

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



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right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	pH at 25 °C	pH meter	BKK_EN0342	17-Oct-24	17-Oct-25	12
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	27-Feb-24	27-Aug-25	18
Water Lab	Dissolved Oxygen	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	18
Water Lab	Dissolved Oxygen (on site)	DO Meter	BKK_LG0038	1-Jul-24	1-Jul-25	12
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0003	2-Aug-24	2-Aug-25	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0439	29-Oct-24	29-Oct-25	12
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0003	2-Aug-24	2-Aug-25	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0273	14-May-24	14-Nov-25	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0003	2-Aug-24	2-Aug-25	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0273	14-May-24	14-Nov-25	18
Water Lab	BOD	DO Meter	BKK_EN0205	2-Feb-24	2-Aug-25	18
Water Lab	BOD	Incubator	BKK_EN0272	22-Aug-24	22-Aug-25	12
Water Lab	BOD	Burette	BKK_EN0171	27-Feb-24	27-Aug-25	18
Water Lab	COD	Hot Block	BKK_EN0370	2-Jan-25	2-Jan-26	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	13-Sep-24	13-Sep-25	12
Water Lab	Lead	ICP-MS	BKK_EL0043	4-Oct-24	3-Apr-26	18
Water Lab	Lead	Hot Block	BKK_EL0054	4-Mar-25	4-Sep-26	18
Water Lab	Lead	Chamber (Cooling Room)	BKK_EN0167	6-Dec-23	6-Jun-25	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.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert.No.: 24CH1295

Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Hach  
Model : HQ411d  
Serial No. : 200100031163  
ID No. : BKK\_EN0342  
Condition As-Received: Used Item  
Received Date : 16 October 2024  
Calibration Date : 17 October 2024  
Reference : 2410-0548DSC-5  
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  
certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

( ) Unnopphol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai

Issue Date : 21 October 2024

**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.



Cert.No.: 24CH1295

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)Ref. Standard Thermometer	2188080	130RC044	24I1022	16 Sep 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
: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	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

**Calibration Results**

**Function : pH Measurement**

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

<u>Unit Under Calibration</u>	<u>Standard pH Buffer Solution</u>	<u>Actual pH Reading</u>	<u>Actual mV Reading (mV)</u>	<u>Uncertainty of pH Measurement (±)</u>	<u>Coverage factor k</u>
pH Electrode S/N.: 230473042902	4.008	4.028	174.6	0.0044	2.00
	6.999	7.014	1.4	0.0084	2.05
	10.010	10.018	-172.8	0.0066	2.00

**Remark** - Can not connect the BNC because the plug does not match with the socket.



Cert.No.: 24CH1295

Page.: 3 of 3

### Calibration Results

#### Function : Temperature Measurement

#### **( \* ) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : PHC281

- Serial No. : 230473042902

Dimension of probe

- Length : 103 mm.

- Diameter : 12 mm.

- Immersion Depth : 90 mm.

Calibration Point ( °C )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty of measurement ( ± °C )	Coverage factor <i>k</i>
25.0	25.002	25.0	-0.002	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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## Certificate of Calibration

Cert.No.: 24CG952

Page.: 1 of 2

Equipment :	Burette
Capacity :	50 mL
Serial No. :	-
ID. No. :	BKK_EN0171
Manufacturer :	Witeg
Made in :	Germany
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand
Ambient Temperature :	(20 ± 2.5) °C
Relative Humidity :	(50 ± 10) %
Barometric Pressure :	760 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Natcha Chayingcheiw

Approved by :

Approved Signatory

- ( ) Unnopphol Harachai  
(✓) Srisuda Khamtha  
( ) Sa-ngeunkam Wongsak

Issue Date :

27 February 2024

**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.



**Equipment :** Burette  
**Received Date :** 23 February 2024  
**Condition As-Received :** New Item  
**Calibration Date :** 27 February 2024  
**Reference :** 2402-0757DSC-1

**Cert.No.:** 24CG952

**Page.:** 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID. No.</u>	<u>Certificate No.</u>	<u>Traceability</u>	<u>Due date</u>
1) Balance	XP205DR	1126143764	140RC004	23MM538	TPA	15 Sep 2024
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	23H1275	TPA	09 June 2024
3) Thermometer	-	0834181	140EC005	23I948	TPA	10 Aug 2024

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.  
3. True value is converted to true volume at the standard temperature of 20 °C

**Calibration result :**

<b>Nominal capacity ( mL )</b>	<b>Reading ( mL )</b>	<b>Uncertainty ( ± mL )</b>	<b>k Factor</b>
50	50.0032	0.010	2.00

**Remark** mL = cm<sup>3</sup>

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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# Metrology

SCI ECO Services Company Limited

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

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

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



Certificate No. T232160

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Cooling Room )

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK\_EN0167

ID No. : T2463A3

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


104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

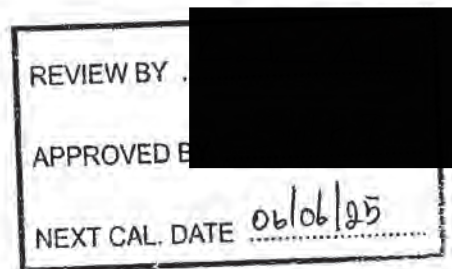
Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat ( Technician )

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 JAN 2024



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 Metrology.



Certificate No. T232160

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Cooling Room )  
**Date of Calibration** : 6 December 2023  
**Environment** : Temperature : 23.4-24.9 °C  
Line Voltage : 221.4-230.2 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001) and AS2853-1986 ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T230773	10 April 2024
TC	TYPE T	TN171-TN180	T230773	10 April 2024
DATA LOGGER	34970A	T149	T230773	10 April 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 3 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

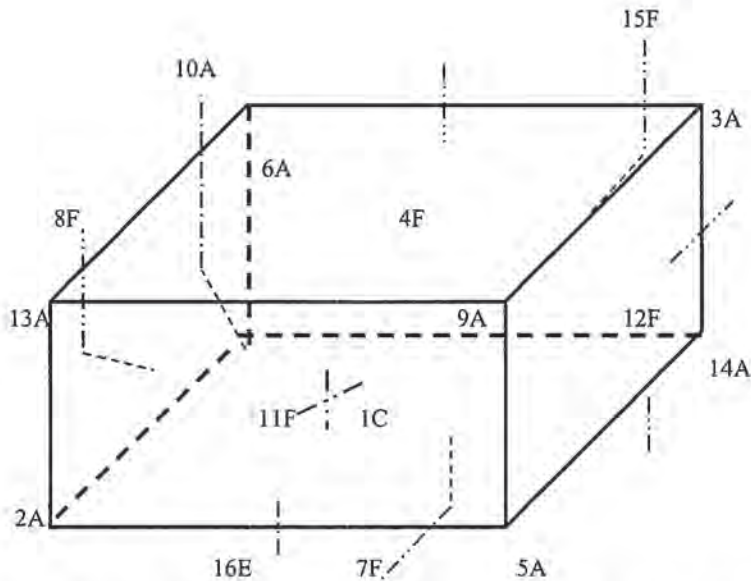
5. Adjustment :

( X ) without adjustment

( ) after adjustment

Approved By. 

## Calibration Report



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

1C	=	TN161
2A	=	TN162
3A	=	TN163
4F	=	TN164
5A	=	TN165
6A	=	TN166
7F	=	TN167
8F	=	TN168
9A	=	TN169
10A	=	TN170
11F	=	TN171

12F	=	TN172
13A	=	TN173
14A	=	TN174
15F	=	TN175
16E	=	TN176

Approved By. [REDACTED]

Certificate No. T232160

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170	TN171	TN172
3.0	2.83	3.34	2.95	3.46	3.45	3.76	3.25	3.46	3.39	3.50	3.58	3.42
	TN173	TN174	TN175	TN176								
	3.33	3.39	3.15	3.43								

Chamber ( Cooling Room )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
3.0	2.8 , 4.1	3.5	3.36	1.10	2.00	1.90	2.09

The calibration result apply only the above calibrated item.

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

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

Approved By. 





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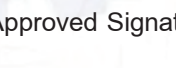
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## Certificate of Testing

**Cert.No.:** 24TW139

**Page.:** 1 of 2

<b>Equipment :</b>	DO Meter	REVIEW BY .....
<b>Manufacturer :</b>	Mettler Toledo	
<b>Model :</b>	Seven2Go Pro S9	
<b>Serial No. :</b>	B915498158	APPROVED BY .....
<b>ID No. :</b>	BKK_LG0038	
<b>Received Date :</b>	28 June 2024	NEXT CAL DATE.....01/07/25.....
<b>Test Date :</b>	01 July 2024	
<b>Reference :</b>	2406-0970DSC-1	
<b>Submitted by :</b>	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand	
<b>Laboratory Condition :</b>	Temperature ( 25 ± 5 ) °C Humidity ( 50 ± 20 ) %	
<b>Test Procedure :</b>	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method	
<b>Tested by :</b>	Walalak Sirithean 	
<b>Approved by :</b>	 Approved Signatory	
( ) Unnopphol Harachai		
( ) Ponpan Paipim		
(✓) Saithip Meangmai		

**Issue Date :**

3 July 2024



**Cert.No.:** 24TW139

**Page.:** 2 of 2

**Condition of this result of calibration**

**1. Reference Standard Instruments :**

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	23MM405	16 July 2024

**2. Standard Material :-**

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :**      **Dissolved Oxygen Meter Adjustment With Air 100 %**

**Dissolved Oxygen Probe No.:**      1030465

<b>Titration Method (Azide Modification Method) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
8.18	8.20	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study  
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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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## Certificate of Calibration

Cert. No.: 24LM109

Page.: 1 of 2

**Equipment :** DO Meter with Sensor

**Manufacturer :** Mettler Toledo

**Model :** Seven2Go Pro S9

**Serial No. :** B915498158

**ID No. :** BKK\_LG0038

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Location :** TPA On Site Calibration Laboratory

**Received Order :** 28 June 2024

**Calibrated Date :** 02 July 2024

**Ambient Temperature :** ( 26 ± 10 ) °C

**Relative Humidity :** ( 50 ± 30 ) %

**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

- ( ) Ponpan Paipim  
( ✓ ) Suwit Imjai  
( ) Kunchit Promprat

**Issue Date :** 03 July 2024

**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.





**Equipment :** DO Meter with Sensor

**Condition As-Received :** Used Item

**Reference :** 2406-0970DSC-2

**Cert. No.:** 24LM109

**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>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	2311216	TPA	11 Oct 2024

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.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 1030465

<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>
20.0	90	20.003	20.1	0.097	0.16	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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Sartorius (Thailand) Co., Ltd.  
129 Rama 9 Road, Huaykwang, Bangkok 10310  
Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com



NSC-TIS-TIS 17025  
CALIBRATION 0426

SARTORIUS

REVIEW BY

APPROVED BY

NEXT CAL DATE.....02/08/25

# Certificate

## of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0027405555  
ID No. : BKK\_EN0003  
Manufacturer : Sartorius

Certificate No. : 24BCI0270  
Issued Date : Monday, August 05, 2024  
Reference No. : 240942  
Page No. : 1 of 2

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

Calibrated Place : Lab Room

Calibrated By : Mr.Chonchai Inthana  
Calibration Date : Friday, August 02, 2024

Calibration  
Procedure No. : This calibration was conducted by  
Using in-house calibration procedure number (WI-003)  
Based on UKAS LAB 14 : 2019

Metrological data :

Capacity : 220 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 23.0 °C ± 5.0 °C  
Humidity : 55.0 % RH ± 10.0 % RH  
Pressure :                      ±                     

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

### Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended 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 calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

### Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set 1mg - 5000g E2,YCS011-522-00	TCS	M23081975	23-Aug-2025
Testo 174 H	Thermo-Hygrometer , Testo 174H	ENTECH	H/T 661303,H661140	12-Nov-2024

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr.chonchai Intrhana(Technical Manager)

SOP FM 33 03 February 2022

S  
T  
A  
M  
P



**Sartorius (Thailand) Co., Ltd.**

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

**SARTORIUS**

# Certificate of Calibration

Model Number : MSE224S-100-DU

Description : Analytical Balance

Serial Number : 0027405555

ID No. : BKK\_EN0003

Manufacturer : Sartorius

Certificate No. : 24BCI0270

Issued Date : Monday, August 05, 2024

Reference No. : 240942

Page No. : 2 of 2


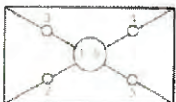
**Calibration Results : Without Adjustment****Repeatability**

The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	200.0000
20 g	20.0000	199.9999
Tolerance	20.0001	200.0000
0.0001 g	20.0000	200.0000
	20.0000	200.0000
Nominal Value : (High Load)	20.0000	200.0000
200 g	20.0001	200.0001
Tolerance	20.0000	200.0000
0.0001 g	20.0000	199.9999
	20.0000	200.0000
Standard Deviation	0.00004	0.00006

**Eccentricity (Off-center loading error)**

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value :	100	g
Tolerance	0.0004	g
		Difference
		
1	-	
2	0.0000	
3	0.0000	
4	0.0000	
5	0.0001	
6	-	

**Linearity**

The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00015
0.1	0.1000	0.1000	0.0000	0.00015
1	1.0000	1.0000	0.0000	0.00015
2	2.0000	2.0000	0.0000	0.00015
5	5.0000	5.0000	0.0000	0.00015
10	10.0000	10.0000	0.0000	0.00015
20	20.0000	20.0000	0.0000	0.00015
50	50.0000	50.0001	0.0001	0.00016
100	100.0000	100.0001	0.0001	0.00019
200	200.0000	200.0000	0.0000	0.00029

End of Report.





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## Certificate of Calibration

Cert. No.: 24TM1618

Page : 1 of 3

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE29  
Serial No. : L622.0282  
ID No. : BKK\_EN0439

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Location : Organic Preparation Lab

Received Order : 29 October 2024  
Calibration Date : 29 October 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

( ) Ponpan Paipim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Issue Date : 30 October 2024

**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.



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2410-0782OC-4

**Cert. No.:** 24TM1618

**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1 ) Data Acquisition	MY57013711	24LM115	TPA	13 Jul 2025

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.

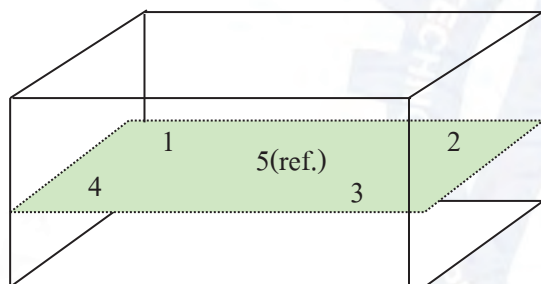
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Heat transfer medium used :** Water

	<u>Environmental</u>		<u>AC Voltage Supply</u>
	( °C )	( %R.H. )	( Volt )
<b>Beginning of Calibration</b>	25	54	222
<b>Finished of Calibration</b>	25	57	226



Front

<u>Position :</u>	<u>Ref. Std. ID No.:</u>
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2410-0782OC-4  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source

**Cert. No.:** 24TM1618

**Page :** 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty  ( ± °C )
			Position					
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	85.133	85.212	85.150	84.983	85.096	0.22

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor <b>k</b>
85.0	0.21	0.13	2

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

**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.

**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.

**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 %.

-o0o-





# Metrology

SCI ECO Services Company Limited

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Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T240904

Page 1 of 3

## Certificate of Calibration

Equipment : Chamber ( Oven )

Manufacturer : Memmert

Model : UF 450

Serial No. : B717.0531

Customer Code : BKK\_EN0273

ID No. : T8042A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250



Customer Location : Laboratory (Oven Room)

Date of Receipt : 08 May 2024

Calibrated By : Preecha Phisassutthikul ( Temperature Calibration Manager )

Approved By :  / Nuafun Sungchum (Metrology Manager)

Date of Issue : 23 MAY 2024

REVIEW BY ..	
APPROVED BY ..	
NEXT CAL. DATE	14/11/25

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 Metrology.

Certificate No. T240904

Page 2 of 3

## Calibration Report

**Equipment** : Chamber ( Oven )  
**Date of Calibration** : 14 May 2024  
**Environment** : Temperature : 26.5-28.1 °C  
Line Voltage : 226.7-229.8 V  
Relative Humidity : 51 - 57 %RH

### Condition of this results of calibration :

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

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	21-(CH1-10)	T231955	17 November 2024
DATA LOGGER	34970A	T121	T231955	17 November 2024

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 104 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

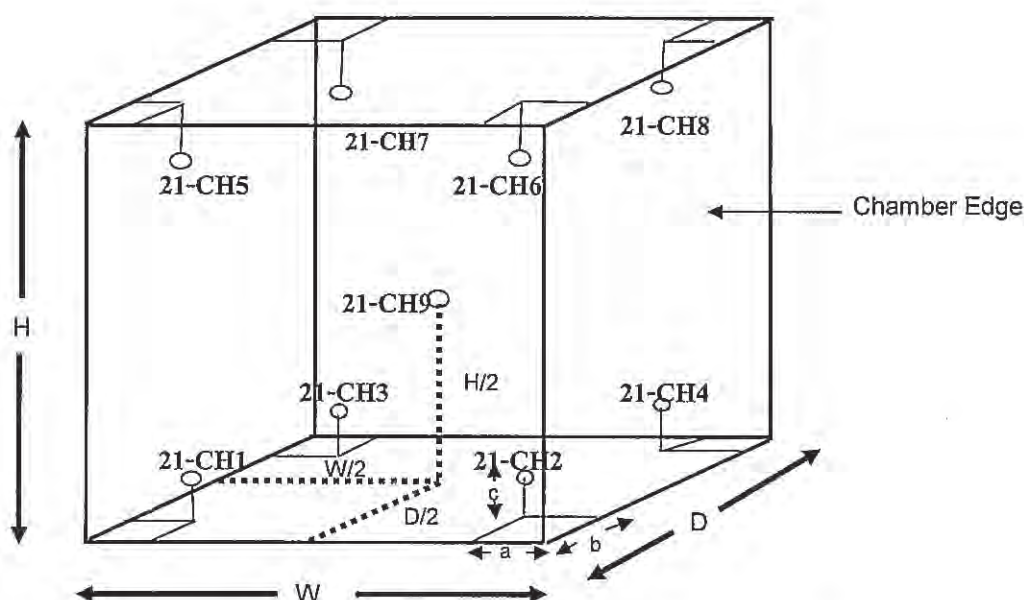
5. Adjustment :

( X ) without adjustment

'( ) after adjustment

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

## Calibration Report



**Remark :**

Internal Dimensions of Chamber : W (Width) = 104 cm. , H(Height)=72 cm. and D(Depth)=60 cm.  
 Size of Installed Standard sensor number 21-CH1 to number 21-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.  
 Size of Installed Standard sensor number 21-CH9 : W/2=104 cm./2 , H/2=72 cm./2 and D/2=60 cm./2

**Measurement Results**

Calibration Point	Average Standard Reading at each position (°C)								
	21-CH1	21-CH2	21-CH3	21-CH4	21-CH5	21-CH6	21-CH7	21-CH8	21-CH9
104	103.4	105.0	103.7	103.6	103.3	104.6	103.3	104.0	103.9
180	179.5	181.1	179.2	179.5	179.0	181.3	179.8	179.9	180.2

Chamber ( Oven )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor <i>k</i>
	Min , Max	Average					
104.0	103.9 , 104	104.0	103.85	0.14	1.27	0.44	2.00
180.0	179.9 , 180.1	180.0	179.94	0.39	2.29	0.76	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

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





## 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 FAX. 0-2719-9484

Cert.No.: 24TW28

Page.: 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5100  
**Serial No. :** 15L103204  
**ID No. :** BKK\_EN0205  
**Received Date :** 01 February 2024  
**Test Date :** 02 February 2024  
**Reference :** 2402-0008DSC-10  
**Submitted by :**

ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Laboratory Condition :**

Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %

**Test Procedure :**

In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

**Tested by :**

Walalak Sirithean

**Approved by :**

Approved Signatory

- (✓) Saithip Meangmai  
( ) Warakorn Lernagatrakul  
( ) Ponpan Paipim

**Issue Date :**

7 February 2024

REVIEW BY ....

APPROVED BY

NEXT CAL DATE.....

02/08/25



**Cert.No.:** 24TW28

**Page.:** 2 of 2

**Condition of this result of calibration**

**1. Reference Standard Instruments :**

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	1124013382	140RC006	23MM18	20 Feb 2024

**2. Standard Material :-**

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :**      **Dissolved Oxygen Meter Adjustment With Air 100 %**

**Dissolved Oxygen Probe No.:** 17A100064

<b>Titration Method (Azide Modification Method)</b> (mg/L)	<b>DO Meter Reading</b> (mg/L)	<b>Standard Deviation</b> (mg/L)
8.18	8.18	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study. 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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**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
**CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES**  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert. No.: 24LM15

Page.: 1 of 2

**Equipment :** DO Meter with Sensor

**Manufacturer :** YSI

**Model :** 5100

**Serial No. :** 15L103204

**ID No. :** BKK\_EN0205

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

**Location :** TPA Chemistry Calibration Laboratory


**Received Order :** 01 February 2024

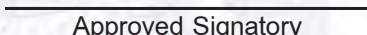
**Calibrated Date :** 02 February 2024

**Ambient Temperature :** (  $26 \pm 10$  ) °C

**Relative Humidity :** (  $50 \pm 30$  ) %

**AC Line Voltage :** (  $220 \pm 22$  ) V

**Calibrated by :** Warakorn Lerngagtrakul  


**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
( ) Ponpan Paipim  
(☒) Suwit Imjai

**Issue Date :** 7 February 2024

**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.





**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2402-0008DSC-13

**Cert. No.:** 24LM15

**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>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Digital Thermometer	2188080	2311216	TPA	11 Oct 2024

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.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 17A100064

<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>
20.0	80	20.003	19.92	-0.083	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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# Metrology

SCI ECO Services Company Limited

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Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360  
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241495

Page 1 of 4

## Certificate of Calibration

Equipment : Chamber ( Incubator )

Manufacturer : MEMMERT

Model : ICP 750

Serial No. : F818.0033

Customer Code : BKK\_EN0272

ID No. : T8041A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab 2

Date of Receipt : 14 August 2024

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By :  / Boonchai Suriyawong ( Assistant Calibration Manager )

Date of Issue : 27 AUG 2024

REVIEW BY ...  ...

APPROVED BY  .....

NEXT CAL DATE..... 22/08/25 .....

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 Metrology.

Certificate No. T241495

Page 2 of 4

## Calibration Report

**Equipment** : Chamber ( Incubator )  
**Date of Calibration** : 22 August 2024 ( Finished Time 11:19 AM )  
**Environment** : Temperature 22.3-23.0 °C  
Line Voltage 222.5-227.5 V

### Condition of this results of test. :

1. This instrument was calibrated by insert 12 standard resistance thermometer into its chamber and test according to WI-T20 ( based on ASTM E145-94 ( Reapproved 2001 ) and AS2853-1986. )

All data show below were final values and the initial data may be obtained upon request.

The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T240709	19 April 2025
RTD	100 ohm	28-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

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

UUC Description :

Time Constant 1 Hour 38 Minute At 20 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

5. Result of test :

( ) without adjustment

( X ) after adjustment

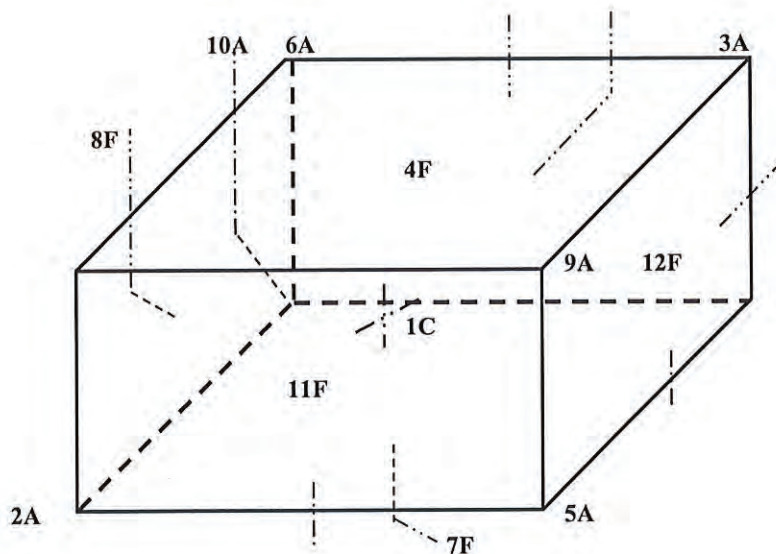
Approved By \_\_\_\_\_



Certificate No. T241495

Page 3 of 4

## Calibration Report



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

1C	=	27-CH1
2A	=	27-CH2
3A	=	27-CH3
4F	=	27-CH4
5A	=	27-CH5
6A	=	27-CH6
7F	=	27-CH7
8F	=	27-CH8
9A	=	27-CH9
10A	=	27-CH10

11F	=	28-CH1
12F	=	28-CH2

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



Certificate No. T241495

Page 4 of 4

## Calibration Report

### Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9	27-CH10
20.0	20.32	20.32	20.29	20.23	20.30	20.34	20.40	20.16	20.34	19.62
	28-CH1	28-CH2								
	19.70	19.65								

Chamber ( Incubator )			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability ( $\pm$ °C)	Uniformity (°C)	Uncertainty ( $\pm$ °C)	Coverage Factor k
	Min , Max	Average					
20.0	19.9 , 20.1	20.0	20.01	0.04	0.19	0.38	2.00

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

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

**Certificate No. T242116****Page 1 of 4****Certificate of Calibration****Equipment** : Hot Block**Manufacturer** : Environmental Express**Model** : B3000-240**Serial No.** : 2021CODW148**Customer Code** : BKK\_EN0370**ID No.** : T2940A5**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

REVIEW BY ..	[REDACTED]
APPROVED BY ..	[REDACTED]
NEXT CAL. DATE	02/01/26

**Customer Location** : Wet Chemistry Lab 2**Date of Receipt** : 25 December 2024**Calibrated By** : Atiphong Rongrat ( Technician )**Approved By** : [REDACTED] / Boonchai Suriyawong (Site Calibration Manager)**Date of Issue** : 27 JAN 2025**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.





# 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. T242116

Page 2 of 4

## Calibration Report

**Equipment** : Hot Block  
**Date of Calibration** : 2 January 2025  
**Environment** : Temperature : 20.1-23.4 °C  
Line Voltage : 222.1-227.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert 29 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

### 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 30 Minute At 150 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( ) without adjustment

( X ) after adjustment

Approved By. 



# Metrological Center

## SCI ECO Services Company Limited

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

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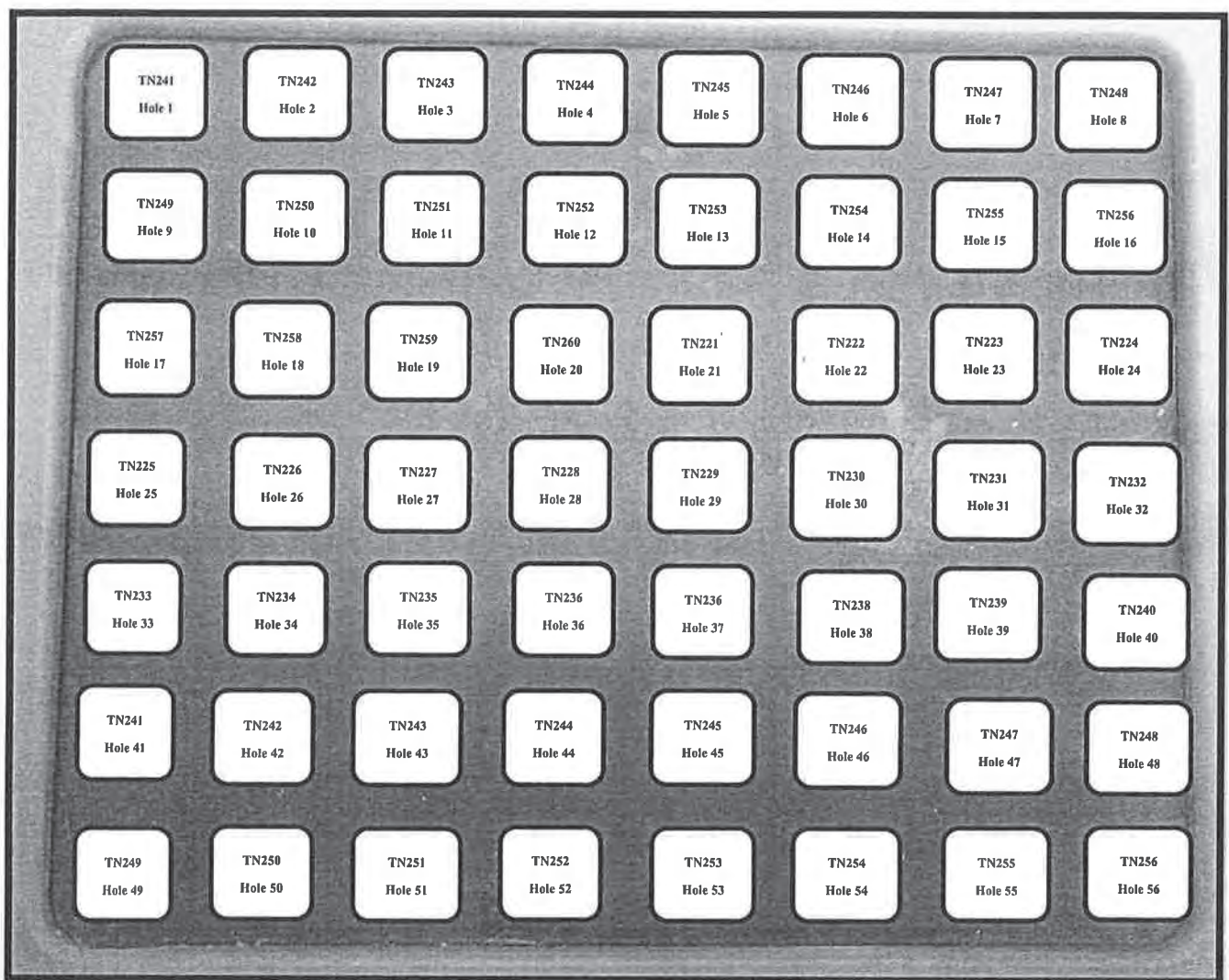
Website : [www.scieco.co.th](http://www.scieco.co.th)

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

Certificate No. T242116

Pa 3 of 4

## Calibration Report



FRONT CONTROL

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



Certificate No. T242116

Pag 4 of 4

## Calibration Report

### Measurement Results

		Average Standard Reading at each position (°C)									
		TN241 Hole 1	TN242 Hole 2	TN243 Hole 3	TN244 Hole 4	TN245 Hole 5	TN246 Hole 6	TN247 Hole 7	TN248 Hole 8	TN249 Hole 9	TN250 Hole 10
CAL POINT	Max	149.78	150.72	150.64	150.94	150.79	151.11	149.77	150.20	150.18	150.28
	Min	149.57	150.52	150.47	150.79	150.65	150.99	149.59	150.06	150.03	150.15
	Average	150.15	150.71	150.71	150.58	150.40	150.52	150.76	150.57	150.49	150.21
		TN251 Hole 11	TN252 Hole 12	TN253 Hole 13	TN254 Hole 14	TN255 Hole 15	TN256 Hole 16	TN257 Hole 17	TN258 Hole 18	TN259 Hole 19	TN260 Hole 20
150	Max	150.32	150.22	150.60	150.51	150.87	150.45	150.37	149.49	150.18	150.33
	Min	150.19	150.04	150.46	150.40	150.74	150.30	150.26	149.33	150.03	150.18
	Average	150.25	150.13	150.53	150.46	150.80	150.37	150.31	149.41	150.11	150.26
		TN221 Hole 21	TN222 Hole 22	TN223 Hole 23	TN224 Hole 24	TN225 Hole 25	TN226 Hole 26	TN227 Hole 27	TN228 Hole 28	TN229 Hole 29	TN230 Hole 30
	Max	150.49	150.86	149.10	149.64	149.11	149.69	149.75	149.82	150.16	150.34
	Min	150.24	150.63	148.90	149.43	148.94	149.54	149.61	149.69	150.07	150.24
	Average	150.36	150.74	149.00	149.53	149.03	149.62	149.68	149.76	150.11	150.29
		TN231 Hole 31	TN232 Hole 32	TN233 Hole 33	TN234 Hole 34	TN235 Hole 35	TN236 Hole 36	TN236 Hole 37	TN238 Hole 38	TN239 Hole 39	TN240 Hole 40
	Max	149.03	149.54	149.50	149.49	150.85	150.73	150.02	149.84	150.12	150.09
	Min	148.93	149.43	149.36	150.72	150.72	150.62	149.94	149.78	150.01	149.98
	Average	148.98	149.49	149.43	150.10	150.78	150.67	149.98	149.81	150.06	150.03
		TN241 Hole 41	TN242 Hole 42	TN243 Hole 43	TN244 Hole 44	TN245 Hole 45	TN246 Hole 46	TN247 Hole 47	TN248 Hole 48	TN249 Hole 49	TN250 Hole 50
	Max	150.86	150.14	150.35	150.97	151.03	151.09	149.81	150.16	149.49	149.51
	Min	150.80	150.00	150.19	150.81	150.85	150.96	149.69	150.02	149.35	149.35
	Average	150.83	150.07	150.27	150.89	150.94	151.02	149.75	150.09	149.42	149.43
		TN251 Hole 51	TN252 Hole 52	TN253 Hole 53	TN254 Hole 54	TN255 Hole 55	TN256 Hole 56				
	Max	149.71	150.32	150.59	149.42	149.87	149.40				
	Min	149.56	150.17	150.49	149.31	149.74	149.29				
	Average	149.64	150.25	150.54	149.37	149.81	149.35				

Hot Block			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min , Max	Average		
148.0	147.9 , 148.1	148.0	0.13	0.84

The calibration result apply only the above calibrated item.

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

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

Approved By:

FM-L13 I08/30-05-57



# Certificate of Calibration

Number of Page(s) 1 of 3

**Certificate No.** BSCC-UV-374/24  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11454908533 CD  
**ID No.** BKK\_EN0018  
**Date of receipt** 13 September 2024  
**Date of calibration** 13 September 2024  
**Date of issue** 13 SEP 2024

REVIEW BY	.....
APPROVED BY	.....
NEXT CAL. DATE	13/9/2025

**Customer name** ALS Laboratory Group (Thailand) Co., Ltd.

**Address** 104 Soi Phattanakan 40, Phattanakan Road, Phattanakan, Suan Luang, Bangkok 10250

**Temperature** (25.3 - 26.7) °C (On site)  
**Humidity** (50.4 - 55.9) %RH (On site)

**Equipment condition** Good Operation

**Calibration Location** Organic Preparation Lab

**Calibration Procedure** In-house method WI-UV-702-01 based on ASTM E275-01

**Traceability** Wavelength Accuracy is traceable to certificate No. 106372 and 106371  
Photometric Accuracy is traceable to certificate No. 106364 and 111398  
Stray Light is traceable to certificate No. 106377  
The above certificate are traceable to SI unit through Sarna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by** Mr.Wanchana Janloey

Approved by



**Mr.Sonthi Temboonsakdi**  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced  
except in full, without written approval of the Bara Scientific Co., Ltd.

# Certificate of Calibration

Certificate No.

**BSCC-UV-374/24**

Number of Page(s)

2 of 3

## Calibration Results:

### 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty ( $\pm$ nm)
241.70	241.55	-0.15	0.18
334.02	333.85	-0.17	0.18
418.53	418.57	0.04	0.18
572.99	572.97	-0.02	0.18
879.41	879.17	-0.24	0.18

### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm$ A)
235	0.0000	0.0000	0.0000	0.0075
	0.7171	0.7169	-0.0002	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8354	0.8345	-0.0009	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2786	0.2781	-0.0005	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6199	0.6194	-0.0005	0.0075

\*CNR = Customer not request

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# Certificate of Calibration

Certificate No.

BSCC-UV-374/24

Number of Page(s)

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## Calibration Results:

### 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm A$ )
420.0	0.0000	0.0000	0.0000	0.0042
	0.5761	0.5765	0.0004	0.0042
	0.7119	0.7105	-0.0014	0.0042
	1.0189	1.0174	-0.0015	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5610	0.5613	0.0003	0.0042
	0.7001	0.6984	-0.0017	0.0042
	1.0026	1.0011	-0.0015	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5235	0.5232	-0.0003	0.0042
	0.6614	0.6598	-0.0016	0.0042
	0.9456	0.9444	-0.0012	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5249	0.5245	-0.0004	0.0042
	0.6975	0.6956	-0.0019	0.0042
	1.0009	0.9994	-0.0015	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5590	0.5586	-0.0004	0.0042
	0.7725	0.7708	-0.0017	0.0042
	1.1125	1.1114	-0.0011	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5666	0.5666	0.0000	0.0042
	0.7620	0.7604	-0.0016	0.0042
	1.0982	1.0971	-0.0011	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.85 $\pm$ 0.11nm	199.58	0.9520	2.0217

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

\*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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## Agilent Technologies

Agilent Technologies (Thailand) Limited  
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Tel. +662 637 6363  
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Email: [ccc-smt@agilent.com](mailto:ccc-smt@agilent.com)  
Website: [www.agilent.com/chem](http://www.agilent.com/chem)

### Customer Contact:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

[chanattagarn.imchom@alsglobal.com](mailto:chanattagarn.imchom@alsglobal.com)  
227158760

### Invoice To:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Delivery Site:

ALS Laboratory Group (Thailand) Co  
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd  
Khwaeng Phatthanakan Khet Suan

### Location:

Room  
Bldg  
Lab  
Dept

## SERVICE REPORT

<b>Customer Purchase Order Number:</b>	<b>Customer Number:</b> 70371013
<b>Service Request:</b>	<b>Service Request Date:</b>
<b>Service Order:</b> 6006676060	<b>Service Confirmation:</b> 6905905441

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	31/4/2026

### Direct Inquiries to:

Contact Name: Customer Contact Center  
Contact E-mail: [ccc-smt@agilent.com](mailto:ccc-smt@agilent.com)  
Contact Telephone: +662 637 6363  
Contact Fax: +662 632 4334

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Tax ID : 0105542068218

Citibank N.A. Bangkok Branch  
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Sub-district, Wattana District, Bangkok 10110 Thailand  
Acc. No: 012-4452-007,  
THB:Krung Thai Bank PCL  
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330  
Thailand

ORIGINAL

**Service Confirmation Number:** 6905905441

**Service Confirmation Date:** 08.10.2024

**Service Instrument:**

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM-7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6106T Chiller	2U15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

**Service Items:**

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	04.10.2024	04.10.2024
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

**Additional Information:**

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

**Service Information:**

**Problem Description:**

\*WU-EQQ-IM-7900-5001253655

**Service Provided:**

Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability.  
I calibrate the instrument No BKK\_EL0043 test all pass.

**Service Overview Code:**

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

**Reported Hours:**

7.0

**Travel Hours:**

2.0

**Customer Field Service**

**Representative Name:**

Panthep Kurasathain

**Customer Field Service**

**Representative Signature:**



**Date:**

08 Oct 2024

**Customer Name:**

Supakwan Mak

**Customer Signature:**



**Date:**

08 Oct 2024

**Additional Comments:**



Certificate No. T250355

Page 1 of 6

**Certificate of Calibration**

**Equipment** : HEATING BLOCK

**Manufacturer** : Environmental Express

**Model** : SC 196

**Serial No.** : 6974CECW3285

**Customer Code** : BKK\_EL0054

**ID No.** : T5306A3

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

**Customer Location** : Acid Digestion Lab

**Date of Receipt** : 26 February 2025

**Calibrated By** : Atiphong Rongrat ( Technician )

**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)

**Date of Issue** : 17 MAR 2025



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.



# 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. T250355

Page 2 of 6

## Calibration Report

Equipment : HEATING BLOCK  
Date of Calibration : 4 March 2025  
Environment : Temperature : 24.4-24.9 °C  
Line Voltage : 221.6-226.3 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

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

### 2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

### 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 40 Minute At 95 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available

### 5. Adjustment :

( ) without adjustment

( X ) after adjustment

Approved By.





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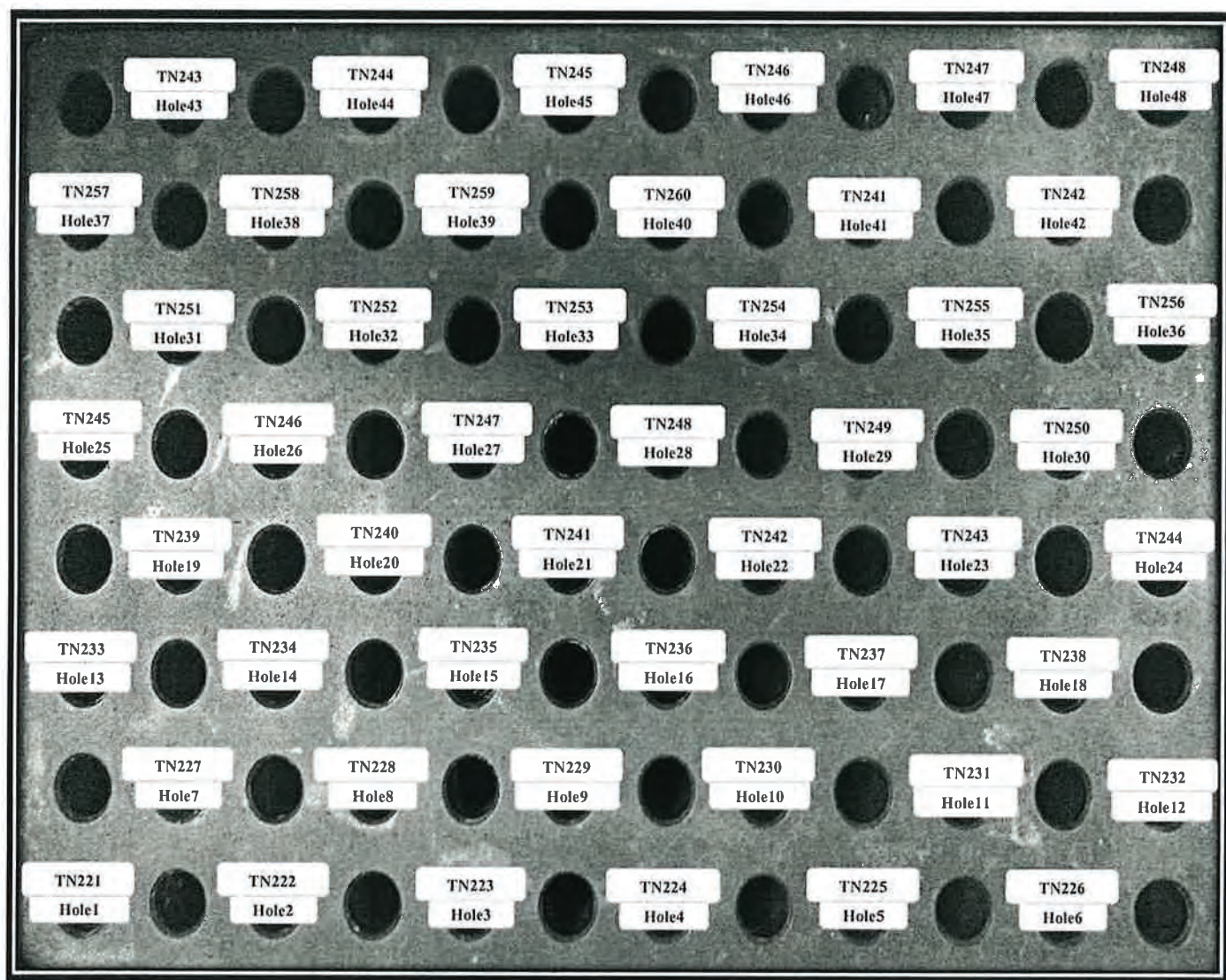
Website : [www.scieco.co.th](http://www.scieco.co.th)

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

Certificate No. T250355

Page 3 of 6

## Calibration Report



### FRONT CONTROL

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



Certificate No. T250355

Page 4 of 6

## Calibration Report

### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
<b>R1 Hole1-Hole6</b>		<b>TN221</b>	<b>TN222</b>	<b>TN223</b>	<b>TN224</b>	<b>TN225</b>	<b>TN226</b>
<b>CAL POINT</b>	Max	94.85	95.37	95.03	95.25	95.52	94.75
<b>95</b>	Min	94.17	94.66	94.38	94.63	94.87	94.12
	Average	94.51	95.02	94.70	94.94	95.20	94.43
<b>R2 Hole7-Hole12</b>		<b>TN227</b>	<b>TN228</b>	<b>TN229</b>	<b>TN230</b>	<b>TN231</b>	<b>TN232</b>
	Max	94.71	94.56	94.79	95.32	95.44	95.06
	Min	94.05	93.88	94.10	94.65	94.90	94.65
	Average	94.38	94.22	94.44	94.99	95.17	94.85
<b>R3 Hole13-Hole18</b>		<b>TN233</b>	<b>TN234</b>	<b>TN235</b>	<b>TN236</b>	<b>TN237</b>	<b>TN238</b>
	Max	95.26	95.43	95.40	95.71	95.41	95.06
	Min	94.54	94.64	94.71	95.10	94.86	94.42
	Average	94.90	95.03	95.06	95.41	95.13	94.74
<b>R4 Hole19-Hole24</b>		<b>TN239</b>	<b>TN240</b>	<b>TN241</b>	<b>TN242</b>	<b>TN243</b>	<b>TN244</b>
	Max	95.13	95.06	95.68	96.16	95.35	95.80
	Min	94.39	94.43	94.86	95.51	94.88	95.12
	Average	94.76	94.75	95.27	95.83	95.12	95.46
<b>R5 Hole25-Hole30</b>		<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>	<b>TN249</b>	<b>TN250</b>
	Max	94.95	95.81	95.39	95.82	95.66	95.66
	Min	94.47	95.03	94.67	94.99	94.84	94.87
	Average	94.71	95.42	95.03	95.41	95.25	95.27
<b>R6 Hole31-Hole36</b>		<b>TN251</b>	<b>TN252</b>	<b>TN253</b>	<b>TN254</b>	<b>TN255</b>	<b>TN256</b>
	Max	96.07	95.34	96.28	95.39	94.95	95.12
	Min	95.28	94.55	95.51	94.62	94.13	94.35
	Average	95.67	94.95	95.90	95.00	94.54	94.73
<b>R7 Hole37-Hole42</b>		<b>TN257</b>	<b>TN258</b>	<b>TN259</b>	<b>TN260</b>	<b>TN241</b>	<b>TN242</b>
	Max	95.15	95.63	96.11	95.09	95.34	95.51
	Min	94.38	94.88	95.32	94.28	94.54	94.72
	Average	94.76	95.25	95.71	94.69	94.94	95.11
<b>R8 Hole43-Hole48</b>		<b>TN243</b>	<b>TN244</b>	<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>
	Max	95.84	95.87	95.44	95.72	95.65	95.75
	Min	95.06	95.10	94.60	94.95	94.87	94.98
	Average	95.45	95.48	95.02	95.34	95.26	95.36

Approved By.

## Calibration Report

### Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
<b>R1 Hole1-Hole6</b>		<b>TN221</b>	<b>TN222</b>	<b>TN223</b>	<b>TN224</b>	<b>TN225</b>	<b>TN226</b>
<b>CAL POINT</b>	Max	104.48	104.40	104.60	105.27	105.24	105.19
<b>105</b>	Min	104.15	104.02	104.25	104.94	104.91	104.93
	Average	104.32	104.21	104.42	105.10	105.08	105.06
<b>R2 Hole7-Hole12</b>		<b>TN227</b>	<b>TN228</b>	<b>TN229</b>	<b>TN230</b>	<b>TN231</b>	<b>TN232</b>
	Max	105.20	105.45	105.58	105.96	105.81	106.03
	Min	104.92	105.14	105.29	105.64	105.53	105.79
	Average	105.06	105.29	105.43	105.80	105.67	105.91
<b>R3 Hole13-Hole18</b>		<b>TN233</b>	<b>TN234</b>	<b>TN235</b>	<b>TN236</b>	<b>TN237</b>	<b>TN238</b>
	Max	106.09	106.14	105.83	106.25	105.97	105.88
	Min	105.80	105.89	105.57	106.00	105.69	105.65
	Average	105.94	106.01	105.70	106.13	105.83	105.77
<b>R4 Hole19-Hole24</b>		<b>TN239</b>	<b>TN240</b>	<b>TN241</b>	<b>TN242</b>	<b>TN243</b>	<b>TN244</b>
	Max	105.87	105.75	105.30	105.07	105.22	105.66
	Min	105.62	105.52	105.13	104.90	105.05	105.49
	Average	105.74	105.63	105.21	104.98	105.14	105.57
<b>R5 Hole25-Hole30</b>		<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>	<b>TN249</b>	<b>TN250</b>
	Max	105.62	105.54	105.52	105.75	105.97	105.69
	Min	105.45	105.35	105.31	105.57	105.81	105.49
	Average	105.53	105.44	105.41	105.66	105.89	105.59
<b>R6 Hole31-Hole36</b>		<b>TN251</b>	<b>TN252</b>	<b>TN253</b>	<b>TN254</b>	<b>TN255</b>	<b>TN256</b>
	Max	106.19	106.34	106.47	105.96	105.76	105.35
	Min	106.02	106.16	106.31	105.77	105.58	105.18
	Average	106.10	106.25	106.39	105.87	105.67	105.27
<b>R7 Hole37-Hole42</b>		<b>TN257</b>	<b>TN258</b>	<b>TN259</b>	<b>TN260</b>	<b>TN241</b>	<b>TN242</b>
	Max	106.21	105.59	105.45	105.36	106.08	106.09
	Min	106.04	105.42	105.28	105.20	105.90	105.92
	Average	106.12	105.51	105.37	105.28	105.99	106.00
<b>R8 Hole43-Hole48</b>		<b>TN243</b>	<b>TN244</b>	<b>TN245</b>	<b>TN246</b>	<b>TN247</b>	<b>TN248</b>
	Max	106.54	106.33	105.78	105.38	105.42	105.69
	Min	106.38	106.16	105.60	105.20	105.25	105.52
	Average	106.46	106.25	105.69	105.29	105.33	105.61

Approved By. [REDACTED]



# Metrological Center

SCI ECO Services Company Limited

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Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 6 of 6

## Calibration Report

### Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability ( $\pm$ °C)	Uncertainty ( $\pm$ °C)
	Min , Max	Average		
102.0	-	102.0	0.43	0.83
107.0	-	107.0	0.20	0.70

\* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

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

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

