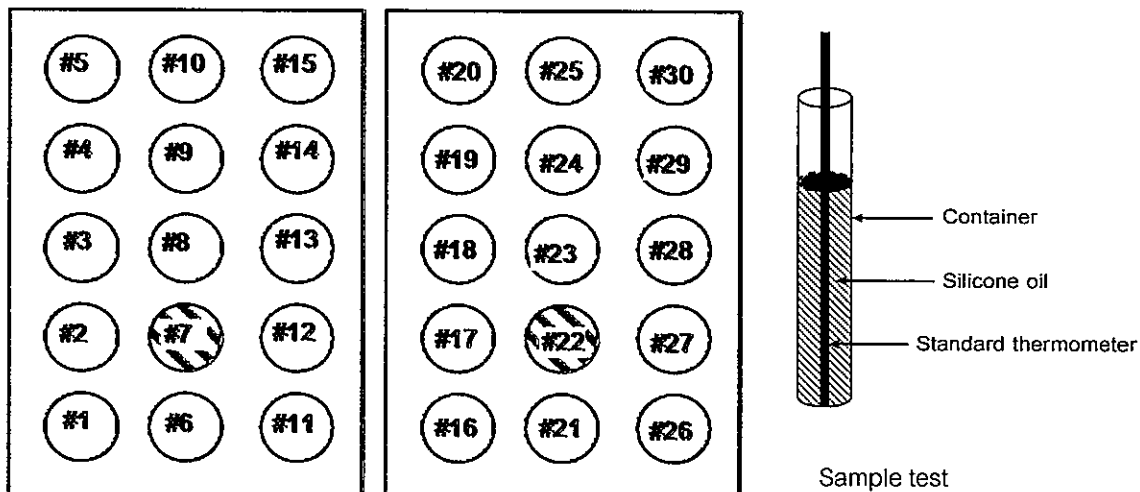
(Mr.Kriangsak Kalasri)

Reviewed by

Approved By :

(Mr. Keattisak Kerdto)

Laboratory Manager



Standard Installation Position:

Module	1									
Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Probe No.	1	2	3	4	5	6	7	8	9	10

Module	2									
Position of Std	#11	#12	#13	#14	#15	#16	#17	#18	#19	#20
Probe No.	1	2	3	4	5	6	7	8	9	10

Module	2									
Position of Std	#21	#22	#23	#24	#25	#26	#27	#28	#29	#30
Probe No.	1	2	3	4	5	6	7	8	9	10

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

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Measurement Results:

Without adjustment

Position heating block	Calibration point (°C)	Setting (°C)	UUC Reading (°C)
Left	150	150	150

Measurement Temperature (°C) @ Probe No.			
Position	Standard Reading (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	150.77	0.77	0.64
#2	149.49	-0.51	0.63
#3	150.38	0.38	0.63
#4	150.28	0.28	0.63
#5	149.74	-0.26	0.63
#6	150.94	0.94	0.64
#7	149.01	-0.99	0.64
#8	150.82	0.82	0.64
#9	149.49	-0.51	0.63
#10	149.11	-0.89	0.63
#11	149.31	-0.69	0.64
#12	150.73	0.73	0.64
#13	150.48	0.48	0.64
#14	149.13	-0.87	0.63
#15	149.19	-0.81	0.64

UUC Characterization

UUC Setting (°C)	UUC Reading (°C)	Measured Uniformity (°C)	Measured Stability (± °C)
150	150	1.55	0.12

Note: UUC = Unit Under Calibration

Definitions

UUC Reading : The average reading of indicating device which forms the integral part of UUC.

Standard Reading : The average reading of standards at any positions or location.

Measured Uniformity : The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with any holes of UUC at steady-state. The reference probe is preferably located in the geometric center of UUC.

Measured Stability : The one-half of greatest maximum difference of measured temperatures at any one probe.



Measurement Results:

Without adjustment

Position heating block	Calibration point (°C)	Setting (°C)	UUC Reading (°C)
Right	150	150	150

Measurement Temperature (°C) @ Probe No.			
Position	Standard Reading (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#16	149.46	-0.54	0.64
#17	149.79	-0.21	0.64
#18	149.27	-0.73	0.64
#19	150.14	0.14	0.64
#20	149.38	-0.62	0.64
#21	150.81	0.81	0.64
#22	150.80	0.80	0.65
#23	150.71	0.71	0.64
#24	149.86	-0.14	0.64
#25	149.23	-0.77	0.64
#26	150.61	0.61	0.64
#27	149.10	-0.90	0.64
#28	150.71	0.71	0.64
#29	149.10	-0.90	0.64
#30	150.74	0.74	0.64

UUC Characterization

UUC Setting (°C)	UUC Reading (°C)	Measured Uniformity (°C)	Measured Stability (± °C)
150	150	1.55	0.12

Note: UUC = Unit Under Calibration

Definitions

UUC Reading : The average reading of indicating device which forms the integral part of UUC.

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Measured Stability : The one-half of greatest maximum difference of measured temperatures at any one probe.

The End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CHO32

Page.: 1 of 3

Certificate of Calibration

Equipment : UV-VIS Spectrophotometer
Manufacturer : Hach
Model : DR 3900
Serial No. : 1687645
ID No. : SGK_CL0038
Condition As-Received: Used Item
Received Date : 24 January 2022
Calibration Date : 24 January 2022
Reference : 2201-0617OC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
Songkhla Branch
114/1 Moo 8, Kanjanavanij Rd., Banphru, Hatyai,
Songkhla 90250 , Thailand
Calibration Place : Chemistry Room
Ambient Temperature : (24.9 - 25.2) °C (On-Site)
Relative Humidity : (39.2 - 45.2) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01
Calibrated by : Kunchit Promprat

REVIEW BY	Ananta B.
APPROVED BY	Kanitta B.
NEXT CAL. DATE	24/1/23

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lerngagtrakul

Issue Date :

7 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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.

A 0037403



Cert. No. : 22CHO32

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	8331	86623	08 Sep 2022
2. Wavelength Standard set	29829	94776	02 Sep 2023
3. Wavelength Standard set	29829	94777	02 Sep 2023

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

3. This certificate is traceable to the International System of Unit maintained at :

- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral BandWidth : 5 nm
Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor <i>k</i>
418.40	418	0.59	2.00
479.88	480	0.59	2.00
513.75	514	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.59	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00

Malu.



Cert. No. : 22CHO32

Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
420.0	Zero	0.000	0.0028	2.00
	0.5723	0.572	0.0033	2.00
	0.7522	0.751	0.0031	2.00
	1.0907	1.090	0.0033	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5616	0.560	0.0034	2.00
	0.7345	0.732	0.0032	2.00
	1.0646	1.063	0.0033	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5118	0.514	0.0034	2.00
	0.6773	0.679	0.0031	2.00
	0.9809	0.984	0.0033	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5228	0.522	0.0030	2.00
	0.6861	0.684	0.0030	2.00
	0.9941	0.993	0.0030	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5546	0.552	0.0029	2.00
	0.7159	0.712	0.0030	2.00
	1.0369	1.033	0.0030	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5401	0.538	0.0029	2.00
	0.6835	0.680	0.0029	2.00
	0.9889	0.986	0.0030	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

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 %.

Malu

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a 1093314



Certificate of Calibration

Represent to Certificate of Calibration ,PTC/07/22071

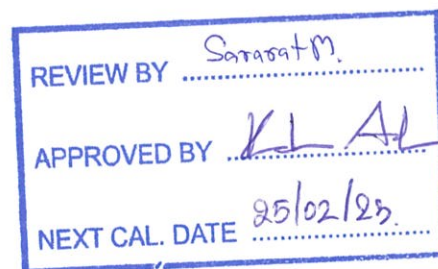
Certificate No.:	PTC/07/22071	Page:	1 of 2
Equipment:	Digital Balance	Condition:	Normal
Manufacturer:	Sartorius	Serial No:	26207042
Model:	MSE224-100-DU	ID No:	BKK_EN0002
Type of Balance:	Single interval		



Customer: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

Environment Condition: Temperature 21.5 °C \pm 0.7 °C
Humidity 61.8 %RH \pm 4.7 %RH
Air density 1.19 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.



The Method used: In house method, PTC-WI-07, base on Euramet cg. 18

Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co.,Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022

Calibration Date: February 25, 2022

Issued Date: March 01, 2022

Calibration By: Mr. Rungroje Metakul



PENTA CALIBRATION CO.,LTD

(Mr.Kriangsak Kalasri)

Reviewed by

Approved By :

(Mr. Keattisak Kerdto)

Laboratory Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

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Represent to Certificate of Calibration ,PTC/07/22071

Certificate No.: PTC/07/22071

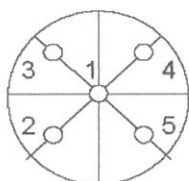
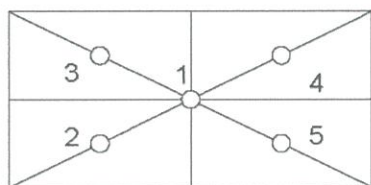
Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3 ,1/2 or of Maximum capacity



Eccentricity test 100 (g)

Position (g)				
1	2	3	4	5
0.0000	-0.0002	-0.0001	0.0001	-0.0001
Maximum deviation:			0.0002	

Repeatability Test : Weight to be $1/2 \leq L_1 \leq$ Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
200	0.00005

Error of indication : from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00016	2.52
0.1	0.10000	0.1000	0.0000	0.00017	2.20
0.5	0.50000	0.5000	0.0000	0.00016	2.28
1	1.00001	1.0000	0.0000	0.00016	2.28
2	2.00001	2.0000	0.0000	0.00016	2.28
5	5.00001	5.0000	0.0000	0.00016	2.28
10	10.00002	10.0000	0.0000	0.00016	2.28
20	20.00002	20.0000	0.0000	0.00016	2.23
50	50.00001	50.0000	0.0000	0.00017	2.15
100	100.00002	99.9999	0.0001	0.00020	2.06
120	120.00004	120.0000	0.0000	0.00023	2.03
150	150.00003	150.0000	0.0000	0.00026	2.00
200	200.00003	199.9999	0.0001	0.00030	2.00

Note: Weight of adjust - (g)

The End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH452
Page.: 1 of 3

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	SevenCompact S220
Serial No. :	B520948426
ID No. :	BKK_EN0072
Condition As-Received:	Used Item
Received Date :	24 March 2021
Calibration Date :	26 March 2021
Reference :	2103-1008DSC-1
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM) - CP-CH8 by comparison with standard thermometer

REVIEW BY	Siriluk P.
APPROVED BY	KL AL
NEXT CAL. DATE	24/9/22

Calibrated by : Warakorn Lernagatrakul

Approved by :

Malee

Approved Signatory

- (☒) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagatrakul

Issue Date : 31 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0026590



Cert.No.: 21CH452

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	1385032	130RC022	20E4213	24 Nov 2021
2) Ref. Standard Thermometer	4982054	110RC044	20I1233	15 Oct 2021

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. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	706694	06 Sep 2022
pH 6.985	CPA chem	722285	19 Dec 2021
pH 10.012	CPA chem	722287	19 Dec 2021

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

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 (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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Calibration Results**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 (\pm)	Coverage factor k
pH Electrode S/N.: 9265091	4.008	4.010	150.3	0.0048	2.05
	6.985	6.989	-22.5	0.0077	2.00
	10.012	10.011	-193.7	0.013	2.00

Function : Temperature Measurement**(*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 9265091

Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point ($^{\circ}\text{C}$)	Standard Temperature ($^{\circ}\text{C}$)	UUC* Reading ($^{\circ}\text{C}$)	Error ($^{\circ}\text{C}$)	Uncertainty of measurement (\pm $^{\circ}\text{C}$)	Coverage factor k
25.0	25.003	25.2	0.197	0.20	2.00

Remark : - UUC* = Unit Under Calibration

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 %.

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