บริษัท ปตท. น้ำมันและการค้าปลีก จำกัด (มหาชน)

รายงานผลการปฏิบัติตามมาตรการป้องกันและแก้ไขผลกระทบสิ่งแวดล้อม
และมาตรการติดตามตรวจสอบผลกระทบสิ่งแวดล้อม

โครงการท่าเทียบเรือขนถ่ายน้ำมันและก๊าซปิโตรเลียมเหลวสุราษฎร์ธานี แห่งที่ 2

ระหว่างเดือนกรกฎาคมถึงธันวาคม พ.ศ. 2566

# ภาคผนวก จ
# ใบรับรองการสอบเทียบเครื่องมือ

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

NSC TISI TIS17025 CALIBRATION 0294

# CALIBRATION CERTIFICATE

Issued Date : 1-May-2023

Certificate No. : 23CH0203
CSR No. : A088/04367


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

REVIEW BY Ananta B.
APPROVED BY Kamrtta H.
NEXT CAL. DATE 28/10/2024

Calibration Place : Chemical Laboratory
Instrument Name : pH meter
Manufacturer : Mettler Toledo
Model : S220
Serial No. : B625631849
ID No. : SGK_CL0030
Electrode No. : 1204613
Received Date : 28-Apr-2023
Calibrated Date : 28-Apr-2023
Ambient Temperature : (25 ± 3) °C
Relative Humidity : (55 ± 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 : HACH LANGE GmbH
- SCaL : Sounthern Calibration Service Co., Ltd.,
- WK : WK Electric Co., Ltd.

Calibrated by : Alisara Ma

Approved by :

Imron Rattanaylum / 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.



SCaL

**Details of Calibration**

1. Reference Standard Equipment Used:

| Equipment | Model | Serial No. | Cert. no. | Due Date |
|---|---|---|---|---|
| Standard Solution | 4.005 | C02994 | 1777 | 5-Sep-2024 |
| Standard Solution | 7.000 | C03007 | 1787 | 17-Oct-2024 |
| Standard Solution | 10.012 | C02953 | 1735 | 29-Apr-2024 |
| Temperature/Electrical Calibrator | MC2-TE | 14987 | WK2106-299-223 | 5-Jun-2024 |
| Digital Thermometer With Sensor | DP-77 | I.360896 | 22SDTH005 | 8-Aug-2023 |

2. The resultes 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 mulfunction

**Result of Calibration :.**

**1. Electrical Measurement**

| Applied Voltage | pH meter Reading | | Correction | Uncertainty |
|---|---|---|---|---|
| ( mV ) | ( mV ) | ( pH ) | ( mV ) | ( ± mV ) |
| 177.48 | 177.5 | 3.70 | -0.02 | 0.17 |
| 0.00 | 0.0 | 6.70 | 0.00 | 0.13 |
| -177.48 | -177.4 | 9.80 | -0.08 | 0.17 |

**2. Before Sample Test Measurement**

| Standard Buffer Solutions | pH meter Reading | | Correction | Uncertainty |
|---|---|---|---|---|
| ( pH ) | ( pH ) | ( mV ) | ( pH ) | ( ± pH ) |
| 4.005 | 3.97 | 159.2 | 0.035 | 0.0090 |
| 6.999 | 6.98 | -15.4 | 0.019 | 0.013 |
| 10.012 | 9.95 | -188.0 | 0.062 | 0.036 |

**3. After Sample Test Measurement**

| Standard Buffer Solutions | pH meter Reading | | Correction | Uncertainty |
|---|---|---|---|---|
| ( pH ) | ( pH ) | ( mV ) | ( pH ) | ( ± pH ) |
| 4.005 | 3.97 | 158.9 | 0.035 | 0.0090 |
| 6.999 | 7.01 | -17.5 | -0.011 | 0.013 |
| 10.012 | 9.98 | -187.6 | 0.032 | 0.036 |

**4. Temperature Measurement**

| Cal Point | Standard Temperature | UUC Reading | Correction | Uncertainty |
|---|---|---|---|---|
| ( °C ) | ( °C ) | ( °C ) | ( °C ) | ( ±°C ) |
| 25 | 25.032 | 25.1 | -0.068 | 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 ...

**Sartorius (Thailand) Co., Ltd.**
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com

NSC-TISI-TIS 17025
CALIBRATION 0426

SARTORIUS

REVIEW BY Ananta B.
APPROVED BY Kanitta H.
NEXT CAL. DATE 25/1/23 24

# Certificate of Calibration

| | | | |
|---|---|---|---|
| Model Number : | MSE224S-100-DU | Certificate No. : | 23BCI0044 |
| Description : | Analytical Balance | Issued Date : | Friday, January 27, 2023 |
| Serial Number : | 0034705158 | Reference No. : | 202361 |
| ID No. | SGK_CL0045 | | |
| Manufacturer : | Sartorius | Page No. : | 1 0f 2 |

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

Calibrated Place : Balance Room.

Calibrated By : Mr. Chonchai Inthana
Calibration Date : Wednesday, January 25, 2023

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

*Metrological data :*
Capacity : 220 g Readability : 0.0001 g

*Ambients Conditions:*
Temperature : 22.4 °C ± 3.0 °C
Humidity : 65.0 % RH ± 5.0 % RH
Pressure – ± –

*Reasons for calibration*
☐ New Installation ☐ Service / Repaired ☑ Re-calibration/ Maintenance

*Equipment Condition:* ☑ Good Operate ☐ Fair

## Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

## Traceability:

| Model Number | Description | Traceability | Cetificate No. | Due Date |
|---|---|---|---|---|
| YCS011-522-00 | Sartorius weight set 1mg - 1kg E2 s/n 37929119 | SPC-RT | C02212565 | 14-Sep-2023 |
| MHB-382SD | Humidity/Barometer/Temp Lutron MHB-382SD | DKSH | C19220444 | 5-Sep-2023 |
| | | | | |

This certificate relate and apply this equipment only.
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Mr.Chonchai Inthana(Technical Manager)

STAMP

SARTORIUS (THAILAND) CO., LTD. SARTORIUS ISO/IEC 17025:2017



**Sartorius (Thailand) Co., Ltd.**
129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310
Tel: +66 2643 8361-6 Fax: +66 2643-8367,

SARTORIUS

# Certificate of Calibration

| | | | |
|---|---|---|---|
| Model Number : | MSE224S-100-DU | Certificate No. : | 23BCI0044 |
| Description : | Analytical Balance | Issued Date : | Friday, January 27, 2023 |
| Serial Number : | 0034705158 | Reference No. : | 202361 |
| ID No. | SGK_CL0045 | | |
| Manufacturer : | Sartorius | Page No. : | 2 of 2 |

## Calibration Results : Without Adjustment

### Repeatability

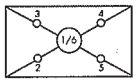
*The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.*

| | | |
|---|---|---|
| Nominal Value : (Low Load) | 20.0000 | 200.0000 |
| 20 g | 20.0001 | 200.0000 |
| Tolerance | 20.0000 | 200.0000 |
| *0.0001* g | 20.0000 | 200.0000 |
| | 20.0000 | 200.0001 |
| Nominal Value : (High Load) | 20.0000 | 200.0000 |
| 200 g | 20.0000 | 200.0001 |
| Tolerance | 20.0000 | 200.0000 |
| *0.0001* g | 20.0000 | 200.0001 |
| | 20.0000 | 200.0001 |
| ***Standard Deviation*** | 0.00003 | 0.00005 |

### Eccentricity (Off-center loading error)

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

Nominal value : 50 g
Tolerance *0.0004* g




| | Difference |
|---|---|
| 1 | – |
| 2 | 0.0001 |
| 3 | 0.0000 |
| 4 | 0.0000 |
| 5 | 0.0000 |
| 6 | – |

### Linearity

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

Tolerance *0.0002* g

| Nominal Value (g) | Conventional Mass Value (g) | Displayed Value (g) | Deviation (g) | Uncertainty (g) |
|---|---|---|---|---|
| 0.01 | 0.0100 | 0.0100 | 0.0000 | 0.00013 |
| 0.1 | 0.1000 | 0.1000 | 0.0000 | 0.00013 |
| 1 | 1.0000 | 1.0000 | 0.0000 | 0.00014 |
| 2 | 2.0000 | 2.0000 | 0.0000 | 0.00014 |
| 5 | 5.0000 | 5.0000 | 0.0000 | 0.00014 |
| 10 | 10.0000 | 10.0000 | 0.0000 | 0.00014 |
| 20 | 20.0000 | 20.0000 | 0.0000 | 0.00014 |
| 50 | 50.0000 | 50.0000 | 0.0000 | 0.00015 |
| 100 | 100.0000 | 100.0000 | 0.0000 | 0.00019 |
| 200 | 200.0000 | 200.0001 | 0.0001 | 0.00030 |

End of Report.

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 : 1-May-2023

Certificate No. : 23TH1728
CSR No. : A088/04367
Page. : 1 of 3

| | | |
|---|---|---|
| Customer | : | ALS Laboratory Group (Thailand) Co., Ltd<br>114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,<br>Amphoe Hat Yai, Songkhla, 90250 |
| Calibration Place | : | Chemical Laboratory |
| Instrument Name | : | Hot Air Oven |
| Manufacturer | : | Memmert |
| Model | : | UF110 |
| Serial No. | : | B416.3387 |
| ID No. | : | SGK_CL0024 |
| Resolution | : | 0.1 °C |
| Received Date | : | 28-Apr-2023 |
| Calibrated Date | : | 28-Apr-2023 |
| Ambient Temperature | : | (30 ± 10) °C |
| Relative Humidity | : | (50 ± 30) % |

REVIEW BY Ananta B.
APPROVED BY Kanitta H.
NEXT CAL. DATE 28/11/2024

Calibration Method Used :

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

Imron Rattanaylum / 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 Acquisiton/Switch Unit | 34970A | MY58009813 | 22SDAT004 | 24-May-2023 |

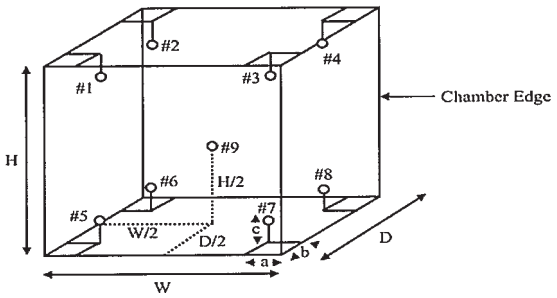
2. The resultes reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

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

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

1. Sensor Installation Diagram




| Sensor Installation Details | | | Dimension of the chamber | | |
|---|---|---|---|---|---|
| a = | 5.0 | cm | W = | 40.0 | cm |
| b = | 5.0 | cm | H = | 40.0 | cm |
| c = | 5.0 | cm | D = | 33.0 | cm |

SCaL

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 | 40.48 | 40.28 | 40.28 | 39.91 | 40.17 | 40.09 | 39.93 | 40.27 | 39.89 | 0.36 |
| 70 | 70.36 | 70.23 | 70.58 | 69.74 | 69.99 | 69.92 | 69.86 | 70.13 | 70.04 | 0.36 |
| 103 | 103.19 | 103.12 | 103.46 | 103.37 | 103.10 | 103.54 | 103.43 | 103.06 | 103.40 | 0.36 |
| 104 | 104.31 | 104.23 | 104.62 | 103.77 | 104.12 | 104.06 | 103.90 | 104.20 | 104.56 | 0.36 |
| 105 | 105.07 | 105.03 | 105.48 | 105.27 | 105.12 | 105.01 | 105.01 | 105.00 | 104.96 | 0.36 |
| 180 | 180.31 | 180.00 | 180.00 | 180.07 | 180.18 | 180.05 | 180.01 | 180.10 | 180.24 | 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 | 0.20 | 0.70 | 0.72 |
| 70 | 70.0 | 70.0 | 0.20 | 0.60 | 0.94 |
| 103 | 103.0 | 103.0 | 0.20 | 0.43 | 0.54 |
| 104 | 104.0 | 104.0 | 0.10 | 0.79 | 0.88 |
| 105 | 105.0 | 105.0 | 0.10 | 0.59 | 0.69 |
| 180 | 180.0 | 180.0 | 0.10 | 0.38 | 0.38 |

- 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

ilac-MRA THAILAND NSC-TIS1-TIS17025 CALIBRATION 0294

# CALIBRATION CERTIFICATE

Issued Date : 16-Jul-2023



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

Calibration Place : Chemical Laboratory
Instrument Name : Incubator
Manufacturer : Memmert
Model : ICP750
Serial No. : F816.0063
ID No. : SGK_CL0028
Resolution : 0.1 °C
Received Date : 13-Jul-2023
Calibrated Date : 13-Jul-2023
Ambient Temperature : (30 ± 10) °C
Relative Humidity : (50 ± 30) %

REVIEW BY Ananta B.
APPROVED BY Kantta H.
NEXT CAL. DATE 13/01/25

Calibration Method Used :

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

Imron Rattanaylum / 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.

SCaL

Details of Calibration

1. Reference Standard Equipment Used:

| Equipment | Model | Serial No. | Cert. no. | Due Date |
|---|---|---|---|---|
| Data Acquisiton/Switch Unit | 34970A | MY58009813 | 23SDAT004 | 23-May-2024 |

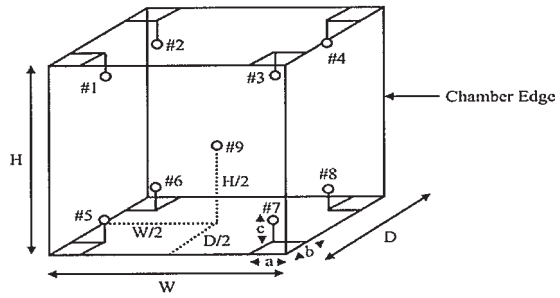
2. The resultes reported in this certificate refer to the condition of the instrument on the date of calibration and carry no implication regarding the longterm stability of instrument.

3. This certificate is not certified any commercial transaction

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

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

1. Sensor Installation Diagram




| Sensor Installation Details | | | Dimension of the chamber | | |
|---|---|---|---|---|---|
| a = | 5.0 | cm | W = | 40.0 | cm |
| b = | 5.0 | cm | H = | 40.0 | cm |
| c = | 5.0 | cm | D = | 33.0 | cm |



SCaL

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 | |
| 20 | 20.10 | 20.04 | 20.03 | 19.97 | 20.08 | 20.23 | 20.10 | 19.94 | 20.07 | 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) |
|---|---|---|---|---|---|
| 20 | 20.0 | 20.0 | 0.14 | 0.17 | 0.32 |

- UUC = Unit Under Calibration

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

... End ...

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

NSC-TISI-TIS17025
CALIBRATION 0008



# Certificate of Calibration

**Equipment :** DO Meter with Sensor

**Manufacturer :** YSI

**Model :** 5000

**Serial No. :** 17B101473

**ID No. :** SGK_CL0073

REVIEW BY Ananta B.
APPROVED BY Kanitta H.
NEXT CAL. DATE 21/05/24

**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.
Songkhla Branch.
114/1 Moo 8, Kanjanavanij Rd., Banphru,

**Location :** TPA Chemistry Calibration Lab.2

**Received Order :** 18 November 2022
**Calibrated Date :** 21 November 2022
**Ambient Temperature :** ( 26 ± 10 ) °C
**Relative Humidity :** ( 50 ± 30 ) %
**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :** Malu.
Approved Signatory

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

**Issue Date :** 22 November 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.





**Equipment :** DO Meter with Sensor
**Condition As-Received :** Used Item
**Reference :** 2111-0663DSC-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 | 3240076 | 22I249 | 02 Mar 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

**Function :** Temperature measurement.

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

| Calibration Point ( °C ) | Immersion Depth ( mm ) | Standard Temperature ( °C ) | UUC* Reading ( °C ) | Error ( °C ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|
| 20.00 | 60 | 20.001 | 19.88 | -0.121 | 0.15 | 2.00 |

**UUC* :** Unit Under Calibration

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

-o0o-

Malu.

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



# Certificate of Testing

| | |
|---|---|
| **Equipment :** | DO Meter |
| **Manufacturer :** | YSI |
| **Model :** | 5000 |
| **Serial No. :** | 17B101473 |
| **ID No. :** | SGK_CL0073 |
| **Received Date :** | 18 November 2022 |
| **Test Date :** | 21 November 2022 |
| **Reference :** | 2211-0663DSC-1 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd.<br>Songkhla Branch.<br>114/1 Moo 8, Kanjanavanij Rd., Banphru,<br>Hatyai, Songkhla 90250, Thailand |
| **Laboratory Condition :** | Temperature ( 25 ± 5 ) °C<br>Humidity (50 ± 20) % |
| **Test Procedure :** | In - house method : CP-CH9<br>by Comparison Technique with Azide Modification Method |
| **Tested by :** | Walalak Sirithean |
| **Approved by :** | Approved Signatory |

(✓) Malee Butkruea
( ) Saithip Meangmai
( ) Warakorn Lerngagtrakul

**Issue Date :** 22 November 2022





**Condition of this result of calibration**

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

| Instruments | Serial No. | ID No. | Certificate No. | Due Date |
|---|---|---|---|---|
| 1) Burette | - | 130BU10 | 21CG1389 | 25 Mar 2023 |
| 2) Balance | 1126143764 | 140RC004 | 22MM50 | 20 Sep 2023 |

2. Standard Material :-

| Material | Manufacturer | Lot.No. | Assay |
|---|---|---|---|
| Sodium Thiosulfate pentahydrate | Merck | AM1763316 | 100.2% |

**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 | 8.12 | 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-

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

NSC-TISI-TIS17025 CALIBRATION 0294

# CALIBRATION CERTIFICATE

Issued Date : 16-Jul-2023

Certificate No. : 23TH3097
CSR No. : A095/04743
Page. : 1 of 3

| | | |
|---|---|---|
| Customer | : | ALS Laboratory Group (Thailand) Co., Ltd<br>114/1 Moo 8, Karnchanawanich Rd. Tambon, Ban Phru,<br>Amphoe Hat Yai, Songkhla, 90250 |
| 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 | : | 13-Jul-2023 |
| Calibrated Date | : | 13-Jul-2023 |
| Ambient Temperature | : | (30 ± 10) °C |
| Relative Humidity | : | (50 ± 30) % |

REVIEW BY Anantaß.
APPROVED BY Kanitta B.
NEXT CAL. DATE 13/01/25

**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 :

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

Calibrated by : Ibrorhim Saleemin

Approved by :

Imron Rattanaylum / 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**

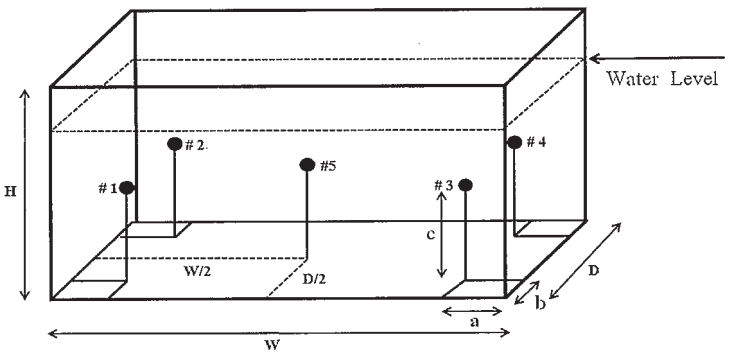
1. Reference Standard Equipment Used:

| Equipment | Model | Serial No. | Cert. no. | Due Date |
|---|---|---|---|---|
| Data Acquisiton/Switch Unit | 34970A | MY58009813 | 23SDAT004 | 23-May-2024 |

2. The resultes 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 mulfunction

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

1. Sensor Installation Diagram




| Sensor Installation Details | | | | Dimension of the chamber | | | |
|---|---|---|---|---|---|---|---|
| a = | 5 | cm | | W = | 45 | cm | |
| b = | 5 | cm | | H = | 30 | cm | |
| c = | 5 | cm | | D = | 35 | cm | |

SCaL

Certificate No. : 23TH3097

CSR No. : A095/04743

Page. : 3 of 3

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 | 79.17 | 79.47 | 79.43 | 79.25 | 79.38 | 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 | 80.0 | 80.0 | 0.24 | 0.38 | 0.38 |

- 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 ...

Agilent Technologies

Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
968 RAMA 4 ROAD, SILOM, BANGRAK
Bangkok 10500 Thailand

Tel. +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

**Customer Contact:**
ALS Laboratory Group (Thailand) Co Ltd
Branch Number 0002
114/1 Moo8 Banplu Subdistric Hat Yai District
TAX ID : 0105540004859
kanitta.hemprasatpor@alsglobal.com
0811721334

**Invoice To:**
ALS Laboratory Group (Thailand) Co Ltd
Branch Number 0002
114/1 Moo8 Banplu Subdistric Hat Yai District SONGKHLA 90250

**Payer:**
ALS Laboratory Group (Thailand) Co Ltd Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan Luang
BANGKOK 10250

**Delivery Site:**
ALS Laboratory Group (Thailand) Co Ltd
Branch Number 0002
114/1 Moo8 Banplu Subdistric Hat Yai District

**Location:**
**Room**
**Bldg**
**Lab**
**Dept**

## SERVICE REPORT

| | |
|---|---|
| **Customer Purchase Order Number:** | **Customer Number:** 70579367 |
| **Service Request:** | **Service Request Date:** |
| **Service Order:** 6005939422 | **Service Confirmation:** 6905074481 |

REVIEW BY Kovinna J.
APPROVED BY Kanitta H.
NEXT CAL. DATE 2/02/25

**Direct Inquiries to:**
Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Bangkok 10500 Thailand
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Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007 ,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330 Thailand

ORIGINAL

**Service Instrument:**

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|---|---|---|---|---|
| SYS-IM-7900 | ICPMS 7900 System | | | |
| G7201C | ICP-MS MassHunter SW only (excludes PC) | USH3799575 | ICP MS 7900 | SYS-IM-7900 |
| G8403A | Agilent 7900 ICP-MS | JP16511669 | ICP MS 7900 | SYS-IM-7900 |
| G8411A | ISIS 3 for Agilent 7850/7900/8900 | JP16510379 | ICP MS 7900 | SYS-IM-7900 |

**Service Items:**

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|---|---|---|---|---|---|---|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 02.08.2023 | 02.08.2023 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

**Additional Information:**



**Service Confirmation Number:** 6905074481
**Service Confirmation Date:** 02.08.2023

**Service Information:**

**Problem Description:**
WU-S-OQ-IM-7900-5001093854

**Service Provided:**
-Perform OQ hardware.
-Test OQ of instrument ICP-MS = SGK_CL0048.
All tests Passed.

**Service Overview Code:**
Reason Code: Scheduled Service
Diagnosis Code: Scheduled Service
Resolution Code: Scheduled Service

| | | |
|---|---|---|
| **Reported Hours:** 9.0 | **Travel Hours:** 3.0 | |
| **Customer Field Service Representative Name:** Uthai Ngamlertsirichai | **Customer Field Service Representative Signature:** Uthai Ng. | **Date:** 02 Aug 2023 |
| **Customer Name:** KANITTA HEMPRASATPORN | **Customer Signature:** กนิษฐา | **Date:** 02 Aug 2023 |

**Additional Comments:**

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

NSC TISI-TIS17025 CALIBRATION 0294

# CALIBRATION CERTIFICATE

Issued Date : 3-Feb-2023

Certificate No. : 23TH0527
CSR No. : A073/03634
Page. : 1 of 3

| | | |
|---|---|---|
| Customer | : | ALS Laboratory Group (Thailand) Co., Ltd<br>114/1 Moo 8 Karnchanawanich Rd. T.Ban Phru,<br>A. Hat Yai, Songkhla 90250 TH |
| Calibration Place | : | Chemical Laboratory |
| Instrument Name | : | Cold Room Water |
| Manufacturer | : | MODULAR |
| Model | : | N/A |
| Serial No. | : | N/A |
| ID No. | : | SGK_CL0065 |
| Resolution | : | 0.1 °C |
| Received Date | : | 31-Jan-2023 |
| Calibrated Date | : | 31-Jan-2023 |
| Ambient Temperature | : | (30 ± 10) °C |
| Relative Humidity | : | (50 ± 30) % |

REVIEW BY Ananta B.
APPROVED BY Kanitta H.
NEXT CAL. DATE 31/07/24

**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 :

Imron Rattanaylum / Technical Manager

The uncertainties are for a confidence probability of approximately 95%

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**Details of Calibration**

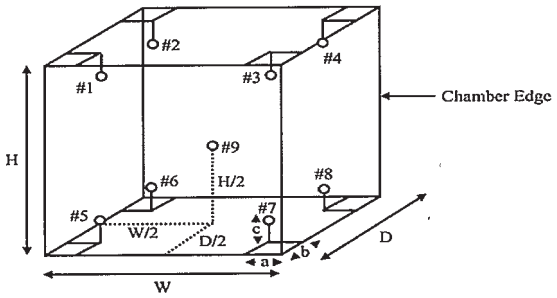
1. Reference Standard Equipment Used:

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

2. The resultes 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 mulfunction

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

**1. Sensor Installation Diagram**




| Sensor Installation Details | | | | Dimension of the chamber | | | |
|---|---|---|---|---|---|---|---|
| a | = | 5.0 | cm | W | = | 40.0 | cm |
| b | = | 5.0 | cm | H | = | 40.0 | cm |
| c | = | 5.0 | cm | D | = | 33.0 | cm |

SCaL

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 | Measured Standard Temperature At Spread Locations ( °C ) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ( °C ) | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | # 9 | Ref.10 | # 11 | # 12 | # 13 | # 14 | # 15 |
| 4 | 3.18 | 3.39 | 3.54 | 3.77 | 3.99 | 3.86 | 3.85 | 3.92 | 4.02 | 3.86 | 3.78 | 3.84 | 3.85 | 4.09 | 3.91 |

The uncertainty of measurement was ± 0.38 °C

3. Performance Result

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

| Cal point ( °C ) | UUC Setting ( °C ) | UUC Reading ( °C ) | Temperature Stability ( ±°C ) | Temperature Uniformity ( °C ) | Overall Variation ( °C ) |
|---|---|---|---|---|---|
| 4 | 4.0 | 4.0 | 1.23 | 0.50 | 0.84 |

- 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)
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TEL. 0-2717-3000-29 FAX. 0-2719-9484

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NSC-TISI-TIS17025
CALIBRATION 0008

Cert. No.: 23TM1408
Page : 1 of 4

# Certificate of Calibration

| | |
|---|---|
| **Equipment :** | Autoclave |
| **Manufacturer :** | TOMY |
| **Model :** | SX-700 |
| **Serial No. :** | 48134190 |
| **ID No. :** | BKK_ML0041 |
| **Submitted by :** | ALS Laboratory Group (Thailand) Co.,Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| **Location :** | Media Preparation Room |
| **Received Order :** | 03 October 2023 |
| **Calibration Date :** | 04 October 2023 |
| **Ambient Temperature :** | ( 26 ± 10 ) °C |
| **Relative Humidity :** | ( 50 ± 30 ) % |
| **Calibrated by :** | Khit Ruttanaprapachai |
| **Approved by :** | Approved Signatory |

REVIEW BY Sithichdc
APPROVED BY
NEXT CAL. DATE ~~05/10/24~~ 04/04/25
หมดอายุ CSP 11/10/23

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

**Issue Date :** 11 October 2023

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

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A 0059272

**Equipment :** Autoclave **Cert. No.:** 23TM1408
**Condition As-Received :** Used Item **Page :** 2 of 4
**Reference :** 2310-0006OC-6

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | MY57013823 | 23LM66 | TPA | 25 Mar 2024 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.
4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990 )

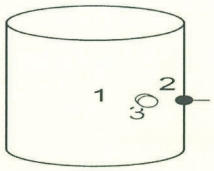
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directry concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

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

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

**Function of UUC* :** Temperature Source




| | Environmental | | |
|---|---|---|---|
| | ( °C ) | ( %R.H. ) | ( Volt ) |
| Beginning of Calibration | 26 | 64 | 221 |
| Finished of Calibration | 27 | 67 | 222 |

| Position | Description | Ref. Std. ID No.: |
|---|---|---|
| 1 = | Center of chamber | 19-17TC-08 |
| 2 = | Temperature sensor | 19-17TC-09 |
| 3 = | Exhaust port | 19-17TC-10 |



**Equipment :** Autoclave **Cert. No.:** 23TM1408
**Condition As-Received :** Used Item **Page :** 3 of 4
**Reference :** 2310-0006OC-6
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source

**Operating parameter Set : Temperature =** 108 °C
**Sterilization period =** 10 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 108 | 108 | 1 | 108.352 | 0.12 | 0.04 | 0.90 | 2 |
| | | 2 | 108.263 | | | | |
| | | 3 | 108.140 | | | | |

**Operating parameter Set : Temperature =** 115 °C
**Sterilization period =** 20 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 115 | 115 | 1 | 115.376 | 0.13 | 0.08 | 0.90 | 2 |
| | | 2 | 115.297 | | | | |
| | | 3 | 115.157 | | | | |

**Operating parameter Set : Temperature =** 118 °C
**Sterilization period =** 10 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 118 | 118 | 1 | 118.083 | 0.11 | 0.09 | 0.90 | 2 |
| | | 2 | 118.037 | | | | |
| | | 3 | 117.954 | | | | |

**Average* :** The average of 30 values in each position.
**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.
**UUC* :** Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .

**Equipment :** Autoclave
**Condition As-Received :** Used Item
**Reference :** 2310-0006OC-6
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source

**Cert. No.:** 23TM1408


**Operating parameter Set : Temperature =** 121 °C
**Sterilization period =** 30 minute

| UUC* Setting ( °C ) | UUC* Reading ( °C ) | Position | Average* Standard Reading ( °C ) | Stability ( ± °C ) | Pressure Reading ( MPa ) | Uncertainty ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 121 | 121 | 1 | 121.186 | 0.17 | 0.11 | 0.91 | 2 |
| | | 2 | 121.082 | | | | |
| | | 3 | 120.980 | | | | |

**Average* :** The average of 30 values in each position.
**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.
**UUC* :** Unit Under Calibration
**Note :** The reported uncertainty of measurement was excluded stability.

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

-o0o-

a 1184531

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-27 FAX. 0-2719-9484

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NSC-TISI-TIS17025 CALIBRATION 0008

**Cert. No.:** 22TM1571


# Certificate of Calibration

**Equipment :** Hot Air Oven
**Manufacturer :** Binder
**Model :** ED 240/E2
**Serial No. :** 00-15533
**ID No. :** BKK_ML0013

REVIEW BY Sithichok
APPROVED BY
NEXT CAL. DATE 21/05/24

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

**Location :** Media Preparatiom Room

**Received Order :** 21 November 2022
**Calibration Date :** 21 November 2022
**Ambient Temperature :** ( 26 ± 10 ) °C
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Krisda Malee

**Approved by :**
( ) Pornthippa Tameyakul
(✓) Malee Butkruea
( ) Suwit Imjai

Approved Signatory

**Issue Date :** 29 November 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 0048150

**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2211-0623OC-1

**Cert. No.:** 22TM1571


**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

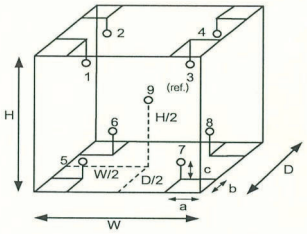
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34970A | MY44067817 | 22LM121 | 22 Aug 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( * ) After Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Not Available

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 26 | 26 |
| REL.Humid. ( % ) | 53 | 55 |
| AC Supply ( Volt ) | 219 | 220 |




| Position : | Ref. Std. ID No.: |
|---|---|
| 1 | 21-15TC-01 |
| 2 | 21-15TC-02 |
| 3 | 21-15TC-03 |
| 4 | 21-15TC-04 |
| 5 | 21-15TC-05 |
| 6 | 21-15TC-06 |
| 7 | 21-15TC-07 |
| 8 | 21-15TC-08 |
| 9 (ref.) | 21-15TC-09 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 5.0 | cm |
| b = | 5.0 | cm |
| c = | 5.0 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.50 | m |
| W = | 0.80 | m |
| H = | 0.60 | m |
| Capacity = | 0.24 | m³ |

Malu.



**Equipment :** Hot Air Oven
**Condition As-Received :** Used Item
**Reference :** 2211-0623OC-1

**Cert. No.:** 22TM1571


**Result of Calibration :-** ( * ) After Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Not Available

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Uncertainty ( ±°C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|---|
| 180 | 180 | 180 | 0.70 | 1.5 | 2.9 | 1.4 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 180 | 179.520 | 180.585 | 178.855 | 179.482 | 178.827 | 179.938 | 179.074 | 180.199 | 180.068 |

**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 %.

-o0o-

Malu.

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-29 FAX. 0-2719-9484

NSC-TISI-TIS17025
CALIBRATION 0008



# Certificate of Calibration

**Equipment :** Incubator

**Manufacturer :** Memmert

**Model :** INE 800

**Serial No. :** E805.0063

**ID No. :** BKK_ML0018

REVIEW BY Sithichok
APPROVED BY
NEXT CAL. DATE 03/10/24

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

**Location :** Incubation & Microbiological Reading

**Received Order :** 03 October 2023
**Calibration Date :** 03 October 2023
**Ambient Temperature :** ( 26 ± 10 ) °C
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Man Pattanapongpaiboon

**Approved by :**

Approved Signatory

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

**Issue Date :** 11 October 2023

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

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





**Equipment :** Incubator
**Condition As-Received :** Used Item
**Reference :** 2310-0006OC-4

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

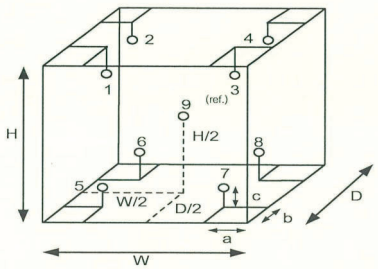
| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | MY49023932 | 23LM122 | TPA | 26 Jul 2024 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close

| Environment during calibration | | |
|---|---|---|
| | Beginning | Finished |
| Temp. ( °C ) | 24 | 24 |
| REL.Humid. ( % ) | 54 | 56 |
| AC Supply ( Volt ) | 222 | 224 |




| Position : | Ref. Std. ID No.: |
|---|---|
| 1 | 20-16RTD-01 |
| 2 | 20-16RTD-02 |
| 3 | 20-16RTD-03 |
| 4 | 23-16RTD-04 |
| 5 | 22-16RTD-05 |
| 6 | 20-16RTD-06 |
| 7 | 20-16RTD-07 |
| 8 | 22-16RTD-08 |
| 9 (ref.) | 22-16RTD-09 |

**Probe Installation Details :**

| | | |
|---|---|---|
| a = | 10 | cm |
| b = | 10 | cm |
| c = | 10 | cm |

**Dimension of Chamber :**

| | | |
|---|---|---|
| D = | 0.60 | m |
| W = | 1.0 | m |
| H = | 1.2 | m |
| Capacity = | 0.75 | m³ |

**Equipment :** Incubator
**Condition As-Received :** Used Item
**Reference :** 2310-0006OC-4
**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Fresh air setting :** Close

**Cert. No.:** 23TM1364
**Page :** 3 of 3

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor *k* |
|---|---|---|---|---|---|---|
| 35.0 | 35.0 | 35.0 | 0.077 | 0.51 | 0.68 | 2 |

| Calibration Point ( °C ) | Measured Temperature ( °C ) Position | | | | | | | | | Uncertainty ( ±°C ) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 35.0 | 35.361 | 35.313 | 35.282 | 35.403 | 34.871 | 34.826 | 34.807 | 34.964 | 34.937 | 0.30 |

**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 %.

-o0o-

a 1184536

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

ilac-MRA
NSC-TISI-TIS17025 CALIBRATION 0008

**Cert. No.:** 23TM637
**Page :** 1 of 3

# Certificate of Calibration

**Equipment :** Water Bath
**Manufacturer :** Memmert
**Model :** WNE 45
**Serial No. :** L712.0429
**ID No. :** BKK_ML0056
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
**Location :** Incubator & Microbiological Reading

REVIEW BY Sithichok
APPROVED BY
NEXT CAL. DATE 20/4/24

**Received Order :** 20 April 2023
**Calibration Date :** 20 April 2023
**Ambient Temperature :** ( 26 ± 10 ) °C
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :** Kunchit Promprat

**Approved by :** Malee.
Approved Signatory

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

**Issue Date :** 24 April 2023

**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 0053357

**Equipment :** Water Bath
**Condition As-Received :** Used Item
**Reference :** 2304-0253OC-1

**Cert. No.:** 23TM637


**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

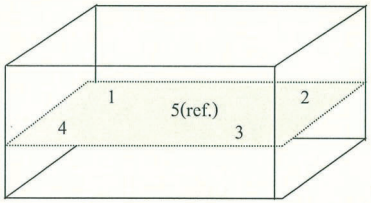
1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 1 ) Data Acquisition | 34970A | MY44073381 | 22LM78/1 | 12 May 2023 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source
**Heat transfer medium used :** Water

| | Environmental | | AC Voltage Supply |
|---|---|---|---|
| | ( °C ) | ( %R.H. ) | ( Volt ) |
| **Beginning of Calibration** | 25 | 45 | 223 |
| **Finished of Calibration** | 25 | 43 | 223 |




Front

| Position : | Ref. Std. S/N.: |
|---|---|
| 1 | 4803988-006 |
| 2 | 4803988-007 |
| 3 | 4804539-014 |
| 4 | 4804539-015 |
| 5(ref.) | 4804539-016 |



**Equipment :** Water Bath
**Condition As-Received :** Used Item
**Reference :** 2304-0253OC-1

**Cert. No.:** 23TM637


**Result of Calibration :-** ( * ) Without Adjustment
**Function of UUC* :** Temperature Source

| Calibration point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Average* Standard Reading ( °C ) Position | | | | | Uncertainty ( ± °C ) |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 44.5 | 44.5 | 44.5 | 44.492 | 44.463 | 44.475 | 44.510 | 44.491 | 0.15 |
| 45.0 | 45.0 | 45.0 | 45.005 | 44.962 | 44.979 | 45.016 | 44.986 | 0.15 |

| Calibration point ( °C ) | Uniformity ( °C ) | Stability ( ± °C ) | Coverage Factor *k* |
|---|---|---|---|
| 44.5 | 0.051 | 0.022 | 2 |
| 45.0 | 0.080 | 0.026 | 2 |

**Average* :** The average of 30 values in each position.
**Uniformity :** The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
**Stability :** One-half of the greatest maximum difference of measured temperature at any one probe.
**UUC* :** Unit Under Calibration
**Note :** The reported uncertainty of measurement was included stability and excluded uniformity.

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

-o0o-

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

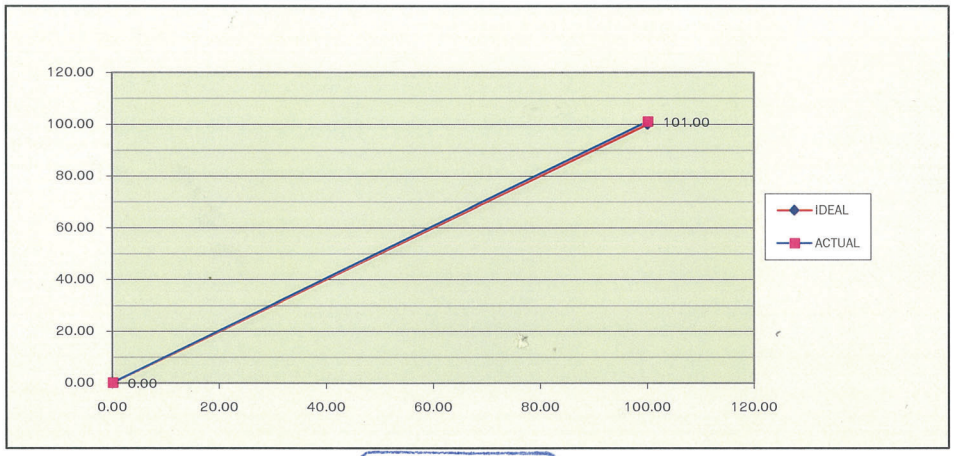
## CALIBRATION REPORT

REVIEW BY Vichuta N.
APPROVED BY [signature]
NEXT CAL. DATE 9/2/67

| | | | | | |
|---|---|---|---|---|---|
| CUSTOMER NAME : | ALS Laboratory Group (Thailand) Co., Ltd. | | | | |
| EQRIPMENT 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 : วราพล คุ้ยกิจเจริญ DATE : 9/8/65

CHECKED BY : [signature] DATE : 9/8/65

JNAC JIRANATEE ASSOCIATES CO., LTD.


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

เลขที่ 63/14-15,67/35-36 ถนน เพชรเกษม7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889



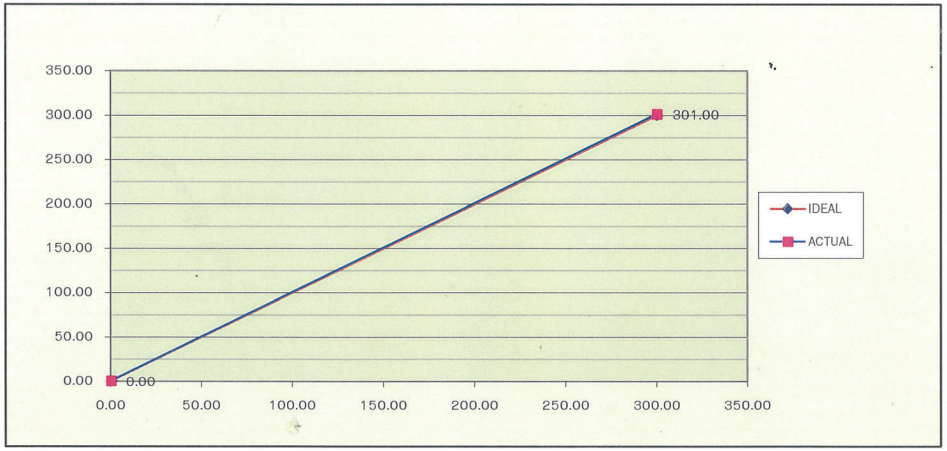

JNAC
JIRANATEE ASSOCIATES CO.,LTD.

## CALIBRATION REPORT

| | | | | | |
|---|---|---|---|---|---|
| CUSTOMER NAME : | ALS Laboratory Group (Thailand) Co., Ltd. | | | | |
| EQRIPMENT NAME : | Total Hydrocarbon Analyzer | | | | |
| MANUFACTURER : | Baseline | MODEL : | 9000 NMHC | SERIAL NO | : 0314DR0170 |
| STANDARD GAS CONCENTRATION (PPM) : | : 100 PPM ( Propane ) | | | 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 | 300.00 | 301.00 | 1.0 | 0.33 |
| AVERAGE (%) | | | | 0.08 |




CALIBRATED BY : วราพล คุ้ยกิจเจริญ DATE : 9/8/65

CHECKED BY : [signature] DATE : 9/8/65

JNAC JIRANATEE ASSOCIATES CO., LTD.


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

เลขที่ 63/14-15,67/35-36 ถนน เพชรเกษม7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889

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JIRANATEE ASSOCIATES CO.,LTD

## 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 คุ้มกิ่งเจริญ DATE : 9/8/65

CHECKED BY : [signature] DATE : 9/8/65

JNAC JIRANATEE ASSOCIATES CO., LTD.

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com

เลขที่ 63/14-15,67/35-36 ถนน เพชรเกษม7,7/1 แขวง วัดท่าพระ เขต บางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02868-1889

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# 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. Bamrit

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 |

**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: | >= | -1.0 | % setpoint in K | ( | -5.0 | °C ) |
| | <= | 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: | >= | -1.0 | % setpoint in K | ( | -3.7 | °C ) |
| | <= | 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: | <= | 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**

| | | | | |
|---|---|---|---|---|
| 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 |





# Electronic Signature

**Purpose**

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

**Details**

| | |
|---|---|
| Full Name of Signer: | Eaknarin Puangsopa |
| 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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User Name: eaknarin_puangsopa
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 |

Page 1 / 10





User Name: eaknarin_puangsopa
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_puangsopa
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: EI - Extractor | None |
| July 6, 2022 1:57:10 PM | End | Execution | Log Amp - 5977B SQ: - Source: 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: - EI - Extractor Filament 1 (Qualitative - No setpoints associated) | None |
| 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 |

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User Name: eaknarin_puangsopa
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: - EI - Extractor Filament 1 (Qualitative - No setpoints associated) | None |
| July 6, 2022 2:41:56 PM | End | Execution | Tune EI - 5977B SQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated) | Run Count : 1 |
| July 6, 2022 2:41:58 PM | Start | Execution | Tune EI - 5977B SQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | None |
| 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: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | None |
| 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: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | None |

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User Name: eaknarin_puangsopa
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: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | Run Count : 1 |
| 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 | OQ |
| 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 | OQ |
| 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 | OQ |
| 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\OFN_SN_F01.D |

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User Name: eaknarin_puangsopa
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 |

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User Name: eaknarin_puangsopa
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 |

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User Name: eaknarin_puangsopa
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 |

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User Name: eaknarin_puangsopa
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 10:57:38 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_puangsopa
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 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.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

*Accredited calibration laboratory*
*ISO/IEC 17025:2017*
*NSC-TISI-TIS 17025*
*CALIBRATION 0367*

*Air speed measurement laboratory*
*Calibration services department.*

REVIEW BY Monakorn P.
APPROVED BY
NEXT CAL. DATE 19/12/24

| Certificate Number |
|---|
| CC-009-66 |

# CERTIFICATE OF CALIBRATION



**MEASUREMENT ITEM** : Cup anemometer
**MANUFACTURER** : Novalynx
**MODEL/TYPE** : Sensor: WS-02FA
Data logger: 110-WS-25DL-D
**SERIAL NUMBER** : Sensor: WSD-A5966
Data logger: A5966
**ID NUMBER** : BKK_FS1371
**CONDITION AS-RECEIVED** : New item
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 16 Jun 2023
**MEASUREMENT DATE** : 19 Jun 2023
**ISSUE DATE** : 19 Jun 2023

**ENVIRONMENTAL CONDITIONS:**
Ambient condition in the laboratory are as follow:

| | | |
|---|---|---|
| Temperature | : 23.0 ± 3.0 | ˚C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010 ± 10 | hPa |

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITIONS**

| | | |
|---|---|---|
| : Wind tunnel cross-section area[1] | 900 | $cm^2$ |
| Win direction frontal area[2] | 100 | $cm^2$ |
| Diameter of mounting pipe[3] | - | mm |
| Blockage ratio of test object[4] | 0.111 | [-] |

**Preconditioning** : 24 hours at ambient conditions.
**Measurement Condition** : The average values during measurement are (23.9) ˚C, (45.2) %RH and (1008.6) hPa.

***Calibration procedure:***
*The cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 $cm^2$ cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.*

***Traceability:***
*This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0052-21 and MW-0066-22*

***Uncertainty of Measurement:***
*The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'*

**TABULATION OF RESULTS:**
The table on next page give the measured values.

**Calibrated by:**
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

JNAC JIRANATE ASSOCIATES CO.,

**Approved signatory:**
Mr. Parinya Booncharoen
Calibration Department Manager

**Remark:**
[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

*Accredited calibration laboratory*
*ISO/IEC 17025:2017*
*NSC-TISI-TIS 17025*
*CALIBRATION 0367*

*Air speed measurement laboratory*
*Calibration services department.*

| Certificate Number |
|---|
| CD-009-66 |

# CERTIFICATE OF CALIBRATION



**MEASUREMENT ITEM** : Wind Direction Sensor
**MANUFACTURER** : Novalynx
**MODEL/TYPE** : Sensor: WS-02FA
Data logger: 110-WS-25DL-D
**SERIAL NUMBER** : Sensor: WSD-A5966
Data logger: A5966
**ID NUMBER** : BKK_FS1371
**CONDITION AS-RECEIVED** : New item
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

**RECEIVED DATE** : 16 Jun 2023
**MEASUREMENT DATE** : 19 Jun 2023
**ISSUE DATE** : 19 Jun 2023

**ENVIRONMENTAL CONDITIONS:**
Ambient condition in the laboratory are as follow:

| | | |
|---|---|---|
| Temperature | : 23.0 ± 3.0 | ˚C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010± 10 | hPa |

**PLACE OF CALIBRATION** : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

**CALIBRATION CONDITION**

| | | |
|---|---|---|
| : Wind tunnel cross-section area[1] | 900 | $cm^2$ |
| Win direction frontal area[2] | 129 | $cm^2$ |
| Diameter of mounting pipe[3] | - | mm |
| Blockage ratio of test object[4] | 0.143 | [-] |

**Preconditioning** : 24 hours at ambient conditions.
**Measurement Condition** : The average values during measurement are (24.3)˚C, (44.7) %RH and (1010.1) hPa.

***Calibration procedure:***
*The wind direction sensor was calibrated against Standard Rotary Encoder model: AX4009TS-DM04-P3-S-U0 in an close test-section of Eiffel-type wind tunnel with 900 $cm^2$ cross test section area. The WI-CL-008 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.*

***Traceability:***
*This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: DA-0043-22*

***Uncertainty of Measurement:***
*The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'*

**TABULATION OF RESULTS:**
The table on next page give the measured values.

**Calibrated by:**
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

JNAC JIRANATE ASSOCIATES CO.

**Approved signatory:**
Mr. Parinya Booncharoen
Calibration Department Manager

**Remark:**
[1] Nozzle cross-section area of the wind tunnel
[2] Projected cross-section area of the tested object include mounting pipe
[3] Diameter of mounting pipe
[4] Ratio [2] to [1]

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Jiranatee Associates Co.,Ltd

| Certificate Number |
| --- |
| CD-009-66 |



**MEASUREMENT RESULTS** [5]

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

| Air speed | $D^{6}_{std}$ | $D^{7}_{uuc}$ | Error | *U (k=2)* |
| --- | --- | --- | --- | --- |
| m/s | Degree (°) | Degree (°) | Degree (°) | Degree (°) |
| 5.01 | 0.000 | 0 | 0 | 1.0 |
| | 45.000 | 43 | -2 | 1.0 |
| | 90.000 | 87 | -3 | 1.0 |
| | 135.000 | 132 | -3 | 1.0 |
| | 180.000 | 182 | 2 | 1.0 |
| | 225.000 | 228 | 3 | 1.0 |
| | 270.001 | 273 | 3 | 1.0 |
| | 315.000 | 318 | 3 | 1.0 |

**Remark:**

[5] Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

[6] Direction of standard

[7] Direction of Unit Under Calibration

***End of Certificate of Calibration***

Jiranatee Associates CO., Ltd.

JNAC JIRANATE ASSOCIATES CO.,LTD.
63/14-15,67/35-36, Soi Petchkasem7,7/1, Petchkasem Rd,
Watthapra, Bangkokyai, Bangkok 10600 Thailand.
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ilac-MRA NSC - TISI - TIS 17025 CALIBRATION 0367

# CERTIFICATE OF CALIBRATION

Certificate No. : CT-019-66


**Equipment Name:** Data Logger with Temperature sensor
**Manufacturer:** Novalynx
**Model:** 110-WS-25DL-D
**Serial No.:** A5966
**ID No.:** BKK_FS1371

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

**Received date:** 16 Jun 2023
**Calibration date:** 19 Jun 2023
**Issue date:** 22 Jun 2023

**Reference Used During Calibration**
1.Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 28 Mar 2024
2.Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 22 July 2023

**Calibration Condition**
Temperature: (23±3)°C
Relative Humidity: (55±15)%

**Calibration Procedure**
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

**Traceability**
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0038-23, Certificate number: ER-0092-22

***Noted:*** *The certificate is valid only to the item calibrated on date and place of calibration.*

**Calibrated by**
☐ Mr. Sorawit Thachalad
☑ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

JNAC JIRANATE ASSOCIATES CO.,

**Approved Signatory:** .....
Mr. Parinya Booncharoen
Calibration Department Manager

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NSC - TISI - TIS 17025
CALIBRATION 0367



**Result of Calibration:-** ☑ Without Adjustment ☐ With Adjustment

**Calibration Range:** 20-40 ˚C

**Function:**

This equipment was connected with temperature sensor Model: HMP60 S/N: V1920207.

Dimension : Diameter 12 mm. Length 80 mm.

| Immersion Depth (mm) | Standard Reading (˚C) | UUC Reading (˚C) | Error (˚C) | Uncertainty (˚C) |
|---|---|---|---|---|
| 70 | 20.058 | 20.0 | -0.1 | 0.099 |
| 70 | 25.051 | 24.9 | -0.2 | 0.099 |
| 70 | 30.044 | 29.9 | -0.1 | 0.099 |
| 70 | 35.040 | 34.9 | -0.1 | 0.099 |
| 70 | 40.034 | 39.8 | -0.2 | 0.099 |

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 ✱

JNAC JIRANATE ASSOCIATES CO.,

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# CERTIFICATE OF CALIBRATION



Measurement Item : Relative humidity with data logger
Manufacturer : Novalynx
Model/Type : 110-WS-25DL-D
Serial Number : A5966
ID No. : BKK_FS1371
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 (25±3)˚C, and relative humidity of (50±15)%.

Measurement Method:
Unit Under Calibration (UUC) was calibrated by comparison method with standard chilled mirror hygrometer model: 1860-3 in the humidity generator chamber to determine the errors.

Traceability:
This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) via MCS Calibration, Inc. Certificate number: 20926-601. Due date: Sep 26, 2024.

Measurement Date : Jun 19, 2023
Issued Date : Jun 22, 2023

Measurement Results:
This equipment was connected with Indoor air quality probe and Displayed (UR) on display. Model: HMP60, Serial number: V1920207.
Calibration was performed in the range of 20%RH to 80%RH
The results of calibration are reported in table below.

| Determined (%RH) | Standard (Reading) (%RH) | UUC (Reading) (%RH) | Error (%RH) | Uncertainty ±(%RH) |
|---|---|---|---|---|
| 20 | 20.06 | 19.5 | -0.6 | 0.53 |
| 50 | 50.22 | 50.4 | 0.2 | 0.53 |
| 80 | 80.21 | 81.5 | 1.3 | 0.53 |

Performed by
☐ Mr. Sorawit Thachalad
☑ Miss Jittraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit

JNAC JIRANATE ASSOCIATES CO.,

Approved Signatory: .....
Mr. Parinya Booncharoen.
Calibration Department Manager

THIS CALIBRATION REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY.

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*Accredited calibration laboratory*
*ISO/IEC 17025:2017*
*NSC-TISI-TIS 17025*
*CALIBRATION 0367*

*Pressure measurement laboratory*
*Calibration services department.*

NSC - TISI - TIS 17025
CALIBRATION 0367

# CERTIFICATE OF CALIBRATION

**Certificate No.** : CP-003-66



**MEASUREMENT ITEM** : Digital barometer
**MANUFACTURER** : Novalynx
**MODEL/TYPE** : Sensor: 110-WS-25BP
Data logger: 110-WS-25DL-D
**SERIAL NUMBER** : Sensor: BP-A5966
Data logger: A5966
**ID NUMBER** : BKK_FS1371
**CONDITION AS-RECEIVED** : New item
**CUSTOMER** : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

**RECEIVED DATE** : 16 Jun 2023
**MEASUREMENT DATE** : 19 Jun 2023
**ISSUE DATE** : 19 Jun 2023

***Calibration procedure:***
*The pressure calibration was done by In-house calibration method as WI-CL-003 according to comparison method with Digital pressure calibrator based on DKD-R 6-1*

***Traceability:***
*The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0205-22*

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

**CONDITION OF THIS RESULT OF CALIBRATION:**
1. Reference Standard Instrument:

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|---|---|---|---|---|
| Absolute Pressure Transducer | CPG2500 | 4100126P | MP-0205-22 | 02 Dec 2023 |

1. Calibration effort for calibration sequence C
2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.
3. Calibration conditions:
4. Condition : ☑ Normal ☐ Abnormal
Pressure transmitting medium : Air
$\rho_{FI}$ (20°C, 1 bar) : 1.19 kg/m$^3$
$H_{amb}$ : (55±15) %
$t_{amb}$ : (23±3) °C
$p_{amb}$ : (1010±10) mbar
5. The certificate is valid only to the item calibrated on date and place of calibration

**Calibrated by:**
☑ Mr. Sorawit Thachalad
☐ Miss Jittraporn Lertsomphol

**Approved signatory:** .....
Mr. Parinya Booncharoen
Calibration Department Manager

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*Accredited calibration laboratory*
*ISO/IEC 17025:2017*
*NSC-TISI-TIS 17025*
*CALIBRATION 0367*

*Pressure measurement laboratory*
*Calibration services department.*

NSC - TISI - TIS 17025
CALIBRATION 0367

CERTIFICATE OF CALIBRATION

**Certificate No.** : CP-003-66



**MEASUREMENT RESULTS** : ☑ Without adjustment ☐ With adjustment
**CALIBRATION IN THE RANGE OF** : 950 mbar to 1050 mbar

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

| STD (mbar) | UUC* (mbar) | Error (mbar) | Uncertainty (k=2) (mbar) |
|---|---|---|---|
| 950.03 | 950.6 | 0.6 | 0.77 |
| 970.14 | 970.4 | 0.3 | 0.51 |
| 990.04 | 990.1 | 0.1 | 0.39 |
| 1010.12 | 1010.1 | -0.1 | 0.38 |
| 1030.09 | 1029.8 | -0.3 | 0.50 |
| 1050.07 | 1049.6 | -0.5 | 0.70 |

**Note**: UUC* Unit Under Calibration
: To convert the result in report unit to Pa should be multiply by 100

***End of certificate***

Jiranatee Associates Co., Ltd.

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# CERTIFICATE OF CALIBRATION

Certificate No.: WD-03072022


**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.

REVIEW BY Marakan P.
APPROVED BY
NEXT CAL. DATE 12/1/24

**Environmental Condition:**
The measurement was carried out in an ambient temperature of (23±3) °C, and relative humidity of (40±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° 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 Jittraporn Lertsomphol

JNAC JIRANATE ASSOCIATES CO., LTD.

Approved Signatory:
Mr. Parinya Booncharoen.
Calibration Department Manager

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Continuation of Certificate of Calibration Number

Certificate No: WD-03072022


**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***

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# CERTIFICATE OF CALIBRATION

Certificate No: WS-03072022


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 | $cm^2$ |
| : Anemometer frontal area | 100 | $cm^2$ |
| : 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

JNAC JIRANATE ASSOCIATES CO., LTD.

Approved Signatory: .....
Mr. Parinya Booncharoen
Calibration Department Manager

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Continuation of Certificate of Calibration Number



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.

| $V_{STD}$ Reading m/s | $V_{UUC*}$ 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 | 0.67 |
| 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***

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NSC-TISI-TIS 17025
CALIBRATION 0394



# Calibration Certificate

**Equipment :** SOUND CALIBRATOR
**Manufacturer :** RION
**Model :** NC-75
**Serial No.:** 35024429
**ID No.:** - SQK_FS 0114

REVIEW BY Nongkorn P.
APPROVED BY
NEXT CAL. DATE 14/11/23

**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 ± 3 ) °C
**Pressure :** ( 101.3 ± 3 ) kPa
**Relative Humidity :** ( 50.0 ± 20 ) %

**Received Date :** 03 NOVEMBER 2022
**Calibration Date :** 14 NOVEMBER 2022
**Date of Issue :** 15 NOVEMBER 2022

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

( 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.





**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 :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| 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).

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit (dB) |
|---|---|---|---|---|
| 94 | 93.94 | -0.06 | 0.14 | 0.40 |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value ( % ) | Uncertainty ( % ) | Tolerance limit ( % ) |
|---|---|---|---|---|
| 1000 | 1000.0 | 0.0 | 0.1 | 1.0 |

**3. Total distortion**

| Measured value ( % ) | Uncertainty ( % ) | Tolerance limit ( % ) |
|---|---|---|
| 0.33 | 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 lavel of confidence of approximately 95 %

**End of Calibration Certificate**



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NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23106
Pages : 1 of 8

# Calibration Certificate

**Equipment :** SOUND LEVEL METER
**Manufacturer :** RION
**Model :** NL-52A / Microphone UC-59 / Preamplifier NH-25
**Serial No.:** 00331095 / 22927 / 22570
**ID No.:** -

**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 ± 3 ) °C
**Pressure :** ( 101.3 ± 3 ) kPa
**Relative Humidity :** ( 50.0 ± 20 ) %

REVIEW BY Monakorn P.
APPROVED BY
NEXT CAL. DATE 27/3/24

**Received Date :** 17 MARCH 2023
**Calibration Date :** 27-28 MARCH 2023
**Date of Issue :** 31 MARCH 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :** T. Petch.
( Thanakul Petchurai )

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**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 :

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---|---|---|---|---|
| Waveform Generator | 33210A | MY48017076 | EF-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 14-FEB-24 |

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).



T. Petch.



**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 | ✓ | - | 0.4 | 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 | ✓ | - | 0.3 | 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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.



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**Result of calibration :**

**1. Absolute sensitivity**

| Reference Acoustic Signal ( dB ) | Measured Value ( dB ) | Deviation ( dB ) | Acceptance Limit ( dB ) |
|---|---|---|---|
| 93.9 (93.98) | 94.0 | 0.0 | ±0.3 |

**2. Self-generated noise**

2.1 Normal test

| Measured Value ( dB ) |
|---|
| 13.3 |

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

| Frequency Weighting | Measured value ( dB ) |
|---|---|
| A - weight | 8.7 |
| C - weight | 14.3 |
| Flat | 19.8 |

**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) | | | |
|---|---|---|---|---|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.3 | 0.3 | 0.3 | ± 1.0 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 0.7 |
| 8000 | 0.0 | 0.0 | 0.1 | + 1.5, - 2.5 |



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**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 | 0.0 | 0.0 | ±1.0 |
| 125 | 0.0 | 0.1 | 0.0 | ±1.0 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 500 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 8000 | 0.0 | 0.1 | 0.1 | + 1.5, - 2.5 |
| 16000 | 0.0 | -1.2 | -1.2 | + 2.5, -16.0 |

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

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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



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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 | ±0.8 |
| 136.0 | 136.0 | 0.0 | ±0.8 |
| 135.0 | 135.0 | 0.0 | ±0.8 |
| 134.0 | 134.0 | 0.0 | ±0.8 |
| 133.0 | 133.0 | 0.0 | ±0.8 |
| 132.0 | 132.0 | 0.0 | ±0.8 |
| 131.0 | 131.0 | 0.0 | ±0.8 |
| 129.0 | 129.0 | 0.0 | ±0.8 |
| 124.0 | 124.0 | 0.0 | ±0.8 |
| 119.0 | 119.0 | 0.0 | ±0.8 |
| 114.0 | 114.0 | 0.0 | ±0.8 |
| 109.0 | 109.0 | 0.0 | ±0.8 |
| 104.0 | 104.0 | 0.0 | ±0.8 |
| 99.0 | 99.0 | 0.0 | ±0.8 |
| 94.0 | 94.0 | 0.0 | ±0.8 |
| 89.0 | 89.0 | 0.0 | ±0.8 |
| 84.0 | 84.0 | 0.0 | ±0.8 |
| 79.0 | 79.0 | 0.0 | ±0.8 |
| 74.0 | 74.1 | 0.1 | ±0.8 |
| 69.0 | 69.1 | 0.1 | ±0.8 |
| 64.0 | 64.0 | 0.0 | ±0.8 |
| 59.0 | 59.1 | 0.1 | ±0.8 |
| 54.0 | 54.0 | 0.0 | ±0.8 |
| 49.0 | 49.0 | 0.0 | ±0.8 |
| 44.0 | 44.0 | 0.0 | ±0.8 |
| 39.0 | 39.0 | 0.0 | ±0.8 |
| 34.0 | 34.0 | 0.0 | ±0.8 |
| 30.0 | 30.0 | 0.0 | ±0.8 |
| 29.0 | 29.0 | 0.0 | ±0.8 |
| 28.0 | 28.0 | 0.0 | ±0.8 |
| 27.0 | 27.0 | 0.0 | ±0.8 |
| 26.0 | 26.0 | 0.0 | ±0.8 |
| 25.0 | 24.9 | -0.1 | ±0.8 |



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**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 | ±0.8 |

**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, Lcpeak ( dB ) | Deviated Value ( dB ) | Acceptance Limits ( dB ) |
|---|---|---|---|---|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| One | 136.4 | 135.6 | -0.8 | ±2.0 |

| 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 | ±1.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±1.0 |



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**11. Overload indication**

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

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

**End of Calibration Certificate**



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