



บริษัท ปตท. น้ำมันและการค้าปลีก จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม  
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการทำเทียบเรือขนถ่ายน้ำมันและก๊าซปิโตรเลียมเหลวสุราษฎร์ธานี แห่งที่ 2

ระหว่างเดือนกรกฎาคมถึงธันวาคม พ.ศ. 2565

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Songkhla Lab	BOD (5 days at 20°C)	Incubator	SGK_CL0028	25-Jan-22	26-Jul-23	18
Songkhla Lab	BOD (5 days at 20°C)	DO/BOD Analyser	SGK_CL0073	2-Dec-21	2-Dec-22	12
Songkhla Lab	pH at 25 oC	pH meter	SGK_CL0030	9-Nov-21	10-May-23	18
Songkhla Lab	Oil & Grease	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Oil & Grease	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Oil & Grease	Water Bath	SGK_CL0035	5-Feb-22	6-Aug-23	12
Songkhla Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Total Dissolved Solids 180°C	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Total Suspended Solids	Electronic Top-Loading Balance	SGK_CL0045	5-Feb-22	5-Feb-23	12
Songkhla Lab	Total Suspended Solids	Oven	SGK_CL0025	9-Nov-21	10-May-23	18
Songkhla Lab	Dissolved Oxygen	DO Meter	SGK_FS0018	21-Jan-22	21-Jan-23	12
Songkhla Lab	Total Coliform	Autoclave	SGK_ML0001	5-Jul-21	3-Jan-23	18
Songkhla Lab	Total Coliform	Incubator	SGK_ML0013	6-Aug-22	6-Feb-24	18
Songkhla Lab	Total Coliform	pH Meter	SGK_ML0016	5-Jul-21	3-Jan-23	18
Songkhla Lab	Total Coliform	Water Bath	SGK_ML0021	6-Aug-21	4-Feb-23	18
Songkhla Lab	Fecal Coliform	Autoclave	SGK_ML0001	5-Jul-21	3-Jan-23	18
Songkhla Lab	Fecal Coliform	Incubator	SGK_ML0013	6-Aug-22	6-Feb-24	18
Songkhla Lab	Fecal Coliform	pH Meter	SGK_ML0016	5-Jul-21	3-Jan-23	18
Songkhla Lab	Fecal Coliform	Water Bath	SGK_ML0021	6-Aug-21	4-Feb-23	18
Songkhla Lab	Arsenic	ICP-MS	SGK_CL0048	8-Feb-22	8-Feb-23	12
Songkhla Lab	Arsenic	Cold Room Water	SGK_CL0065	16-Aug-21	14-Feb-23	18
Ambient	Volatile Organic Compounds	GC-MSD	RYG_EN0136	7-Jul-22	7-Jan-24	18
Ambient	Total Hydrocarbon	Total Hydrocarbon Analyzer	BKK_EN0057	9-Aug-22	9-Feb-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKK_FS0917	1-Nov-21	2-May-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	SGK_FS0036	13-Jul-22	12-Jan-24	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 24 hrs	Sound Calibrator	SGK_FS0011	9-Sep-22	9-Sep-23	12
Noise	Leq 24 hrs	Sound Level Meter	SGK_FS0014	11-Jul-22	11-Jul-23	12
Noise	Noise Annoyance	Sound Calibrator	SGK_FS0011	9-Sep-22	9-Sep-23	12
Noise	Noise Annoyance	Sound Level Meter	SGK_FS0014	11-Jul-22	11-Jul-23	12



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.: 22TM75

Page.: 1 of 3

## Certificate of Calibration

Equipment : Incubator  
Manufacturer : Memmert  
Model : ICP 750  
Serial No. : F816.0063  
ID No. : SGK\_CL0028  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
Songkhla Branch.  
114/1 Moo 8, Kanjanavanij Rd., Banphru,  
Hatyai, Songkhla 90250, Thailand  
Location : BOD Room  
Received Order : 24 January 2022  
Calibration Date : 25 January 2022  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Kunchit Promprat

REVIEW BY Ananta B.  
APPROVED BY Kanitta H.  
NEXT CAL. DATE 26/7/23

Approved by :

Malee  
Approved Signatory

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

Issue Date : 7 February 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.

A 0037405



Equipment : Incubator  
 Condition As-Received : Used Item  
 Reference : 2201-0617OC-3  
 Procedure Used :-

Cert. No.: 22TM75

Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1 ) Data Acquisition	34972A	MY57013823	21LM3/1	26 Feb 2022

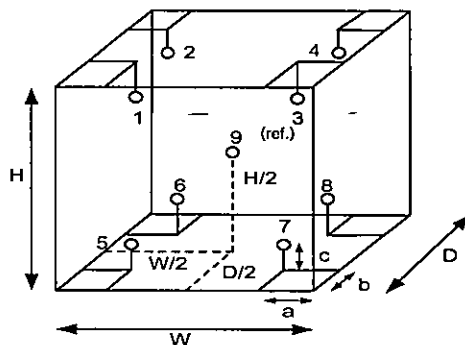
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 )	28	28
REL.Humid. ( % )	57	52
AC Supply ( Volt )	231	231

#### Probe Installation Details :

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

#### Dimension of Chamber :

D = 0.60 m  
 W = 1.0 m  
 H = 1.2 m  
 Capacity = 0.75 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	21-17RTD-01
2	21-17RTD-02
3	17RTD-03
4	17RTD-04
5	17RTD-05
6	17RTD-06
7	17RTD-07
8	17RTD-08
9 (ref.)	17RTD-09

*Malu.*



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2201-0617OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 22TM75

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>
20.0	20.0	20.1	0.094	0.50	0.83	0.30	2

Calibration Point ( °C )	Measured Temperature ( °C )								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.280	20.370	20.363	20.378	19.915	19.925	19.673	19.727	20.098

**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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*Mah.*



**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.:** 21TW256

**Page.:** 1 of 2

## Certificate of Testing

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



Cert.No.: 21TW256

Page.: 2 of 2

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

Dissolved Oxygen Probe No.: 17B100103

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

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

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*Malu.*

a 1084082





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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.: 21LM26

Page.: 1 of 2

## Certificate of Calibration

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

The Uncertainties are for a confidence probability of approximately 95%

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

A 0032821



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

Cert. No.: 21LM26

Page.: 2 of 2

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

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

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

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

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

**Function :** Temperature measurement.

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

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

**UUC\* :** Unit Under Calibration

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

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*Mala*



## CALIBRATION CERTIFICATE

Issued Date : 12-Nov-2021

Certificate No. : 21PH192

CSR No. : A012/00583

Page. : 1 of 2

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

Calibration Place : Chemical Laboratory

Instrument Name : pH meter

Manufacturer : Mettler Toledo

Model : S220

Serial No. : B625631849

ID No. : SGK\_CL0030

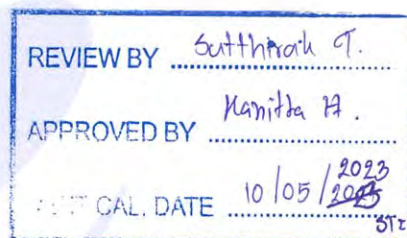
Electrode No. : 6404000

Received Date : 9-Nov-2021

Calibrated Date : 9-Nov-2021

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

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



### Calibration Method Used :

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

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

### Traceability of measurement :

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

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

Calibrated by : Jessadagon Lemhud

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

3. This certificate is not certified any commercial transaction

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

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

#### 1. Electrical Measurement

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

#### 2. Sample Test Measurement

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

#### 3. Temperature Measurement

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

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...





# Southern Calibration Service Co., Ltd.

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

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



## CALIBRATION CERTIFICATE

Issued Date : 8-Feb-2022

Certificate No. : 22EB149

CSR No. : A023/01123

Page. : 1 of 3

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

Calibration Place : Chemical Laboratory  
Instrument Name : Electronic Balance  
Manufacturer : Sartorius  
Model : MSE224S-100-DU  
Serial No. : 34705158  
ID No. : SGK\_CL0045  
Resolution : 0.0001 g  
Received Date : 5-Feb-2022  
Calibrated Date : 5-Feb-2022  
Ambient Temperature : (30 ±10) °C  
Relative Humidity : (50 ±20) %

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

### Calibration Method Used :

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

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

### Traceability of measurement :

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

- Tcs : Thai Calibration Service Co.,Ltd.

Calibrated by : Imron Rattanaylum

Approved by :

Sakeereen Heemhad / Technical Manager

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Certificate No. : 22EB149

CSR No. : A023/01123

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### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

3. This certificate is not certified any commercial transaction

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

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

#### 1. Repeatability

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

#### 2. Effect of tare

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

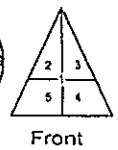
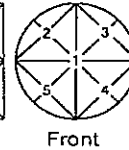
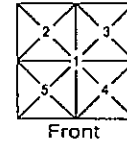
**Result of Calibration :**

**3. Off-centre loading**

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

The balance reading obtained are given in the table.

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



**4. Departure from nominal value**

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

- UUC = Unit Under Calibration

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

...End...



# Southern Calibration Service Co., Ltd.

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

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



## CALIBRATION CERTIFICATE

Issued Date : 12-Nov-2021

Certificate No. : 21OV734

CSR No. : A012/00583

Page. : 1 of 3

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

Calibration Place : Chemical Laboratory

Instrument Name : Hot Air Oven

Manufacturer : Memmert

Model : UF110

Serial No. : B416.3392

ID No. : SGK\_CL0025

Resolution : 0.1 °C

Received Date : 9-Nov-2021

Calibrated Date : 9-Nov-2021

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY *Sutthirak S.*  
APPROVED BY *Kamilla H.*  
NEXT CAL. DATE *10/05/2023*

### Calibration Method Used :

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

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

### Traceability of measurement :

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

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

*Sakeereen*  
Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

3. This certificate is not certified any commercial transaction

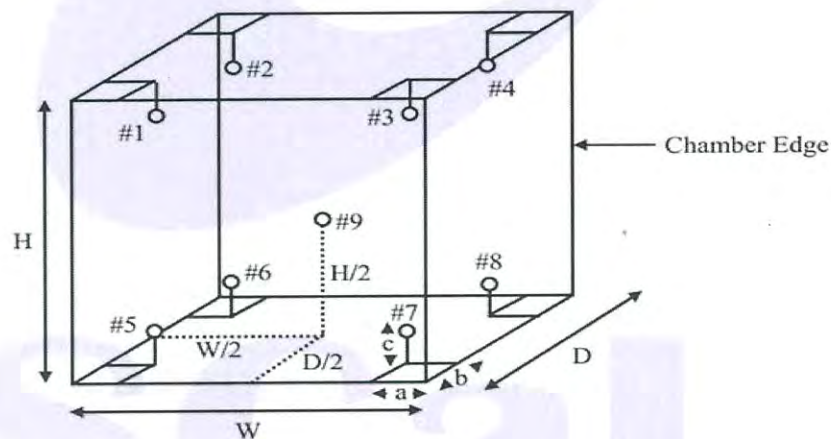
4. Condition of Item : normal condition , no indication for any damage or malfunction

### Result of Calibration .:

(✓) Without Adjustment

( ) After Adjustment

#### 1. Sensor Installation Diagram



#### Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

#### Dimension of the chamber

W = 40.0 cm

H = 40.0 cm

D = 33.0 cm

### Result of Calibration :

#### 2. Temperature Measurement Accuracy Test

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

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

#### 3. Performance Result

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

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

- UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...



# Southern Calibration Service Co., Ltd.

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

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



## CALIBRATION CERTIFICATE

Issued Date : 8-Feb-2022

Certificate No. : 22WB004

CSR No. : A0223/01123

Page. : 1 of 3

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

Calibration Place : Chemical Laboratory  
Instrument Name : Water Bath  
Manufacturer : Memmert  
Model : WNE29  
Serial No. : L616.0538  
ID No. : SGK\_CL0035  
Resolution : 0.1 °C  
Received Date : 5-Feb-2022  
Calibrated Date : 5-Feb-2022  
Ambient Temperature : (30 ± 10) °C  
Relative Humidity : (50 ± 30) %

REVIEW BY	Ananta B.
APPROVED BY	Kanitta H.
NEXT CAL. DATE	6/02/2023

### Calibration Method Used :

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

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

### Traceability of measurement :

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

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Imron Rattanaylum

Approved by :

Sakeereen Heemhad / Technical Manager

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

### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

3. This certificate is not certified any commercial transaction

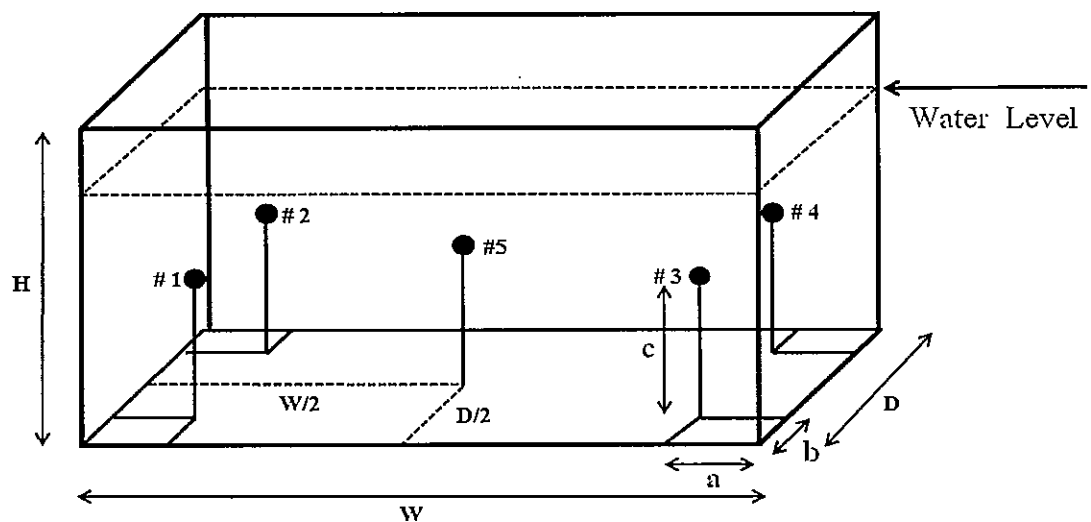
4. Condition of Item : normal condition , no indication for any damage or malfunction

### Result of Calibration :

(✓) Without Adjustment

( ) After Adjustment

#### 1. Sensor Installation Diagram



#### Sensor Installation Details

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

#### Dimension of the chamber

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

### Result of Calibration .:

#### 2. Temperature Measurement Accuracy Test

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

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

#### 3. Performance Result

The performance of the Water Bath are reported as shown below

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

- UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...





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.: 22TW16

Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : Mettler Toledo  
Model : Seven2Go Pro  
Serial No. : B728366470  
ID No. : SGK\_FS0018  
Received Date : 19 January 2022  
Test Date : 21 January 2022  
Reference : 2201-0586DSC-1  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
Songkhla Branch.  
114/1 Moo 8 Karnchanawanich Rd., T.Ban Phru,  
A.Hat Yai, Songkhla 90250 Thailand

REVIEW BY	<i>Warakorn P.</i>
APPROVED BY	<i>rich chon</i>
NEXT CAL. DATE	21/01/23

Laboratory Condition : Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

*Warakorn.*

Approved Signatory

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

Issue Date : 31 January 2022



Cert.No.: 22TW16

Page.: 2 of 2

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

Dissolved Oxygen Probe No.: 526334

<b>Titration Method (Azide Modification Method)</b> (mg/L)	<b>DO Meter Reading</b> (mg/L)	<b>Standard Deviation</b> (mg/L)
8.16	8.21	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

-o0o-

Wara korn





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.: 22LM7

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor

**Manufacturer :** Mettler Toledo

**Model :** Seven2Go Pro

**Serial No. :** B728366470

**ID No. :** SGK\_FS0018

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

**Location :** TPA Chemistry Calibration Laboratory

**Received Order :** 19 January 2022

**Calibrated Date :** 26 January 2022

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

**Relative Humidity :** ( 50 ± 30 ) %

**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Malee Butkruea

**Approved by :**   
Approved Signatory

( ) Pornthippa Tameyakul  
(✓) Suwit Imjai

**Issue Date :** 31 January 2022

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0037107





Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2201-0586DSC-2

Cert. No.: 22LM7

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:-

**Instrument**

**Model**

**Serial No.**

**Cert. No.**

**Due Date**

1) Digital Thermometer

1523

2188080

2111273

22 Nov 2022

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

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

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

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 526334'

<b><u>Calibration Point</u></b> ( °C )	<b><u>Immersion Depth</u></b> ( mm )	<b><u>Standard Temperature</u></b> ( °C )	<b><u>UUC* Reading</u></b> ( °C )	<b><u>Error</u></b> ( °C )	<b><u>Uncertainty</u></b> ( ± °C )	<b><u>Coverage Factor</u></b> <i>k</i>
20.0	80	20.001	20.2	0.199	0.16	2.00

**UUC\* :** Unit Under Calibration

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

-o0o-

*Yusuf*



## CALIBRATION CERTIFICATE

Issued Date : 8-Jul-2021

Certificate No. : 21ATC051

CSR No. : A047/2301

Page. : 1 of 3

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

**Calibration Place** : Microbiological Laboratory

**Instrument Name** : Autoclave

**Manufacturer** : TOMY

**Model** : SX-700

**Serial No.** : 52134079

**ID No.** : SGK\_ML0001

**Resolution** : 1 °C

**Received Date** : 5-Jul-2021

**Calibrated Date** : 5-Jul-2021

**Ambient Temperature** : (30 ± 10) °C

**Relative Humidity** : (50 ± 30) %

REVIEW BY	<i>APD Nattawut P.</i>
APPROVED BY	<i>Kanitta H.</i>
NEXT CAL. DATE	<i>03/01/2023</i>

### Calibration Method Used :

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

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

### Traceability of measurement :

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

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

Calibrated by : Ibrorhim Saleemin

Approved by :

*o.w.*  
Adull Lemsoh / Laboratory Manager

The uncertainties are for a confidence probability of approximately 95%

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### Details of Calibration

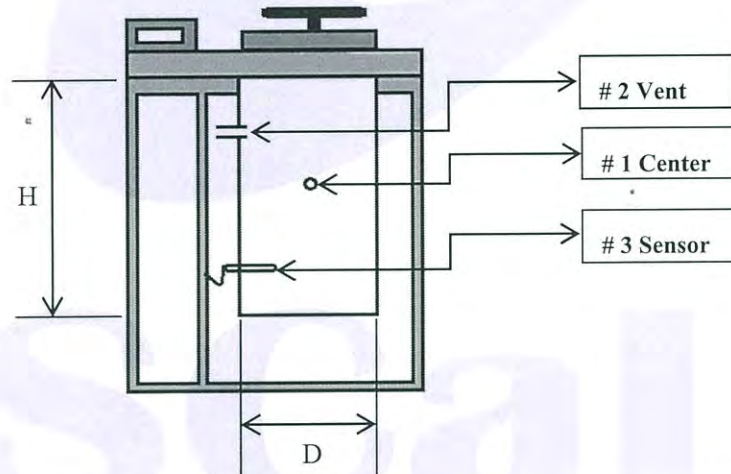
#### 1. Reference Standard Equipment Used:

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

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

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

#### 1. Sensor Installation Diagram



Chamber Diameter (D) : 30 cm

Chamber Height (H) : 70 cm

### Result of Calibration ::

#### 2. Temperature Measurement Accuracy Test

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

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

#### 3. Performance Result

The performance of the Autoclave are reported as shown below

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

\* UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...



**Southern Calibration Service Co., Ltd.**

669/35 Karnjanavanit Rd., Banpru, Hatyai, Songkla 90250 Thailand  
Tel : 08 1599 0417 Fax : 0 7480 5133 Email : s.calibration@gmail.com www.scal-lab.com



## CALIBRATION CERTIFICATE

Issued Date : 9-Aug-2022

Certificate No. : 22OV529

CSR No. : A037/01847

Page : 1 of 3

Customer : ALS Laboratory Group (Thailand) Co., Ltd  
114/1 Moo 8, Kamchanawanich Rd. Tambon, Ban Phru,  
Amphoe Hat Yai, Songkhla, 90250

Calibration Place : Microbiological Laboratory

Instrument Name : Incubator

Manufacturer : Memmert

Model : ICP750

Serial No. : F816.0061

ID No. : SGK\_ML0013

Resolution : 0.1 °C

Received Date : 6-Aug-2022

Calibrated Date : 6-Aug-2022

Ambient Temperature : (30 ± 10) °C

Relative Humidity : (50 ± 30) %

REVIEW BY	APD Nathawut P.
	MO
APPROVED BY	Kanitta H.
NEXT CAL. DATE	06/02/2024

### Calibration Method Used :

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

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

### Traceability of measurement :

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

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

Calibrated by : Ibrorhim Saleemin

Approved by :

Kanyarat Chaipet / Technical Manager

**The uncertainties are for a confidence probability of approximately 95%**

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### Details of Calibration

#### 1. Reference Standard Equipment Used:

Equipment	Model	Serial No.	Cert. no.	Due Date
Data Acquisition/Switch Unit	34970A	MY58009813	22SDAT004	24-May-2023

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

3. This certificate is not certified any commercial transaction

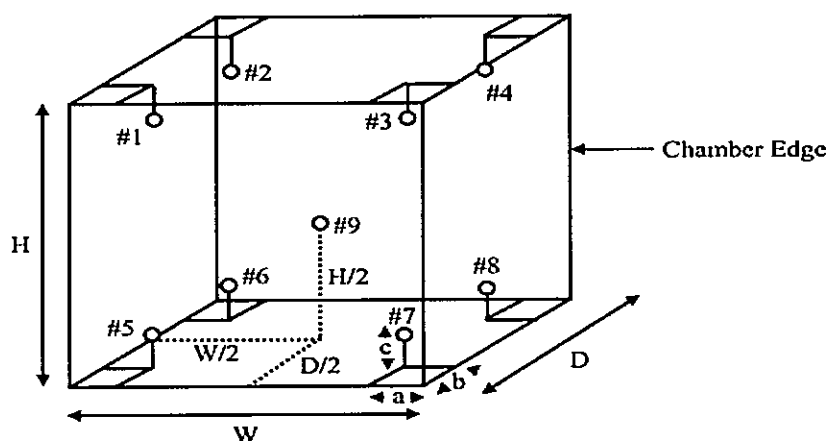
4. Condition of Item : normal condition , no indication for any damage or malfunction

#### Result of Calibration :

( ☒ ) Without Adjustment

( ☐ ) After Adjustment

#### 1. Sensor Installation Diagram



#### Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

#### Dimension of the chamber

W = 104.0 cm

H = 120.0 cm

D = 60.0 cm



Certificate No. : 22OV529

CSR No. : A037/01847

Page. : 3 of 3

**Result of Calibration :**

**2. Temperature Measurement Accuracy Test**

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

Cal point ( °C )	Measured Standard Temperature At Spread Locations ( °C )									Uncertainty ( ± °C )
	#1	#2	#3	#4	#5	#6	#7	#8	Ref. 9	
35	34.99	34.92	34.95	34.88	34.96	35.00	34.94	34.94	34.94	0.38

**3. Performance Result**

The performance of the Incubator are reported as shown below

Cal point ( °C )	UUC Setting ( °C )	UUC Reading ( °C )	Temperature Stability ( ± °C )	Temperature Uniformity ( °C )	Overall Variation ( °C )
35	35.0	35.0	0.10	0.12	0.19

- UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...





## CALIBRATION CERTIFICATE

Issued Date : 8-Jul-2021

Certificate No. : 21PH098

CSR No. : A047/2301

Page. : 1 of 2

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

**Calibration Place** : Microbiological Laboratory

**Instrument Name** : pH meter

**Manufacturer** : Sartorius

**Model** : Basic pH Meter PB-10

**Serial No.** : C07160695

**ID No.** : SGK\_ML0016

**Electrode No.** : N/A

**Received Date** : 5-Jul-2021

**Calibrated Date** : 5-Jul-2021

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

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

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

### Calibration Method Used :

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

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

### Traceability of measurement :

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

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

Calibrated by : Jessadagon Lemhud

Approved by :

Adull Lemsoh / Laboratory Manager

The uncertainties are for a confidence probability of approximately 95%

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



### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

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

#### 1. Electrical Measurement

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

#### 2. Sample Test Measurement

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

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...



# Southern Calibration Service Co., Ltd.

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

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



## CALIBRATION CERTIFICATE

Issued Date : 9-Aug-2021

Certificate No. : 21WB064

CSR No. : A047/2346

Page. : 1 of 3

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

**Calibration Place** : Microbiological Laboratory

**Instrument Name** : Water Bath

**Manufacturer** : Memmert

**Model** : WPE45

**Serial No.** : L716.0558

**ID No.** : SGK\_ML0021

**Resolution** : 0.1 °C

**Received Date** : 6-Aug-2021

**Calibrated Date** : 6-Aug-2021

**Ambient Temperature** : (30 ± 10) °C

**Relative Humidity** : (50 ± 30) %

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

### Calibration Method Used :

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

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

### Traceability of measurement :

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

- Q Reborn : Quality Reborn Co.,Ltd.

**Calibrated by** : Ibrorhim Saleemin

**Approved by** :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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



### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

2. The results reported in this certificate refer to the condition of the instrument on the date of calibration

and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

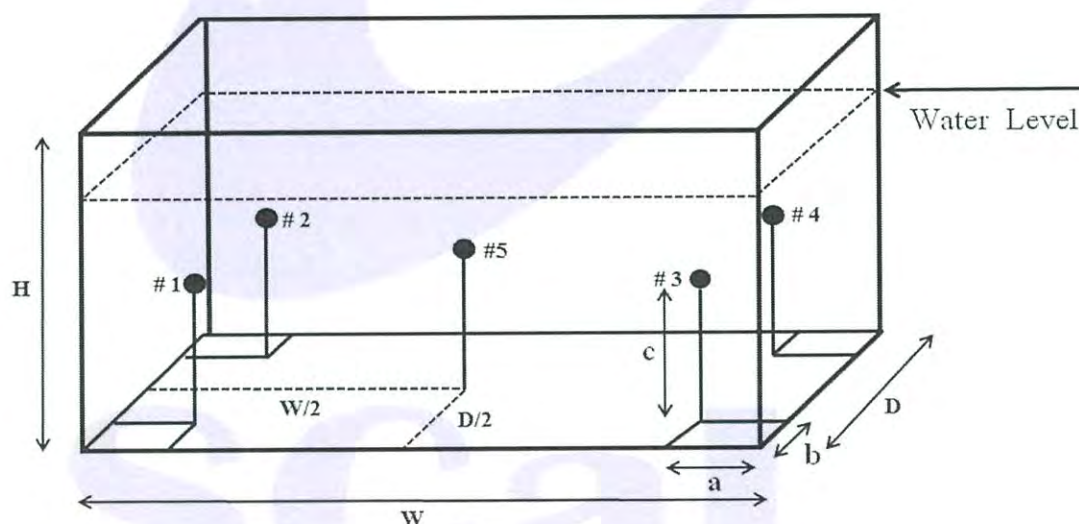
4. Condition of Item : normal condition , no indication for any damage or malfunction

### Result of Calibration :

(✓) Without Adjustment

( ) After Adjustment

#### 1. Sensor Installation Diagram



#### Sensor Installation Details

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

#### Dimension of the chamber

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

### Result of Calibration .:

#### 2. Temperature Measurement Accuracy Test

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

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

#### 3. Performance Result

The performance of the Water Bath are reported as shown below

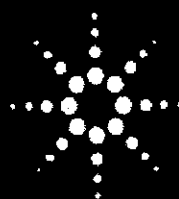
Cal point ( °C )	UUC Setting ( °C )	UUC Reading ( °C )	Temperature Stability ( ± °C )	Temperature Uniformity ( °C )	Overall Variation ( °C )
44.5	44.6	44.6	0.20	0.24	0.24

- UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...

SCaL



Agilent CrossLab Compliance Services

Agilent  
CrossLab

From Insight to Outcome

## EQUIPMENT QUALIFICATION REPORT (EQR)

## Agilent CrossLab Compliance

Qualification Type: ICPMS-OQ

System ID: JP16511669

EQP Name: AgilentRecommended

EQP Revision: ICPMS.02.50

EQP Publish Date: March 2020

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

Report Type: Report

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

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

REVIEW BY .....Ananta B.....

APPROVED BY .....Kanitta H.....

NEXT CAL. DATE .....8/2/2023.....

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

# Certificate of System Qualification

ICPMS-OQ

System ID: JP16511669

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

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

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

EQP Name: AgilentRecommended

EQP Revision: ICPMS.02.50

Overall Qualification Status: Pass

## Autosampler Check

### Overall Autosampler Check Test Status

Pass

## Integrated Sample Introduction System (ISIS) Check

### Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

## Autotune

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

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

System ID: JP16511669

## Overall Autotune Test Status

Pass

## Background (No Gas Mode)

Setpoint Status:

Pass

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

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

## Overall Background (No Gas Mode) Test Status

Pass

## Background (Gas Mode)

Gas Mode:

Helium

Setpoint Status:

Pass

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

	78	
	4.60	cps
<=	115	
Pass		

Gas Mode:

Hydrogen

Setpoint Status:

Pass

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

	78	
	1.45	cps
<=	4.6	
Pass		

## Overall Background (Gas Mode) Test Status

Pass

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

System ID: JP16511669

**20-Minute Stability (No Gas Mode)**

Masses (AMU):

Stability RSD:

Agilent Recommended:

Status:

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

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

Pass



## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### ICP-MS 1

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

#### ISIS 1

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

#### Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU16351847

Chiller 1

Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	701711328

# Electronic Signature

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## Details

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

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User Name: burin\_ngamvjljt  
 Hostname: ASSGKWX019

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

OQ HW 7900ICPMS ALS Transaction log :

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

User Name: burin\_ngamvijit  
 Hostname: ASSGKWX019

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

OQ HW 7900iCPMS ALS Transaction log :

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

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User Name: burln\_ngamvijit

System Id: JP16511669

Hostname: ASSGKWX019

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

## OQ HW 7900ICPMS ALS Transaction log :

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



# Southern Calibration Service Co., Ltd.

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

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



## CALIBRATION CERTIFICATE

Issued Date : 19-Aug-2021

Certificate No. : 21OV449

CSR No. : A078/3892

Page : 1 of 3

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

**Calibration Place** : Chemical Laboratory

**Instrument Name** : Cold Room Water

**Manufacturer** : MODULAR

**Model** : N/A

**Serial No.** : N/N

**ID No.** : SGK\_CL0065

**Resolution** : 0.1 °C

**Received Date** : 16-Aug-2021

**Calibrated Date** : 16-Aug-2021

**Ambient Temperature** : (30 ± 10) °C

**Relative Humidity** : (50 ± 30) %

REVIEW BY Sutthirak T.

APPROVED BY Kanitta H.

NEXT CAL. DATE 14/02/2023

### Calibration Method Used :

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

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

### Traceability of measurement :

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

- Q Reborn : Quality Reborn Co.,Ltd.

Calibrated by : Ibrorhim Saleemin

Approved by :

Sakeereen Heemhad / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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

### Details of Calibration

#### 1. Reference Standard Equipment Used:

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

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

3. This certificate is not certified any commercial transaction

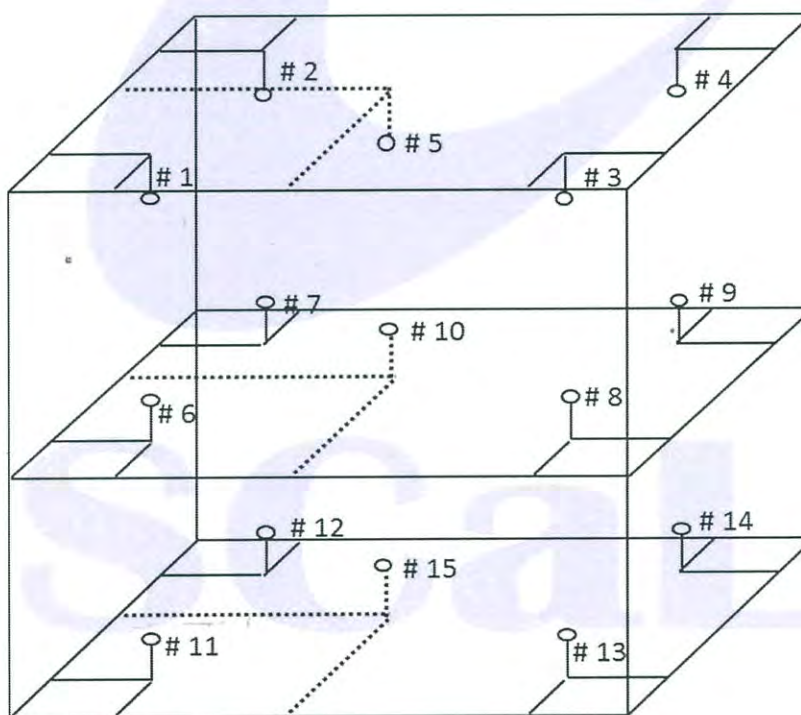
4. Condition of Item : normal condition , no indication for any damage or malfunction

### Result of Calibration ∴

(✓) Without Adjustment

( ) After Adjustment

#### 1. Sensor Installation Diagram



#### Sensor Installation Details

a = 5.0 cm

b = 5.0 cm

c = 5.0 cm

#### Dimension of the chamber

W = 370.0 cm

H = 250.0 cm

D = 540.0 cm



### Result of Calibration :

#### 2. Temperature Measurement Accuracy Test

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

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

The uncertainty of measurement was  $\pm 0.38$  °C

#### 3. Performance Result

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

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

\* UUC = Unit Under Calibration

The report uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%

... End ...

# Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: RYG\_EN0136  
Organization Name: ALS Laboratory Group ( Thailand ) Co Ltd.  
Organization Location: 616/10 Moo 5, Tambol Mae Nam Koo, A.Pluakdaeng, Rayong, 21140, Thailand  
Date: July 7, 2022 11:27:53 AM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.52, GCMS.02.52  
Overall Qualification Status: Pass

REVIEW BY N. Banniy  
APPROVED BY [Signature]  
NEXT CAL. DATE 07/01/24

## CDS Logon Verification - GC

Logon: dej.changchon

## Overall CDS Logon Verification - GC Test Status

Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

	Setpoint	Actual
Inlet Pressure:	25.0 psi	25.1 psi
Accuracy:		0.1 psi
Agilent Recommended:		<= 1.2

Date: July 7, 2022 11:27:53 AM  
System ID: RYG\_EN0136



## Overall Inlet Pressure Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.6 °C

Accuracy: 0.6 °C

Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -5.0 °C )  
 $\leq 1.0$  % setpoint in K ( 5.0 °C )

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 99.9 °C

Accuracy: -0.1 °C

Agilent Recommended:  $\geq -1.0$  % setpoint in K ( -3.7 °C )  
 $\leq 1.0$  % setpoint in K ( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 99.91667 °C

Stability: 0.1 °C

Agilent Recommended:  $\leq 0.5$ 

## Overall GC Oven Temperature Stability Test Status

Pass

---

**Log Amp**

---

Tested Combination1	Front	SSL	/ External	SQ
---------------------	-------	-----	------------	----

Name:	5977B			
-------	-------	--	--	--

Setpoint Status:	Pass			
------------------	------	--	--	--

**Overall Log Amp Test Status**

Pass
------

---

**RFPA**

---

Tested Combination1	Front	SSL	/ External	SQ
---------------------	-------	-----	------------	----

Name:	5977B			
-------	-------	--	--	--

Setpoint Status:	Pass			
------------------	------	--	--	--

Amu:	1050	m/z
------	------	-----

Drift After Five Minutes:
---------------------------

RFPA Voltage:
---------------

	-1	mV		479	mV
Agilent Recommended:	>= -100	and	<= 100	<= 1100	

**Overall RFPA Test Status**

Pass
------

---

**Tune EI**

---

Tested Combination1	Front	SSL	/ External	SQ
---------------------	-------	-----	------------	----

Name:	5977B			
-------	-------	--	--	--

Setpoint Status:	Pass			
------------------	------	--	--	--

Filament:	1
-----------	---

Setpoint Status:	Pass			
------------------	------	--	--	--

Filament:	2
-----------	---

**Overall Tune EI Test Status**

Pass
------

---

**Signal to Noise EI**

---

Date:	July 7, 2022 11:27:53 AM
System ID:	RYG_EN0136

---

Tested Combination1	Front	SSL	/ External	SQ
Name:	5977B			

---

Source:	EI - Extractor	Filament:	1
---------	----------------	-----------	---

Setpoint Status:	Pass
------------------	------

Signal to Noise:	7485
------------------	------

Agilent Recommended:	>= 1200
----------------------	---------

---

Source:	EI - Extractor	Filament:	2
---------	----------------	-----------	---

Setpoint Status:	Pass
------------------	------

Signal to Noise:	2097
------------------	------

Agilent Recommended:	>= 1200
----------------------	---------

---

This test's 2 comment(s) and 7 deviation(s) are available in the Attachments section.

**Overall Signal to Noise EI Test Status**

Pass
------

## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	RYG_EN0136
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

#### Tested Combination1

Injection Technique	Manual Injection
Inlet	Front
Detector	External
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

#### Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN16463238
Firmware Revision	B.02.04.3
Component ID/Asset No.	081117000236
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977B
Serial Number	US1701M008
Firmware Revision	5977 6.00.34
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
Component ID/Asset No.	081117000236

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2



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Logged On User Name:	eaknarin_puangsopa@agilent.com
Signature Creation Date:	July 7, 2022
Reason for Signature:	Executed protocol and published this original version of document

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---

Date:	July 7, 2022 11:27:53 AM
System ID:	RYG_EN0136

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 6, 2022 1:11:54 PM	Audit	SessionCreated	Session	None
July 6, 2022 1:11:54 PM	Start	Configuration	Session	None
July 6, 2022 1:11:54 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
July 6, 2022 1:17:19 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.52/GcMs.02.52.eqp], EQP File Name: [GcMs.02.52.eqp], EQP Name: [AgilentRecommended]
July 6, 2022 1:17:25 PM	End	Configuration	Session	None
July 6, 2022 1:17:29 PM	Start	Qualification	Session	OQ
July 6, 2022 1:17:30 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
July 6, 2022 1:19:43 PM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
July 6, 2022 1:19:46 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 6, 2022 1:19:59 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
July 6, 2022 1:20:15 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
July 6, 2022 1:21:43 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
July 6, 2022 1:21:45 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
July 6, 2022 1:25:12 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
July 6, 2022 1:25:15 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
July 6, 2022 1:25:17 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
July 6, 2022 1:25:32 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
July 6, 2022 1:33:42 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 6, 2022 1:33:43 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
July 6, 2022 1:33:45 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
July 6, 2022 1:53:05 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
July 6, 2022 1:53:07 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
July 6, 2022 1:53:11 PM	Start	Execution	Log Amp - 5977B SQ: - Source: None EI - Extractor	
July 6, 2022 1:57:10 PM	End	Execution	Log Amp - 5977B SQ: - Source: EI EI - Extractor	Run Count : 1
July 6, 2022 1:57:24 PM	Start	Execution	RFPA - 5977B SQ: - Source: EI - Extractor	None
July 6, 2022 2:09:24 PM	End	Execution	RFPA - 5977B SQ: - Source: EI - Extractor	Run Count : 1
July 6, 2022 2:09:28 PM	Start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
July 6, 2022 2:24:46 PM	End	Qualification	Session	OQ
July 6, 2022 2:24:46 PM	Start	Reporting	Session	None
July 6, 2022 2:41:39 PM	End	Reporting	Session	None
July 6, 2022 2:41:39 PM	Start	Configuration	Session	None
July 6, 2022 2:41:40 PM	End	Configuration	Session	None

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 6, 2022 2:41:40 PM	Start	Qualification	Session	OQ
July 6, 2022 2:41:40 PM	Start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
July 6, 2022 2:41:56 PM	End	Execution	Tune EI - 5977B SQ: - Source: - Run Count : 1 EI - Extractor Filament 1 (Qualitative - No setpoints associated)	
July 6, 2022 2:41:58 PM	Start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
July 6, 2022 2:42:48 PM	End	Qualification	Session	OQ
July 6, 2022 2:42:48 PM	Start	Reporting	Session	None
July 6, 2022 2:50:52 PM	End	Reporting	Session	None
July 6, 2022 2:50:52 PM	Start	Qualification	Session	OQ
July 6, 2022 2:50:52 PM	Start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
July 6, 2022 2:51:12 PM	End	Qualification	Session	OQ
July 6, 2022 2:51:12 PM	Start	Reporting	Session	None
July 6, 2022 2:55:29 PM	End	Reporting	Session	None
July 6, 2022 2:55:29 PM	Start	Qualification	Session	OQ
July 6, 2022 2:55:29 PM	Start	Execution	Tune EI - 5977B SQ: - Source: - None EI - Extractor Filament 2 (Qualitative - No setpoints associated)	



User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 6, 2022 2:55:40 PM	End	Execution	Tune EI - 5977B SQ: - Source: - Run Count : 1 EI - Extractor Filament 2 (Qualitative - No setpoints associated)	
July 6, 2022 2:55:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 6, 2022 3:21:52 PM	End	Qualification	Session	QQ
July 6, 2022 3:21:52 PM	Start	Reporting	Session	None
July 6, 2022 3:25:04 PM	End	Reporting	Session	None
July 6, 2022 3:25:04 PM	Start	Qualification	Session	QQ
July 6, 2022 3:25:04 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 6, 2022 4:06:40 PM	Audit	AceClosed	Session	None
July 7, 2022 9:13:47 AM	Audit	AceRestarted	Session	None
July 7, 2022 9:13:49 AM	Audit	SessionReloaded	Session	None
July 7, 2022 9:13:54 AM	Start	Qualification	Session	QQ
July 7, 2022 9:13:54 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 9:58:06 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OQF_SN_F01.D

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 7, 2022 9:59:53 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 1
July 7, 2022 10:01:46 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 1
July 7, 2022 10:01:46 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 10:02:00 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F01.D
July 7, 2022 10:04:55 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 2
July 7, 2022 10:07:30 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 2
July 7, 2022 10:07:30 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 10:07:44 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F01.D

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 7, 2022 10:08:18 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 3
July 7, 2022 10:10:28 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 3
July 7, 2022 10:10:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 10:10:55 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F01.D
July 7, 2022 10:14:03 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 4
July 7, 2022 10:14:54 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 4
July 7, 2022 10:14:54 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 10:15:15 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F01.D

User Name: eaknarin\_puangsoa  
 Hostname: ASRYGW7002

System Id: RYG\_EN0136  
 Print Date: July 7, 2022 11:27:56 AM

ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 7, 2022 10:15:27 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 5
July 7, 2022 10:16:48 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Deviation filed for Run Count : 5
July 7, 2022 10:16:48 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	None
July 7, 2022 10:17:05 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F01.D
July 7, 2022 10:17:14 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 1 - L: >= 1200	Run Count : 6
July 7, 2022 10:18:40 AM	End	Qualification	Session	OQ
July 7, 2022 10:18:40 AM	Start	Reporting	Session	None
July 7, 2022 10:21:10 AM	End	Reporting	Session	None
July 7, 2022 10:21:10 AM	Start	Qualification	Session	OQ
July 7, 2022 10:21:17 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 7, 2022 10:56:49 AM	End	Qualification	Session	OQ
July 7, 2022 10:56:49 AM	Start	Reporting	Session	None
July 7, 2022 10:57:38 AM	End	Reporting	Session	None

Page 8 / 10

Date: July 7, 2022 11:27:53 AM  
 System ID: RYG\_EN0136

User Name: eaknarin\_puangsoa

System id: RYG\_EN0136

Hostname: ASRYGW7002

Print Date: July 7, 2022 11:27:56 AM

## ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 7, 2022 10:57:38 AM	Start	Qualification	Session	OQ
July 7, 2022 10:57:38 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 7, 2022 11:06:50 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F021.D
July 7, 2022 11:11:47 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 7, 2022 11:13:13 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 1
July 7, 2022 11:14:29 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 1
July 7, 2022 11:14:29 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 7, 2022 11:14:47 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F021.D
July 7, 2022 11:16:34 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 2



User Name: eaknarin\_puangsoa

System Id: RYG\_EN0136

Hostname: ASRYGW7002

Print Date: July 7, 2022 11:27:56 AM

## ALS\_RYG\_EN0136 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
July 7, 2022 11:19:56 AM	Audit	TestUnlocked	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Deviation filed for Run Count : 2
July 7, 2022 11:19:56 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	None
July 7, 2022 11:20:13 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Data files Path : D:\OQ2022\OFN_SN_F021.D
July 7, 2022 11:21:52 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Extractor using Filament 2 - L: >= 1200	Run Count : 3
July 7, 2022 11:22:49 AM	End	Qualification	Session	OQ
July 7, 2022 11:22:49 AM	Start	Reporting	Session	None
July 7, 2022 11:26:46 AM	Audit	Reporting	Session	Report Generated : Certificate



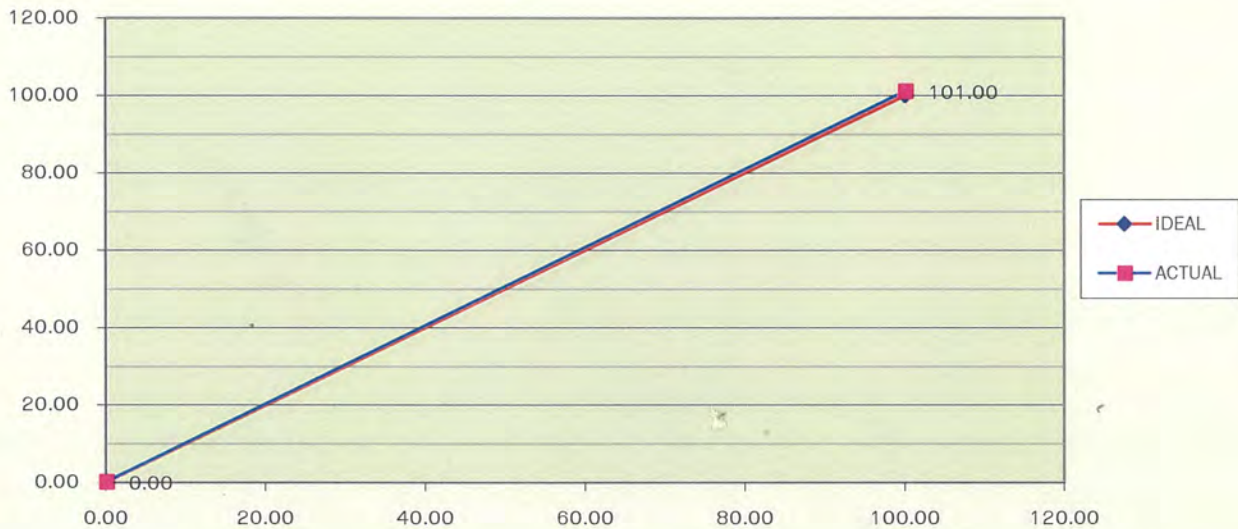
JIRANATEE ASSOCIATES CO., LTD.

**CALIBRATION REPORT**REVIEW BY Vichuta N.APPROVED BY Sararat M.NEXT CAL. DATE 9/2/67

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd.	
EQUIPMENT NAME : Total Hydrocarbon Analyzer	
MANUFACTURER : Baseline	MODEL : 9000 NMHC
SERIAL NO : 0314DR0170	
STANDARD GAS CONCENTRATION (PPM) : 100 PPM (Methane)	
CYLINDER NO : ND55981	
CYLINDER PRESSURE (psig) : 900 PSI	
CERTIFIED DATE : 12/02/2022	
CERTIFIED BY : AIRGAS	
EXPIRED DATE : 12/02/2025	

**CALIBRATION RESULTS**

POINT NO	CALIBRATION RESULTS			
	IDEAL	ACTUAL	ERROR	%ERROR
ZERO	0.00	0.00	0.00	-
1	100.00	101.00	1.0	-1.00
AVERAGE (%)				0.25

CALIBRATED BY : วิภาพล ดุสิตเจริญDATE : 9/8/65CHECKED BY : ศุภชัย อังคารDATE : 9/8/65

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 31 , E-Mail : Engineer@Jiranatee.com

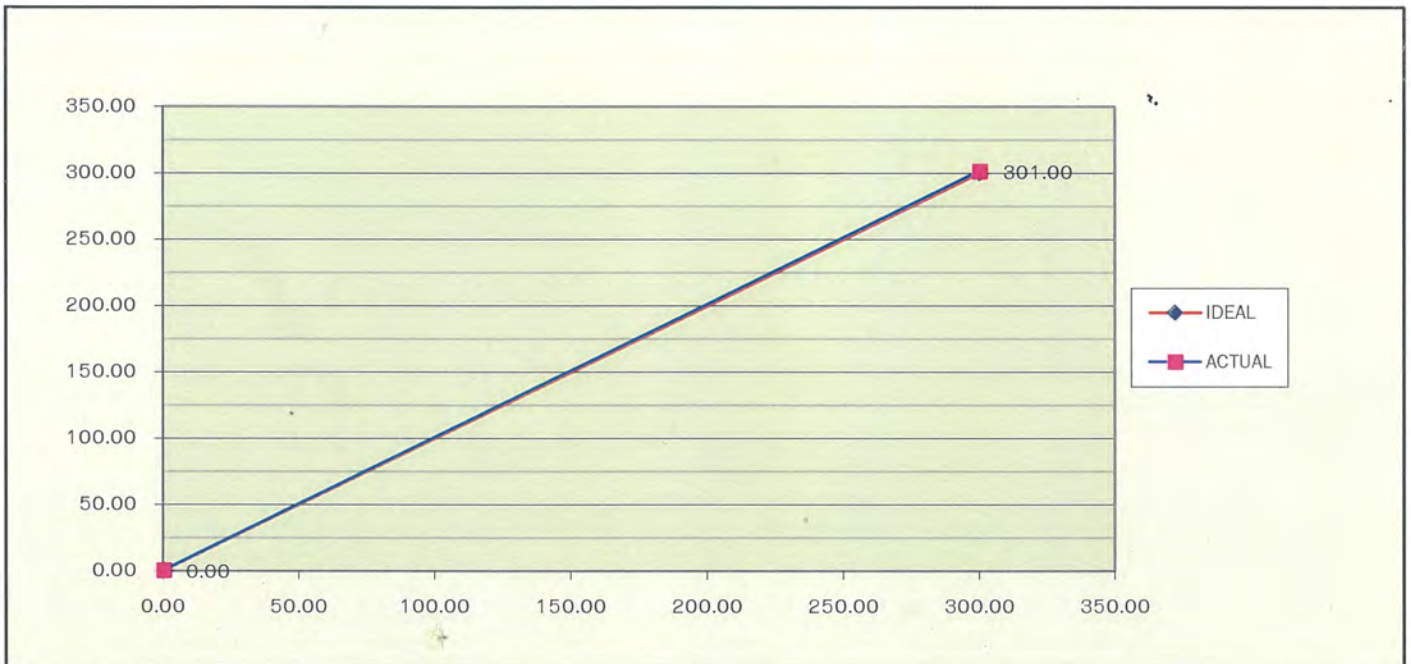
เลขที่ 63/14-15,67/35-36 ถนน เพชรเกษม 7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889

## CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd.	
EQUIPMENT NAME : Total Hydrocarbon Analyzer	
MANUFACTURER : Baseline	MODEL : 9000 NMHC SERIAL NO : 0314DR0170
STANDARD GAS CONCENTRATION (PPM) : 100 PPM ( Propane )	
CYLINDER PRESSURE (psig) : 900 PSI	CERTIFIED DATE : 12/02/2022
CERTIFIED BY : AIRGAS	EXPIRED DATE : 12/02/2025

### CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL	ACTUAL	ERROR	%ERROR
ZERO	0.00	0.00	0.00	-
1	300.00	301.00	1.0	0.33
AVERAGE (%)				0.08



CALIBRATED BY : วรณล ศักดิ์เจริญ DATE : 9/8/65

CHECKED BY : ศิษฐ์ วัฒนา DATE : 9/8/65



ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 31 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ถนนเพชรเกษม 7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889



**FLOW CALIBRATE**

CUSTOMER NAME	:	ALS Laboratory Group (Thailand) Co., Ltd.		
EQRIPMENT NAME	:	Flow Calibrator		
MANUFACTURER	:	Bios	MODEL : 510 L	SERIAL NO : 129549

Flow Parameter	Step	Set	Display	Flow Meter
Sample	Before	40	38	15 cc/min
	After	40	40	39.7 cc/min
Air	Before	175	175	190 cc/min
	After	175	175	176 cc/min
Fuel	Before	35	32	36 cc/min
	After	35	35	35 cc/min

**CALIBRATED BY :** วราพล ดวกิ่งเจริญ **DATE :** 9/8/65  
**CHECKED BY :** สันติ วัฒนะ **DATE :** 9/8/65



ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com  
 เลขที่ 63/14-15,67/35-36 ถนน เพชรเกษม 7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889

## CERTIFICATE OF CALIBRATION

Certificate No.: WD-01112021

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25LB  
: Wind direction sensor: WS-02P

Serial Number : Data logger: A5377  
: Wind direction sensor: -

ID No : Data logger: BKK\_FS0917  
: Wind direction sensor: -

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

### Environmental Condition:

The measurement was carried out in an ambient temperature of  $(23 \pm 3) ^\circ\text{C}$ , and relative humidity of  $(40 \pm 10) \%$ .

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control, The measurement were taken at  $45^\circ$  intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21086014, Certificate No.: KWS64/0025.

Measurement Date : Nov 01, 2021.

Issued Date : Nov 01, 2021.

### Performed by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory:.....

Mr. Parinya Booncharoen.  
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-01112021

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	41	-4	3.0
3		90	90	87	-3	3.0
4		135	135	135	0	3.0
5		180	180	183	3	3.0
6		225	225	229	4	3.0
7		270	270	274	4	3.0
8		315	315	320	5	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	41	-4	3.0
11		90	90	87	-3	3.0
12		135	135	135	0	3.0
13		180	180	183	3	3.0
14		225	225	229	4	3.0
15		270	270	274	4	3.0
16		315	315	320	5	3.0

UUC\*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor  $k=2$  providing a level of confidence of approximately 95%

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





## CERTIFICATE OF CALIBRATION

Certificate No: WS-01112021

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx.  
: Cup anemometer: Novalynx.

Model/Type : Data logger: 200-WS-25LB  
: Cup anemometer: WS-02F

Serial Number : Data logger: A5377  
: Cup anemometer: -

ID No : Data logger: BKK\_FS0917  
: Cup anemometer: -

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
: Anemometer frontal area 100 cm<sup>2</sup>  
: Diameter of mounting pipe - mm  
: Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 25.4 ±0.8 °C  
: Air pressure 1015.1 ±0.4 hPa  
: Relative air humidity 47.9 ±3.5 %RH

Calibration Procedure Calibration was carried out base on;  
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;  
MCASNET Anemometer Calibration Procedure - Version 2: 2009;

Traceability This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Nov 01, 2021.  
Issued Date : Nov 01, 2021.

**Calibrated by**

- ☒ Mr. Sorawit Thachalad  
☐ Miss Orathai Wiwatwittaya



Approved Signatory: .....

  
Mr. Parinya Booncharoen  
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-01112021

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>STD</sub> Reading m/s	V <sub>UUC</sub> * Reading m/s	Error (m/s)	Uncertainty (%)
1.994	1.9	-0.1	2.5
4.002	4.0	0.0	1.2
6.00	6.0	0.0	0.95
8.02	8.0	0.0	0.73
10.01	10.1	0.1	0.63
12.00	12.1	0.1	0.74
13.99	14.1	0.1	0.76
16.01	16.3	0.3	0.80
15.01	15.3	0.3	0.64
13.00	13.1	0.1	0.45
11.01	11.1	0.1	0.57
9.02	9.0	0.0	0.64
7.02	7.0	0.0	0.98
4.992	5.0	0.0	1.2
2.980	2.9	-0.1	1.5
0.996	0.9	-0.1	4.5

UUC\*: Unit Under Calibration

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

#### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 - 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2021	CL-027-64	-30 - 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2021	RH-03032021	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2021	BP-01032021	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

\*\*\*End of certificate of calibration\*\*\*





## CERTIFICATE OF CALIBRATION

Certificate No.: WD-03072022

Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novalynx.  
: Wind direction sensor: Novalynx.

Model/Type : Data logger: 200-WS-25LB  
: Wind direction sensor: WS-02F

Serial Number : Data logger: A5193  
: Wind direction sensor: -

ID No : Data logger: SGK\_FS0036  
: Wind direction sensor: -

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250  
Thailand.

### Environmental Condition:

The measurement was carried out in an ambient temperature of  $(23 \pm 3) ^\circ\text{C}$ , and relative humidity of  $(40 \pm 10) \%$ .

### Measurement Method:

The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and line laser is used for axis control. The measurement were taken at  $45^\circ$  intervals in clockwise and counterclockwise directions.

Note: The UUC was warmed up for 1 hour prior to the calibration being performed

### Traceability:

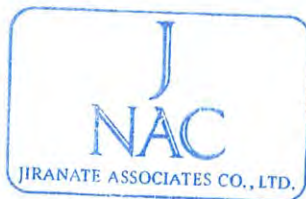
The measurement results are traceable to the international system of units (SI) through Certificate No.: Q21086014, Certificate No.: KWS64/0025.

Measurement Date : Jul 13, 2022.


Issued Date : Jul 14, 2022.

### Calibrated by

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jitraporn Lertsomphol



Approved Signatory:.....

  
Mr. Parinya Booncharoen.  
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WD-03072022

Pages 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.

Calibration in the range of 0 – 360 ° at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty ±(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	42	-3	3.0
3		90	90	87	-3	3.0
4		135	135	131	-4	3.0
5		180	180	178	-2	3.0
6		225	225	226	1	3.0
7		270	270	272	2	3.0
8		315	315	317	2	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	42	-3	3.0
11		90	90	87	-3	3.0
12		135	135	131	-4	3.0
13		180	180	178	-2	3.0
14		225	225	226	1	3.0
15		270	270	272	2	3.0
16		315	315	317	2	3.0

UUC\*: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%

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





## CERTIFICATE OF CALIBRATION

Certificate No: WS-03072022

Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novalynx  
: Cup anemometer: Novalynx

Model/Type : Data logger: 200-WS-25LB  
: Cup anemometer: WS-02F

Serial Number : Data logger: A5193  
: Cup anemometer: -

ID No : Data logger: SGK\_FS0036  
: Cup anemometer: -

Customer : ALS laboratory group (Thailand) co., ltd.  
: 104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Test Conditions : Wind tunnel cross test section area 900 cm<sup>2</sup>  
: Anemometer frontal area 100 cm<sup>2</sup>  
: Diameter of mounting pipe - mm  
: Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 23.5 ±0.8 °C  
: Air pressure 1004.2 ±0.4 hPa  
: Relative air humidity 44.5 ±3.5 %RH

Calibration Procedure : Calibration was carried out base on;  
IEC 61400-12-1 ED.1: 2005-Power Performance Measurements of Electricity Producing Wind Turbines;  
MEASNET Anemometer Calibration Procedure – Version 2: 2009;

Traceability : This calibration documents the traceable to national standard, Which realize the unit of measurements according to the international system of units (SI) through National Institute of Metrology Thailand (NIMT).

Measurement Date : Jul 13, 2022.

Issued Date : Jul 14, 2022.

**Calibrated by**

- ☒ Mr. Sorawit Thachalad  
☐ Miss Jittraporn Lertsomphol



Approved Signatory: .....

Mr. Parinya Booncharoen  
Calibration Department Manager

Continuation of Certificate of Calibration Number

Certificate No: WS-03072022

Page 2 of 2 Pages

Result of calibration: ☒ Without adjustment ☐ With adjustment

Calibration in the range of 1 – 16 m/s at a calibration interval of 1 m/s.

The results of calibration and associated measurement uncertainties are reported in the table below.

V <sub>STD</sub> Reading m/s	V <sub>UUC*</sub> Reading m/s	Error (m/s)	Uncertainty (%)
2.061	1.9	-0.2	2.6
4.123	3.9	-0.2	1.3
6.02	5.9	-0.1	1.3
7.99	8.0	0.0	0.86
9.98	10.0	0.0	0.87
12.01	12.1	0.1	0.57
14.00	14.1	0.1	0.83
15.98	16.3	0.3	0.61
15.00	15.1	0.1	0.56
13.01	13.2	0.2	0.74
10.98	11.1	0.1	0.53
8.99	9.0	0.0	0.70
6.98	7.0	0.0	1.1
5.152	5.0	-0.2	1.0
3.012	2.8	-0.2	1.7
1.044	0.8	-0.2	4.8

UUC\*: Unit Under Calibration

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

#### Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Pitot static	TESTO INC.	06352145	Aug 07, 2021	MW-0034-21	5 – 30 m/s
2	Precision Differential Pressure Meter	Zoglab	DPM2500	Aug 07, 2021	MW-0034-21	5 – 30 m/s
3	Air velocity transducer (hot wire)	TSI INC.	8455-12	Aug 08, 2021	MW-0035-21	0 – 5 m/s
4	Temperature	Zoglab	DSR-THP	March 30, 2022	CL-027-65	-30 – 70°C
5	Relative humidity	Zoglab	DSR-THP	March 30, 2022	RH-03032022	0 – 100 %RH
6	Atmospheric pressure	Zoglab	DSR-THP	March 30, 2022	BP-01032022	500 – 1100 hPa
7	Wind tunnel	ESSOM	MP330D	-	-	0 – 50 Hz

\*\*\*End of certificate of calibration\*\*\*





# SITHIPHORN ASSOCIATES CO.,LTD.

## CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd., Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : ACC22028

Pages : 1 of 3

### Calibration Certificate

**Equipment :** SOUND CALIBRATOR  
**Manufacturer :** RION  
**Model :** NC-74  
**Serial No.:** 34478386  
**ID No.:** SGK\_FS0011

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWANG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -  
**Ambient Temperature :** ( 23.0  $\pm$  3 ) °C  
**Pressure :** ( 101.3  $\pm$  3 ) kPa  
**Relative Humidity :** ( 50.0  $\pm$  20 ) %

**Received Date :** 06 SEPTEMBER 2022  
**Calibration Date :** 09 SEPTEMBER 2022  
**Date of Issue :** 14 SEPTEMBER 2022

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	9/9/23

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*[Signature]*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

## Continuation of Calibration Certificate

Cert. No. : ACC22028

Job No. : VC65AC0081

Pages : 2 of 3

Calibration Procedure : CP-AC-03

**Calibration Method :**

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	33461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-22	07-Feb-23

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).



## Continuation of Calibration Certificate

Cert. No. : ACC22028

Job No. : VC65AC0081

Pages : 3 of 3

**Result of calibration :****1. Sound pressure level**

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.1	0.10	0.15	0.40

**2. Frequency**

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ( % )	Uncertainty ( % )	Tolerance limit ( % )
1000	1002.5	0.3	0.1	1.0

**3. Total distortion**

Measured value ( % )	Uncertainty ( % )	Tolerance limit ( % )
1.82	0.10	3.0

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$   
or any value following calculation, providing a level of confidence of approximately 95 %

————— End of Calibration Certificate —————

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com



Cert. No. : ACL22164

Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00472129 / 169442 / 72463  
**ID No.:** SGK\_FS0014

**Condition As Found :** GOOD

**Customer :** ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,  
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,  
BANGKOK, 10250 THAILAND.

**Location :** -

**Ambient Temperature :** ( 23.0  $\pm$  3 ) °C  
**Pressure :** ( 101.3  $\pm$  3 ) kPa  
**Relative Humidity :** ( 50.0  $\pm$  20 ) %

**Received Date :** 06 JULY 2022  
**Calibration Date :** 11-18 JULY 2022  
**Date of Issue :** 19 JULY 2022

REVIEW BY	<i>Nirakorn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	11/7/23

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchurai*  
( Thanakul Petchurai )

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.



## Continuation of Calibration Certificate

Cert. No. : ACL22164

Job No. : VC65AC0069

Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

**Condition of this result of calibration :**

## 1. Reference Standard Instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
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Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

**Cert. No. : ACL22164**  
**Job No. : VC65AC0069**  
**Pages : 3 of 8**

**Summary of Measurement Result :**

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1



## Continuation of Calibration Certificate

Cert. No. : ACL22164

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Pages : 4 of 8

**Result of calibration :****1. Absolute sensitivity**

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.95)	93.9	0.0	±0.3

**2. Self-generated noise**

## 2.1 Normal test

Measured Value ( dB )
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value ( dB )
A - weight	11.6
C - weight	17.6
Flat	23.3

**3. Acoustical signal tests of frequency weightings**

Meter free-field acoustic response at a level of 84 dB

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.0	0.0	0.0	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.6	0.7	0.7	±5.0



Continuation of Calibration Certificate

Cert. No. : ACL22164  
Job No. : VC65AC0069  
Pages : 5 of 8

**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±2.0
125	-0.1	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

**5. Frequency and time weightings at 1 kHz**

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

**6. Long - term stability**

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	94.0	94.0	0.0	± 0.3

## Continuation of Calibration Certificate

Cert. No. : ACL22164

Job No. : VC65AC0069

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## 7. Level linearity on the reference level range

Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1



## Continuation of Calibration Certificate

Cert. No. : ACL22164

Job No. : VC65AC0069

Pages : 7 of 8

**8. Level linearity including the level range control**

Range	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Auto	94.0	94.0	0.0	±1.1

**9. Tone burst response**

Time Weighting	Tone burst duration, Tb ( ms )	Cycle	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value, L <sub>cpeak</sub> ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value ( dB )	Measured Value ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

## Continuation of Calibration Certificate

Cert. No. : ACL22164

Job No. : VC65AC0069

Pages : 8 of 8

## 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

## 12. High level stability

Frequency Weighting	SLM Display at initial ( dB )	SLM Display at final ( dB )	Deviated Value ( dB )	Acceptance Limits ( dB )
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor  $k = 2$  or any value following calculation, providing a level of confidence of approximately 95 %

————— **End of Calibration Certificate** —————