

## ภาคผนวก ง

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ใบรับรองการสอบเทียบเครื่องมือ



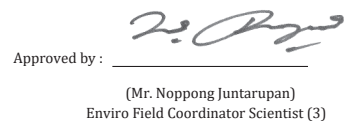
right solutions.  
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter                   | Equipment Name                 | ID No.     | Calibrated Date | Next Cal  | Freq. Calibrate (Months) |
|-------------|-----------------------------|--------------------------------|------------|-----------------|-----------|--------------------------|
| Ambient     | Particulate Matter (PM-10)  | High Volume                    | BKK_FS0385 | -               | -         | On site Calibration      |
| Ambient     | Particulate Matter (PM-10)  | High Volume                    | BKK_FS0378 | -               | -         | On site Calibration      |
| Ambient     | Particulate Matter (PM-10)  | Digital Balance                | BKK_EN0403 | 3-Jun-24        | 3-Jun-25  | 12                       |
| Ambient     | Total Suspended Particulate | High Volume                    | BKK_FS0364 | -               | -         | On site Calibration      |
| Ambient     | Total Suspended Particulate | High Volume                    | BKK_FS0366 | -               | -         | On site Calibration      |
| Ambient     | Total Suspended Particulate | Digital Balance                | BKK_EN0403 | 3-Jun-24        | 3-Jun-25  | 12                       |
| Ambient     | Nitrogen Dioxide            | NO <sub>2</sub> Analyzer       | BKK_FS1098 | 3-Jul-24        | 3-Jan-25  | 6                        |
| Ambient     | Nitrogen Dioxide            | NO <sub>2</sub> Analyzer       | BKK_FS1406 | 2-Jul-24        | 2-Jan-25  | 6                        |
| Ambient     | Sulfur Dioxide              | SO <sub>2</sub> Analyzer       | BKK_FS1097 | 5-Jul-24        | 5-Jan-25  | 6                        |
| Ambient     | Sulfur Dioxide              | SO <sub>2</sub> Analyzer       | BKK_FS1408 | 5-Jul-24        | 5-Jan-25  | 6                        |
| Noise       | Leq 24 hrs                  | Sound Calibrator               | BKK_FS0630 | 27-Jun-24       | 27-Jun-25 | 12                       |
| Noise       | Leq 24 hrs                  | Sound Level Meter              | BKK_FS0874 | 10-Jan-24       | 9-Jan-25  | 12                       |
| Noise       | Leq 24 hrs                  | Sound Level Meter              | BKK_FS0877 | 1-Nov-23        | 1-Nov-24  | 12                       |
| Noise       | Leq 5 min                   | Sound Calibrator               | BKK_FS0630 | 27-Jun-24       | 27-Jun-25 | 12                       |
| Noise       | Leq 5 min                   | Sound Level Meter              | BKK_FS0874 | 10-Jan-24       | 9-Jan-25  | 12                       |
| Noise       | Leq 5 min                   | Sound Level Meter              | BKK_FS0877 | 1-Nov-23        | 1-Nov-24  | 12                       |
| Noise       | Noise Annoyance             | Sound Calibrator               | BKK_FS0630 | 27-Jun-24       | 27-Jun-25 | 12                       |
| Noise       | Noise Annoyance             | Sound Level Meter              | BKK_FS0874 | 10-Jan-24       | 9-Jan-25  | 12                       |
| Noise       | Noise Annoyance             | Sound Level Meter              | BKK_FS0877 | 1-Nov-23        | 1-Nov-24  | 12                       |
| Water Lab   | pH at 25 °C                 | pH meter                       | BKK_EN0342 | 17-Oct-24       | 17-Oct-25 | 12                       |
| Water Lab   | Oil & Grease                | Electronic Top-Loading Balance | BKK_EN0003 | 2-Aug-24        | 2-Aug-25  | 12                       |
| Water Lab   | Oil & Grease                | Water Bath                     | BKK_EN0148 | 4-Jul-23        | 4-Jan-25  | 18                       |
| Water Lab   | Total Kjeldahl Nitrogen     | Digestion Unit                 | BKK_EN0223 | 24-May-24       | 24-May-25 | 12                       |
| Water Lab   | Total Kjeldahl Nitrogen     | Discrete analyzer              | BKK_EN0037 | 16-Aug-24       | 16-Aug-25 | 12                       |
| Water Lab   | Total Suspended Solids      | Electronic Top-Loading Balance | BKK_EN0003 | 2-Aug-24        | 2-Aug-25  | 12                       |
| Water Lab   | Total Suspended Solids      | Oven                           | BKK_EN0273 | 14-May-24       | 14-Nov-25 | 18                       |
| Water Lab   | BOD                         | DO Meter                       | BKK_EN0017 | 16-Nov-23       | 16-May-25 | 18                       |
| Water Lab   | BOD                         | Incubator                      | BKK_EN0304 | 20-Mar-24       | 20-Mar-25 | 12                       |
| Water Lab   | BOD                         | Burette                        | BKK_EN0171 | 27-Feb-24       | 27-Aug-25 | 18                       |
| Water Lab   | Fecal Coliform              | Autoclave                      | BKK_ML0037 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Fecal Coliform              | Incubator                      | BKK_ML0010 | 17-Jul-23       | 17-Jan-25 | 18                       |
| Water Lab   | Fecal Coliform              | Hot Air Oven                   | BKK_ML0013 | 23-Apr-24       | 23-Oct-25 | 18                       |
| Water Lab   | Fecal Coliform              | Water Bath                     | BKK_ML0056 | 1-Mar-24        | 1-Mar-25  | 12                       |

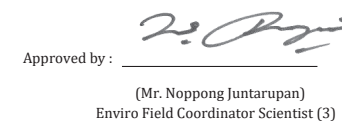


| Test No. | Delta H <sub>2</sub> O<br>(inch) | Qa<br>(m <sup>3</sup> /min) | I: Chart<br>(CFM) | Linear Regression         |         |
|----------|----------------------------------|-----------------------------|-------------------|---------------------------|---------|
| 1        | 2.4                              | 0.947                       | 34                | Slope :                   | 28.2991 |
| 2        | 2.8                              | 1.022                       | 36                | Intercept :               | 6.9685  |
| 3        | 3.8                              | 1.189                       | 40                | Correlation Coefficient : | 0.9981  |
| 4        | 4.6                              | 1.307                       | 44                |                           |         |
| 5        | 5.6                              | 1.441                       | 48                |                           |         |



## High Volume Air Sampler Calibration Worksheet

| Test No. | Delta H <sub>2</sub> O<br>(inch) | Qa<br>(m <sup>3</sup> /min) | I : Chart<br>(CFM) | Linear Regression         |         |
|----------|----------------------------------|-----------------------------|--------------------|---------------------------|---------|
| 1        | 2.4                              | 0.947                       | 34                 | Slope :                   | 27.1787 |
| 2        | 2.8                              | 1.022                       | 36                 | Intercept :               | 8.3252  |
| 3        | 3.6                              | 1.158                       | 40                 | Correlation Coefficient : | 0.9996  |
| 4        | 4.6                              | 1.307                       | 44                 |                           |         |
| 5        | 5.8                              | 1.466                       | 48                 |                           |         |



## CERTIFICATE OF CALIBRATION

Certificate No. : PST-0126-24

W/O No. : WO-0051-24

### Customer

Page no. 1 of 3

Company : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
Address : 104 Phatthanakan 40, Phatthanakan Road, Khwaeng Phatthanakan,  
City / Province : Khet Suan Luang, Bangkok  
Zip/Postal : 10250

### Device

Equipment : Electronic Balance Capacity : 120 / 220 g  
Manufacturer : OHAUS Readability : 0.00001 / 0.0001 g  
Model : EX225D/AD ID No. : BKK\_EN0403  
Serial No. : C309774648  
Condition : Normal

### Environment Conditions

Location of Calibration : Enviroment Lab  
Ambient Temperature : 20.1 (°C) ± 3 °C  
Relative Humidity : 70.3 (%RH) ± 15 %RH  
Barometric Pressure : 1011.1 (mba) ± 10 hPa  
Comment :

REVIEW BY *finda k*  
APPROVED BY *Siriluk P*  
NEXT CAL. DATE *03/06/25*

Date of Receipt : June 3, 2024

Date of Calibration : June 3, 2024

Issue Date : June 5, 2024

Calibrated by : Mr.Kittichai Rattanatham  
Calibrator

Approved by *K.OW*  
( Mr.Kittichai Rattanatham )  
Approved Signature

The reported measurement result relates only to the measurand and applies only at the time of measurement.

This Certificate is issued in accordance with the conditions of accreditation granted by Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and is traceability to recognize national standards and to the unit of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval prior written approval of the calibration center, Play Solution Technology Co.,Ltd

## CERTIFICATE OF CALIBRATION

Certificate No. : PST-0126-24

W/O No. : WO-0051-24

### Result of Calibration

: Without Adjustment

Page no. 2 of 3

### 1. Repeatability

| Weighing Range 1 | g   | Nominal Value | g | Standard Deviation | g |
|------------------|-----|---------------|---|--------------------|---|
| Max.capacity     | 220 | 50            |   | 0.000012           |   |
|                  |     | 200           |   | 0.000048           |   |

### 2.Linearity, Departure of Indication from nominal value

#### Weighing Range 1

| Nominal Value | Standard Value | Indication | Error of Indication | Expanded Uncertainty | Factor k |
|---------------|----------------|------------|---------------------|----------------------|----------|
| g             | g              | g          | g                   | g                    |          |
| 0.01          | 0.01000        | 0.01000    | -0.000001           | 0.000082             | 2.87     |
| 0.1           | 0.10001        | 0.10001    | 0.000004            | 0.000082             | 2.87     |
| 0.5           | 0.50000        | 0.50001    | 0.000012            | 0.00008              | 2.87     |
| 1             | 1.00001        | 1.00002    | 0.000013            | 0.00008              | 2.87     |
| 5             | 5.00002        | 5.00003    | 0.000009            | 0.00008              | 2.52     |
| 10            | 9.99999        | 9.99999    | -0.000001           | 0.00008              | 2.28     |
| 50            | 50.00001       | 49.99998   | -0.000027           | 0.00016              | 2.00     |
| 100           | 100.00002      | 100.00002  | 0.000004            | 0.00030              | 2.00     |
| 150           | 150.00002      | 150.0001   | 0.000077            | 0.00045              | 2.00     |
| 200           | 200.00003      | 200.0001   | 0.000068            | 0.00060              | 2.00     |
|               |                |            |                     |                      |          |
|               |                |            |                     |                      |          |
|               |                |            |                     |                      |          |
|               |                |            |                     |                      |          |



## CERTIFICATE OF CALIBRATION

Certificate No. : PST-0126-24

W/O No. : WO-0051-24

### Result of Calibration

Page no. 3 of 3

#### 3.Eccentricity

Test load at least 1/3 of the maximum capacity, typically placed between 1/2 and 1/3 of the distance from the centre of the load receptor to the edge.



#### Weighing Range 1

Test Load : 100 g

| Position      | Indication g |
|---------------|--------------|
| 1             | 100.00004    |
| 2             | 100.00005    |
| 3             | 100.00002    |
| 4             | 100.00004    |
| 5             | 100.00003    |
| Max.Deviation | 0.00002      |

#### Standard method

The calibration was performed by using calibration laboratory's in-house calibration method : CP-M-001 based on "UKAS LAB 14 : Calibration of weighing machine" : edition 6 | October 2019

#### Reference standards instrument

| Instrument          | OIML Class | S/N        | Certificate No. | Due Date          |
|---------------------|------------|------------|-----------------|-------------------|
| Standard Weight Set | E2         | 4000021952 | 22-128725       | November 30, 2024 |
| Standard Weight Set | -          | -          | -               | -                 |
| Standard Weight Set | -          | -          | -               | -                 |
| Standard Weight Set | -          | -          | -               | -                 |

#### Measurement Uncertainty

The given measurement uncertainty is the standard of the measurement multiplied by an extension factor  $k$  which corresponds to a confidence level of about 95% for a normal distribution. The standard uncertainty was calculated according to UKAS M3003.

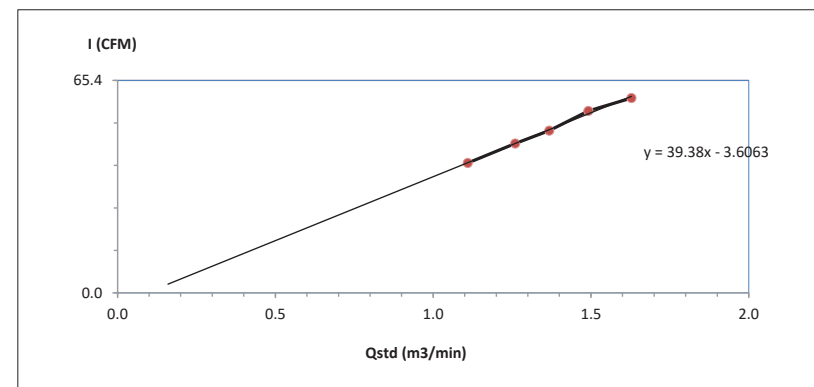
**Traceability :** The measurement is traceable to national standard, which realize the physical unit of measurement (SI)  
- Through the reference calibration laboratory of Asia Medical and Agricultural Laboratory and Research Center Co.,Ltd

END OF REPORT


## High Volume Air Sampler Calibration Worksheet

|                       |  |                               |            |
|-----------------------|--|-------------------------------|------------|
| Project Site :        | Nava Nakorn Public Company Limited                 | Barometric Pressure (mm Hg) : | 758.7      |
| Calibrate Location :  | บริเวณบ้านพักอาศัยด้านทิศเหนือ<br>ใกล้เคียงโครงการ | Temperature ( °C ) :          | 30.8       |
| Calibrate Date :      | 22-Oct-24  | High Volume ID :              | BKK_FS0364 |
| CalibrationSheet No.: | C-221024-BKK_FS0364                                | High Volume Model :           | TE-5009X   |
| Calibrator ID:        | BKK_FS0625   | High Volume S/N :             | 4154       |
| Calibrator Model :    | TE-5028A   | Calibrator Slope :            | 1.67329    |
| Calibrator S/N :      | 2585   | Calibrator Intercept :        | -0.01925   |


| Test No. | Delta H <sub>2</sub> O<br>(inch) | Q <sub>std</sub><br>(m <sup>3</sup> /min) | I : Chart<br>(CFM) | Linear Regression  |
|----------|----------------------------------|---|--------------------|--|
| 1        | 3.4                              | 1.1097                                    | 40                 | Slope : 39.3803<br>Intercept : -3.6063<br>Correlation Coefficient : 0.9979 |
| 2        | 4.4                              | 1.2597                                    | 46                 |  |
| 3        | 5.2                              | 1.3678                                    | 50                 |  |
| 4        | 6.2                              | 1.4918                                    | 56                 |  |
| 5        | 7.4                              | 1.6280                                    | 60                 |  |



Calibrated by

  
( Mr.Thananat Anake )  
Field Scientist(2)

Approved by :

  
(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)



### High Volume Air Sampler Calibration Worksheet

Project Site : Nava Nakorn Public Company Limited Barometric Pressure (mm Hg) : 758.7

Calibrate Location : บริเวณพื้นที่โครงการ Temperature ( °C ) : 30.8

Calibrate Date : 22-Oct-24 High Volume ID : BKK\_FS0366

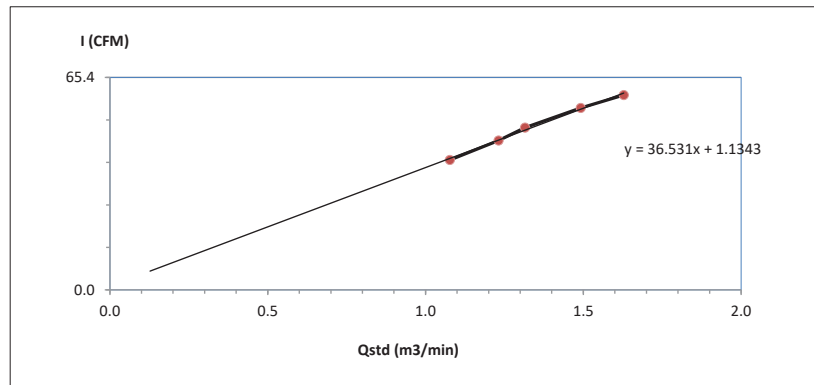
CalibrationSheet No.: C-221024-BKK\_FS0366 High Volume Model : TE-5009X

Calibrator ID: BKK\_FS0625 High Volume S/N : 4156

Calibrator Model : TE-5028A Calibrator Slope : 1.67329

Calibrator S/N : 2585 Calibrator Intercept : -0.01925

| Test No. | Delta H <sub>2</sub> O<br>(inch) | Q <sub>std</sub><br>(m <sup>3</sup> /min) | I : Chart<br>(CFM) | Linear Regression   |
|----------|----------------------------------|---|--------------------|---|
| 1        | 3.2                              | 1.0771                                    | 40                 | Slope : 36.5308<br>Intercept : 1.1343<br>Correlation Coefficient : 0.9971 |
| 2        | 4.2                              | 1.2312                                    | 46                 |   |
| 3        | 4.8                              | 1.3149                                    | 50                 |   |
| 4        | 6.2                              | 1.4918                                    | 56                 |   |
| 5        | 7.4                              | 1.6280                                    | 60                 |   |



Calibrated by Mr. Thananat Anake

( Mr. Thananat Anake )  
Field Scientist(2)

Approved by Mr. Noppong Juntarupan

(Mr. Noppong Juntarupan)  
Enviro Field Coordinator Scientist (3)



### MULTIPOINT CALIBRATION REPORT

Calibration Date 3-Jul-24 Equipment Name NOx Analyzer

Manufacturer Teledyne API Model T200

Serial No. 6305 Equipment ID BKK\_FS1098

Calibrator Manufacturer Teledyne API Model 700

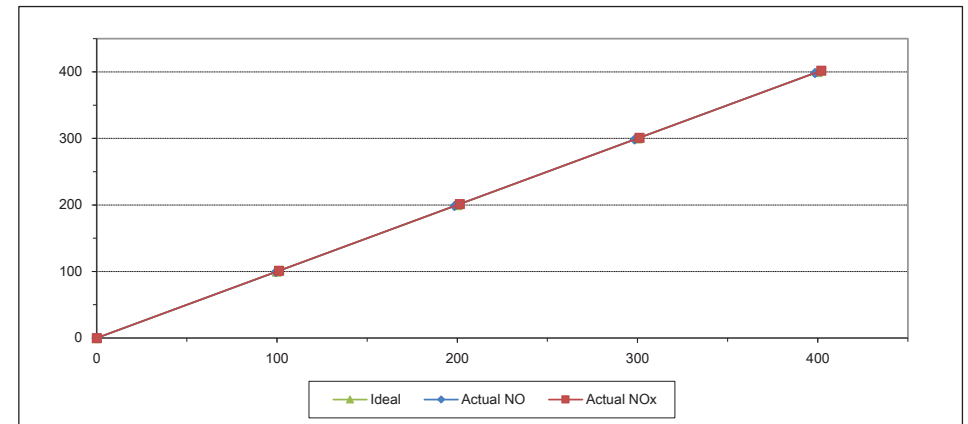
Serial No. 947

Std. Gas Concentration (PPM) 55.88 Cylinder No. GN0027222

Cylinder Pressure (psi) 1800 Certified By Airgas Inc.

Certified Date 9-Feb-22 Expired Date 9-Feb-30

| Point       | CALIBRATION RESULTS |           |          |           |            |           |            |
|-------------|---------------------|-----------|----------|-----------|------------|-----------|------------|
|             | Ideal               | Actual NO | Error NO | %Error NO | Actual NOx | Error NOx | %Error NOx |
| ZERO        | 0.00                | 0.10      | 0.10     | 0.10      | 0.10       | 0.10      | 0.10       |
| 1           | 100.00              | 99.40     | -0.60    | -0.60     | 101.20     | 1.20      | 1.20       |
| 2           | 200.00              | 198.50    | -1.50    | -0.75     | 201.40     | 1.40      | 0.70       |
| 3           | 300.00              | 298.50    | -1.50    | -0.50     | 301.10     | 1.10      | 0.37       |
| 4           | 400.00              | 398.50    | -1.50    | -0.38     | 402.00     | 2.00      | 0.50       |
| AVERAGE (%) |                     |           |          | -0.42     |            |           | 0.57       |



Calibrated By

Mr. Jirawut Sakam

( Mr. Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By

Mr. Sarayuth Jittrantorn

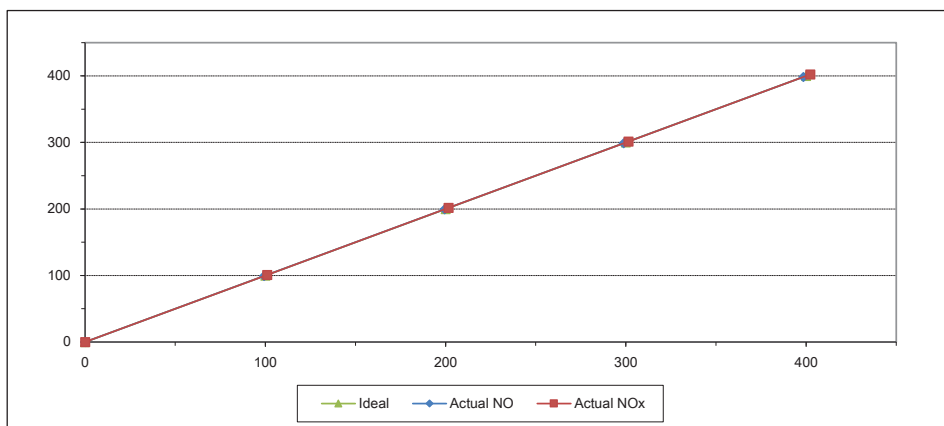
( Mr. Sarayuth Jittrantorn )  
Assistant General Manager



## MULTIPOINT CALIBRATION REPORT

|                              |              |                |              |
|------------------------------|--------------|----------------|--------------|
| Calibration Date             | 2-Jul-24     | Equipment Name | NOx Analyzer |
| Manufacturer                 | Teledyne API | Model          | N200         |
| Serial No.                   | 90           | Equipment ID   | BKK_FS1406   |
| Calibrator Manufacturer      | Teledyne API | Model          | 700          |
| Serial No.                   | 947          |                |              |
| Std. Gas Concentration (PPM) | 55.88        | Cylinder No.   | GN0027222    |
| Cylinder Pressure (psi)      | 1800         | Certified By   | Airgas Inc.  |
| Certified Date               | 9-Feb-22     | Expired Date   | 9-Feb-30     |

| Point       | CALIBRATION RESULTS |           |          |           |            |           |            |
|-------------|---------------------|-----------|----------|-----------|------------|-----------|------------|
|             | Ideal               | Actual NO | Error NO | %Error NO | Actual NOx | Error NOx | %Error NOx |
| ZERO        | 0.00                | 0.10      | 0.10     | 0.10      | 0.10       | 0.10      | 0.10       |
| 1           | 100.00              | 99.30     | -0.70    | -0.70     | 101.00     | 1.00      | 1.00       |
| 2           | 200.00              | 199.50    | -0.50    | -0.25     | 201.70     | 1.70      | 0.85       |
| 3           | 300.00              | 298.80    | -1.20    | -0.40     | 301.50     | 1.50      | 0.50       |
| 4           | 400.00              | 398.50    | -1.50    | -0.38     | 402.30     | 2.30      | 0.58       |
| AVERAGE (%) |                     |           |          | -0.33     |            |           | 0.60       |



Calibrated By

( Mr.Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By

( Mr.Sarayuth Jittrantont )  
Assistant General Manager

ALS Laboratory Group

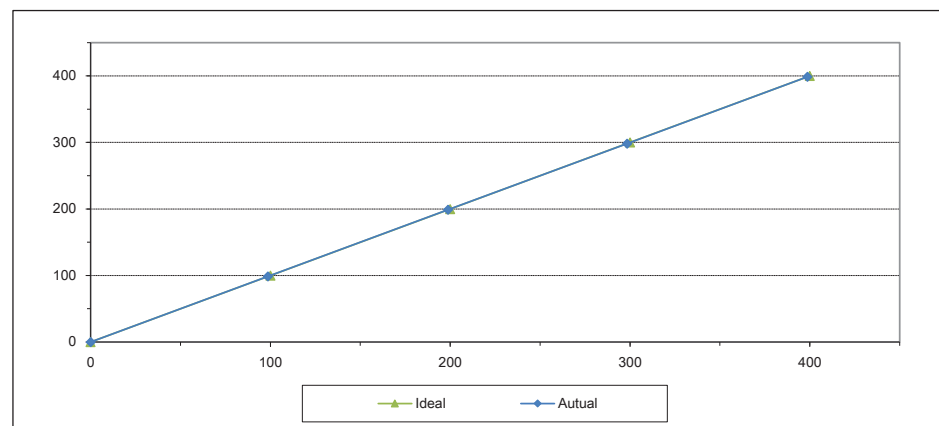
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

|                              |              |                |              |
|------------------------------|--------------|----------------|--------------|
| Calibration Date             | 5-Jul-24     | Equipment Name | SO2 Analyzer |
| Manufacturer                 | Teledyne API | Model          | T100         |
| Serial No.                   | 5345         | Equipment ID   | BKK_FS1097   |
| Calibrator Manufacturer      | Teledyne API | Model          | 700          |
| Serial No.                   | 947          |                |              |
| Std. Gas Concentration (PPM) | 56.3         | Cylinder No.   | GN0027222    |
| Cylinder Pressure (psi)      | 1800         | Certified By   | Airgas Inc.  |
| Certified Date               | 9-Feb-22     | Expired Date   | 9-Feb-30     |

| Point       | CALIBRATION RESULTS |        |       |        |
|-------------|---------------------|--------|-------|--------|
|             | Ideal               | Autual | Error | %Error |
| ZERO        | 0.00                | 0.10   | 0.10  | 0.10   |
| 1           | 100.00              | 98.60  | -1.40 | -1.40  |
| 2           | 200.00              | 198.80 | -1.20 | -0.60  |
| 3           | 300.00              | 298.40 | -1.60 | -0.53  |
| 4           | 400.00              | 398.70 | -1.30 | -0.33  |
| AVERAGE (%) |                     |        |       | -0.55  |



Calibrated By

( Mr.Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By

( Mr.Sarayuth Jittrantont )  
Assistant General Manager

ALS Laboratory Group

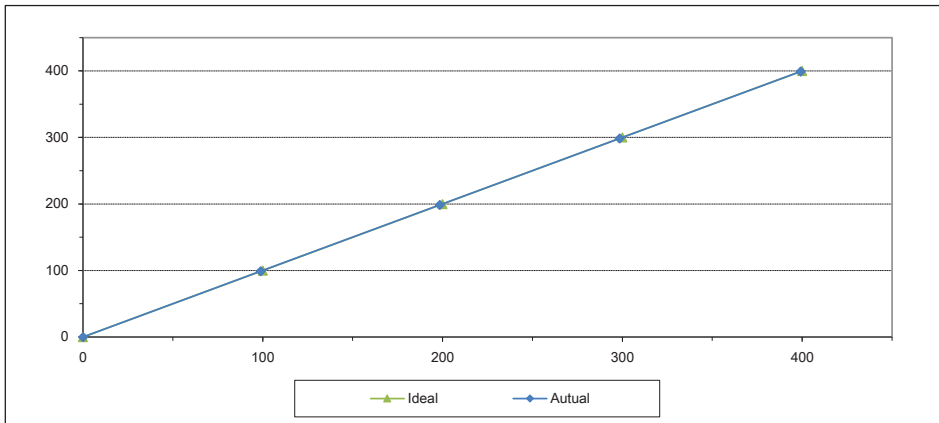
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



## MULTIPOINT CALIBRATION REPORT

|                              |              |                |              |
|------------------------------|--------------|----------------|--------------|
| Calibration Date             | 5-Jul-24     | Equipment Name | SO2 Analyzer |
| Manufacturer                 | Teledyne API | Model          | N100         |
| Serial No.                   | 88           | Equipment ID   | BKK_FS1408   |
| Calibrator Manufacturer      | Teledyne API | Model          | 700          |
| Serial No.                   | 947          |                |              |
| Std. Gas Concentration (PPM) | 56.3         | Cylinder No.   | GN0027222    |
| Cylinder Pressure (psi)      | 1800         | Certified By   | Airgas Inc.  |
| Certified Date               | 9-Feb-22     | Expired Date   | 9-Feb-30     |

| Point       | CALIBRATION RESULTS |        |       |        |
|-------------|---------------------|--------|-------|--------|
|             | Ideal               | Autual | Error | %Error |
| ZERO        | 0.00                | 0.10   | 0.10  | 0.10   |
| 1           | 100.00              | 98.90  | -1.10 | -1.10  |
| 2           | 200.00              | 198.50 | -1.50 | -0.75  |
| 3           | 300.00              | 298.50 | -1.50 | -0.50  |
| 4           | 400.00              | 399.20 | -0.80 | -0.20  |
| AVERAGE (%) |                     |        |       | -0.49  |



Calibrated By

( Mr.Jirawut Sakam )  
Field Environmental Scientist (3)

Approved By

( Mr.Sarayuth Jitranont )  
Assistant General Manager

ALS Laboratory Group

FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12

## SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN  
associates



Cert. No. : ACC24026

Pages : 1 of 3

## Calibration Certificate

Equipment : SOUND CALIBRATOR  
Manufacturer : RION  
Model : NC-74  
Serial No.: 34178117  
ID No.: BKK\_FS0630

Condition As Found : GOOD

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

Location : -  
Ambient Temperature : ( 23.0 ± 3 ) °C  
Pressure : ( 101.3 ± 3 ) kPa  
Relative Humidity : ( 50.0 ± 20 ) %  
Received Date : 11 JUNE 2024  
Calibration Date : 27 JUNE 2024  
Date of Issue : 28 JUNE 2024



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.

**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN  
associates



Cert. No. : ACC24026  
Job No. : VC67AC0105  
Pages : 2 of 3

Calibration Procedure : CP-AC-03

**Calibration Method :**

This equipment was calibrated by follow 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-0007-24     | 05-FEB-25 |
| Digital Multimeter      | 33461A    | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter      | 33461A    | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter      | 33461A    | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070  | 62100114   | EF-0008-24     | 05-FEB-25 |
| Condenser Microphone    | 4180      | 2977900    | AA-1001-24     | 12-FEB-25 |
| Measuring Amplifier     | NA-42KAI  | 34560495   | AA-3001-24     | 05-FEB-25 |
| Audio Analyzer          | AVR-3360A | V744B6069  | EF-0009-24     | 09-FEB-25 |

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).

*G. Petch*

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Cert. No. : ACC24026  
Job No. : VC67AC0105  
Pages : 3 of 3

**Result of calibration :**

**1. Sound pressure level**

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|-------------------------------------|---------------------|---------------------|------------------|-----------------------|
| 94                                  | 94.14               | 0.14                | 0.14             | 0.40                  |

**2. Frequency**

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value ( % ) | Uncertainty ( % ) | Acceptance limit ( % ) |
|--------------------------|---------------------|----------------------|-------------------|------------------------|
| 1000                     | 1001.7              | 0.2                  | 0.1               | 1.0                    |

**3. Total distortion**

| Measured value ( % ) | Uncertainty ( % ) | Acceptance limit ( % ) |
|----------------------|-------------------|------------------------|
| 1.56                 | 0.10              | 3.0                    |

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

End of Calibration Certificate

*G. Petch*



Cert. No. : ACL24016  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00572565 / 170402 / 72903  
**ID No.:** BKK\_FS0874

**Condition As Found :** GOOD

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

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

**Received Date :** 22 DECEMBER 2023  
**Calibration Date :** 10-11 JANUARY 2024  
**Date of Issue :** 12 JANUARY 2024



**Calibrated by :** Nathakorn Pisutpaisan

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

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

Cert. No. : ACL24016  
Job No. : VC67AC0045  
Pages : 2 of 8

**Calibration Procedure :** CP-AC-01

### Calibration Method :

This equipment was calibrated by follow 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. Petchurai

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Cert. No. : ACL24016  
Job No. : VC67AC0045  
Pages : 3 of 8

**Summary of Measurement Result :**

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

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Job No. : VC67AC0045  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 17.2                     |

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

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 13.1                     |
| C - weight             | 19.4                     |
| Flat                   | 25.1                     |

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

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

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.1  | 0.1      | 0.1      | ± 1.5                |
| 1000                | 0.0  | 0.0      | 0.0      | ± 1.0                |
| 8000                | 0.8  | 0.7      | 0.8      | ±5.0                 |

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

Weighting network response with relative to 1 kHz.

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

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

5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>Weighting | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast                   | 94.0                           | 94.0                        | 0.0                         | ± 0.1                          |
| Slow                   | 94.0                           | 94.0                        | 0.0                         | ± 0.1                          |
| Lcq                    | 94.0                           | 94.0                        | 0.0                         | ± 0.1                          |

**6. Long - term stability**

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

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**7. Level linearity on the reference level range**

| Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0                          | 137.0                       | 0.0                         | ± 1.1                          |
| 136.0                          | 136.0                       | 0.0                         | ± 1.1                          |
| 135.0                          | 135.0                       | 0.0                         | ± 1.1                          |
| 134.0                          | 134.0                       | 0.0                         | ± 1.1                          |
| 133.0                          | 133.0                       | 0.0                         | ± 1.1                          |
| 132.0                          | 132.0                       | 0.0                         | ± 1.1                          |
| 131.0                          | 131.0                       | 0.0                         | ± 1.1                          |
| 129.0                          | 129.0                       | 0.0                         | ± 1.1                          |
| 124.0                          | 124.0                       | 0.0                         | ± 1.1                          |
| 119.0                          | 119.0                       | 0.0                         | ± 1.1                          |
| 114.0                          | 114.0                       | 0.0                         | ± 1.1                          |
| 109.0                          | 109.0                       | 0.0                         | ± 1.1                          |
| 104.0                          | 104.0                       | 0.0                         | ± 1.1                          |
| 99.0                           | 99.0                        | 0.0                         | ± 1.1                          |
| 94.0                           | 94.0                        | 0.0                         | ± 1.1                          |
| 89.0                           | 89.0                        | 0.0                         | ± 1.1                          |
| 84.0                           | 84.0                        | 0.0                         | ± 1.1                          |
| 79.0                           | 79.0                        | 0.0                         | ± 1.1                          |
| 74.0                           | 74.0                        | 0.0                         | ± 1.1                          |
| 69.0                           | 69.0                        | 0.0                         | ± 1.1                          |
| 64.0                           | 64.0                        | 0.0                         | ± 1.1                          |
| 59.0                           | 59.0                        | 0.0                         | ± 1.1                          |
| 54.0                           | 54.0                        | 0.0                         | ± 1.1                          |
| 49.0                           | 49.0                        | 0.0                         | ± 1.1                          |
| 44.0                           | 44.0                        | 0.0                         | ± 1.1                          |
| 39.0                           | 39.0                        | 0.0                         | ± 1.1                          |
| 34.0                           | 34.0                        | 0.0                         | ± 1.1                          |
| 30.0                           | 30.0                        | 0.0                         | ± 1.1                          |
| 29.0                           | 29.0                        | 0.0                         | ± 1.1                          |
| 28.0                           | 27.9                        | -0.1                        | ± 1.1                          |
| 27.0                           | 27.0                        | 0.0                         | ± 1.1                          |
| 26.0                           | 25.9                        | -0.1                        | ± 1.1                          |
| 25.0                           | 24.9                        | -0.1                        | ± 1.1                          |

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

| Range | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto  | 94.0                           | 94.0                        | 0.0                         | ±1.1                           |

**9. Tone burst response**

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, L <sub>peak</sub><br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0  | 0.0                         | ±3.0                           |
| One                                  | 136.4                          | 136.3  | -0.1                        | ±3.0                           |

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

7. Reten.

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Job No. : VC67AC0045  
Pages : 8 of 8

**11. Overload indication**

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

**12. High level stability**

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

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

End of Calibration Certificate

7. Reten.

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Cert. No. : ACL23335  
Pages : 1 of 8

## Calibration Certificate

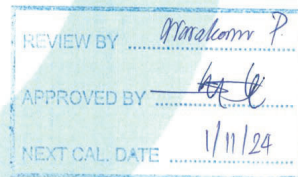
**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00572552 / 170384 / 72890  
**ID No.:** BKK\_FS0877

**Condition As Found :** GOOD

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

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

**Received Date :** 20 OCTOBER 2023  
**Calibration Date :** 01-02 NOVEMBER 2023  
**Date of Issue :** 03 NOVEMBER 2023



**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

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## Continuation of Calibration Certificate

Cert. No. : ACL23335  
Job No. : VC67AC0014  
Pages : 3 of 8

### Summary of Measurement Result :

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

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

*T. Petchur*



Continuation of Calibration Certificate

Cert. No. : ACL23335  
Job No. : VC67AC0014  
Pages : 4 of 8

**Result of calibration :**

**1. Absolute sensitivity**

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

**2. Self-generated noise**

2.1 Normal test

| Measured Value<br>( dB ) |
|--------------------------|
| 15.1                     |

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

| Frequency<br>Weighting | Measured value<br>( dB ) |
|------------------------|--------------------------|
| A - weight             | 11.6                     |
| C - weight             | 17.6                     |
| Flat                   | 23.5                     |

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

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

| Frequency<br>( Hz ) | Deviation from various frequency weighting response curve (dB) |          |          |                      |
|---------------------|--|----------|----------|----------------------|
|                     | Flat   | C-weight | A-weight | Acceptance<br>Limits |
| 125                 | 0.3  | 0.4      | 0.4      | ± 1.5                |
| 1000                | 0.0  | 0.0      | 0.0      | ± 1.0                |
| 8000                | -0.8   | -0.8     | -0.7     | ±5.0                 |

*T. Petch*

Continuation of Calibration Certificate

Cert. No. : ACL23335  
Job No. : VC67AC0014  
Pages : 5 of 8

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

Weighting network response with relative to 1 kHz.

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

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

5.1 Frequency weightings at 1 kHz

| Frequency<br>Weighting | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>Weighting | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( 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<br>Weighting | SLM Display<br>at initial<br>( dB ) | SLM Display<br>at final<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight             | 94.0                                | 94.1                              | 0.1                         | ± 0.3                          |

*T. Petch*

## Continuation of Calibration Certificate

Cert. No. : ACL23335  
Job No. : VC67AC0014  
Pages : 7 of 8

## 8. Level linearity including the level range control

| Range | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto  | 94.0                           | 94.0                        | 0.0                         | ±1.1                           |

## 9. Tone burst response

| Time<br>Weighting | Tone burst<br>duration, Tb<br>( ms ) | Cycle | Anticipated<br>Value<br>( dB ) | Measured<br>Value<br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast              | 0.25                                 | 1     | 108.0                          | 107.9                       | -0.1                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 117.0                          | 116.9                       | -0.1                        | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 134.0                          | 134.0                       | 0.0                         | ±1.0                           |
| Slow              | 2                                    | 8     | 108.0                          | 107.9                       | -0.1                        | 1.5 ; -5.0                     |
|                   | 200                                  | 800   | 127.6                          | 127.5                       | -0.1                        | ±1.0                           |
| SEL               | 0.25                                 | 1     | 99.0                           | 98.8                        | -0.2                        | 1.5 ; -5.0                     |
|                   | 2                                    | 8     | 108.0                          | 107.9                       | -0.1                        | 1.0 ; -2.5                     |
|                   | 200                                  | 800   | 128.0                          | 128.0                       | 0.0                         | ±1.0                           |

## 10. Peak C sound level

| Number of cycle<br>in<br>test signal | Anticipated<br>Value<br>( dB ) | Measured<br>Value, L <sub>peak</sub><br>( dB ) | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|--------------------------------------|--------------------------------|--|-----------------------------|--------------------------------|
| Continuous                           | 133.0                          | 133.0  | 0.0                         | ±3.0                           |
| One                                  | 136.4                          | 135.9  | -0.5                        | ±3.0                           |

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

## Continuation of Calibration Certificate

Cert. No. : ACL23335  
Job No. : VC67AC0014  
Pages : 8 of 8

## 11. Overload indication

| Measured value ( dB )      |                            | Deviated<br>Value<br>( dB ) | Acceptance<br>Limits<br>( dB ) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive<br>one-half cycle | Negative<br>one-half cycle |                             |                                |
| 89.5                       | 89.5                       | 0.0                         | ±1.5                           |

## 12. High level stability

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

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

End of Calibration Certificate





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



## Certificate of Calibration

Cert.No.: 24CH1295  
Page.: 1 of 3

Equipment : pH Meter  
Manufacturer : Hach  
Model : HQ411d  
Serial No. : 200100031163  
ID No. : BKK\_EN0342  
Condition As-Received: Used Item  
Received Date : 16 October 2024  
Calibration Date : 17 October 2024  
Reference : 2410-0548DSC-5  
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand

Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagtrakul

Approved by :

*Saithip*  
Approved Signatory

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

Issue Date : 21 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 24CH1295  
Page.: 2 of 3

### Condition of this calibration result

1. Reference Standard Instrument

| Instrument                  | Serial No. | ID No.   | Cert. No. | Due Date    |
|-----------------------------|------------|----------|-----------|-------------|
| 1)Ref. Standard Thermometer | 2188080    | 130RC044 | 2411022   | 16 Sep 2025 |

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

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.  
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00  
:The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Buffer Solution | Manufacturer    | Lot No. | Exp. date   |
|-----------------|-----------------|---------|-------------|
| pH 4.008        | CPA chem        | 1034203 | 27 Sep 2026 |
| pH 6.999        | Hach Lenge GmbH | C03145  | 28 Feb 2026 |
| pH 10.010       | CPA chem        | 1034205 | 27 Sep 2025 |

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

### Calibration Results

Function : pH Measurement

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

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

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



Cert.No.: 24CH1295  
Page.: 3 of 3

#### Calibration Results

Function : Temperature Measurement

( \* ) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PHC281  
- Serial No. : 230473042902  
Dimension of probe  
- Length : 103 mm.  
- Diameter : 12 mm.  
- Immersion Depth : 90 mm.

| Calibration Point ( °C ) | Standard Temperature ( °C ) | UUC* Reading ( °C ) | Error ( °C ) | Uncertainty of measurement ( ± °C ) | Coverage factor k |
|--------------------------|-----------------------------|---------------------|--------------|-------------------------------------|-------------------|
| 25.0                     | 25.002                      | 25.0                | -0.002       | 0.13                                | 2.00              |

Remark : UUC\* = Unit Under Calibration

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

-o0o-

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



NSC-TIS-17025  
CALIBRATION 0426

REVIEW BY *finda k*  
APPROVED BY *Siriluk P*

NEXT CAL DATE... 02/08/25

## Certificate of Calibration

Model Number : MSE224S-100-DU  
Description : Analytical Balance  
Serial Number : 0027405555  
ID No. : BKK\_EN0003  
Manufacturer : Sartorius  
Certificate No. : 24BCI0270  
Issued Date : Monday, August 05, 2024  
Reference No. : 240942  
Page No. : 1 of 2

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

Calibrated Place : Lab Room

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

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

#### Metrological data :

Capacity : 220 g Readability : 0.0001 g

#### Ambients Conditions:

Temperature : 23.0 °C ± 5.0 °C

Humidity : 55.0 % RH ± 10.0 % RH

Pressure : ±

#### Reasons for calibration

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

Equipment Condition: ☒ Good Operate ☐ Fair

#### Measurement Method UKAS Publication Ref :Lab 14

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

#### Traceability:

| Model Number  | Description                                       | Traceability | Certificate No.    | Due Date    |
|---------------|---|--------------|--------------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g F2,YCS011-522-00 | TCS          | M23081975          | 23-Aug-2025 |
| Testo 174 H   | Thermo-Hygrometer , Testo 174H                    | ENTECH       | H/T 661303,H661140 | 12-Nov-2024 |

This certificate relate and apply this equipment only.

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*Om*

Mr.chonchai Inthana(Technical Manager)

SOP FM 33 03 February 2022



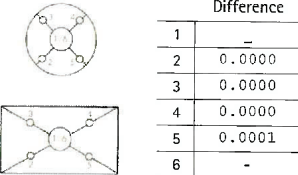


# Certificate of Calibration

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

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

## Calibration Results : Without Adjustment

| Repeatability  |          |          | Eccentricity (Off-center loading error)   |        |   |
|--|----------|----------|---|--------|---|
| <i>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.</i> |          |          | <i>The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).</i> |        |   |
| Nominal Value : (Low Load)   | 20.0000  | 200.0000 | Nominal value :   | 100    | g |
| 20 g   | 20.0000  | 199.9999 | Tolerance   | 0.0004 | g |
| Tolerance  | 0.0001 g | 200.0000 |    |        |   |
|  | 20.0000  | 200.0000 |   |        |   |
|  | 20.0000  | 200.0000 |   |        |   |
|  | 20.0000  | 200.0000 |   |        |   |
| Nominal Value : (High Load)  | 20.0000  | 200.0000 |   |        |   |
| 200 g  | 20.0001  | 200.0001 |   |        |   |
| Tolerance  | 0.0001 g | 200.0000 |   |        |   |
|  | 20.0000  | 199.9999 |   |        |   |
|  | 20.0000  | 200.0000 |   |        |   |
| Standard Deviation   | 0.00004  | 0.00006  |   |        |   |

| Linearity  |                         |                 |           |             |
|--|-------------------------|-----------------|-----------|-------------|
| <i>The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.</i> |                         |                 |           |             |
| Tolerance  | 0.0002                  | g               |           |             |
| Nominal Value  | Conventional Mass Value | Displayed Value | Deviation | Uncertainty |
| (g)  | (g)                     | (g)             | (g)       | (g)         |
| 0.01   | 0.0100                  | 0.0100          | 0.0000    | 0.00015     |
| 0.1  | 0.1000                  | 0.1000          | 0.0000    | 0.00015     |
| 1  | 1.0000                  | 1.0000          | 0.0000    | 0.00015     |
| 2  | 2.0000                  | 2.0000          | 0.0000    | 0.00015     |
| 5  | 5.0000                  | 5.0000          | 0.0000    | 0.00015     |
| 10   | 10.0000                 | 10.0000         | 0.0000    | 0.00015     |
| 20   | 20.0000                 | 20.0000         | 0.0000    | 0.00015     |
| 50   | 50.0000                 | 50.0001         | 0.0001    | 0.00016     |
| 100  | 100.0000                | 100.0001        | 0.0001    | 0.00019     |
| 200  | 200.0000                | 200.0000        | 0.0000    | 0.00029     |
| End of Report  |                         |                 |           |             |

Certificate No. T231303

Page 1 of 3

## Certificate of Calibration

Equipment : Liquid Bath ( Water )

Manufacturer : MEMMERT

Model : WNB29

Serial No. : L611.0135

Customer Code : BKK\_EN0148

ID No. : T6455A4

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

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

Customer Location : ORGANIC PREPARATION LAB

Date of Receipt : 27 June 2023

Calibrated By : Sujjar Naknakred ( Site Calibration Manager )

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 11 JUL 2023

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Certificate No. T231303

Page 2 of 3

## Calibration Report

**Equipment** : Liquid Bath ( Water )  
**Date of Calibration** : 4 July 2023  
**Environment** : Temperature : 22.2-22.5 °C  
Line Voltage : 221.6-224.8 V  
Relative Humidity : 55 - 65 %RH

### Condition of this results of calibration :

1. This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T36 ( based on ASTM E715-80 ( Reapproved 2001 ) ).  
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

### 2. Reference Standard Instrument :

| Instrument  | Model   | Instrument No.             | Certificate No. | Due Date      |
|-------------|---------|----------------------------|-----------------|---------------|
| RTD         | 100 OHM | M18 (CH1,CH6-CH7,CH9-CH10) | T230545         | 10 April 2024 |
| DATA LOGGER | 34970A  | T149                       | T230545         | 10 April 2024 |

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 45 Minute At 60 °C

### 5. Adjustment :

( X ) without adjustment ( ) after adjustment

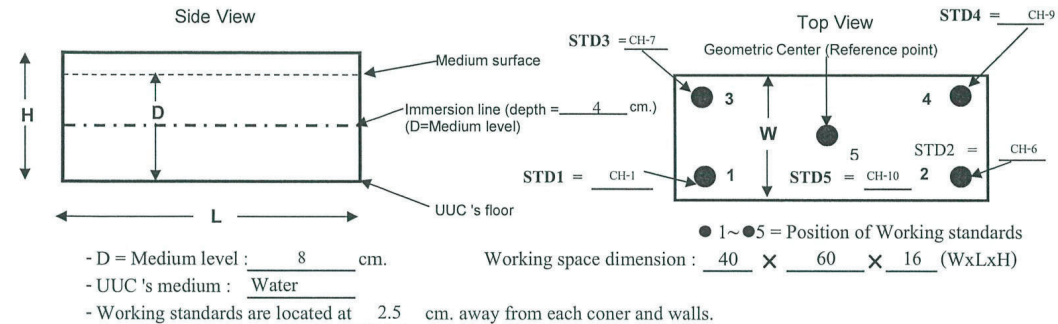
Approved By. 



Certificate No. T231303

Page 3 of 3

## Calibration Report



### Measurement Results:

| Calibration Point | Average Standard Reading at each position ( °C ) |       |       |       |       |
|-------------------|--|-------|-------|-------|-------|
|                   | CH-1   | CH-6  | CH-7  | CH-9  | CH-10 |
| 60                | 60.03  | 60.06 | 60.24 | 60.11 | 60.18 |
| 85                | 84.79  | 84.83 | 85.42 | 85.05 | 85.20 |
| 95                | 93.71  | 93.83 | 94.62 | 94.15 | 94.42 |

| Liquid Bath ( Water ) |                |         | Temperature Distribution |                    |                     |                      |                   |
|-----------------------|----------------|---------|--------------------------|--------------------|---------------------|----------------------|-------------------|
| Setting ( °C )        | Reading ( °C ) |         | Average ( °C )           | Stability ( ± °C ) | Uniformity ( ± °C ) | Uncertainty ( ± °C ) | Coverage Factor k |
|                       | Min , Max      | Average |                          |                    |                     |                      |                   |
| 61.0                  | 60.9 , 61.1    | 61.0    | 60.12                    | 0.13               | 0.19                | 0.29                 | 2.04              |
| 86.0                  | 85.8 , 86.2    | 86.0    | 85.06                    | 0.19               | 0.47                | 0.44                 | 2.17              |
| 95.0                  | 94.6 , 95      | 94.9    | 94.15                    | 0.32               | 0.65                | 0.55                 | 2.13              |

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

Approved By. 





## Metrological Center

SCI ECO Services Company Limited

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


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

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

Certificate No. T240977

Page 1 of 5

### Certificate of Calibration

Equipment : DIGESTION UNIT  
Manufacturer : Environmental Express  
Model : TKN100  
Serial No. : 2017TKNBC142  
Customer Code : BKK\_EN0223  
ID No. : T6773A4  
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,  
Khet Suan Luang, Bangkok 10250  
Customer Location : Wet Chemistry Lab1  
Date of Receipt : 15 May 2024  
Calibrated By : Sujjar Naknakred ( Site Calibration Manager )  
Approved By :  Preecha Phisassutthikul ( Temperature Calibration Manager )  
Date of Issue : 28 MAY 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



## Metrological Center

SCI ECO Services Company Limited

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

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

Certificate No. T240977

Page 2 of 5


### Calibration Report

Equipment : DIGESTION UNIT  
Date of Calibration : 24 May 2024  
Environment : Temperature : 28.7 - 30.0 °C  
Line Voltage : 222.8 - 225.9 V  
Relative Humidity : 55 - 65 %RH

#### Condition of this results of calibration :

- This equipment was calibrated by insert four standard thermocouples type S into its chamber , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to WI-T10.
- Reference Standard Instrument :

| Instrument  | Model  | Instrument No.    | Certificate No. | Due Date      |
|-------------|--------|-------------------|-----------------|---------------|
| TC          | Type S | M20A1-(CH17-CH20) | T240714         | 23 April 2025 |
| DATA LOGGER | 34970A | T149              | T240714         | 23 April 2025 |
- This certificate is traceable to :  
National Institute of Metrology ( Thailand ) through Metrological Center ( NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good  
Equipment Description :  
Time Constant 2 Hour 2 Minute At 380 °C  
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max  
☐ Close  
☒ Not Available
- Adjustment :  
( ) without adjustment ( X ) after adjustment

Approved By. 



## Metrological Center

SCI ECO Services Company Limited

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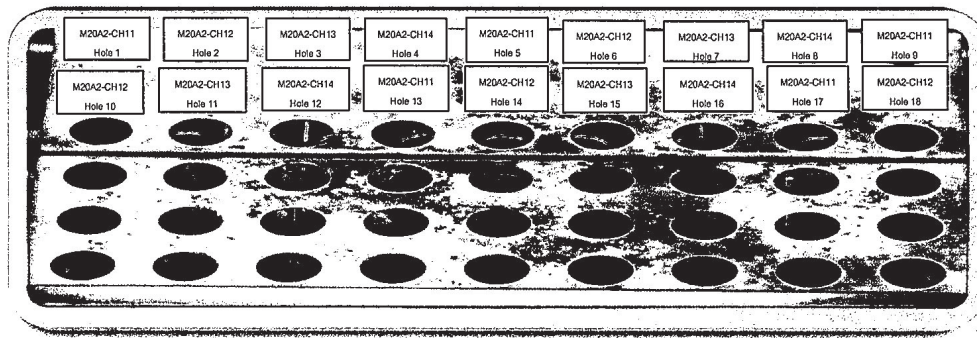
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T240977

Page 3 of 5

### Calibration Report



DISPLAY CONTROL (FRONT)

#### Measurement Results

| Cal. Point | Setting | Reading       | STD.          | Position of Standards at Block |                      |                      |                      |                      |                      |                      |                      |                      |
|------------|---------|---------------|---------------|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| (°C)       | (°C)    | (°C)          | Reading       | M20A2-CH11<br>Hole 1           | M20A2-CH12<br>Hole 2 | M20A2-CH13<br>Hole 3 | M20A2-CH14<br>Hole 4 | M20A2-CH11<br>Hole 5 | M20A2-CH12<br>Hole 6 | M20A2-CH13<br>Hole 7 | M20A2-CH14<br>Hole 8 | M20A2-CH11<br>Hole 9 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C    | 377.34                         | 380.04               | 380.62               | 383.20               | 380.97               | 379.00               | 381.21               | 378.62               | 379.36               |
|            |         |               | Stability ±°C | 0.31                           | 0.27                 | 0.31                 | 0.25                 | 0.24                 | 0.37                 | 0.15                 | 0.26                 | 0.23                 |

| Cal. Point | Setting | Reading       | STD.          | Position of Standards at Block |                       |                       |                       |                       |                       |                       |                       |                       |
|------------|---------|---------------|---------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C)       | (°C)    | (°C)          | Reading       | M20A2-CH12<br>Hole 10          | M20A2-CH13<br>Hole 11 | M20A2-CH14<br>Hole 12 | M20A2-CH11<br>Hole 13 | M20A2-CH12<br>Hole 14 | M20A2-CH13<br>Hole 15 | M20A2-CH14<br>Hole 16 | M20A2-CH11<br>Hole 17 | M20A2-CH12<br>Hole 18 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C    | 376.66                         | 381.17                | 380.28                | 383.11                | 383.26                | 382.04                | 380.37                | 381.00                | 381.61                |
|            |         |               | Stability ±°C | 0.35                           | 0.34                  | 0.35                  | 0.24                  | 0.21                  | 0.23                  | 0.23                  | 0.20                  | 0.22                  |

Approved By.

FM-L13 I08/30-05-57



## Metrological Center

SCI ECO Services Company Limited

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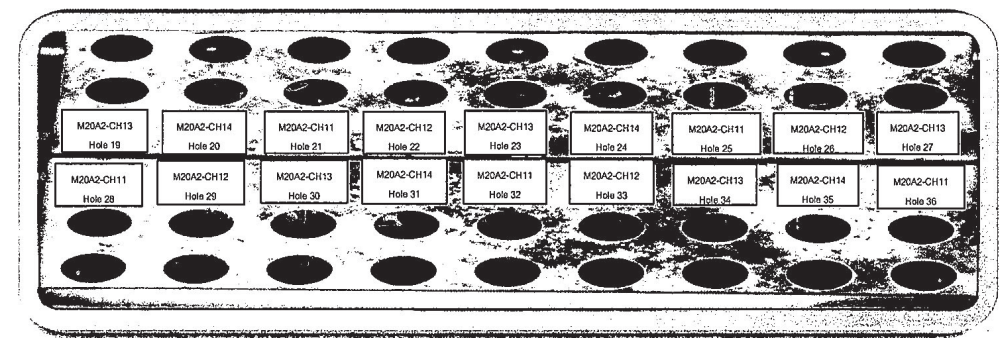
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Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T240977

Page 4 of 5

### Calibration Report



DISPLAY CONTROL (FRONT)

#### Measurement Results

| Cal. Point | Setting | Reading       | STD.          | Position of Standards at Block |                       |                       |                       |                       |                       |                       |                       |                       |
|------------|---------|---------------|---------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C)       | (°C)    | (°C)          | Reading       | M20A2-CH13<br>Hole 19          | M20A2-CH14<br>Hole 20 | M20A2-CH11<br>Hole 21 | M20A2-CH12<br>Hole 22 | M20A2-CH13<br>Hole 23 | M20A2-CH14<br>Hole 24 | M20A2-CH11<br>Hole 25 | M20A2-CH12<br>Hole 26 | M20A2-CH13<br>Hole 27 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C    | 376.97                         | 383.29                | 383.26                | 381.86                | 380.47                | 381.36                | 382.07                | 379.37                | 381.87                |
|            |         |               | Stability ±°C | 0.22                           | 0.26                  | 0.22                  | 0.22                  | 0.23                  | 0.22                  | 0.25                  | 0.21                  | 0.22                  |

| Cal. Point | Setting | Reading       | STD.          | Position of Standards at Block |                       |                       |                       |                       |                       |                       |                       |                       |
|------------|---------|---------------|---------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C)       | (°C)    | (°C)          | Reading       | M20A2-CH11<br>Hole 28          | M20A2-CH12<br>Hole 29 | M20A2-CH13<br>Hole 30 | M20A2-CH14<br>Hole 31 | M20A2-CH11<br>Hole 32 | M20A2-CH12<br>Hole 33 | M20A2-CH13<br>Hole 34 | M20A2-CH14<br>Hole 35 | M20A2-CH11<br>Hole 36 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C    | 377.29                         | 381.19                | 381.69                | 380.72                | 381.02                | 380.42                | 378.65                | 380.63                | 376.92                |
|            |         |               | Stability ±°C | 0.25                           | 0.27                  | 0.27                  | 0.26                  | 0.22                  | 0.28                  | 0.19                  | 0.23                  | 0.22                  |

Approved By.

FM-L13 I08/30-05-57



# Metrological Center

SCI ECO Services Company Limited

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

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

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด  
DOUBLE S DIAGNOSTICS CO., LTD.

4 ซอยอุดมสุข 14 แขวงบางนา เขตบางนา กรุงเทพฯ 10260 โทรศัพท์: (02) 747-7009 โทรสาร: (02) 747-7008  
4 Soi Udomsuk 14, Bangna, Bangkok 10260 Tel. (02) 747-7009 Fax: (02) 747-7008

Maintenance Plan YEAR : 2024

| เดือน | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| รวม   |     |     |     |     |     |     |     |     |     |     |     |     |

## Periodical maintenance check list for Konelab

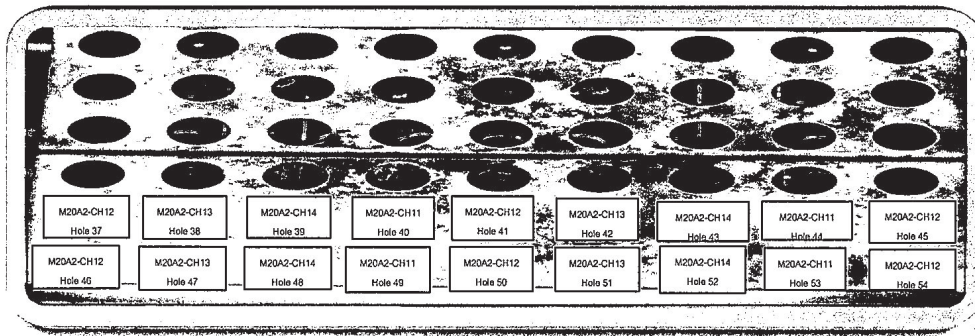
|   | 6M                                  | 12M                                 | Note! |
|---|-------------------------------------|-------------------------------------|-------|
| 1.Diluent-wash tubing change                              | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | none  |
| 2.ISE tubing change                                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |       |
| 3.Syringe check/change                                    |                                     | <input checked="" type="checkbox"/> |       |
| 4.Dispensing check/ change                                |                                     | <input checked="" type="checkbox"/> |       |
| 5.Waste tubing change when necessary                      |                                     | <input checked="" type="checkbox"/> |       |
| 6.Lamp check/change                                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 7.Mixer paddle/paddle change(not Konelab20)               |                                     | <input checked="" type="checkbox"/> |       |
| 8.ISE needles check/change                                |                                     | <input checked="" type="checkbox"/> | none  |
| 9.Pump tubing check/ chance                               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 10.Broken/worn out part check /change                     |                                     | <input checked="" type="checkbox"/> |       |
| 11.Peristaltic pump check /cleaning/ lubrication          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 12.Heating check  |                                     | <input checked="" type="checkbox"/> |       |
| 13.Cooling check  |                                     | <input checked="" type="checkbox"/> |       |
| 14.Dispenser mechanic check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 15.Cuvette transfer mechanic check/adjustment             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 16.Dispenser movement check/adjustment                    | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 17.Sample/reagent register check/adjustment               | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 18.Dispensing tubing tightness check                      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 19.Photometer and optics cleaning/check/adjustment        | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 20.Workstation PC cleaning if necessary                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 21.Mechanic cleaning/lubrication                          | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 22.Instrument cleaning if necessary                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 23.Complete analyzer testing with waterblank/QC or sample | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 24.Test parameters/Adjustment/config. Save to USB key     | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |
| 25.UPS Test   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |       |

Place: ALS LAB Instrument: K20 Aquaken  
Date/Time: 16/8/62 Serial no: 22281  
Service done by: 157082 Install date:  
Signature of customer: 16/08/2024 Date/Time:

Certificate No. T240977

Page 5 of 5

## Calibration Report



DISPLAY CONTROL (FRONT)

### Measurement Results

| Cal. Point | Setting | Reading       | STD.          | Position of Standards at Block |                       |                       |                       |                       |                       |                       |                       |                       |
|------------|---------|---------------|---------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| (°C)       | (°C)    | (°C)          | Reading       | M20A2-CH12<br>Hole 37          | M20A2-CH13<br>Hole 38 | M20A2-CH14<br>Hole 39 | M20A2-CH11<br>Hole 40 | M20A2-CH12<br>Hole 41 | M20A2-CH13<br>Hole 42 | M20A2-CH14<br>Hole 43 | M20A2-CH11<br>Hole 44 | M20A2-CH12<br>Hole 45 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C    | 380.39                         | 378.84                | 380.87                | 381.85                | 379.87                | 382.97                | 383.29                | 379.42                | 378.50                |
|            |         |               | Stability ±°C | 0.21                           | 0.16                  | 0.19                  | 0.25                  | 0.18                  | 0.19                  | 0.19                  | 0.23                  | 0.42                  |

| Cal. Point | Setting | Reading       | STD.           | Position of Standards at Block |                       |                       |                       |                       |                       |                       |                       |                       |
|------------|---------|---------------|----------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| ( °C)      | ( °C)   | ( °C)         | Reading        | M20A2-CH12<br>Hole 46          | M20A2-CH13<br>Hole 47 | M20A2-CH14<br>Hole 48 | M20A2-CH11<br>Hole 49 | M20A2-CH12<br>Hole 50 | M20A2-CH13<br>Hole 51 | M20A2-CH14<br>Hole 52 | M20A2-CH11<br>Hole 53 | M20A2-CH12<br>Hole 54 |
| 380.0      | 380.0   | 379.8 - 380.2 | Average °C     | 377.89                         | 381.24                | 380.93                | 379.91                | 380.08                | 380.61                | 381.63                | 383.34                | 383.04                |
|            |         |               | Stability ± °C | 0.63                           | 0.41                  | 0.24                  | 0.14                  | 0.15                  | 0.15                  | 0.14                  | 0.16                  | 0.38                  |

The expanded uncertainty of temperature measurement was  $\pm 1.65^\circ\text{C}$

The calibration result apply only the above calibrated item.

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

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

Approved By.

8/16/2024 14:53

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Performed8/16/2024  
LotWB34

=====

ACCEPTANCE CRITERIA

=====

|                                | Result | Limit        | Warning |
|--------------------------------|--------|--------------|---------|
| Temperature (?C)               | 37.8   | 37.0 +/- 1.0 |         |
| Dispensing ratio               | 16.4   | 14.8 - 17.2  |         |
| CV%                            | 0.29   | <1.7         |         |
| Photometric noise              |        |              |         |
| Max SD L340_2 (mA)             | 0.17   | <2.0         |         |
| Max SD L340_4 (mA)             | 0.87   | <3.0         |         |
| Linearity of photometer        |        |              |         |
| Slope                          | 1.0141 | 0.94 - 1.06  |         |
| Curvature                      | 0.0053 | +/- 0.02     |         |
| Max bias from linear fit (mA)  | 4.3    | <15.0        |         |
| Max delta %                    | -1.6   | +/- 6.0      |         |
| Linearity of sample dispensing |        |              |         |
| Proport. volume XDISP2 (?l)    | 2.06   | 1.96 - 2.16  |         |
| Proport. volume XDISP4 (?l)    | 4.14   | 3.85 - 4.40  |         |
| XDISP2 CV%                     | 1.21   | <2.0         |         |
| XDISP4 CV%                     | 0.90   | <2.0         |         |
| XDISP10 CV%                    | 0.68   | <2.0         |         |
| Needle 0 ?l volume             |        |              |         |
| Average (A)                    | 0.005  | <0.050       |         |
| Standard deviation (A)         | 0.002  | <0.005       |         |
| Volume (?l)                    | 0.03   | <0.32        |         |

=====

OTHER INFORMATION

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| Dispensing ratio |            | Photom. noise: SD (mA) |              |
|------------------|------------|------------------------|--------------|
| Posit            | Result (A) | Posit                  | L340_2L340_4 |
| 1                | 0.1549     | 1                      | 0.150.80     |
| 2                | 0.1549     | 2                      | 0.170.79     |
| 3                | 0.1537     | 3                      | 0.040.65     |
| 4                | 0.1547     | 4                      | 0.160.31     |
| 5                | 0.1547     | 5                      | 0.110.58     |
| 6                | 0.1545     | 6                      | 0.140.87     |

8/16/2024 14:53

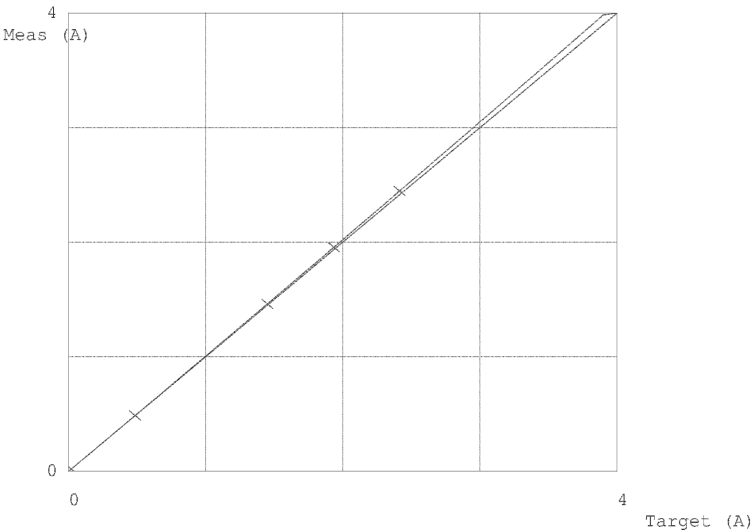
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Linearity of sample dispensing

| Test    | Absorbance (A) |
|---------|----------------|
| XDISP2  | 0.306          |
| XDISP4  | 0.612          |
| XDISP10 | 1.471          |

Linearity of photometer

| L340_ | Target (A) | Meas (A) | Delta (A) | Delta % |
|-------|------------|----------|-----------|---------|
| 1     | 0.002      | 0.006    | -0.004    | -217.7  |
| 2     | 0.486      | 0.493    | -0.007    | -1.5    |
| 3     | 1.451      | 1.469    | -0.018    | -1.2    |
| 4     | 1.936      | 1.963    | -0.027    | -1.4    |
| 5     | 2.415      | 2.454    | -0.039    | -1.6    |







# Metrology

SCI ECO Services Company Limited

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

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

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

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



Certificate No. T240904

Page 1 of 3

## Certificate of Calibration

Equipment : Chamber ( Oven )

Manufacturer : Memmert

Model : UF 450

Serial No. : B717.0531

Customer Code : BKK\_EN0273

ID No. : T8042A4

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

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory (Oven Room)

Date of Receipt : 08 May 2024

Calibrated By : Preecha Phisassutthikul ( Temperature Calibration Manager )

Approved By : dp / Nuafun Sungchum (Metrology Manager)

Date of Issue : 23 MAY 2024

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.



# Metrology

SCI ECO Services Company Limited

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



Certificate No. T240904

Page 2 of 3

## Calibration Report

Equipment : Chamber ( Oven )

Date of Calibration : 14 May 2024

Environment : Temperature : 26.5-28.1 °C

Line Voltage : 226.7-229.8 V

Relative Humidity : 51 - 57 %RH

### Condition of this results of calibration :

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

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

### 2. Reference Standard Instrument :

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

### 3. This certificate is traceable to :

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

### 4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 104 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max

☐ Close

☒ Not Available

### 5. Adjustment :

( X ) without adjustment

( ) after adjustment

Approved By dp



# Metrology

SCI ECO Services Company Limited

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

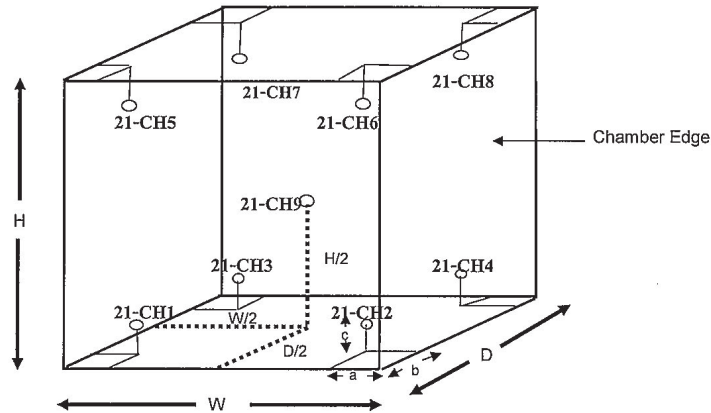


NSC-TISI-TIS 17025  
CALIBRATION 0244

Certificate No. T240904

Page 3 of 3

## Calibration Report



### Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm. , H (Height) = 72 cm. and D (Depth) = 60 cm.

Size of Installed Standard sensor number 21-CH1 to number 21-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 21-CH9 : W/2 = 104 cm./2 , H/2 = 72 cm./2 and D/2 = 60 cm./2

### Measurement Results

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

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

\* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By.

FM-L15 I18/18-08-66



## TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

### CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Cert.No.: 23TW243

Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5000-230V  
Serial No. : 09J101147  
ID No. : BKK\_EN0017  
Received Date : 15 November 2023  
Test Date : 16 November 2023  
Reference : 2311-0505DSC-4  
Submitted by :

DO Meter

YSI

5000-230V

09J101147

BKK\_EN0017

15 November 2023

16 November 2023

2311-0505DSC-4

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

Laboratory Condition : Temperature ( 25 ± 5 ) °C

Humidity (50 ± 20) %

Test Procedure : In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

Approved Signatory

(✓) Saithip Meangmai  
( ) Warakorn Lernagtrakul  
( ) Ponpan Paipim

Issue Date : 17 November 2023

B 0328589



Cert.No.: 23TW243

Page.: 2 of 2

**Condition of this result of calibration**

**1. Reference Standard Instruments :**

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

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

**2. Standard Material :-**

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

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

Dissolved Oxygen Probe No.: 16K100498

| <u>Titration Method</u><br>(Azide Modification Method) | <u>DO Meter</u><br>Reading | <u>Standard Deviation</u> |
|--|----------------------------|---------------------------|
| (mg/L)   | (mg/L)                     | (mg/L)                    |
| 8.18   | 8.18                       | 0.0055                    |

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

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*Santip*

a 1190297



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



Cert. No.: 23LM192

Page.: 1 of 2

**Certificate of Calibration**

|                              |   |
|------------------------------|---|
| <b>Equipment :</b>           | DO Meter with Sensor  |
| <b>Manufacturer :</b>        | YSI   |
| <b>Model :</b>               | 5000-230V   |
| <b>Serial No. :</b>          | 09J101147   |
| <b>ID No. :</b>              | BKK_EN0017  |
| <b>Submitted by :</b>        | ALS Laboratory Group (Thailand) Co., Ltd.<br>104 Phatthanakan 40, Phatthanakan Rd.,<br>Khwaeng Phatthanakan, Khet Suan Luang,<br>Bangkok 10250 Thailand |
| <b>Location :</b>            | TPA Chemistry Calibration Laboratory  |
| <b>Received Order :</b>      | 15 November 2023  |
| <b>Calibrated Date :</b>     | 16 November 2023  |
| <b>Ambient Temperature :</b> | ( 26 ± 10 ) °C  |
| <b>Relative Humidity :</b>   | ( 50 ± 30 ) %   |
| <b>AC Line Voltage :</b>     | ( 220 ± 22 ) V  |
| <b>Calibrated by :</b>       | Kunchit Promprat  |
| <b>Approved by :</b>         | <br>Approved Signatory   |
|                              | ( ) Pornthippa Tameyakul<br>( ) Ponpan Paipim<br>(✓) Suwit Imjai  |
| <b>Issue Date :</b>          | 17 November 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.

A 0060730





Equipment : DO Meter with Sensor  
Condition As-Received : Used Item  
Reference : 2311-0505DSC-10

Cert. No.: 23LM192  
Page.: 2 of 2

**Procedure Used :-**

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

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

| Instrument             | Serial No. | Cert. No. | Traceable | Due Date    |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 3240076    | 23I305    | TPA       | 15 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.

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

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

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 16K100498

| Calibration Point<br>( °C ) | Immersion Depth<br>( mm ) | Standard Temperature<br>( °C ) | UUC* Reading<br>( °C ) | Error<br>( °C ) | Uncertainty<br>( ± °C ) | Coverage Factor<br>k |
|-----------------------------|---------------------------|--------------------------------|------------------------|-----------------|-------------------------|----------------------|
| 20.0                        | 60                        | 19.997                         | 19.93                  | -0.067          | 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-

*Yunt*

a 1190298



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com



CERTIFICATE No : 24T2852

REFERENCE No : 72619-8

PAGE : 1 OF 2

**Certificate of Calibration**

EQUIPMENT : COOLED INCUBATOR

MANUFACTURER : MEMMERT

MODEL : ICP750

SERIAL No : F819.0021

ID No : BKK\_EN0304

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : ALS LABORATORY GROUP (THAILAND) CO., LTD.  
104 PHATTHANAKAN 40, PHATTHANAKAN  
RD.,KHWAENG PHATTHANAKAN,KHET SUAN  
LUANG, BANGKOK 10250, THAILAND

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 20-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 21-Mar-24

RECEIVED DATE : 20-Mar-24

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

F-G010 REV : 03





# QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24T2852

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COOLED INCUBATOR  
MANUFACTURER : MEMMERT  
MODEL : ICP750  
ID No : BKK\_EN0304  
RECEIVED DATE : 20-Mar-24  
AMBIENT TEMPERATURE : 26 °C ± 1 °C

S/N : F819.0021  
CALIBRATION DATE : 20-Mar-24  
RELATIVE HUMIDITY : 54 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

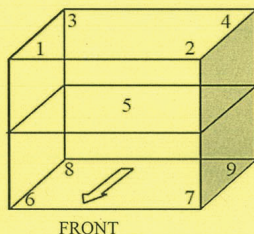
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

### 2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT                    | MODEL       | SERIAL No | CERTIFICATE No | DUE DATE  |
|-------------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH TC TYPE K | HYDRA 2635A | 7286308   | 23T6641        | 14-Jul-24 |

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1

Overall Line Voltage (V) variation : 5

Instrument Condition : Normal

#### CHAMBER PERFORMANCE

| Controller Temperature (°C) | Indicating Temperature (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| 20.0                        | 20.0                        | 0.16                        | 0.21                        | 0.41                   |

#### TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations |       |       |       |        |       |       |       |       | Uncertainty (±°C) |
|----------------------|----------------------|---|-------|-------|-------|--------|-------|-------|-------|-------|-------------------|
|                      |                      | #1  | #2    | #3    | #4    | Ref. 5 | #6    | #7    | #8    | #9    |                   |
| 20.0                 | 20.0                 | 19.88   | 19.93 | 19.87 | 19.86 | 19.98  | 19.94 | 19.94 | 19.89 | 19.91 | 0.42              |

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



## TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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



## Certificate of Calibration

Cert.No.: 24CG952

Page.: 1 of 2

Equipment : Burette  
Capacity : 50 mL  
Serial No. : -  
ID. No. : BKK\_EN0171  
Manufacturer : Witeg  
Made in : Germany  
Submitted by :

REVIEW BY Siriluk P.  
APPROVED BY Kanok Anu.  
NEXT CAL DATE. 27/08/25

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

Ambient Temperature : (20 ± 2.5) °C  
Relative Humidity : (50 ± 10) %  
Barometric Pressure : 760 mmHg  
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Natcha Chayyingcheiw

Approved by :

Siriluk P.  
Approved Signatory

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

Issue Date : 27 February 2024

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

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





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

Cert.No.: 24CG952  
Page.: 2 of 2

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

This certification is traceable to SI Unit

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

#### Calibration result :

| Nominal capacity<br>( mL ) | Reading<br>( mL ) | Uncertainty<br>( ± mL ) | k<br>Factor |
|----------------------------|-------------------|-------------------------|-------------|
| 50                         | 50.0032           | 0.010                   | 2.00        |

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

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

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Cert. No.: 23TM1103  
Page : 1 of 3

## Certificate of Calibration

Equipment : Autoclave  
Manufacturer : Sanyo  
Model : MLS-3781  
Serial No. : 830167  
ID No. : BKK\_ML0037

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

Location : Media Preparation Room

Received Order : 17 July 2023  
Calibration Date : 17 July 2023  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Preecha Hlahib

Approved by :

Approved Signatory

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

Issue Date : 24 July 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 0053615



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2307-0285OC-3

**Cert. No.:** 23TM1103  
**Page :** 2 of 3

**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 )

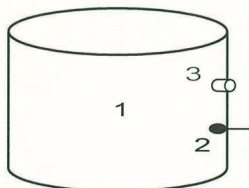
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly 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 | 22            | 53        | 220      |
| Finished of Calibration  | 22            | 54        | 220      |

| Position | Description        | Ref. Std. ID No.: |
|----------|--------------------|-------------------|
| 1 =      | Center of chamber  | 22-17TC-01        |
| 2 =      | Temperature sensor | 23-17TC-02        |
| 3 =      | Exhaust port       | 19-17TC-03        |

*Signature*

a 1159503



**Equipment :** Autoclave  
**Condition As-Received :** Used Item  
**Reference :** 2307-0285OC-3

**Cert. No.:** 23TM1103  
**Page :** 3 of 3

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

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

**Operating parameter Set : Temperature =** 121 °C

**Sterilization period =** 15 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        | 120.877                          | 0.39               | 0.12                     | 1.0                  | 2                 |
|                     |                     | 2        | 120.870                          |                    |                          |                      |                   |
|                     |                     | 3        | 120.866                          |                    |                          |                      |                   |

**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 .

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

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*Signature*

a 1159504





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



Cert. No.: 23TM1146  
Page : 1 of 3

## Certificate of Calibration

**Equipment :** Incubator  
**Manufacturer :** SHEL-LAB  
**Model :** 1915A  
**Serial No. :** 0200599  
**ID No. :** BKK\_ML0010  
**Submitted by :** ALS Laboratory Group (Thailand) Co.,Ltd.  
104 Phatthanakan 40, Phatthakan Rd.,  
Khwaeng Phatthanakan, Khet Suan Luang,  
Bangkok 10250 Thailand  
**Location :** Incubation & Micrological Reading  
**Received Order :** 17 July 2023  
**Calibration Date :** 17 July 2023  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**Calibrated by :** Man Pattanapongpaiboon

**Approved by :**   
Approved Signatory

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

**Issue Date :** 24 July 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.



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2307-0285OC-1  
**Procedure Used :-**

**Cert. No.:** 23TM1146  
**Page :** 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY49001451 | 23LM27    | TPA       | 25 Feb 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.

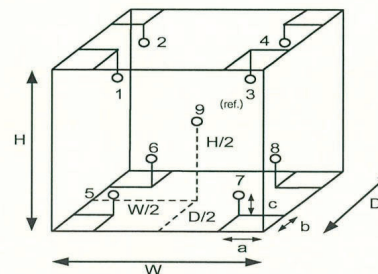
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**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 )             | 221       | 223      |



### Probe Installation Details :

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

### Dimension of Chamber :

D = 0.50 m  
W = 0.75 m  
H = 1.2 m  
Capacity = 0.45 m<sup>3</sup>

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 19RTD-2/1         |
| 2          | 19RTD-2/2         |
| 3          | 19RTD-2/3         |
| 4          | 19RTD-2/4         |
| 5          | 19RTD-2/5         |
| 6          | 19RTD-2/6         |
| 7          | 19RTD-2/7         |
| 8          | 19RTD-2/8         |
| 9 (ref.)   | 19RTD-2/9         |







Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2307-0285OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 23TM1146

Page : 3 of 3

| Calibration Point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Temperature<br>stability<br>( ± °C ) | Temperature<br>uniformity<br>( °C ) | Overall<br>Variation<br>( °C ) | Coverage<br>Factor<br>k |
|-----------------------------|---------------------------|---------------------------|--------------------------------------|-------------------------------------|--------------------------------|-------------------------|
| 35.0                        | 35.0                      | 35.0                      | 0.055                                | 0.30                                | 0.44                           | 2                       |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |        |        |        |        |        |        |        |          | Uncertainty<br><br>( ± °C ) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-----------------------------|
|                                | Position                    |        |        |        |        |        |        |        |          |                             |
|                                | 1                           | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9 (ref.) |                             |
| 35.0                           | 34.888                      | 34.933 | 34.815 | 34.813 | 35.064 | 35.019 | 35.156 | 35.141 | 35.087   | 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 %.

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Male.

a 1172188



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert. No.: 24TM667

Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Binder

Model : ED 240/E2

Serial No. : 00-15533

ID No. : BKK\_ML0013

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

Location : Media Preparation Room

Received Order : 23 April 2024

Calibration Date : 23 April 2024

Ambient Temperature : ( 26 ± 10 ) °C

Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Tawatchai Pama

Approved by :   
Approved Signatory

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

Issue Date : 26 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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





**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2404-0439OC-8

**Cert. No.:** 24TM667  
**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 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 | MY49001451 | 24LM44    | TPA       | 17 Mar 2025 |

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

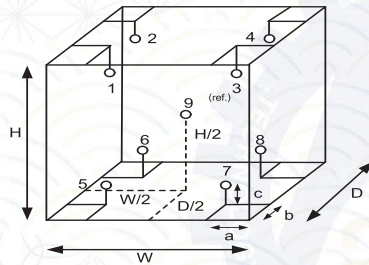
3. This certification is traceable to the International System of Unit.

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

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

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

**Fresh air setting :** Close



**Probe Installation Details :**

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

**Dimension of Chamber :**

D = 0.50 m  
W = 0.80 m  
H = 0.60 m  
Capacity = 0.24 m<sup>3</sup>

| Environment during calibration |           |          |
|--------------------------------|-----------|----------|
|                                | Beginning | Finished |
| Temp. ( °C )                   | 24        | 23       |
| REL.Humid. ( % )               | 65        | 65       |
| AC Supply ( Volt )             | 223       | 222      |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1          | 24-19TC-01        |
| 2          | 24-19TC-02        |
| 3          | 24-19TC-03        |
| 4          | 24-19TC-04        |
| 5          | 24-19TC-05        |
| 6          | 24-19TC-06        |
| 7          | 24-19TC-07        |
| 8          | 24-19TC-08        |
| 9 (ref.)   | 24-19TC-09        |



**Equipment :** Hot Air Oven  
**Condition As-Received :** Used Item  
**Reference :** 2404-0439OC-8

**Cert. No.:** 24TM667  
**Page :** 3 of 3

**Result of Calibration :-**

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

**Fresh air setting :** Close

| Calibration Point ( °C ) | UUC* Setting ( °C ) | UUC* Reading ( °C ) | Temperature stability ( ± °C ) | Temperature uniformity ( °C ) | Overall Variation ( °C ) | Coverage Factor k |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 180                      | 180                 | 180                 | 0.64                           | 2.7                           | 3.7                      | 2                 |

| Calibration<br>Point<br>( °C ) | Measured Temperature ( °C ) |         |         |         |         |         |         |         |          | Uncertainty<br><br>( ± °C ) |
|--------------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|-----------------------------|
|                                | Position                    |         |         |         |         |         |         |         |          |                             |
|                                | 1                           | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9 (ref.) |                             |
| 180                            | 181.009                     | 181.511 | 180.922 | 181.359 | 181.217 | 183.659 | 181.664 | 181.986 | 181.474  | 1.5                         |

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

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

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

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

**UUC\* :** Unit Under Calibration

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

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

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## Certificate of Calibration

Cert. No.: 24TM469  
Page : 1 of 3

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 : Incubation \$ Microbiological Reading

Received Order : 01 March 2024  
Calibration Date : 01 March 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee

Approved by :

( ) Pornthippa Tameyakul  
( ) Unnophol Harachai  
(✓) Suwit Imjai

Issue Date : 4 March 2024

REVIEW BY Sithichok T.  
APPROVED BY [Signature]  
NEXT CAL DATE 01/03/25

Approved Signatory

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 : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0001OC-1  
Procedure Used :-

Cert. No.: 24TM469  
Page : 2 of 3

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

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

| Instrument           | Serial No. | Cert. No. | Traceable | Due Date    |
|----------------------|------------|-----------|-----------|-------------|
| 1 ) Data Acquisition | MY57013711 | 23LM115   | TPA       | 11 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.

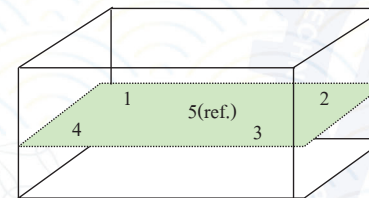
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

|                          | Environmental |           | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
|                          | ( °C )        | ( %R.H. ) | ( Volt )          |
| Beginning of Calibration | 24            | 55        | 221               |
| Finished of Calibration  | 23            | 56        | 220               |



Front

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



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2403-0001OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source

Cert. No.: 24TM469

Page : 3 of 3

| Calibration<br>point<br>( °C ) | UUC*<br>Setting<br>( °C ) | UUC*<br>Reading<br>( °C ) | Average* Standard Reading ( °C ) |        |        |        |          | Uncertainty<br>( ± °C ) |
|--------------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-------------------------|
|                                |                           |                           | Position                         |        |        |        |          |                         |
|                                |                           |                           | 1                                | 2      | 3      | 4      | 5 (ref.) |                         |
| 44.5                           | 44.5                      | 44.5                      | 44.469                           | 44.462 | 44.492 | 44.510 | 44.496   | 0.15                    |
| 45.0                           | 45.0                      | 45.0                      | 44.975                           | 44.974 | 45.007 | 45.023 | 44.999   | 0.15                    |

| Calibration<br>point<br>( °C ) | Uniformity<br>( °C ) | Stability<br>( ± °C ) | Coverage<br>Factor<br><i>k</i> |
|--------------------------------|----------------------|-----------------------|--------------------------------|
| 44.5                           | 0.087                | 0.029                 | 2                              |
| 45.0                           | 0.069                | 0.031                 | 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 %.

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