

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ

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_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	BOD	DO Meter	BKK_EN0017	24-May-22	24-Nov-23	18
Water Lab	BOD	Incubator	BKK_EN0305	5-Apr-23	5-Apr-24	18
Water Lab	COD	Hot Block	BKK_EN0222	1-Mar-23	1-Mar-24	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12
Water Lab	Lead	ICP-MS	BKK_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	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.: 22CH1222

Page.: 1 of 2

Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	Mettler Toledo
Model :	Seven Compact S220
Serial No. :	B520948426
ID No. :	BKK_EN0072
Condition As-Received:	Used Item
Received Date :	09 September 2022
Calibration Date :	12 September 2022
Reference :	2209-0312DSC-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)

REVIEW BY	Sinluk P.
APPROVED BY	KL AL
NEXT CAL. DATE	12/03/24

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Malee

Approved Signatory

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

Issue Date : 15 September 2022

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.: 22CH1222

Page.: 2 of 2

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	22E2769	24 Aug 2023

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	823320	20 June 2024
pH 6.985	CPA chem	794122	14 Feb 2023
pH 10.008	CPA chem	823323	20 June 2023

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 <i>k</i>
	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	0.0	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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 <i>k</i>
pH Electrode S/N.: PCE-86-EX1001	4.008	3.999	153.9	0.0055	2.09
	6.985	7.017	-13.7	0.0084	2.00
	10.008	9.996	-179.0	0.0078	2.06

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-

Mahu.

a 1126274



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.: 22CG3154

Page.: 1 of 2

Certificate of Calibration

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 :	759 mmHg
Calibration Procedure :	ASTM E 542 - 01
Calibrated by :	Panward Pramklam

REVIEW BY	<i>Sin'luk P.</i>
APPROVED BY	<i>KLAL</i>
NEXT CAL. DATE	<i>29/03/2024</i>

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
() Malee Butkruea
(☒) Ponpan Paipim
() Srisuda Khamtha

Issue Date :

31 August 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 0044607



Equipment : Burette
Received Date : 26 August 2022
Condition As-Received : Used Item
Calibration Date : 30 August 2022
Reference : 2208-0918DSC-2

Cert.No.: 22CG3154

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	AE200S	N03679	140RC001	21MM429	NIMT	22 Sep 2022
2) Thermo-Hygrograph	THDX-CE	00016540	140EC001	22H1243	NIST,NIMT	09 June 2023
3) Thermometer	-	1594592	140EC010	22I181	NIMT	10 Feb 2023

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 :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9959	0.010	2.00

Remark mL = cm³

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-

a 1123908



Metrological Center

SCI ECO Services Company Limited

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

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

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

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th



Certificate No. T221644

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold 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


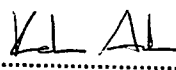
Customer Location : Environmental Laboratory

Date of Receipt : 27 June 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 04 JUL 2022

REVIEW BY	
APPROVED BY	
NEXT CAL. DATE	30/12/23

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. T221644

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 30 June - 1 July 2022
Environment : Temperature : 18.9-23.7 °C
Line Voltage : 222.9-226.5 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 (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	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 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 3 Hour - Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

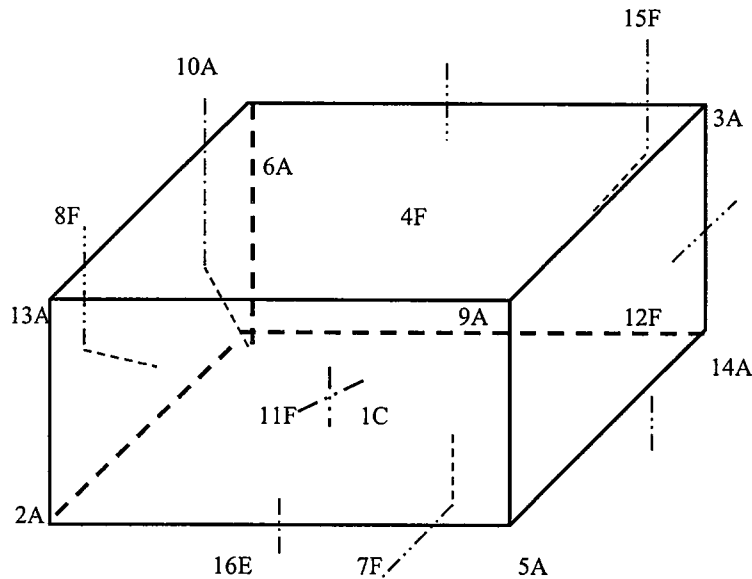
(X) after adjustment

Approved By. 

Certificate No. T221644

Page 3 of 4

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. 

Certificate No. T221644

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Calibration Report

Measurement Results:

Average Standard Reading at each position (°C)										
Calibration Point	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	2.71	2.82	2.75	2.89	2.95	3.68	3.02	2.96	3.03	2.85
	TN171	TN172	TN173	TN174	TN175	TN176				
	2.97	3.02	2.89	3.04	2.97	3.33				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage
	Min , Max	Average					Factor <i>k</i>
3.0	2.9 , 4.0	3.2	2.99	1.05	1.30	1.66	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. 

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

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



NSC-TISI-TIS 17025

CALIBRATION 0426

SARTORIUS

Certificate

of Calibration

REVIEW BY	<u>Sirilut P.</u>
APPROVED BY	<u>LL AL</u>
NEXT CAL. DATE	<u>8/2/24</u>

Model Number : MSE224S-100-DUDescription : Analytical BalanceSerial Number : 26207042ID No. : BKK_EN0002Manufacturer : SartoriusCertificate No. : 23BCI0072Issued Date : Monday, February 13, 2023Reference No. : 203245Page No. : 1 of 2Customer Name : ALS Laboratory Group (Thailand)Co., Ltd.104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250.Calibrated Place : Balance RoomCalibrated By : Mr. Chonchai InthanaCalibration Date : Wednesday, February 08, 2023**Calibration**Procedure No. : This calibration was conducted byUsing 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 : 23.2 °C ± 5.0 °CHumidity : 60.0 % RH ± 10.0 % RHPressure : — ± —**Reasons for calibration**☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ MaintenanceEquipment 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	SPC-RT	C02212565	14-Sep-2023
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	DKSH	C19220444	5-Sep-2023

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.

SOP FM 33 03 February 2022

Choi
Mr.Chonchai Inthana(Technical Manager)

S
T
A
M
P

Certificate of Calibration

Model Number : MSE224S-100-DU
 Description : Analytical Balance
 Serial Number : 26207042
 ID No. : BKK_EN0002
 Manufacturer : Sartorius

Certificate No. : 23BCI0072
 Issued Date : Monday, February 13, 2023
 Reference No. : 203245
 Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

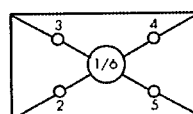
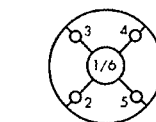
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

Nominal Value : (Low Load)	20.0000	200.0000
20 g	20.0000	199.9999
Tolerance	20.0000	200.0000
0.0001 g	20.0000	199.9999
	20.0001	200.0000
	20.0000	200.0000
Nominal Value : (High Load)	20.0000	199.9999
200 g	20.0000	199.9999
Tolerance	20.0000	200.0000
0.0001 g	20.0000	199.9999
	20.0001	199.9999
Standard Deviation	0.00004	0.00005

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 : 50 g
 Tolerance 0.0004 g



Difference	
1	—
2	-0.0001
3	0.0000
4	0.0001
5	0.0000
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	0.00014
0.1	0.1000	0.1000	0.0000	0.00014
1	1.0000	1.0000	0.0000	0.00014
2	2.0000	2.0000	0.0000	0.00014
5	5.0000	5.0000	0.0000	0.00014
10	10.0000	10.0000	0.0000	0.00014
20	20.0000	20.0000	0.0000	0.00014
50	50.0000	50.0000	0.0000	0.00015
100	100.0000	100.0000	0.0000	0.00019
200	200.0000	199.9999	-0.0001	0.00030

End of Report.



Metrological Center

SCI ECO Services Company Limited

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

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th



Certificate No. T220139

Page 1 of 3

Certificate of Calibration

Equipment : Liquid Bath (Water)

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK_EN0148

ID No. : T6455A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

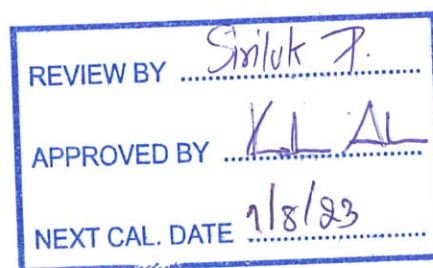
Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 26 January 2022

Calibrated By : Watcharapon Sangtong (Technician)

Approved By :  / Sujjar Naknakred (Site Calibration Manager)

Date of Issue : 08 FEB 2022



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. T220139

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Calibration Report

Equipment : Liquid Bath (Water)
Date of Calibration : 31 January 2022
Environment : Temperature : 22.4-23.9 °C
Line Voltage : 221.4-225.4 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)).

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	M34 (CH1-CH5)	T210115	2 February 2022
DATA LOGGER	34970A	T47	T210115	2 February 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 1 Hour - Minute At 60 °C

5. Adjustment :

(X) without adjustment

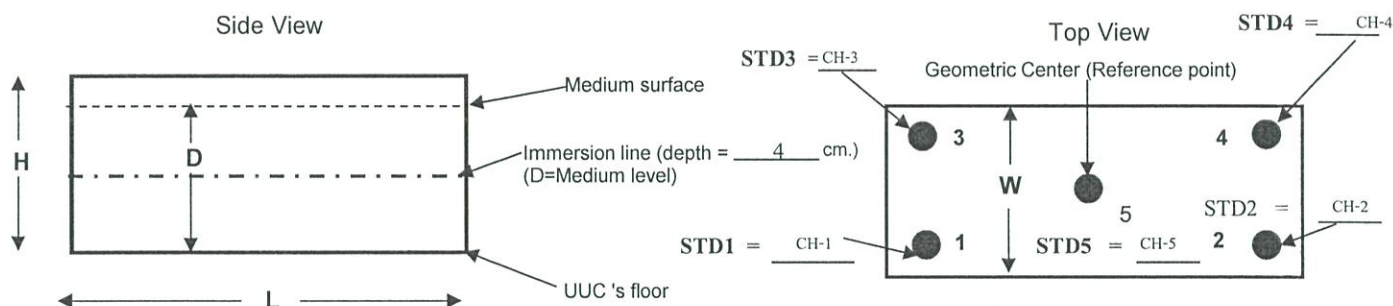
() after adjustment

Approved By. 

Certificate No. T220139

Page 3 of 3

Calibration Report



- D = Medium level : 8 cm.
 - UUC's medium : Water
 - Working standards are located at 2.5 cm. away from each corner and walls.
- Working space dimension : 62 × 41 × 14 (W×L×H)

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
60	59.95	60.04	60.12	60.01	59.89
85	85.17	84.89	85.34	84.78	84.93
95	93.46	93.14	93.81	93.05	93.28

Liquid Bath (Water)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (± °C)	Uniformity (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average				
61.0	60.9 , 61	61.0	0.10	0.19	0.25	2.00
86.0	85.9 , 86.1	86.0	0.12	0.39	0.32	2.06
95.0	94.8 , 95.1	94.9	0.14	0.51	0.38	2.11

* 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. 



Metrological Center

SCI ECO Services Company Limited

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

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

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

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



Certificate No. T222502

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF 450

Serial No. : B7170531

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 : Oven Room

Date of Receipt : 23 November 2022

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 09 DEC 2022

REVIEW BY	Sinluk P.
APPROVED BY	KL AL
NEXT CAL. DATE	29/05/24

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. T222502

Page 2 of 4

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 29 November 2022
Environment : Temperature : 29.1-29.6 °C
Line Voltage : 221.3-223.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors and nine standard thermocouples type T 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	27-(CH1-10)	T210004	30 December 2022
TC	TYPE T	TN261-TN270	T210010	30 December 2022
DATA LOGGER	34970A	T149	T210004	30 December 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 1 Hour 49 Minute At 104 °C
Fresh Air Damper ☒ Open ☐ Min ☐ Medium ☒ Max
☐ Close
☐ Not Available

5. Adjustment :

() without adjustment

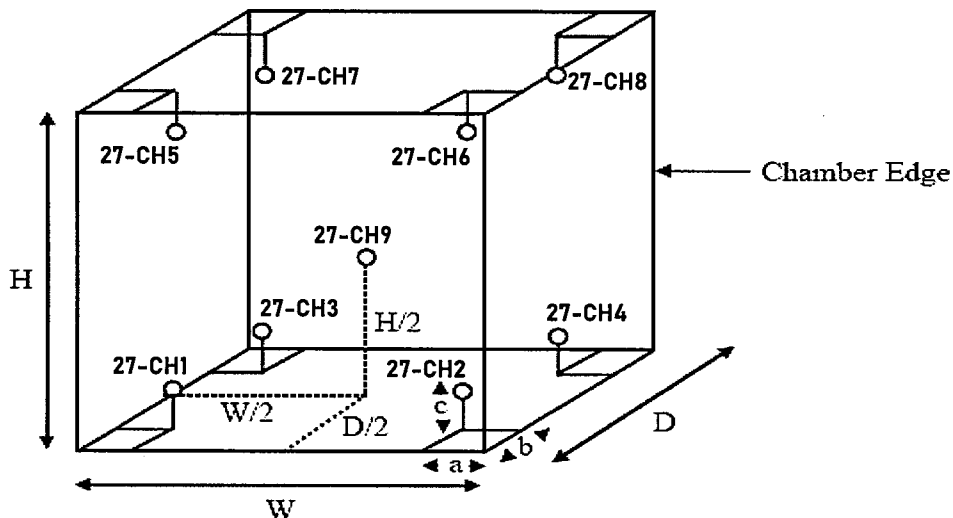
(X) after adjustment

Approved By. Bm Loi

Certificate No. T222502

Page 3 of 4

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 27-CH1 to number 27-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 27-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9
104	104.07	103.60	103.45	104.02	104.47	103.57	104.59	103.78	104.18


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	-	104.0	103.97	0.07	0.70	0.42	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.

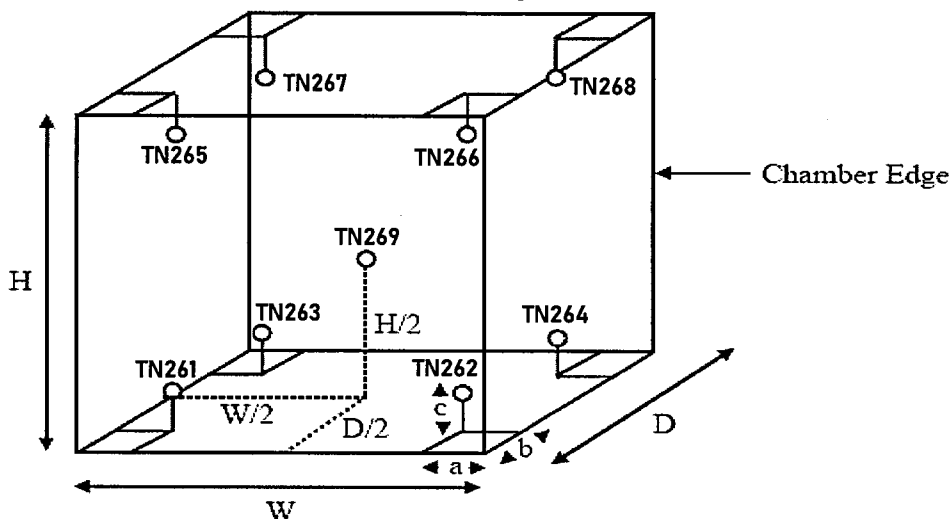
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

Certificate No. T222502

Page 4 of 4

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 TN261 to number TN268 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number TN269 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (° C)								
	TN261	TN262	TN263	TN264	TN265	TN266	TN267	TN268	TN269
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99	180.36

Chamber (Oven)			Temperature Distribution				
Setting (° C)	Reading (° C)		Average (° C)	Stability (± ° C)	Uniformity (° C)	Uncertainty (± ° C)	Coverage Factor <i>k</i>
	Min , Max	Average					
180.0	-	180.0	179.98	0.38	1.78	1.10	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. 



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.: 22TW122

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 09J101147
ID No. : BKK_EN0017
Received Date : 20 May 2022
Test Date : 24 May 2022
Reference : 2205-0638DSC-8

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 ± 5) °C
Humidity (50 ± 20) %

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

Tested by : Warakorn Lernagtrakul

Approved by :

Malee

Approved Signatory

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

Issue Date : 31 May 2022

REVIEW BY	<i>Siriluk P.</i>
APPROVED BY	<i>Ku An</i>
NEXT CAL. DATE	<i>24/11/23</i>



Cert.No.: 22TW122

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	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

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.: 16K100498

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.13	0.015

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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Malu

a 1110482



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.: 22LM83

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-230V

Serial No. : 09J 101147

ID No. : BKK_EN0017

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 : 20 May 2022

Calibrated Date : 30 May 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Tawatchai Pama

Approved by : Malee Butkruea
Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 31 May 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 0039957



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2205-0638DSC-10
Procedure Used :-

Cert. No.: 22LM83
Page.: 2 of 2

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	A09204	2218	04 Jan 2023

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 thermistor sensor , ID No.: 16K100498

<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	20.003	20.01	0.007	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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Malu -

a 1090806



Metrological Center

SCI ECO Services Company Limited

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

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

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

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



Certificate No. T230683

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : MEMMERT

Model : ICP 750

Serial No. : F818.0075

Customer Code : BKK_EN0305

ID No. : T9571A4

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 : 30 March 2023

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  / Boonchai Suriyawong (Assistant Calibration Manager)

Date of Issue : 10 APR 2023

REVIEW BY	Sinluk P.
APPROVED BY	KL AL
NEXT CAL. DATE	05/04/24

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. T230683

Page 2 of 4

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 5 April 2023 (Finished Time 4:30 PM)
Environment : Temperature 22.9-28.6 °C
Line Voltage 221.7-225.5 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	37-(CH1-10)	T222493	28 November 2023
RTD	100 ohm	36-(CH1-10)	T222493	28 November 2023
DATA LOGGER	34970A	T193	T222493	28 November 2023

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 2 Hour 24 Minute At 20 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Result of test :

() without adjustment

(X) after adjustment

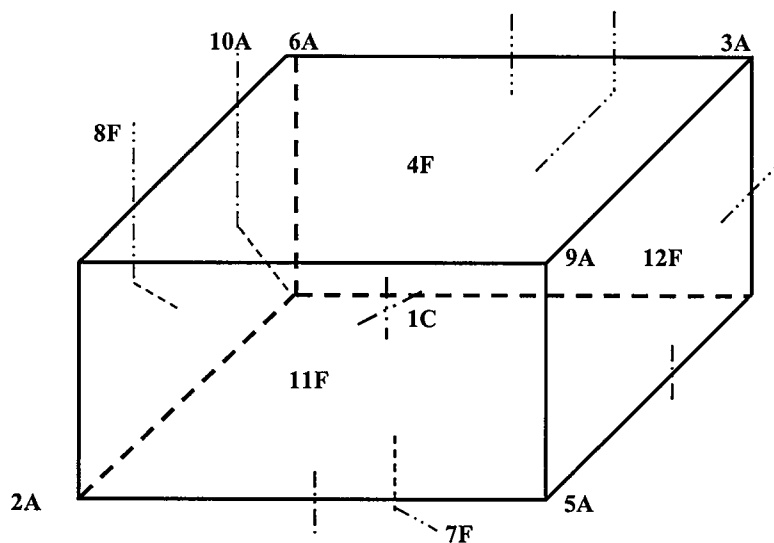
Approved By. _____



Certificate No T230683

Calibration Report

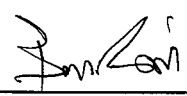
Page 3 of 4



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

1C	=	37CH1
2A	=	37CH2
3A	=	37CH3
4F	=	37CH4
5A	=	37CH5
6A	=	37CH6
7F	=	37CH7
8F	=	37CH8
9A	=	37CH9
10A	=	37CH10

11F	=	36CH1
12F	=	36CH2

Approved By. 

Certificate No. T230683

Calibration Report

Page 4 of 4

Measurement Results

Average Standard Reading at each position (°C)										
Calibration Point	37CH1	37CH2	37CH3	37CH4	37CH5	37CH6	37CH7	37CH8	37CH9	37CH10
20.0	20.32	20.28	20.17	20.22	20.22	20.04	20.17	19.74	20.31	19.93
	36CH1	36CH2								
	20.14	20.20								
Calibration Point	37CH1	37CH2	37CH3	37CH4	37CH5	37CH6	37CH7	37CH8	37CH9	37CH10
25	25.28	25.15	25.13	25.13	25.20	25.02	25.11	24.79	25.20	25.26
	36CH1	36CH2								
	25.13	24.94								

Chamber (Incubator)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
20.0	19.9 , 20.1	20.0	20.02	0.09	0.54	0.38	2.00
25.0	24.9 , 25.1	25.0	25.03	0.03	0.51	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. 



Metrological Center

SCI ECO Services Company Limited

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

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

Certificate No. T230352

Page 1 of 5

Certificate of Calibration

Equipment : HOT BLOCK
Manufacturer : Environmental Express
Model : B3000- 240
Serial No. : 2017CODW116
Customer Code : BKK_EN0222
ID No. : T6769A4
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

REVIEW BY Sinlut P.
APPROVED BY KL AL
NEXT CAL. DATE 01/03/24

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

Customer Location : Wet Chemistry Lab2

Date of Receipt : 21 February 2023

Calibrated By : Watcharasak Puttarat (Technician)

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

Date of Issue : 20 MAR 2023

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

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

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

Certificate No. T230352

Page 2 of 5

Calibration Report

Equipment : HOT BLOCK
Date of Calibration : 1 March 2023
Environment : Temperature : 22.9-24.4 °C
Line Voltage : 222.7-227.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 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	TN121-TN130	T222122	5 October 2023
TC	TYPE T	TN131-TN140	T222122	5 October 2023
DATA LOGGER	34970A	T150	T222122	5 October 2023

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

5. Adjustment :

(X) without adjustment

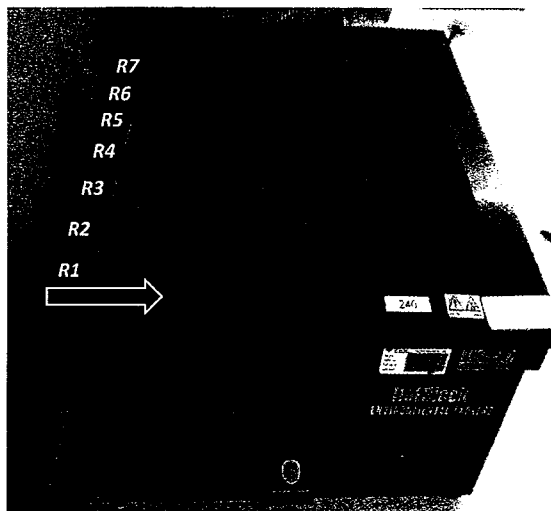
() after adjustment

Approved By

Certificate No T230352

Page 3 of 5

Calibration Report



Row	Hole							
R7	H49	H50	H51	H52	H53	H54	H55	H56
R6	H41	H42	H43	H44	H45	H46	H47	H48
R5	H33	H34	H35	H36	H37	H38	H39	H40
R4	H25	H26	H27	H28	H29	H30	H31	H32
R3	H17	H18	H19	H20	H21	H22	H23	H24
R2	H9	H10	H11	H12	H13	H14	H15	H16
R1	H1	H2	H3	H4	H5	H6	H7	H8

H: STANDARD THERMOCOUPLE TYPE T

H1	=	TN121	H9	=	TN129	H17	=	TN137	H25	=	TN125	H33	=	TN133	H41	=	TN121	H49	=	TN129
H2	=	TN122	H10	=	TN130	H18	=	TN138	H26	=	TN126	H34	=	TN134	H42	=	TN122	H50	=	TN130
H3	=	TN123	H11	=	TN131	H19	=	TN139	H27	=	TN127	H35	=	TN135	H43	=	TN123	H51	=	TN131
H4	=	TN124	H12	=	TN132	H20	=	TN140	H28	=	TN128	H36	=	TN136	H44	=	TN124	H52	=	TN132
H5	=	TN125	H13	=	TN133	H21	=	TN121	H29	=	TN129	H37	=	TN137	H45	=	TN125	H53	=	TN133
H6	=	TN126	H14	=	TN134	H22	=	TN122	H30	=	TN130	H38	=	TN138	H46	=	TN126	H54	=	TN134
H7	=	TN127	H15	=	TN135	H23	=	TN123	H31	=	TN131	H39	=	TN139	H47	=	TN127	H55	=	TN135
H8	=	TN128	H16	=	TN136	H24	=	TN124	H32	=	TN132	H40	=	TN140	H48	=	TN128	H56	=	TN136

Approved By.





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E-Mail : calibrate@scg.co.th

Certificate No. T230352

Page 4 of 5

Calibration Report

Measurement Results

			Average Standard Reading at each position (°C)									
Calibration Point			TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
150	150.0	Max	152.61	150.49	150.10	148.27	149.85	151.19	149.99	149.29	149.97	150.03
		Min	152.15	149.87	149.73	147.75	149.26	150.78	149.49	148.56	149.15	149.15
		Average	152.41	150.22	149.90	147.99	149.48	150.92	149.71	148.92	149.51	149.67
			TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140
		Max	149.84	148.34	148.34	149.88	152.39	149.73	149.66	149.16	149.76	151.18
		Min	149.35	147.85	148.40	148.94	152.39	149.19	148.83	148.68	149.51	150.92
		Average	149.67	148.10	148.59	149.55	152.39	149.36	149.25	148.96	149.64	151.05
			TN121	TN122	TN123	TN124	TN125	TN136	TN127	TN128	TN129	TN130
		Max	152.91	150.56	149.20	148.63	149.78	151.28	150.09	148.83	148.16	148.33
		Min	152.72	150.04	148.59	147.96	149.42	150.96	149.83	148.20	147.62	147.29
		Average	152.80	150.29	148.89	148.30	149.60	151.08	149.97	148.52	147.90	147.80
			TN131	TN132	TN133	TN134	TN135	TN136	TN137	TN138	TN139	TN140
		Max	148.81	148.04	148.56	148.11	149.07	149.06	148.58	149.85	149.07	150.89
		Min	148.08	147.63	148.07	147.63	148.81	148.62	148.18	149.60	148.86	150.63
		Average	148.45	147.84	148.36	147.81	148.94	148.84	148.37	149.74	148.96	150.78
			TN121	TN122	TN123	TN124	TN125	TN126	TN127	TN128	TN129	TN130
		Max	150.76	152.63	151.14	150.47	151.07	150.93	149.35	150.31	149.28	149.81
		Min	150.59	152.40	150.69	150.17	150.77	150.54	148.80	149.93	148.84	149.23
		Average	150.69	152.52	150.95	150.33	150.94	150.73	149.18	150.10	149.04	149.56
			TN131	TN132	TN133	TN134	TN135	TN136				
		Max	150.97	150.34	151.70	149.10	153.13	150.74				
		Min	150.77	149.94	151.36	148.83	152.91	150.61				
		Average	150.87	150.13	151.53	148.97	153.05	150.66				

Approved By



Metrological Center

SCI ECO Services Company Limited

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Certificate No. T230352

Page 5 of 5

Calibration Report

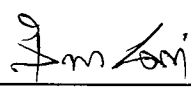
Measurement Results

HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (\pm °C)	Uncertainty (\pm °C)
	Min , Max	Average		
150.0	150 , 150.1	150.0	0.60	1.01

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. 

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-307/22
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 16 September 2022
Date of calibration 16 September 2022
Date of issue 23 September 2022

REVIEW BY *Shiruk P.*
APPROVED BY *Kw An*
16/9/23
NEXT CAL. DATE *23/9/22*

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

Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (22.1-23.3) °C (On site)

Humidity (58.8-63.2) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

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

Traceability Wavelength Accuracy is traceable to certificate No. 95917 and 95918
Photometric Accuracy is traceable to certificate No. 95924 and 95937
Stray Light is traceable to certificate No. 95908
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Waruth Janphung

Approved by



Mr.Kanchit Choothep
Technical 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-307/22

Number of Page(s)

2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (\pm nm)
241.70	241.65	-0.05	0.18
334.02	333.92	-0.10	0.18
418.53	418.46	-0.07	0.18
572.99	572.96	-0.03	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
	0.7467	0.7461	-0.0006	0.0075
257	0.0000	0.0000	0.0000	0.0075
	0.8662	0.8647	-0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2904	0.2911	0.0007	0.0075
350	0.0000	0.0000	0.0000	0.0075
	0.6429	0.6426	-0.0003	0.0075

*CNR = Customer not request

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-307/22**

Number of Page(s)

3 of 3

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
	0.5783	0.5777	-0.0006	0.0042
	0.7628	0.7635	0.0007	0.0046
	1.0206	1.0230	0.0024	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5621	0.5618	-0.0003	0.0042
	0.7455	0.7460	0.0005	0.0048
	0.9985	1.0005	0.0020	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5227	0.5219	-0.0008	0.0042
	0.6880	0.6884	0.0004	0.0051
	0.9487	0.9503	0.0016	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5207	0.5199	-0.0008	0.0042
	0.6973	0.6971	-0.0002	0.0049
	0.9959	0.9964	0.0005	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5544	0.5534	-0.0010	0.0042
	0.7253	0.7242	-0.0011	0.0050
	1.0942	1.0943	0.0001	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5616	0.5606	-0.0010	0.0042
	0.6927	0.6921	-0.0006	0.0053
	1.0881	1.0885	0.0004	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.96 \pm 0.11nm	200.30	0.9505	2.0229

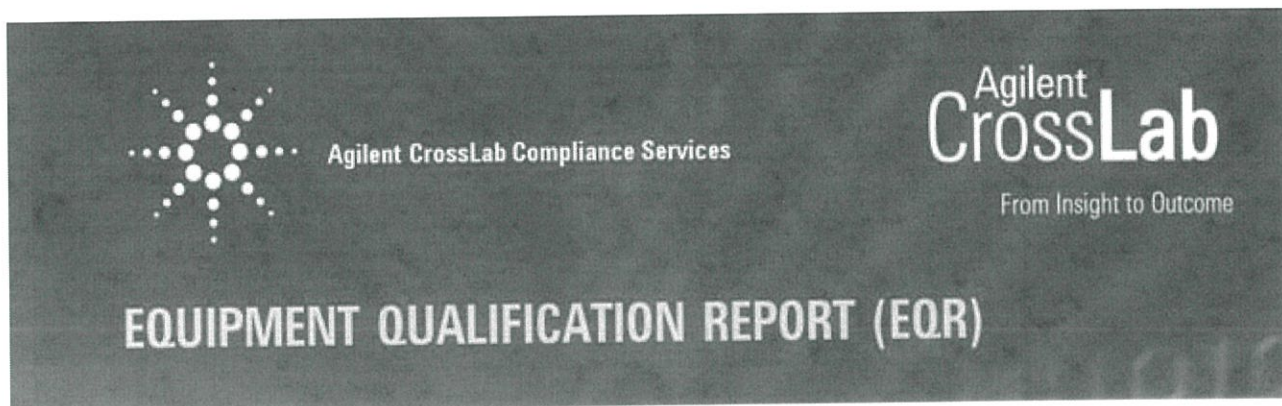
The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*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.
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.

**Agilent CrossLab Compliance**

Qualification Type: ICPMS-OQ

System ID: JP12091612

EQP Name: AgilentRecommended

EQP Revision: ICPMS.02.50

EQP Publish Date: March 2020

Date: June 14, 2022 10:32:16 AM

Report Type: Report

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

Org. Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250
Thailand.REVIEW BY Tattaporn C.APPROVED BY Santana N.NEXT CAL. DATE 14/12/23

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Test Summary

Purpose

This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Details

Test	Status	Runs
Autosampler Check : ASX-520	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS2	Pass	1
Autotune : G3281A	Pass	1
Background (No Gas Mode) : G3281A	Pass	1
Background (Gas Modes) : G3281A	Pass	1
20-Minute Stability (No Gas Mode) : G3281A	Pass	1

Overall Qualification Status

Pass

Service Details

Purpose

This section includes local contact and delivery details for this service.

General Details

Service Order No./Request: 6005218484
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
Report Type: Report

Organization Details

Name: ALS Laboratory Group (Thailand) Co.,Ltd.
Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.

Local Contact Details

Name: Khan Chatchanai
Job Title: Lab Manager
Qualification Location: Spectro Room

Operator Details

Name: Panthep Kurasathain
Job Title: Field Service Engineer

Data Acquisition Details

Acquisition Software Name: MassHunter
Acquisition Software Revision: D.01.01

Customer Data System (CDS): IcpMs: MassHunter

Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3281A
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP12091612
Firmware Revision	D.01.01

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4911A
Installed Options	#003: 2 pumps, 1 valve, auto dilution and discrete sampling
Type	Peristaltic pump system

Autosampler 1

Manufacturer	Agilent Technologies
Name	ASX-520
Model Number	G3286A
Serial Number	031403A520

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	4N1220700

Calculation Formulas

Purpose

This section includes calculation formulas for all available tests. Depending upon which tests are scheduled, all or some apply to your qualification.

For a description of calculations for ICP-MS tests performed by the MassHunter software, refer to the MassHunter application and documentation.

Protocol Details

Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ICPMS.02.50	20-Minute Stability (No Gas Mode)
ICPMS.02.50	Autosampler Check
ICPMS.02.50	Autotune
ICPMS.02.50	Background (Gas Modes)
ICPMS.02.50	Background (No Gas Mode)
ICPMS.02.50	Integrated Sample Introduction System (ISIS) Check

Autosampler Check

Purpose

This test demonstrates that the autosampler module is correctly installed and connected. It does not test module performance.

Setpoint

Results

Criteria	Observed Result	Expected Result	Status
After the self test, is probe in the home position?	Yes	Yes	Pass
As commanded, is the probe positioned at vial 2?	Yes	Yes	Pass

Setpoint Status: Pass Runs: 1

Overall Autosampler Check Test Status

Pass

Integrated Sample Introduction System (ISIS) Check

Purpose

This test demonstrates that the ISIS module is correctly installed and connected. It does not test module performance.

Setpoint

Results

Criteria	Observed Result	Expected Result	Status
As commanded, does the pump rotate?	Yes	Yes	Pass
As commanded, do the valves load and inject?	Yes	Yes	Pass
Setpoint Status:	Pass		Runs: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Autotune

Purpose

This test uses traceable checkout standards to run a software-executed autotune in all modes. The tune report provides values for peak width, mass axis, sensitivity, oxide species, and doubly-charged species tests.

Setpoint

Results

Peakwidth Mass 7

Agilent Recommended:

Status:

Peakwidth Mass 89

Agilent Recommended:

Status:

Peakwidth Mass 205

Agilent Recommended:

Status:

Mass Axis 7

Agilent Recommended:

Status:

Mass Axis 89

Agilent Recommended:

Status:

Mass Axis 205

Agilent Recommended:

Status:

	0.735	AMU
>=	0.65	
<=	0.80	

Pass

	0.732	AMU
>=	0.65	
<=	0.80	

Pass

	0.746	AMU
>=	0.65	
<=	0.80	

Pass

	7.00	AMU
>=	6.9	
<=	7.1	

Pass

	89.00	AMU
>=	88.9	
<=	89.1	

Pass

	205.00	AMU
>=	204.9	
<=	205.1	

Pass

Mass 7 Sensitivity No Gas

81.18

Mcps/ppm

Agilent Recommended:

>= 25.5

Status:

Pass

Mass 89 Sensitivity No Gas

247.81

Mcps/ppm

Agilent Recommended:

>= 85

Status:

Pass

Mass 205 Sensitivity No Gas

184.87

Mcps/ppm

Agilent Recommended:

>= 51

Status:

Pass

Mass 59 Sensitivity He

84.86

Mcps/ppm

Agilent Recommended:

>= 20.4

Status:

Pass

Oxide Ratio 156/140

1.119

%

Agilent Recommended:

<= 1.38

Status:

Pass

Doubly Charged Species Ratio 70/140

1.140

%

Agilent Recommended:

<= 2.3

Status:

Pass

Setpoint Status:

Pass

Runs: 1

Overall Autotune Test Status

Pass

Background (No Gas Mode)

Purpose

This test examines the background of the ICP-MS in no gas mode by monitoring ions during a blank run.

Setpoint

Conditions

Masses:	7	AMU
	89	AMU
	205	AMU

Measurements and Results

Masses (AMU):	7	89	205	
Measured Value:	4.900	7.100	18.400	cps
Agilent Recommended:	<= 10	<= 10	<= 30	
Status:	Pass	Pass	Pass	

Setpoint Status: Pass

Runs: 1

Overall Background (No Gas Mode) Test Status

Pass

Background (Gas Mode)

Purpose

This test examines the background of the ICP-MS in the various gas modes by monitoring ions during a blank run.

Setpoint Gas Mode: Helium

Conditions

Mass: 78 AMU
Integration Time: 1.0 sec
Cycles: 20

Measurements and Results

Mass (AMU): 78
Measured Value: 21.1000 cps
Agilent Recommended: ≤ 460
Status: Pass

Setpoint Status: Pass

Runs: 1

Overall Background (Gas Mode) Test Status

Pass

20-Minute Stability (No Gas Mode)

Purpose

This test monitors the abundance of ions present in the checkout standard over a 20-minute period to verify that the signal is stable. The %RSD of the abundance of given ions is calculated internally by the software and compared to the limit.

Setpoint

Conditions

Mode:	Spectrum	
Masses:	7, 9, 59, 89, 140, 205	
Integration Time:	9.99	sec
Peak Pattern:	3	points/peak
Repetitions:	20	
Sweeps/Replicates:	100	

Measurements and Results

Masses (AMU):	7	89	205	
Stability RSD:	0.2	0.6	0.6	%
Agilent Recommended:	<= 3.45	<= 3.45	<= 3.45	
Status:	Pass	Pass	Pass	

Setpoint Status: Pass Runs: 1

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

Pass

Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	17
EQR	General	Operator's training certificate and qualifications	18
EQR	General	Certificate of Qualification for ACE	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Tune reports	21
EQR	General	Test Report	24
EQR	General	Test Report	26

General

Document Name: Certificate of System Qualification



Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:59:15 PM

Drive Serial #: ACA025C9

Platform Revision:

ACE 3.11

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GCMS	17	Conforms
Gas Chromatography	29	Conforms
Gel Permeation Chromatography	9	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	18	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	15	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status

Conforms

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:	Panthep Kurasathain
Title Of Course:	AN-CE-ICPMS-2-017-B:7700x/7700s ICP-MS Intro. -Oper.H/W.S/W & OQ/PV
Completion Date:	November 22, 2012
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

General

Document Name:

Certificate of Qualification for ACE



Certificate of Completion

Learner Name:	Panthep Kurasathain
Title Of Course:	AN-CE-SS-II-030-A: ACE 3.X User Update Training
Completion Date:	July 7, 2020
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

Document Name: Certificate of Qualification for ACE



Certificate of Completion

Learner Name: Panthep Kurasathain

Title Of Course: AN-CE-ICPMS-2-035-B: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-MS Systems

Completion Date: October 31, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

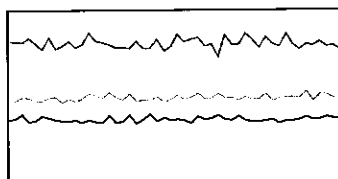
Document Name: Tune reports

Tune Report

Operator Name Supakwan Mak
 Acq/Data Batch C:\Agilent\ICPM\H11\UserTune.b
 Acq. Date-Time 6/14/2022 9:03:15 AM
 Report Comment PMOQ 14 June 2022
 Instrument Name G3281A JP12091612

[No Gas]

Sensitivity



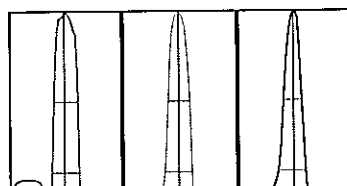
Mass	Range	Count	RSD%	Background
7	10000	8118	3.585	4.900
89	50000	24781	3.128	7.100
205	50000	18487	3.808	18.400

Sampling Period [sec] 0.311
 Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 1.119 %
 Doubly Charged 70 / 140 1.140 %

Resolution/Axis



Mass	Peak Height	Axis	W-50%	W-10%
7	8050.47	7.00	0.65	0.735
89	24725.81	89.00	0.57	0.732
205	18559.81	205.00	0.49	0.746

Integration Time [sec] 0.1
 Acquisition Time [sec] 22.74
 Y Axis Linear

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	1.05 L/min	Makeup Gas	0.00 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.80 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	8.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	8.6 V	Deflect	12.0 V
Extract 2	-190.0 V	Cell Entrance	-30 V	Plate Bias	-40 V
Omega Bias	-90 V	Cell Exit	-50 V		

Cell Parameters

Use Gas	No	3rd Gas Flow	---	Energy Discrimination	5.0 V
He Flow	0.0 mL/min	OctP Bias	-8.0 V		

Document Name: Tune reports

Tune Report

H2 Flow — OctP RF 200 V

QP Parameters

Mass Gain	152	Axis Gain	1.0032	QP Bias	-3.0 V
Mass Offset	123	Axis Offset	0.12		

Hardware Settings

Torch

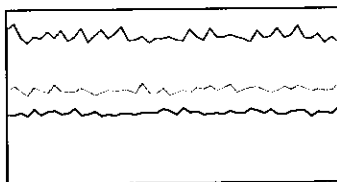
Torch H	-0.4 mm	Torch V	0.0 mm
---------	---------	---------	--------

EM

Discriminator	4.5 mV	Analog HV	1708 V	Pulse HV	1356 V
---------------	--------	-----------	--------	----------	--------

[He]

Sensitivity



Mass	Range	Count	RSD%	Background
59	10000	8486	3.392	15,700
89	20000	10724	3.135	13,900
205	50000	20200	3.166	22,100

Sampling Period [sec] 0.31
Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 1.122 %
Doubly Charged 70 / 140 1.288 %

Tune Parameters

Plasma Parameters

Plasma Mode	—	Nebulizer Gas	1.05 L/min	Makeup Gas	0.00 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.80 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	8.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	7.4 V	Deflect	3.6 V
Extract 2	-200.0 V	Cell Entrance	-90 V	Plate Bias	-115 V
Omega Bias	-90 V	Cell Exit	-70 V		

Cell Parameters

Use Gas	Yes	3rd Gas Flow	—	Energy Discrimination	3.0 V
He Flow	4.5 mL/min	OctP Bias	-21.0 V		
H2 Flow	—	OctP RF	190 V		

QP Parameters

Mass Gain	152	Axis Gain	1.0032	QP Bias	-18.0 V
Mass Offset	123	Axis Offset	0.12		

Hardware Settings

Torch

Torch H	-0.4 mm	Torch V	0.0 mm
---------	---------	---------	--------

2 of 3

6/14/2022 9:03 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

Document Name: Tune reports

Tune Report

EM

Discriminator

4.5 mV

Analog HV

1708 V

Pulse HV

1356 V

3 of 3

6/14/2022 9:03 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Service\PMOQ 13-6-22\BG He.b\

Analysis File: BG He.batch.bin

Tune Step: #1 He

	Rjct	Acq. Date-Time	Data File	Sample Name	Type	Level	Dilution
1		6/14/2022 10:03:39 AM	001SMPL.d	BG He	Sample		1.0000

Page 1 / 2

6/14/2022 10:09:04 AM

Document Name: Test Report

Batch Summary Report

Analyte Table

		78 (He1)	
Sample Name		CPS	CPS RSD
1	BG He	21.1000	38.0

Page 2 / 2

6/14/2022 10:09:04 AM

Date: June 14, 2022 10:32:16 AM
System ID: JP12091612

General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Service\PMOQ 13-6-22\ OQ 20 Min.b\
Analysis File: OQ 20 Min.batch.bin
Tune Step: #1 No Gas

	Ret	Acq. Date-Time	Data File	Sample Name	Type	Level	Dilution
1		6/14/2022 9:29:27 AM	001SMPL.d	20 min	Sample		1.0000

Document Name:

Test Report

Batch Summary Report

Analyte Table

		7 [No Gas]		9 [No Gas]		59 [No Gas]		89 [No Gas]	
	Sample Name	CPS	CPS RSD	CPS	CPS RSD	CPS	CPS RSD	CPS	CPS RSD
1	20 min	82477.8975	0.2	285.3875	5.8	162011.0035	0.7	241211.0790	0.6

		140 [No Gas]		205 [No Gas]	
	Sample Name	CPS	CPS RSD	CPS	CPS RSD
1	20 min	252452.6980	0.7	181154.8205	0.6

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:	Panthep Kurasathain
Logged On User Name:	panthep_kurasathain@agilent.com
Signature Creation Date:	June 14, 2022
Reason for Signature:	Executed protocol and published this original version of document

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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User Name: panthep_kurasathain
 Hostname: ASBKKWX313

System Id: JP12091612
 Print Date: June 14, 2022 10:32:20 AM

ALS OQHW 7700 14Jun2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Audit	SessionCreated	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
June 14, 2022 10:19:18 AM	Audit	EqpLoaded	Session	EQP details for primary technique [lcpMs] - File path: [Protocol]Packs/lcpMs/Configurations/02.50/lcpMs.02.50.eqp], EQP File Name: [lcpMs.02.50.eqp], EQP Name: [AgilentRecommended]
June 14, 2022 10:19:20 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check : ASX-520: Autosampler Check	None
June 14, 2022 10:19:42 AM	End	Execution	Autosampler Check : ASX-520: Autosampler Check	Run Count : 1
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS2: Integrated Sample Introduction System (ISIS) Check	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS2: Integrated Sample Introduction System (ISIS) Check	Run Count : 1
June 14, 2022 10:19:50 AM	Start	Execution	Autotune : G3281A: Autotune 1	None
June 14, 2022 10:22:22 AM	End	Execution	Autotune : G3281A: Autotune 1	Run Count : 1

User Name: panthep_kurasathain
 Hostname: ASBKKWX313

System Id: JP12091612
 Print Date: June 14, 2022 10:32:20 AM

ALS OQHW 7700 14Jun2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:22:24 AM	Start	Execution	Background (No Gas Mode) : G3281A: No Gas Mode Background 1	None
June 14, 2022 10:22:48 AM	End	Execution	Background (No Gas Mode) : G3281A: No Gas Mode Background 1	Run Count : 1
June 14, 2022 10:22:49 AM	Start	Execution	Background (Gas Modes) : G3281A: Gas Mode Background :Helium	None
June 14, 2022 10:23:35 AM	End	Execution	Background (Gas Modes) : G3281A: Gas Mode Background :Helium	Run Count : 1
June 14, 2022 10:23:37 AM	Start	Execution	20-Minute Stability (No Gas Mode) : G3281A: 20-Minute Stability (No Gas Mode) 1	None
June 14, 2022 10:24:06 AM	End	Execution	20-Minute Stability (No Gas Mode) : G3281A: 20-Minute Stability (No Gas Mode) 1	Run Count : 1
June 14, 2022 10:24:08 AM	End	Qualification	Session	OQ
June 14, 2022 10:24:08 AM	Start	Reporting	Session	None
June 14, 2022 10:30:26 AM	Audit	Reporting	Session	Report Generated : Certificate
June 14, 2022 10:30:39 AM	Audit	Reporting	Session	Report Generated : Report

Certificate of System Qualification

ICPMS-OQ

System ID: JP12091612
Organization Name: ALS Laboratory Group (Thailand) Co.,Ltd.
Organization Location: 104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.

Date: June 14, 2022 10:32:51 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
Oxide Ratio 156/140	Pass
Doubly Charged Species Ratio 70/140	Pass

Overall Autotune Test Status

Pass

Date: June 14, 2022 10:32:51 AM
System ID: JP12091612

Background (No Gas Mode)

Setpoint Status: Pass

Masses (AMU):	7	89	205	
Measured Value:	4.900	7.100	18.400	cps
Agilent Recommended:	<= 10	<= 10	<= 30	
Status:	Pass	Pass	Pass	

Overall Background (No Gas Mode) Test Status

Pass

Background (Gas Mode)

Gas Mode: Helium

Setpoint Status: Pass

Mass (AMU):	78	
Measured Value:	21.1000	cps
Agilent Recommended:	<= 460	
Status:	Pass	

Overall Background (Gas Mode) Test Status

Pass

20-Minute Stability (No Gas Mode)

Masses (AMU):	7	89	205	
Stability RSD:	0.2	0.6	0.6	%
Agilent Recommended:	<= 3.45	<= 3.45	<= 3.45	
Status:	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	7700x
Model Number	G3281A
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP12091612
Firmware Revision	D.01.01

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4911A
Installed Options	#003: 2 pumps, 1 valve, auto dilution and discrete sampling
Type	Peristaltic pump system

Autosampler 1

Manufacturer	Agilent Technologies
Name	ASX-520
Model Number	G3286A
Serial Number	031403A520

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	4N1220700

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:	Panthep Kurasathain
Logged On User Name:	panthep_kurasathain@agilent.com
Signature Creation Date:	June 14, 2022
Reason for Signature:	Executed protocol and published this original version of document

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User Name: panthep_kurasathain
 Hostname: ASBKKWX313

System Id: JP12091612
 Print Date: June 14, 2022 10:32:52 AM

ALS QQHW 7700 14Jun2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Audit	SessionCreated	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
June 14, 2022 10:19:18 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]
June 14, 2022 10:19:20 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check : ASX-520: Autosampler Check	None
June 14, 2022 10:19:42 AM	End	Execution	Autosampler Check : ASX-520: Autosampler Check	Run Count : 1
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS2: Integrated Sample Introduction System (ISIS) Check	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS2: Integrated Sample Introduction System (ISIS) Check	Run Count : 1
June 14, 2022 10:19:50 AM	Start	Execution	Autotune : G3281A: Autotune 1	None
June 14, 2022 10:22:22 AM	End	Execution	Autotune : G3281A: Autotune 1	Run Count : 1

User Name: panthep_kurasathaln
 Hostname: ASBKKWX313

System Id: JP12091612
 Print Date: June 14, 2022 10:32:52 AM

ALS OQHW 7700 14Jun2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:22:24 AM	Start	Execution	Background (No Gas Mode) : G3281A: No Gas Mode Background 1	None
June 14, 2022 10:22:48 AM	End	Execution	Background (No Gas Mode) : G3281A: No Gas Mode Background 1	Run Count : 1
June 14, 2022 10:22:49 AM	Start	Execution	Background (Gas Modes) : G3281A: Gas Mode Background :Helium	None
June 14, 2022 10:23:35 AM	End	Execution	Background (Gas Modes) : G3281A: Gas Mode Background :Helium	Run Count : 1
June 14, 2022 10:23:37 AM	Start	Execution	20-Minute Stability (No Gas Mode) : G3281A: 20-Minute Stability (No Gas Mode) 1	None
June 14, 2022 10:24:06 AM	End	Execution	20-Minute Stability (No Gas Mode) : G3281A: 20-Minute Stability (No Gas Mode) 1	Run Count : 1
June 14, 2022 10:24:08 AM	End	Qualification	Session	OQ
June 14, 2022 10:24:08 AM	Start	Reporting	Session	None
June 14, 2022 10:30:26 AM	Audit	Reporting	Session	Report Generated : Certificate
June 14, 2022 10:30:39 AM	Audit	Reporting	Session	Report Generated : Report

User Name: panthep_kurasathain
Hostname: ASBKKWX313

System Id: JP12091612
Print Date: June 14, 2022 10:32:52 AM

ALS OQHW 7700 14Jun2022 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:32:26 AM	Audit	Reporting	Session	Report Signed : Report PDF Name: ALS OQHW 7700 14Jun2022_20220614_OQ Report_1.pdf User Name: panthep_kurasathain@agilen t.com Full Name of Signer: Panthep Kurasathain Reason for signature: Executed protocol and published this original version of document



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. T220730

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	: 30 March 2022
Calibrated By	: Watcharapon Sangtong (Technician)
Approved By	:  / Sujjar Naknakred (Site Calibration Manager)
Date of Issue	: 12 APR 2022

REVIEW BY	Tattaporn C.
APPROVED BY	Santun.
NEXT CAL. DATE	7/10/23

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. T220730

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 7 April 2022
Environment : Temperature : 21.8-23.1 °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	T210008	08 June 2022
TC	TYPE T	TN231-TN240	T210008	08 June 2022
DATA LOGGER	34970A	T149	T210008	08 June 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 25 Minute At 95 °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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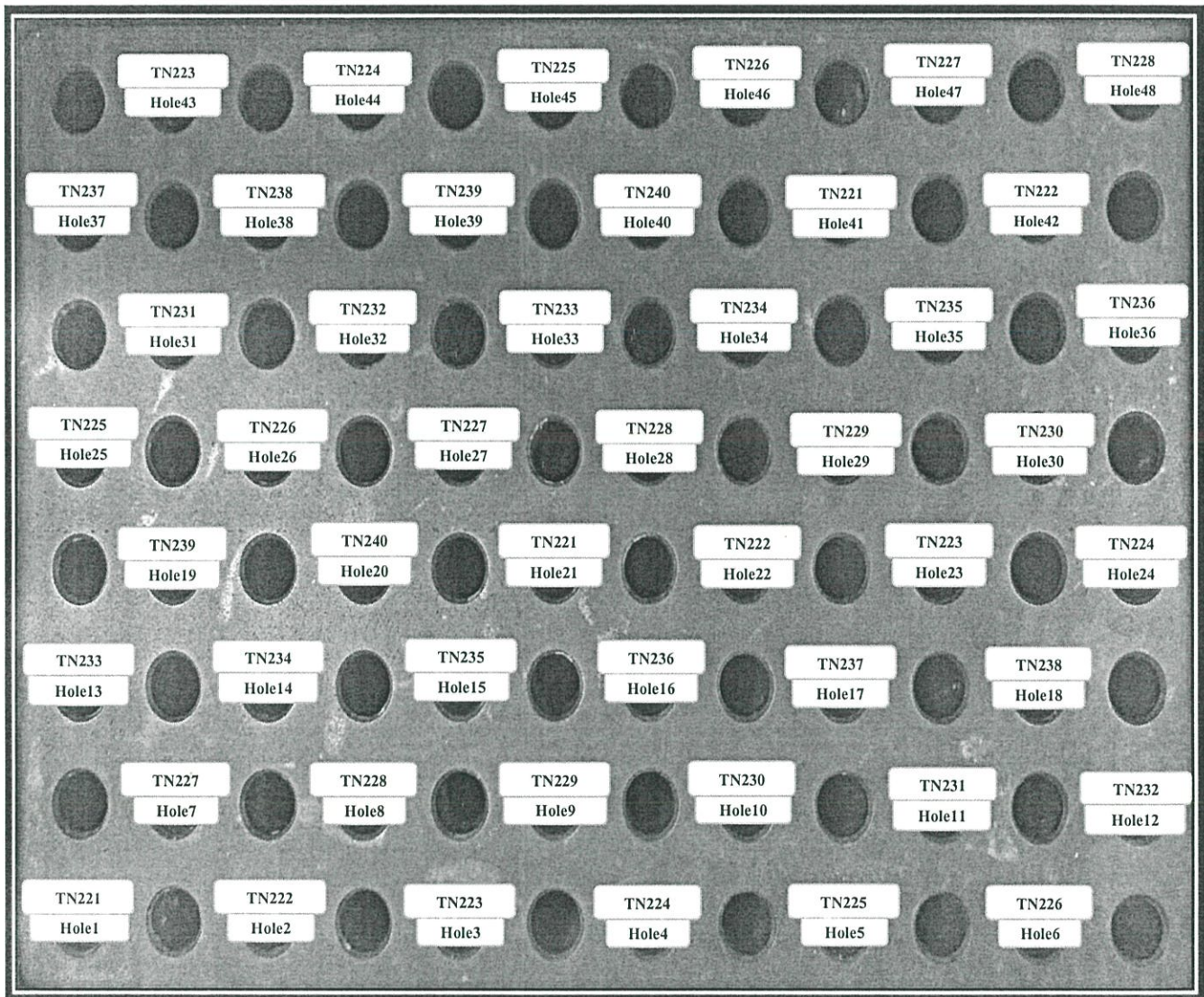
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. 

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (° C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	93.60	93.82	94.05	94.20	94.36	94.26
95	Min	93.07	93.26	93.51	93.66	93.82	93.71
	Average	93.33	93.54	93.78	93.93	94.09	93.98
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.59	94.79	94.63	94.55	94.82	95.00
	Min	94.05	94.25	94.08	93.97	94.26	94.44
	Average	94.32	94.52	94.36	94.26	94.54	94.72
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.03	94.54	94.78	94.84	95.06	94.73
	Min	94.46	93.98	94.20	94.28	94.49	94.18
	Average	94.74	94.26	94.49	94.56	94.78	94.45
R4 Hole19-Hole24		TN239	TN240	TN221	TN222	TN223	TN224
	Max	94.89	94.82	95.73	95.85	95.73	96.10
	Min	94.33	94.26	95.51	95.62	95.51	95.85
	Average	94.61	94.54	95.62	95.73	95.62	95.97
R5 Hole25-Hole30		TN225	TN226	TN227	TN228	TN229	TN230
	Max	96.28	96.39	96.37	96.54	96.19	96.04
	Min	96.01	96.10	96.02	96.20	95.89	95.71
	Average	96.15	96.24	96.20	96.37	96.04	95.88
R6 Hole31-Hole36		TN231	TN232	TN233	TN234	TN235	TN236
	Max	96.84	96.97	97.03	96.48	96.33	95.76
	Min	96.53	96.65	96.71	96.08	95.98	95.43
	Average	96.68	96.81	96.87	96.28	96.16	95.60
R7 Hole37-Hole42		TN237	TN238	TN239	TN240	TN221	TN222
	Max	96.46	96.15	96.19	96.06	96.95	97.09
	Min	96.13	95.84	95.85	95.72	96.64	96.78
	Average	96.30	95.99	96.02	95.89	96.80	96.93
R8 Hole43-Hole48		TN223	TN224	TN225	TN226	TN227	TN228
	Max	96.91	96.58	96.13	96.19	96.34	96.19
	Min	96.55	96.21	95.80	95.87	96.03	95.88
	Average	96.73	96.40	95.96	96.03	96.18	96.03

Approved By.



Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)					
R1 Hole1-Hole6		TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	104.47	104.65	104.79	105.31	105.47	105.46
105	Min	104.15	104.27	104.45	104.98	105.14	105.20
	Average	104.31	104.46	104.62	105.15	105.31	105.33
R2 Hole7-Hole12		TN227	TN228	TN229	TN230	TN231	TN232
	Max	105.55	105.73	105.65	105.84	105.97	106.07
	Min	105.28	105.43	105.35	105.52	105.68	105.83
	Average	105.42	105.58	105.50	105.68	105.82	105.95
R3 Hole13-Hole18		TN233	TN234	TN235	TN236	TN237	TN238
	Max	106.14	106.06	105.81	106.05	105.81	105.87
	Min	105.85	105.81	105.55	105.80	105.53	105.64
	Average	106.00	105.94	105.68	105.92	105.67	105.75
R4 Hole19-Hole24		TN239	TN240	TN221	TN222	TN223	TN224
	Max	105.86	105.60	104.44	104.51	104.28	104.78
	Min	105.61	105.37	104.27	104.35	104.12	104.61
	Average	105.74	105.48	104.35	104.43	104.20	104.69
R5 Hole25-Hole30		TN225	TN226	TN227	TN228	TN229	TN230
	Max	104.94	104.93	104.97	105.08	104.68	104.69
	Min	104.77	104.75	104.76	104.90	104.51	104.49
	Average	104.85	104.84	104.86	104.99	104.60	104.59
R6 Hole31-Hole36		TN231	TN232	TN233	TN234	TN235	TN236
	Max	105.44	105.45	105.61	104.95	104.84	104.42
	Min	105.27	105.27	105.44	104.76	104.66	104.25
	Average	105.36	105.36	105.53	104.86	104.75	104.33
R7 Hole37-Hole42		TN237	TN238	TN239	TN240	TN221	TN222
	Max	105.17	104.70	104.59	104.51	105.22	105.53
	Min	105.00	104.53	104.41	104.35	105.04	105.37
	Average	105.08	104.62	104.50	104.43	105.13	105.45
R8 Hole43-Hole48		TN223	TN224	TN225	TN226	TN227	TN228
	Max	105.61	105.45	105.10	104.77	104.87	105.02
	Min	105.44	105.28	104.92	104.60	104.70	104.85
	Average	105.53	105.37	105.01	104.69	104.79	104.93

Approved By.



Certificate No. T220730

Page 5 of 6

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (\pm °C)	Uncertainty (\pm °C)
	Min , Max	Average		
100.0	100.0 , 100.4	100.1	0.29	0.83
105.0	105.0 , 105.4	105.1	0.20	0.79

* 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. 