

ภาคผนวกที่ 4

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

- คุณภาพอากาศในบรรยากาศ
- ระดับเสียงในบรรยากาศ
- คุณภาพน้ำ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|--|---|-------------------------|
| | ชื่อเครื่องมือ | ชื่อเครื่องมือ |
| 1. คุณภาพอากาศในบรรยากาศ | | |
| TSP | High Volume Air Sampler No. B42 | Digital Balance |
| PM ₁₀ | High Volume PM ₁₀ Sampler No. B17 | Digital Balance |
| 2. ระดับเสียงในบรรยากาศ | | |
| L _{eq} 8 hr L _{eq} 24 hr, L _{max} และ L ₉₀ | Acoustic Calibrator Sound Level Meter No. ACO-C1-B04 | - |
| 3. คุณภาพน้ำ | | |
| pH | - | pH Meter |
| Total Suspended Solids | - | Digital Balance |
| BOD ₅ | - | BOD Analyzer |
| Grease & Oil | - | Digital Balance |
| Temperature | - | Thermometer |
| Turbidity | - | Turbidity Meter |
| Total Coliform Bacteria | - | Incubator |

คุณภาพอากาศในบรรยากาศ



High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3611

Calibration Data

| High Volume Air Sampler Data | | Calibration Data | | |
|------------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B35 | B35 | 05/02/2025 | y = 1.163x-3.579 | 0.997 |
| B36 | B36 | 05/02/2025 | y = 1.130x-2.116 | 0.999 |
| B37 | B37 | 04/02/2025 | y = 1.146x-2.265 | 0.996 |
| B38 | B38 | 04/02/2025 | y = 1.156x-6.034 | 0.998 |
| B39 | B39 | 03/02/2025 | y = 1.151x-3.366 | 0.998 |
| B40 | B40 | 03/02/2025 | y = 1.174x-4.582 | 0.999 |
| B41 | B41 | 06/02/2025 | y = 1.123x-1.633 | 0.997 |
| B42 | B42 | 03/02/2025 | y = 1.149x-3.382 | 0.997 |
| B43 | B43 | 03/02/2025 | y = 1.137x-2.074 | 0.997 |
| B44 | B44 | 03/02/2025 | y = 1.155x-1.460 | 0.999 |
| R01 | R01 | 04/02/2025 | y = 1.121x-3.007 | 0.999 |
| R02 | R02 | 03/02/2025 | y = 1.159x-5.099 | 0.999 |
| R03 | R03 | 05/02/2025 | y = 1.138x-2.774 | 0.998 |
| R04 | R04 | 05/02/2025 | y = 1.118x-2.575 | 0.999 |
| R05 | R05 | 03/02/2025 | y = 1.136x-1.720 | 0.998 |
| R06 | R06 | 05/02/2025 | y = 1.154x-2.706 | 0.997 |
| R07 | R07 | 03/02/2025 | y = 1.037x+1.361 | 0.999 |
| R08 | R08 | 03/02/2025 | y = 1.146x-3.762 | 0.996 |
| R09 | R09 | 05/02/2025 | y = 1.121x-2.360 | 0.997 |
| R10 | R10 | 05/02/2025 | y = 1.180x-4.626 | 0.999 |
| R11 | R11 | 05/02/2025 | y = 1.147x-3.861 | 0.996 |
| R12 | R12 | 03/02/2025 | y = 1.128x-4.676 | 0.998 |
| R13 | R13 | 04/02/2025 | y = 1.135x-4.055 | 0.999 |
| R14 | R14 | 04/02/2025 | y = 1.153x-3.122 | 0.997 |
| R15 | R15 | 03/02/2025 | y = 1.161x-5.223 | 0.998 |
| R16 | R16 | 03/02/2025 | y = 1.187x-6.674 | 0.999 |
| R17 | R17 | 03/02/2025 | y = 1.120x-1.730 | 0.999 |
| R18 | R18 | 03/02/2025 | y = 1.146x-2.347 | 0.998 |
| R19 | R19 | 06/02/2025 | y = 1.161x-5.195 | 0.999 |
| R20 | R20 | 06/02/2025 | y = 1.134x-3.449 | 0.998 |



High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3611

Calibration Data

| High Volume PM-10 Data | | Calibration Data | | |
|------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B01 | B01 | 04/02/2025 | y = 1.135x-1.122 | 0.996 |
| B02 | B02 | 04/02/2025 | y = 1.140x-0.728 | 0.999 |
| B03 | B03 | 04/02/2025 | y = 1.160x-3.702 | 0.998 |
| B04 | B04 | 05/02/2025 | y = 1.154x-4.671 | 0.999 |
| B05 | B05 | 06/02/2025 | y = 1.151x-2.705 | 0.998 |
| B06 | B06 | 03/02/2025 | y = 1.114x-1.672 | 0.997 |
| B07 | B07 | 03/02/2025 | y = 1.085x+0.543 | 0.996 |
| B08 | B08 | 04/02/2025 | y = 1.149x-2.014 | 0.998 |
| B09 | B09 | 03/02/2025 | y = 1.081x+0.344 | 0.997 |
| B10 | B10 | 03/02/2025 | y = 1.094x-1.679 | 0.997 |
| B11 | B11 | 05/02/2025 | y = 1.137x-0.690 | 0.997 |
| B12 | B12 | 03/02/2025 | y = 1.094x-1.679 | 0.997 |
| B13 | B13 | 03/02/2025 | y = 1.172x-3.186 | 0.998 |
| B14 | B14 | 05/02/2025 | y = 1.160x-5.111 | 0.998 |
| B15 | B15 | 03/02/2025 | y = 1.141x-2.637 | 0.998 |
| B16 | B16 | 04/02/2025 | y = 1.106x+1.699 | 0.998 |
| B17 | B17 | 04/02/2025 | y = 1.105x+1.676 | 0.998 |
| B18 | B18 | 04/02/2025 | y = 1.176x-3.948 | 0.997 |
| B19 | B19 | 04/02/2025 | y = 1.065x+0.997 | 0.998 |
| B20 | B20 | 04/02/2025 | y = 1.163x-5.103 | 0.997 |
| B21 | B21 | 05/02/2025 | y = 1.120x+0.250 | 0.999 |
| B22 | B22 | 06/02/2025 | y = 1.152x-3.458 | 0.998 |
| B23 | B23 | 06/02/2025 | y = 1.149x-3.696 | 0.999 |
| B24 | B24 | 03/02/2025 | y = 1.109x-1.930 | 0.999 |
| B25 | B25 | 03/02/2025 | y = 1.166x-4.876 | 0.998 |
| B26 | B26 | 05/02/2025 | y = 1.118x-2.223 | 0.997 |
| B27 | B27 | 03/02/2025 | y = 1.127x-3.668 | 0.999 |
| B28 | B28 | 04/02/2025 | y = 1.112x-2.294 | 0.999 |
| B29 | B29 | 04/02/2025 | y = 1.155x-4.309 | 0.997 |
| B30 | B30 | 04/02/2025 | y = 1.136x-2.651 | 0.998 |
| B31 | B31 | 03/02/2025 | y = 1.086x+2.828 | 0.999 |
| B32 | B32 | 04/02/2025 | y = 1.099x-0.279 | 0.998 |
| B33 | B33 | 04/02/2025 | y = 1.152x-4.474 | 0.997 |
| B34 | B34 | 04/02/2025 | y = 1.149x-0.892 | 0.997 |



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY :

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA05/50
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24° C \pm 1° C
MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 54 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|------------------------|-------|-----------|----------------|-----------|
| 1) STANDARD WEIGHT SET | E2 | QK-I-151 | C02250116 | 28-Jan-27 |
| 2) STANDARD WEIGHT | E2 | 15843 | C02250117 | 29-Jan-27 |

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

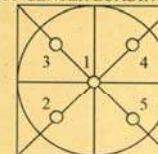
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.00000 | 0.00000 | 0.000065 |
| 0.02 | 0.01999 | 0.00001 | 0.000065 |
| 0.10 | 0.10001 | -0.00001 | 0.000066 |
| 0.20 | 0.20001 | -0.00001 | 0.000066 |
| 0.50 | 0.50002 | -0.00002 | 0.000065 |
| 1.00 | 1.00003 | -0.00003 | 0.000066 |
| 2.00 | 2.00001 | -0.00001 | 0.000067 |
| 5.00 | 5.00002 | -0.00002 | 0.000068 |
| 10.00 | 10.00000 | 0.00000 | 0.000070 |
| 20.00 | 20.00004 | -0.00004 | 0.000078 |
| 50.00 | 50.00000 | 0.00000 | 0.00013 |
| 100.00 | 100.00001 | -0.00001 | 0.00019 |
| 120.00 | 120.0002 | -0.0002 | 0.00022 |

5. OFF CENTER LOADING ERROR



| POINT | READING (g) |
|--------------------|-------------|
| 1 | 50.0000 |
| 2 | 50.0000 |
| 3 | 50.0000 |
| 4 | 50.0000 |
| 5 | 50.0000 |
| OFF-CENTER LOADING | 0.0000 |

NOTE: 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



ระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

CALIBRATION CERTIFICATE

Submitted by : S.P.S.Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

1 / 2

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BLMTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoo Mai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

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

Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 93.81 | -0.19 | ± 0.10 | ±0.40 dB |

2. Frequency

| Standard Microphone Type | Measured Frequency (Hz) | Deviated value (Hz) | Uncertainty (Hz) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|----------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 999.9 | -0.1 | ± 1.5 | ±1.0% |

3. Total Distortion

| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 0.95 | ± 0.50 | ±3.0% |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 21 Feb. 2025

Industrial Metrology and Testing Service Centre

Date of Issue : 24 Feb. 2025

Ref : 2011268021900739001

End of Certificate

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The results relate only to the items tested/calibrated or value assigned.

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FM.BLMTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

668 Mu 2 Tambon Bangpoo Mai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office

196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

Noise B_076/25

Sound Level Meter Calibration Report

| Acoustic Calibrator Data | | | | | | |
|--|----------------|-------|------------------|------------------|---------------------|------------------|
| Brand | ACO | | Number | AC 03/56 | | |
| Model | 2127 | | Serial No. | 130006 | | |
| Calibration Range | 94 dB, 1000 Hz | | Last Calibration | 21 February 2025 | | |
| | | | Due Date | 21 February 2026 | | |
| Calibration Data | | | | | | |
| Sound Level Meter Data | | | | Calibration Data | | |
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| ACO-C1-B04 | ACO | 6238 | 00223041 | 11 March 2025 | 93.9 | 93.9 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.81 ± 0.10 dB | |





CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

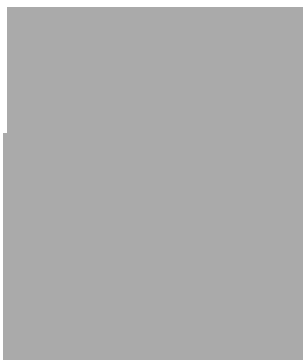
CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD, JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25070523

F3-011-05/12-23

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CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
DATE OF CALIBRATION : 18 June 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-01 [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. CLC-CPTH-04 [Temperature] based on ASTM E 644-04 as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, Wika Model CTP5000-250-D S/N. PO00043543-1-10-1.

Certificate No. Q25070523

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CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 080124 , 120124. Due Date 23 January 2026.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4281-14495731 , Due Date 27 September 2025.
3. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 1042/67, Due Date 16 October 2025.
5. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0146-24, Due Date 28 October 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25070523

F3-011-05/12-23

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@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

| Standard pH Buffer Solution (pH) | pH Meter Reading (pH) | pH Meter Reading (mV) | Correction (pH) | Uncertainty of pH Measurement (\pm pH) | k Factor |
|--|-----------------------------|-----------------------------|--------------------|---|----------|
| 4.003 | 4.005 | 168.2 | -0.002 | 0.010 | 2,00 |
| 7.005 | 7.010 | -8.1 | -0.005 | 0.013 | 2,00 |
| 10.015 | 10.010 | -177.7 | +0.005 | 0.014 | 2,00 |

Technical Note. Setting function CAL 3 point (4,7,10).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 4 of 68

2. TEMPERATURE RESULT

| Immersion depth (mm) | Actual Temperature (°C) | DUC Reading (°C) | Correction (°C) | Uncertainty \pm (°C) |
|----------------------|---------------------------|--------------------|-------------------|--------------------------|
| 100 | 25.00 | 25.0 | 0.00 | 0.07 |

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25070523

F3-011-05/12-23

page 4 of 4



@clccalibration



CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY :

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA09/61
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24°C \pm 1°C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|------------------------|-------|-----------|----------------|-----------|
| 1) STANDARD WEIGHT SET | E2 | QK-1-151 | C02250116 | 28-Jan-27 |
| 2) STANDARD WEIGHT | E2 | 15843 | C02250117 | 29-Jan-27 |

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.0000 | 0.0000 | 0.00012 |
| 0.10 | 0.1000 | 0.0000 | 0.00012 |
| 0.20 | 0.2000 | 0.0000 | 0.00012 |
| 0.50 | 0.5000 | 0.0000 | 0.00012 |
| 1.00 | 1.0000 | 0.0000 | 0.00012 |
| 2.00 | 2.0000 | 0.0000 | 0.00012 |
| 5.00 | 5.0000 | 0.0000 | 0.00012 |
| 10.00 | 10.0000 | 0.0000 | 0.00012 |
| 20.00 | 20.0001 | -0.0001 | 0.00012 |
| 50.00 | 50.0000 | 0.0000 | 0.00014 |
| 100.00 | 100.0001 | -0.0001 | 0.00019 |
| 200.00 | 200.0001 | -0.0001 | 0.00032 |

5. OFF CENTER LOADING ERROR



| POINT | READING (g) |
|--------------------|-------------|
| 1 | 100.0000 |
| 2 | 100.0000 |
| 3 | 100.0000 |
| 4 | 100.0000 |
| 5 | 100.0000 |
| OFF-CENTER LOADING | 0.0000 |

NOTE: 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



Calibration Date : 18 Mar 25
Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
Chatuchak, Bangkok, Thailand 10900

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : -
ID NO. HS001
Technician : Kittipong M.

Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt

Calibration Details

| Calibration Point | 100% air sat. (@20 °C, DO = 9.09 mg/l) | (status) | (status) |
|-----------------------|---|----------|----------|
| Measurement 1 (mg/l) | 9.08 | (PASS) | - |
| Measurement 2 (mg/l) | 9.08 | (PASS) | - |
| Measurement 3 (mg/l) | 9.08 | (PASS) | - |
| Measurement 4 (mg/l) | 9.07 | (PASS) | - |
| Measurement 5 (mg/l) | 9.07 | (PASS) | - |
| Measurement 6 (mg/l) | 9.07 | (PASS) | - |
| Measurement 7 (mg/l) | 9.07 | (PASS) | - |
| Measurement 8 (mg/l) | 9.07 | (PASS) | - |
| Measurement 9 (mg/l) | 9.07 | (PASS) | - |
| Measurement 10 (mg/l) | 9.07 | (PASS) | - |

| | | | | |
|------------------|------|------|---|---|
| Mean Measurement | 9.07 | mg/l | - | - |
| Inaccuracy | 0.02 | mg/l | - | - |

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Certificate of Calibration

Certificate No. : 68-400046-2

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co., Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer
Manufacturer : SK Model : N/A
Range : 0 °C to 100 °C Resolution : 1 °C
Serial No. : N/A Immersion : Total
ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 21 January 2025

Date of Calibration : 24 January 2025

Date of Issue : 24 January 2025

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No. | Due Date | Traceability |
|--------|------------|-------------|---|
| 400001 | TT-0023-24 | 16 Feb 2026 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date | Traceability |
|--------|-----------|-------------|---|
| 400003 | 23E1866 | 01 Jun 2025 | National Institute of Metrology Thailand (NIMT) |
| 400004 | 23E1866 | 01 Jun 2025 | National Institute of Metrology Thailand (NIMT) |



Certificate of Calibration

Certificate No. : 68-400046-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4429 °C

| Standard Reading (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (± °C) |
|----------------------------|-----------------------|----------------------|-------------------------|
| 20.4801 | 20 | 0.5 | 0.31 |

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

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

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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.: 25CH217

Page.: 1 of 3

Equipment : Turbidity Meter
Manufacturer : Eutech
Model : CyberScan WLTB1000
Serial No. : 201802206
ID. No. : TB 02/50
Condition As-Received: Used Item
Received Date : 17 February 2025
Calibration Date : 18 February 2025
Reference : 2502-0500WN-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution

Calibrated by :

Approved by :

() Chakrit Waewwanjua

() Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

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 Calibration and Testing Equipment Services.



Cert.No. : 25CH217

Page. : 2 of 3

Condition of this calibration result

1. Reference Standard Instruments :

| Instruments | Serial No. | ID No. | Certificate No. | Due date |
|-----------------------|------------|----------|-----------------|--------------|
| 1) Thermo-Hygrograph | 1103328 | 130EC010 | 24H1372 | 12 July 2025 |
| 2) Electronic Balance | 14233821 | 110RC001 | 24MM131 | 04 July 2025 |

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

2. Standard Material : The Formazin suspension has been prepared gravimetric from

| Material | Manufacturer | Lot No. | Assay |
|---------------------------|--------------|------------|--------|
| 1) Hexamethylenetetramine | HIMEDIA | 0000493947 | 99.65% |
| 2) Hydrazinium Sulfate | HIMEDIA | 0000522014 | 99.40% |

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

Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU

Turbidity Meter Serial Number : 201802206

| Standard Formazine suspension (NTU) | UUC* Reading (NTU) | Error (NTU) | Uncertainty of Measurement (± NTU) | Coverage Factor <i>k</i> | Tolerance Limit (± NTU) | Judgement |
|---|----------------------------|------------------|--|--------------------------------|---------------------------------|-----------|
| 20 | 19.4 | -0.6 | 0.38 | 2.00 | 2.0 | Pass |
| 40 | 39.9 | -0.1 | 0.40 | 2.00 | 2.0 | Pass |
| 100 | 98.9 | -1.1 | 0.70 | 2.00 | 2.0 | Pass |
| 400 | 391 | -9 | 1.5 | 2.05 | 20.0 | Pass |

Remark - UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units



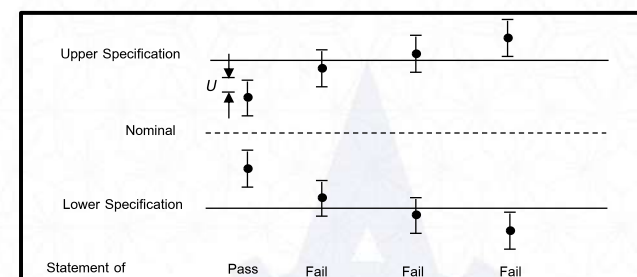
Cert.No. : 25CH217

Page. : 3 of 3

Decision Rule : The decision rule is prescribed by customer (Error ± Uncertainty < Specification)

Statement of conformity are reported as :

- Pass - the measured value included the measurement uncertainty is below the acceptance limit.
- Fail - the measured value included the measurement uncertainty is above the acceptance limit.



$U=95\%$ expanded measurement uncertainty

Tolerance Limit (Specification Limit) provided by customer

Tolerance Limit (TL) (Specification Limit) : specified upper or lower bound of permissible values of property.

Acceptance Limit (AL) : specified upper or lower bound of permissible measured quantity values.

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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MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkac Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003

Date Issued : 23-Sep-24

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 16-Sep-24

Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Certificate No. : S2024090374-0003

Environment : Ambient Temperature : Start record 23.7 °C, Stop record 23.5 °C

Relative Humidity : Start record 54.6 %RH, Stop record 54.4 %RH

| Calibration Temperature (°C) | Setting Temperature (°C) | Indicating Temperature (°C) | Measured Stability ¹ (°C) | Measured Uniformity ² (°C) | Overall Variation ³ (°C) |
|------------------------------|--------------------------|-----------------------------|--------------------------------------|---------------------------------------|-------------------------------------|
| 35 | 35.0 | 35.0 | 0.04 | 0.21 | 0.38 |
| 41.5 | 41.5 | 41.5 | 0.07 | 0.19 | 0.30 |

Without adjustment

| Calibration Temperature (°C) | STD No. 1 (°C) | STD No. 2 (°C) | STD No. 3 (°C) | STD No. 4 (°C) | STD No. 5 (°C) | STD No. 6 (°C) | STD No. 7 (°C) | STD No. 8 (°C) | STD No. 9 (°C) | Uncertainty ⁴ (°C) |
|------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-------------------------------|
| 35 | 34.81 | 35.12 | 34.93 | 34.92 | 35.02 | 34.82 | 34.92 | 35.13 | 34.98 | 0.23 |
| 41.5 | 41.31 | 41.49 | 41.33 | 41.34 | 41.41 | 41.31 | 41.52 | 41.32 | 41.46 | 0.23 |

Decision Rule with Guard Band

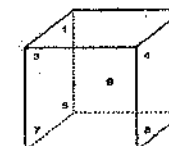
| Calibration Temperature (°C) | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | MPE (±°C) |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| 35 | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | 0.5 |
| 41.5 | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | 0.5 |

Pass = $|\text{error}| + |\text{uncertainty}| \leq [\text{MPE}]$ MPE = Maximum Permissible Error

Fail = $|\text{error}| + |\text{uncertainty}| > [\text{MPE}]$

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202407373-0005 for Temperature Indicator with Sensor Serial No. US37020317, Due 31-Jan-25

- Notes :
- The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 - The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 - Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 - The uncertainty of measurement is included temperature stability.
 - The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate