

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
T +66 2 760 3000 F +66 2 760 3197

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	26-Mar-21	24-Sep-22	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	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_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	BOD (5 days at 20°C)	DO Meter	BKK_EN0017	29-Dec-20	29-Jun-22	18
Water Lab	BOD (5 days at 20°C)	Incubator	BKK_EN0005	4-Oct-21	4-Apr-23	18
Water Lab	COD	Hot Block	BKK_EN0222	21-Mar-22	21-Mar-23	12
Water Lab	COD	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Lead	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18



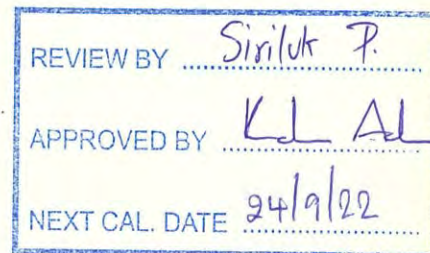
TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



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

Certificate of Calibration

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



Calibrated by : Warakorn Lernagatrakul

Approved by :

Malee

Approved Signatory

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

Issue Date :

31 March 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0026590



Cert.No.: 21CH452

Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

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

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

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

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: B520948426	4.000	177.48	177.4	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00

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Cert.No.: 21CH452

Page.: 3 of 3

Calibration Results**Function : pH Measurement**

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 9265091	4.008	4.010	150.3	0.0048	2.05
	6.985	6.989	-22.5	0.0077	2.00
	10.012	10.011	-193.7	0.013	2.00

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

This equipment was connected with Temperature Probe;

- Model : InLab Expert Pro-ISM

- Serial No. : 9265091

Dimension of probe;

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

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

Remark : - UUC* = Unit Under Calibration

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

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Malu.

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

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

**SARTORIUS**

Certificate

of Calibration

REVIEW BY	Siriluk P.
APPROVED BY	KL AL
NEXT CAL. DATE	3/9/22

Model Number : **MSU224S-000-DA**
Description : **Analytical Balance**
Serial Number : **27405555 # BKK_EN0003**
Manufacturer : **Sartorius**

Certificate No. : **21BCI0263**
Issued Date : **Monday, September 06, 2021**
Reference No. : **502052**
Page No. : **1 Of 2**

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

Calibrated Place : **Lab Room**

Calibrated By : **Mr.Chonchai Inthana**
Calibration Date : **Friday, September 03, 2021**

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

Metrological data :

Capacity : **220** g Readability : **0.0001** g

Ambients Conditions:

Temperature : **23.5 °C** ± **5.0 °C**
Humidity : **59.1 % 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 - 200g E2,YCS011-522-00	Sartorius	119934 D-K-19398-01-00	10-Sep-2021
MHB-382SD	Humidity/Barometer/Temp Lutron MHB-382SD	SPCC	KSPR2111869	31-Aug-2022

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.

ISO17025-RF-22 26/03/2020 R2


Mr.Chonchai Inthana(Technical Manager)

S
T
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M
P



Certificate

of Calibration

Model Number : **MSU224S-000-DA**Description : **Analytical Balance**Serial Number : **27405555 # BKK_EN0003**Manufacturer : **Sartorius**Certificate No. : **21BCI0263**Issued Date : **Monday, September 06, 2021**Reference No. : **502052**Page No. : **2 of 2**

Calibration Results : Without Adjustment

Repeatability

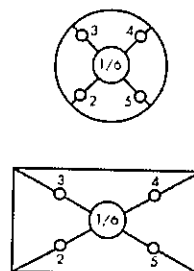
The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.

Nominal Value : (Low Load)	20.0000	200.0001
20 g	20.0001	200.0000
Tolerance	20.0000	200.0001
0.0001 g	20.0000	200.0001
	20.0001	200.0001
Nominal Value : (High Load)	20.0000	200.0001
200 g	20.0001	200.0000
Tolerance	20.0000	200.0001
0.0001 g	20.0000	200.0000
	20.0000	200.0001
Standard Deviation	0.00005	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	0.0000
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	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
1	1.0000	1.0000	0.0000	0.00013
2	2.0000	2.0000	0.0000	0.00013
5	5.0000	5.0000	0.0000	0.00013
10	10.0000	10.0000	0.0000	0.00013
20	20.0000	20.0000	0.0000	0.00013
50	50.0001	50.0002	0.0001	0.00014
100	100.0001	100.0002	0.0001	0.00018
200	200.0001	200.0001	0.0000	0.00029

End of Report.



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. 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

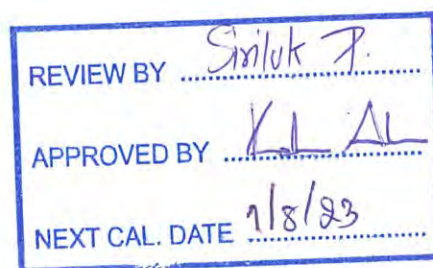
Customer Location : ORGANIC PREPARATION LAB

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

Page 2 of 3

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

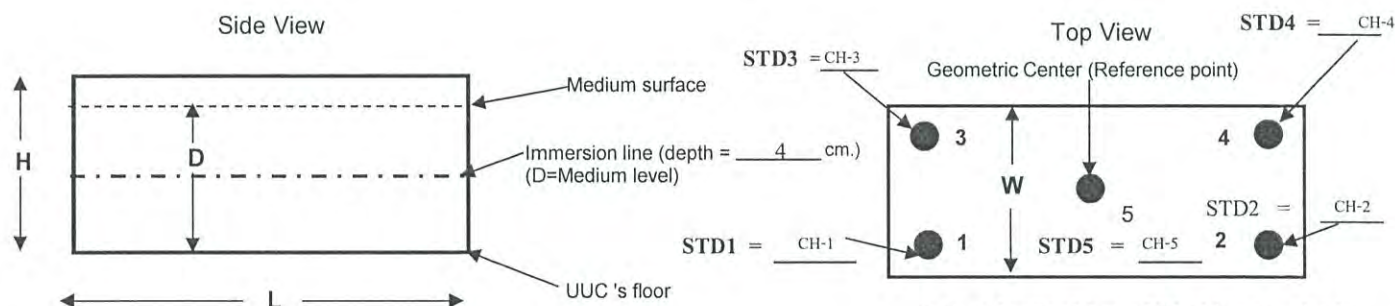
() after adjustment

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. 



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert. No.: 21TM2189

Page.: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UFE 500

Serial No. : G511.1574

ID No. : BKK_EN0007

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

Location : Oven Room

Received Order : 1 December 2021

Calibration Date : 1 December 2021

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachai

Approved by :

Malee

Approved Signatory

() Pornthippa Tameyakul

(☒) Malee Butkruea

() Suwit Imjai

Issue Date : 7 December 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0032815



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2112-0002OC-1

Cert. No.: 21TM2189

Page.: 2 of 3

Procedure Used :-

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

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) Data Acquisition	34970A	MY44060450	21LM4/1	06 Mar 2022

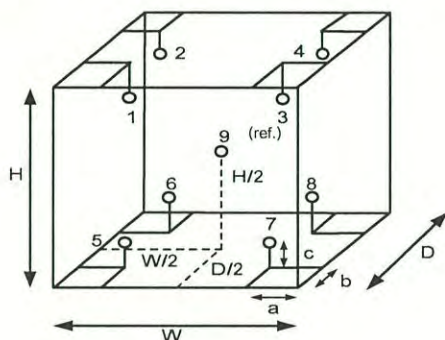
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL.Humid. (%)	51	53
AC Supply (Volt)	221	222

Ref. Std. ID No.: @ Calibration Point		
Position :	(104) °C	(121,175,180) °C
1	19-14RTD-01	19-14TC-01
2	19-14RTD-02	19-14TC-02
3	19-14RTD-03	19-14TC-03
4	19-14RTD-04	19-14TC-04
5	19-14RTD-05	19-14TC-05
6	19-14RTD-06	19-14TC-06
7	21-14RTD-07	19-14TC-07
8	19-14RTD-08	19-14TC-08
9 (ref.)	19-14RTD-09	19-14TC-09

Probe Installation Details : **Dimension of Chamber :**

a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
			Capacity =	0.11	m ³

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Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2112-0002OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 21TM2189

Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
104.0	104.0	104.0	0.059	0.52	0.59	0.45	2
121.0	121.0	121.0	0.11	0.75	1.2	1.1	2
175.0	175.0	175.0	0.13	0.90	1.6	1.1	2
180.0	180.0	180.0	0.13	0.93	1.6	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.265	104.229	104.080	103.922	104.390	104.304	104.284	103.994	103.909
121.0	120.838	120.519	120.661	120.524	121.162	120.855	120.703	120.126	120.726
175.0	175.021	174.603	174.848	174.652	175.830	175.321	175.411	174.440	175.222
180.0	179.792	179.374	179.575	179.376	180.643	180.081	180.174	179.217	180.014

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

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

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

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

UUC* : Unit Under Calibration

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

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

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CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES


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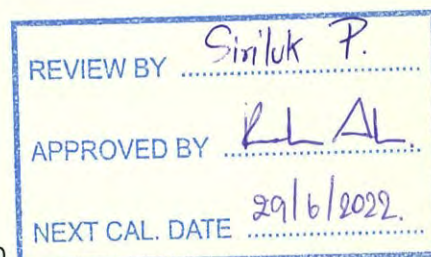
TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 20TW271

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	YSI
Model :	5000-230V
Serial No. :	09J101147
ID No. :	BKK_EN0017
Received Date :	28 December 2020
Test Date :	29 December 2020
Reference :	2012-0821WSC-1
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
Calibrated by :	Walalak Sirithean
Approved by :	 Approved Signatory
<input checked="" type="checkbox"/> Malee Butkruea <input type="checkbox"/> Saithip Meangmai <input type="checkbox"/> Warakorn Lerngagtrakul	
Issue Date :	5 January 2021





Cert.No.: 20TW271

Page.: 2 of 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)
8.00	7.99	0.0045

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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Maku.



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



Cert. No.: 21TM91

Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-230V

Serial No. : 09J101147

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 : 28 December 2020

Calibrated Date : 4 January 2021

Ambient Temperature : (26 \pm 10) °C

Relative Humidity : (50 \pm 30) %

AC Line Voltage : (220 \pm 22) V

Calibrated by : Suwit Imjai

Approved by :

Approved Signatory

() Pornthippa Tameyakul
(✓) Malee Butkruea

Issue Date : 7 January 2021

The Uncertainties are for a confidence probability of approximately 95%

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

A 0023424



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2012-0821WSC-2

Cert. No.: 21TM91
Page.: 2 of 2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Digital Thermometer	1502A	A52847	2011246	14 Oct 2021

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 maintained at:-

- National Institute of Metrology Thailand (NIMT)

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	20.010	19.94	-0.070	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 %.

-o0o-

Malu .



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. T212123

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : SHEL LAB

Model : 2020-2E

Serial No. : 802899

Customer Code : BKK_EN0005

ID No. : T7499A0

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab2

Date of Receipt : 1 October 2021

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  /Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 07 OCT 2021



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. T212123

Page 2 of 3

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 4-5 October 2021
Environment : Temperature : 23.8-24.9 °C
Line Voltage : 227.5-231.1 V
Relative Humidity : 55 - 65 %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	29-(CH1-10)	T210118	2 February 2022
DATA LOGGER	34970A	T47	T210118	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 2 Hour 20 Minute At 20 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

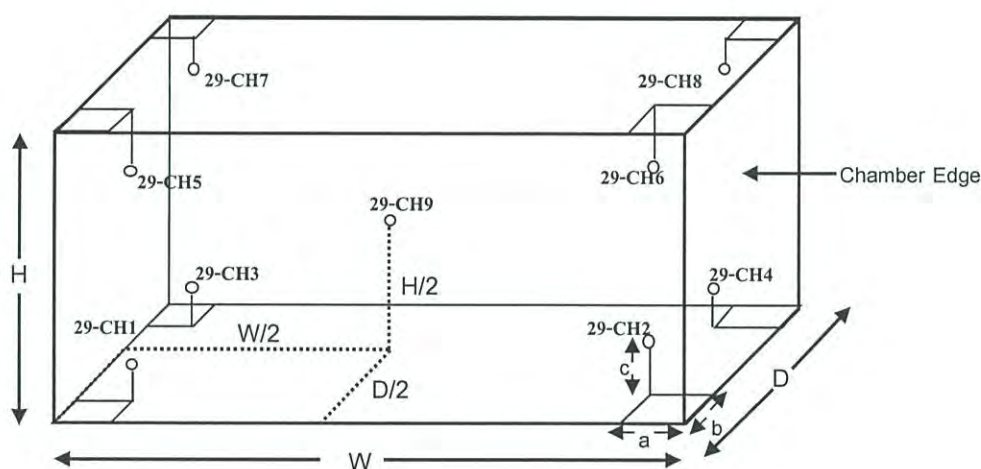
Approved By. _____



Certificate No. T212123

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 70 cm. , H (Height) = 130 cm. and D (Depth) = 55 cm.

Size of Installed Standard sensor number 29-CH1 to number 29-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 29-CH9 : W/2 = 70 cm./2 , H/2 = 130 cm./2 and D/2 = 55cm./2

Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	29-CH1	29-CH2	29-CH3	29-CH4	29-CH5	29-CH6	29-CH7	29-CH8	29-CH9
20	20.04	20.06	20.19	19.86	19.68	20.08	20.12	19.80	20.07
25	24.99	25.06	25.18	24.89	24.74	25.12	25.16	24.80	25.10

Chamber (Incubator)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average				
20.0	-	20.0	0.05	1.01	0.38	2.00
25.0	-	25.0	0.07	0.96	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. T220630

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.**104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250**Customer Location : Wet Chemistry Lab2****Date of Receipt : 21 March 2022****Calibrated By : Watcharapon Sangtong (Technician)****Approved By :  / Sujjar Naknakred (Site Calibration Manager)****Date of Issue : 03 APR 2022**

REVIEW BY	<u>Sararat M.</u>
APPROVED BY	<u>LL AL</u>
NEXT CAL. DATE	<u>21/03/23.</u>

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. T220630

Page 2 of 5

Calibration Report

Equipment : HOT BLOCK
Date of Calibration : 21 March 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	TN51-TN60	T220275	28 February 2023
TC	TYPE T	TN61-TN70	T220275	28 February 2023
DATA LOGGER	34970A	T47	T220275	28 February 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 1 Hour - Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By. 

Certificate No. **T220630**

Page **3** of **5**

Calibration Report

R7	49	50	51	52	53	54	55	56
R6	41	42	43	44	45	46	47	48
R5	33	34	35	36	37	38	39	40
R4	25	26	27	28	29	30	31	32
R3	17	18	19	20	21	22	23	24
R2	9	10	11	12	13	14	15	16
R1	1	2	3	4	5	6	7	8
Controller								

○ STANDARD THERMOCOUPLE TYPE T

No.1 = TN51	No.13 = TN63	No.25 = TN55	No.37 = TN67	No.49 = TN59
No.2 = TN52	No.14 = TN64	No.26 = TN56	No.38 = TN68	No.50 = TN60
No.3 = TN53	No.15 = TN65	No.27 = TN57	No.39 = TN69	No.51 = TN61
No.4 = TN54	No.16 = TN66	No.28 = TN58	No.40 = TN70	No.52 = TN62
No.5 = TN55	No.17 = TN67	No.29 = TN59	No.41 = TN51	No.53 = TN63
No.6 = TN56	No.18 = TN68	No.30 = TN60	No.42 = TN52	No.54 = TN64
No.7 = TN57	No.19 = TN69	No.31 = TN61	No.43 = TN53	No.55 = TN65
No.8 = TN58	No.20 = TN70	No.32 = TN62	No.44 = TN54	No.56 = TN66
No.9 = TN59	No.21 = TN51	No.33 = TN63	No.45 = TN55	
No.10 = TN60	No.22 = TN52	No.34 = TN64	No.46 = TN56	
No.11 = TN61	No.23 = TN53	No.35 = TN65	No.47 = TN57	
No.12 = TN62	No.24 = TN54	No.36 = TN66	No.48 = TN58	

Approved By. _____



Certificate No. T220630

Page 4 of 5

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)							
R1		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58
CAL POINT	Max	149.42	150.39	149.10	149.91	150.93	150.58	151.54	150.13
150	Min	149.27	150.15	148.51	149.65	150.72	150.39	151.43	149.97
	Average	149.35	150.27	148.81	149.78	150.83	150.48	151.49	150.05
R2		TN59	TN60	TN61	TN62	TN63	TN64	TN65	TN66
	Max	150.66	150.45	151.00	151.76	150.66	150.67	150.73	149.65
	Min	150.46	150.16	150.74	151.51	150.48	150.48	150.56	149.40
	Average	150.56	150.31	150.87	151.63	150.57	150.58	150.65	149.52
R3		TN67	TN68	TN69	TN70	TN51	TN52	TN53	TN54
	Max	150.90	151.18	151.10	151.05	150.16	150.55	149.86	150.39
	Min	150.68	151.00	150.84	150.75	149.36	149.17	148.95	149.17
	Average	150.79	151.09	150.97	150.90	149.76	149.86	149.41	149.78
R4		TN55	TN56	TN57	TN58	TN59	TN60	TN61	TN62
	Max	150.82	150.07	151.63	150.72	150.35	149.78	150.24	150.04
	Min	149.53	149.71	149.57	148.67	148.46	148.86	149.55	148.81
	Average	150.17	149.89	150.60	149.70	149.41	149.32	149.90	149.42
R5		TN63	TN64	TN65	TN66	TN67	TN68	TN69	TN70
	Max	150.00	149.68	150.31	149.66	150.34	150.48	150.09	149.51
	Min	149.81	149.58	149.49	149.42	149.20	149.60	149.69	149.38
	Average	149.90	149.63	149.90	149.54	149.77	150.04	149.89	149.44
R6		TN51	TN52	TN53	TN54	TN55	TN56	TN57	TN58
	Max	149.25	150.37	148.53	149.06	150.91	150.04	151.13	149.83
	Min	149.07	150.18	148.28	148.78	150.69	149.83	150.95	149.65
	Average	149.16	150.28	148.41	148.92	150.80	149.94	151.04	149.74
R7		TN59	TN60	TN61	TN62	TN63	TN64	TN65	TN66
	Max	149.38	149.24	149.88	150.17	149.72	149.45	149.63	149.51
	Min	149.22	149.05	149.68	149.99	149.61	149.34	149.48	149.36
	Average	149.30	149.15	149.78	150.08	149.67	149.40	149.56	149.43

Approved By. _____





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. T220630

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	149.9 , 150.1	150.0	1.04	1.44

* 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.

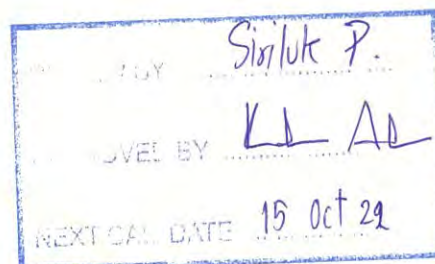
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-290/21
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533CD
ID No. BKK_EN0018
Date of receipt 15 October 2021
Date of calibration 15 October 2021
Date of issue 25 October 2021



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

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

Temperature (25.0 - 26.4) °C (On site)
Humidity (49.5 - 53.4) %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. 87839 and 87844
Photometric Accuracy is traceable to certificate No. 87846 and 87877
Stray Light is traceable to certificate No. 87825
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

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-290/21

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	333.80	-0.22	0.18
418.53	418.40	-0.13	0.18
572.99	572.85	-0.14	0.18
879.41	879.15	-0.26	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
	0.7174	0.7198	0.0024	0.0075
257	0.0000	-0.0001	-0.0001	0.0075
	0.8362	0.8377	0.0015	0.0075
313	0.0000	0.0000	0.0000	0.0075
	0.2778	0.2803	0.0025	0.0075
350	0.0000	-0.0001	-0.0001	0.0075
	0.6202	0.6221	0.0019	0.0075

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Certificate of Calibration

Certificate No. **BSCC-UV-290/21**

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
	0.5631	0.5570	-0.0061	0.0042
	0.7390	0.7334	-0.0056	0.0042
	1.0863	1.0816	-0.0047	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5524	0.5469	-0.0055	0.0042
	0.7217	0.7166	-0.0051	0.0042
	1.0606	1.0570	-0.0036	0.0042
465.0	0.0000	0.0000	0.0000	0.0042
	0.5018	0.4966	-0.0052	0.0042
	0.6657	0.6610	-0.0047	0.0042
	0.9775	0.9740	-0.0035	0.0042
546.1	0.0000	0.0000	0.0000	0.0042
	0.5147	0.5113	-0.0034	0.0042
	0.6743	0.6705	-0.0038	0.0042
	0.9909	0.9890	-0.0019	0.0042
590.0	0.0000	0.0000	0.0000	0.0042
	0.5427	0.5394	-0.0033	0.0042
	0.7037	0.7001	-0.0036	0.0042
	1.0338	1.0323	-0.0015	0.0042
635.0	0.0000	0.0000	0.0000	0.0042
	0.5268	0.5235	-0.0033	0.0042
	0.6720	0.6685	-0.0035	0.0042
	0.9864	0.9847	-0.0017	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91 \pm 0.11nm	200.31	0.9399	2.0274

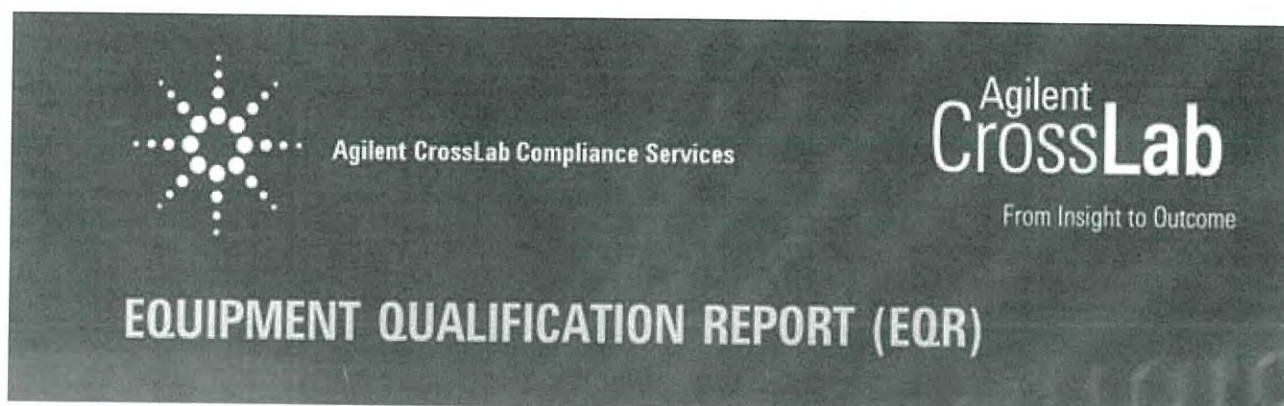
The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*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:	JP15471169
EQP Name:	AgilentRecommended
EQP Revision:	ICPMS.02.50
EQP Publish Date:	March 2020
Date:	September 30, 2021 4:07:18 PM
Report Type:	Report
Org. Name:	ALS Laboratory Group (Thailand) Co.,Ltd.
Org. Location:	104 Phattanakarn 40, Suan Luang, Bangkok 10250.

REVIEW BY	Supakorn M.
APPROVED BY	Sauntan N.
NEXT CAL. DATE	29 March 2023

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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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 : SPS4	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS3	Pass	1
Autotune : G8403A	Pass	1
Background (No Gas Mode) : G8403A	Pass	1
Background (Gas Modes) : G8403A	Pass	1
20-Minute Stability (No Gas Mode) : G8403A	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: 6004837154
EQP Name: AgilentRecommended
EQP Revision: ICPMS.02.50
Report Type: Report

Organization Details

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

Local Contact Details

Name: Chatchanai Komarakul.
Job Title: Manager
Qualification Location: Laboratory

Operator Details

Name: Panthep Kurasathain
Job Title: Field Service Engineer.

Data Acquisition Details

Acquisition Software Name: MassHunter
Acquisition Software Revision: C.01.04

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	7900
Model Number	G8403A
Installed Options	#100H: Standard Package with Hydrogen option
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP15471169
Firmware Revision	C.01.04

ISIS 1

Manufacturer	Agilent Technologies
Name	ISIS3
Model Number	G8411A
Type	Peristaltic pump system
Serial Number	JP15510227

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15430722

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	3U1610713

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	0.719	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Peakwidth Mass 89	0.750	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Peakwidth Mass 205	0.713	AMU
Agilent Recommended:	>= 0.65	
	<= 0.80	
Status:	Pass	
Mass Axis 7	7.05	AMU
Agilent Recommended:	>= 6.9	
	<= 7.1	
Status:	Pass	
Mass Axis 89	88.95	AMU
Agilent Recommended:	>= 88.9	
	<= 89.1	
Status:	Pass	
Mass Axis 205	205.00	AMU
Agilent Recommended:	>= 204.9	
	<= 205.1	
Status:	Pass	

Mass 7 Sensitivity No Gas

94.28

Mcps/ppm

Agilent Recommended:

>=

25.5

Status:

Pass

Mass 89 Sensitivity No Gas

307.15

Mcps/ppm

Agilent Recommended:

>=

127.5

Status:

Pass

Mass 205 Sensitivity No Gas

203.77

Mcps/ppm

Agilent Recommended:

>=

76.5

Status:

Pass

Mass 59 Sensitivity He

28.38

Mcps/ppm

Agilent Recommended:

>=

23.8

Status:

Pass

Mass 89 Sensitivity H2

129.27

Mcps/ppm

Agilent Recommended:

>=

68

Status:

Pass

Oxide Ratio 156/140

1.047

%

Agilent Recommended:

<=

1.38

Status:

Pass

Doubly Charged Species Ratio 70/140

1.482

%

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:	3.200	3.300	9.900	cps
Agilent Recommended:	<= 6.9	<= 4.6	<= 11.5	
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: 42.8500 cps
Agilent Recommended: ≤ 115
Status: Pass

Setpoint Status: Pass

Runs: 1

Setpoint Gas Mode: Hydrogen

Conditions

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

Measurements and Results

Mass (AMU): 78
Measured Value: 2.1500 cps
Agilent Recommended: ≤ 4.6
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:	0.96400	0.51495	0.73011	%
Agilent Recommended:	<= 2.3	<= 2.3	<= 2.3	
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	18
EQR	General	Operator's training certificate and qualifications	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Certificate of Qualification for ACE	21
EQR	General	Tune reports	22
EQR	General	Test Report	25
EQR	General	Test Report	27
EQR	General	Test Report	29

General

Document Name: Certificate of System Qualification

**Agilent Technologies****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

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Panthep Kurasathain

Title Of Course: AN-CE-ICPMS-2-038-A:Agilent 7900 ICPMS FSE update training

Completion Date: June 7, 2014

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-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

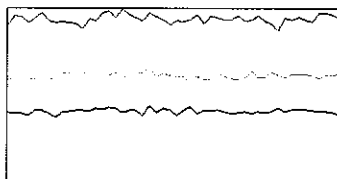
Document Name: Tune reports

Tune Report

Operator Name Supakwan Mak
 Acq/Data Batch C:\Agilent\ICPMS\11\UserTune_7900.b
 Acq. Date-Time 2021-09-30 14:44:08
 Report Comment OQ 30 Sep 2021
 Instrument Name GB403A JP15471169

[No Gas]

Sensitivity



Mass	Range	Count	RSD%	Background
7	10000	9428	2.630	3.200
89	50000	30716	2.825	3.300
205	60000	20377	3.319	9.900

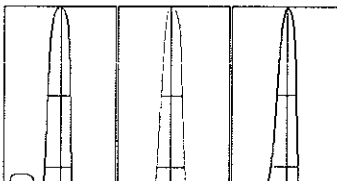
Sampling Period [sec] 0.311

Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 1.047 %
 Doubly Charged 70 / 140 1.482 %

Resolution/Axis



Mass	Peak Height	Axis	W-50%	W-10%
7	9474.89	7.05	0.62	0.719
89	30716.43	88.95	0.59	0.750
205	20596.12	205.00	0.52	0.713

Integration Time [sec] 0.1

Acquisition Time [sec] 22.74

Y Axis Linear

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	1.00 L/min	Makeup Gas	0.10 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.10 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	9.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	9.1 V	Deflect	13.6 V
Extract 2	-205.0 V	Cell Entrance	-30 V	Plate Bias	-35 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		

1 of 3

2021-09-30 2:44 PM

Date: September 30, 2021 4:07:18 PM
 System ID: JP15471169

Document Name:

Tune reports

Tune Report

H2 Flow 0.0 mL/min

OctP RF 190 V

QP Parameters

Mass Gain 124

Axis Gain 0.9990

QP Bias -3.0 V

Mass Offset 125

Axis Offset 0.01

Hardware Settings

Torch

Torch H -0.3 mm

Torch V 0.1 mm

EM

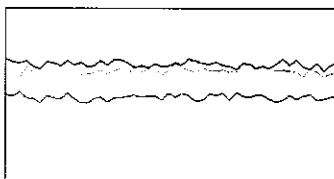
Discriminator 4.0 mV

Analog HV 2247 V

Pulse HV 1318 V

[H2]

Sensitivity



Mass	Range	Count	RSD%	Background
59	5000	2453	3.423	0.400
89	20000	12927	2.822	0.200
205	20000	13635	2.445	8.701

Sampling Period [sec] 0.31

Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 0.804 %

Doubly Charged 70 / 140 1.020 %

Tune Parameters

Plasma Parameters

Plasma Mode ---

Nebulizer Gas 1.00 L/min

Makeup Gas 0.10 L/min

RF Power 1550 W

Option Gas ---

Auxiliary Gas 0.90 L/min

RF Matching 1.10 V

Nebulizer Pump 0.10 rps

Plasma Gas 15.0 L/min

Sample Depth 9.0 mm

S/C Temp 2 °C

Lens Parameters

Extract 1 0.0 V

Omega Lens 9.0 V

Deflect 6.0 V

Extract 2 -210.0 V

Cell Entrance -30 V

Plate Bias -100 V

Omega Bias -105 V

Cell Exit -90 V

Cell Parameters

Use Gas Yes

3rd Gas Flow ---

Energy Discrimination 3.5 V

He Flow 0.0 mL/min

OctP Bias -22.0 V

H2 Flow 5.0 mL/min

OctP RF 200 V

QP Parameters

Mass Gain 124

Axis Gain 0.9990

QP Bias -18.5 V

Mass Offset 125

Axis Offset 0.01

Hardware Settings

Torch

Torch H -0.3 mm

Torch V 0.1 mm

2 of 3

2021-09-30 2:44 PM

Document Name:

Tune reports

Tune Report

EM

Discriminator

4.0 mV

Analog HV

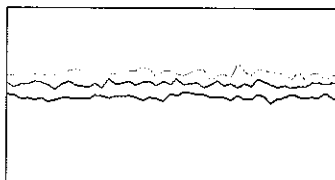
2247 V

Pulse HV

1318 V

[He]

Sensitivity



Mass	Range	Count	RSD%	Background
59	5000	2838	2.592	6.000
89	5000	3149	3.359	5.200
205	20000	9837	2.895	4.201

Sampling Period [sec] 0.31

Integration Time [sec] 0.1

Oxide/Doubly Charged Ratio

Oxide 156 / 140 0.498 %

Doubly Charged 70 / 140 0.788 %

Tune Parameters

Plasma Parameters

Plasma Mode	---	Nebulizer Gas	1.00 L/min	Makeup Gas	0.10 L/min
RF Power	1550 W	Option Gas	---	Auxiliary Gas	0.90 L/min
RF Matching	1.10 V	Nebulizer Pump	0.10 rps	Plasma Gas	15.0 L/min
Sample Depth	9.0 mm	S/C Temp	2 °C		

Lens Parameters

Extract 1	0.0 V	Omega Lens	9.2 V	Deflect	12.4 V
Extract 2	-225.0 V	Cell Entrance	-30 V	Plate Bias	-100 V
Omega Bias	-105 V	Cell Exit	-50 V		

Cell Parameters

Use Gas	Yes	3rd Gas Flow	---	Energy Discrimination	3.5 V
He Flow	3.8 mL/min	OctP Bias	-8.0 V		
H2 Flow	0.0 mL/min	OctP RF	200 V		

QP Parameters

Mass Gain	124	Axis Gain	0.9990	QP Bias	-4.5 V
Mass Offset	125	Axis Offset	0.01		

Hardware Settings

Torch

Torch H	-0.3 mm	Torch V	0.1 mm
---------	---------	---------	--------

EM

Discriminator

4.0 mV

Analog HV

2247 V

Pulse HV

1318 V

General

Document Name: Test Report

Batch Summary Report

Batch Folder: C:\Batch2021\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		2021-09-30 14:21:47	BG He.d	BG He	Sample		1.0000

Document Name:

Test Report

Batch Summary Report

Analyte Table

		78 [He1]
	Sample Name	CPS
1	BG He	42.8500

Page 2 / 2

2021-09-30 14:23:40

General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Service\CQ 30 Sep 2021\BG H2 new.b\
Analysis File: BG H2 new.batch.bin
Tune Step: #1 H2

	Rict	Acq. Date-Time	Data File	Sample Name	Type	Level	Dilution
1		2021-09-30 15:08:58	BG H2.d	BG H2	Sample		1.0000

Document Name:

Test Report

Batch Summary Report

Analyte Table

		78 [H2]
	Sample Name	CPS
1	BG H2	2.1500

General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Service\OQ 30 Sep 2021\20 Min.b\
Analysis File: 20 Min.batch.bin
Tune Step: #1 No Gas

	Rict	Acq. Date-Time	Data File	Sample Name	Type	Level	Dilution
1		2021-09-30 15:17:44	20 Min.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]	140 [No Gas]	205 [No Gas]
Sample Name		CPS RSD	CPS RSD	CPS RSD	CPS RSD	CPS RSD	CPS RSD
1	20 Min	0.96400	7.02464	0.46857	0.51495	0.61014	0.73011

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:	September 30, 2021
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: ASBKKWX315

System Id: JP15471169
 Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:50:07 PM	Audit	SessionCreated	Session	None
September 30, 2021 3:50:07 PM	Start	Configuration	Session	None
September 30, 2021 3:50:07 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
September 30, 2021 3:52:52 PM	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]
September 30, 2021 3:52:54 PM	End	Configuration	Session	None
September 30, 2021 3:52:57 PM	Start	Qualification	Session	OQ
September 30, 2021 3:52:57 PM	Start	Execution	Autosampler Check : SPS4: Autosampler Check	None
September 30, 2021 3:53:03 PM	End	Execution	Autosampler Check : SPS4: Autosampler Check	Run Count : 1
September 30, 2021 3:53:04 PM	Start	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS3: Integrated Sample Introduction System (ISIS) Check	None
September 30, 2021 3:53:08 PM	End	Execution	Integrated Sample Introduction System (ISIS) Check : ISIS3: Integrated Sample Introduction System (ISIS) Check	Run Count : 1

User Name: panthep_kurasathain
 Hostname: ASBKKWX315

System Id: JP15471169
 Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:53:10 PM	Start	Execution	Autotune : G8403A: Autotune 1	None
September 30, 2021 3:55:08 PM	End	Execution	Autotune : G8403A: Autotune 1	Run Count : 1
September 30, 2021 3:55:12 PM	Start	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	None
September 30, 2021 3:55:40 PM	End	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	Run Count : 1
September 30, 2021 3:55:43 PM	Start	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Helium	None
September 30, 2021 3:56:17 PM	End	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Helium	Run Count : 1
September 30, 2021 3:56:19 PM	Start	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Hydrogen	None
September 30, 2021 3:56:38 PM	End	Execution	Background (Gas Modes) : G8403A: Gas Mode Background :Hydrogen	Run Count : 1
September 30, 2021 3:56:41 PM	Start	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	None
September 30, 2021 3:57:22 PM	End	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	Run Count : 1
September 30, 2021 3:57:24 PM	End	Qualification	Session	OQ
September 30, 2021 3:57:24 PM	Start	Reporting	Session	None

User Name: panthep_kurasathain
Hostname: ASBKKWX315

System Id: JP15471169
Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 4:03:07 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:03:17 PM	Audit	Reporting	Session	Report Generated : Report
September 30, 2021 4:03:59 PM	Start	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	End	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	Start	Reporting	Session	None
September 30, 2021 4:04:26 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:04:36 PM	Audit	Reporting	Session	Report Generated : Report

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	Sangtong N.
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

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

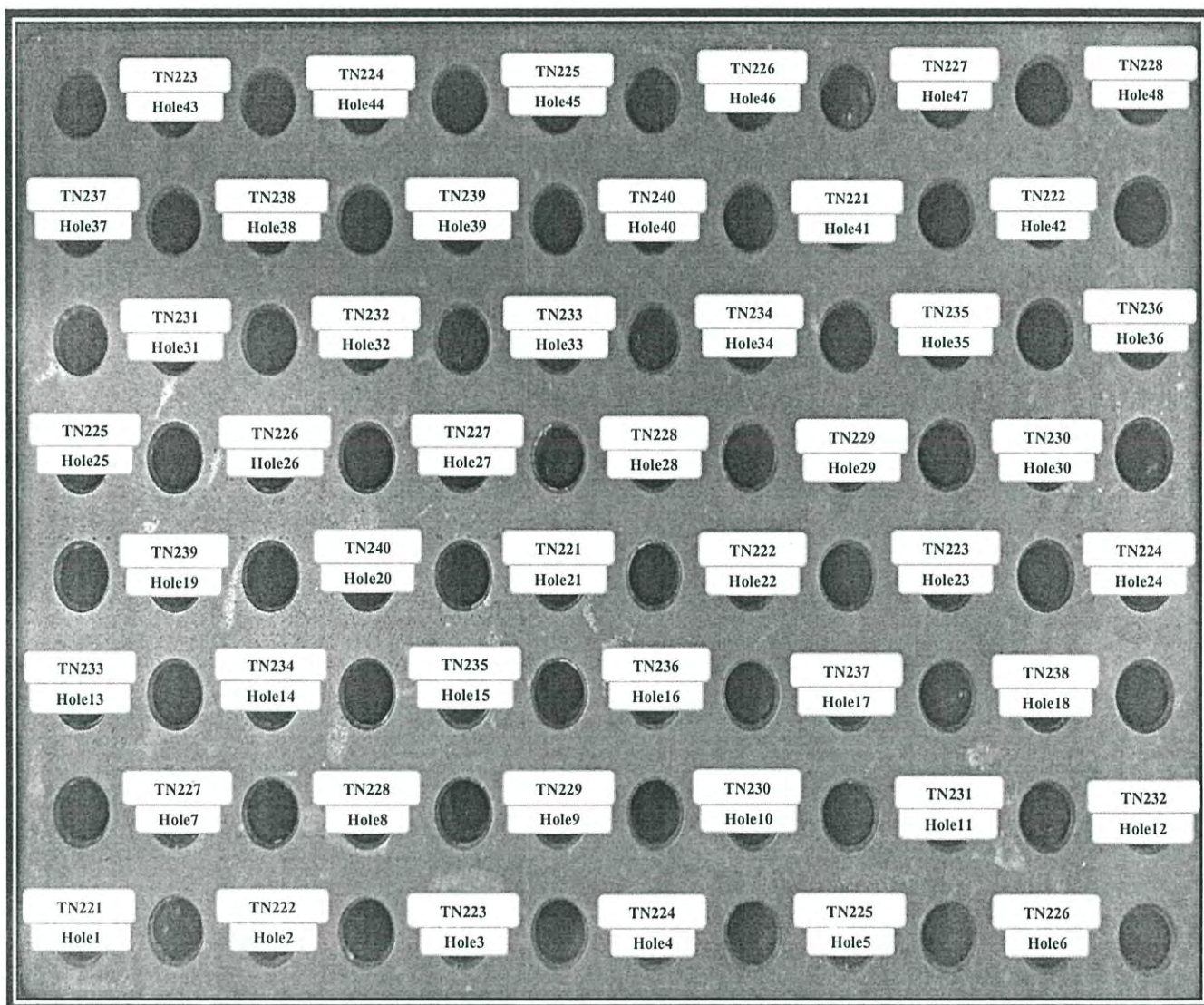
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Certificate No. **T220730**

Page **4 of 6**

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. _____



Certificate No. T220730

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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

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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. 



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. T211009

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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 : Laboratory

Date of Receipt : 6 May 2021

Calibrated By : Watcharapon Songthong (Technician)

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

Date of Issue : 20 MAY 2021

REVIEW BY	<u>Sinlue P.</u>
APPROVED BY	<u>LL AL</u>
NEXT CAL. DATE	<u>16/11/22</u>

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. T211009

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Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 18 May 2021
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 :

- 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 .

- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	8 January 2022
TC	TYPE T	TN171-TN180	T210009	8 January 2022
DATA LOGGER	34970A	T149	T210009	8 January 2022

- This certificate is traceable to :

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

- Condition of calibrated item : good

Equipment Description :

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

- Adjustment :

(X) without adjustment

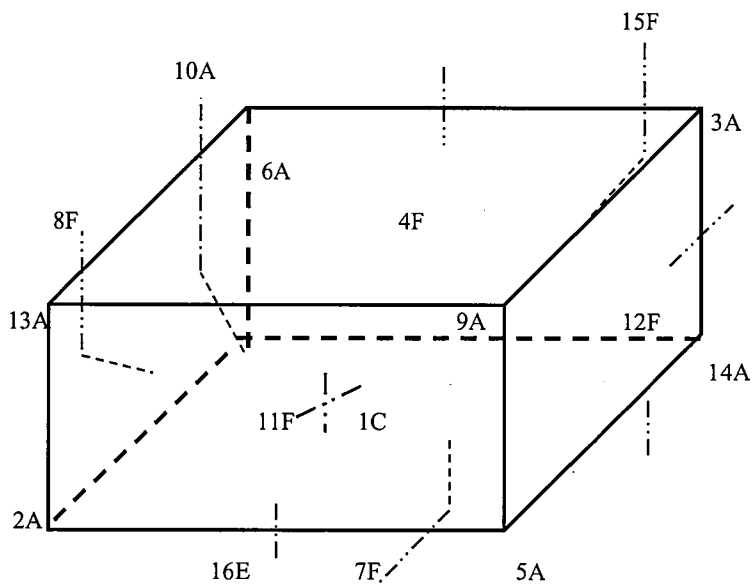
() after adjustment

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Certificate No. T211009

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Calibration Report



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

1C = TN161	12F = TN172
2A = TN162	13A = TN173
3A = TN163	14A = TN174
4F = TN164	15F = TN175
5A = TN165	16E = TN176
6A = TN166	
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	
11F = TN171	

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Certificate No. T211009

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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	3.23	3.38	3.23	3.41	3.36	3.52	3.51	3.11	3.29	3.50
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.36	3.18	3.52	3.22	3.28	3.31				

Chamber (Cold 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	2.7 , 3.4	3.0	3.34	1.00	1.10	1.46	2.00

* The Acuoted 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. 