

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ



รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* | Remark |
|---|---|--|----------------|-----------------------------------|--|-------------------|---------------------|--------------------------|--------|
| เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ | | | | | | | | | |
| 1 | pH Meter | ความเป็นกรด-ด่าง (pH) อุณหภูมิ (Temperature) | Mettler-Toledo | Seven Easy S20 / 1231155210 | National Food Institute, Ministry of Industry, Thailand | 2201793-001-01 | 24 Feb 23 | 23 Feb 24 | - |
| 2 | pH Meter | | Mettler-Toledo | Seven Easy S20 / 1230525212 | National Food Institute, Ministry of Industry, Thailand | 2302181-001-01 | 24 Mar 23 | 22 Mar 24 | - |
| 3 | Conductivity Meter | ความเค็ม (Salinity) | SI Analytics | Lab955 / 16300356 | SPC Calibration Center Co.,Ltd. | C24230059 | 16 Mar 23 | 14 Mar 24 | - |
| 4 | Analytical Balance (Readability 0.01 mg) | ของแข็งแขวนลอย (SS) ของแข็งทั้งหมด (TS) ของแข็งละลายน้ำทั้งหมด (TDS) | Mettler-Toledo | XSR205DU / C090971872 | Technology Promotion Association (Thailand-Japan) | 23MMM112 | 26 Apr 23 | 24 Apr 24 | - |
| 5 | Analytical Balance (Readability 0.01 mg) | | Mettler-Toledo | XSR205DU / C210685394 | Technology Promotion Association (Thailand-Japan) | 23MMM113 | 26 Apr 23 | 25 Apr 24 | - |
| 6 | Hot Air Oven | | Memmert | UF55 / B212.0411 | Technology Promotion Association (Thailand-Japan) | 23TM373 | 11 Apr 23 | 9 Apr 24 | - |
| 7 | Analytical Balance (Readability 0.1 mg) | น้ำมันและไขมัน (Oil & Grease) | Mettler-Toledo | XSR204 / C117635043 | National Food Institute, Ministry of Industry, Thailand | 2302827-001-01 | 10 May 23 | 8 May 24 | - |
| 8 | BOD Incubator | บีโอดี (BOD) | Arco | UC4-1320 / (UAE.WAO.015/25561) | Technology Promotion Association (Thailand-Japan) | 23TM249 | 15 Feb 23 | 14 Feb 24 | - |
| 9 | BOD Incubator | | Arco | UR-1320 / (UAE.WAO.018/2551) | Technology Promotion Association (Thailand-Japan) | 23TM375 | 12 Apr 23 | 10 Apr 24 | - |
| 10 | COD Reactor (Heating Block) | ซีโอดี (COD) | Hanna | HI839800-02 / H0185001 | Hanna Instruments (Thailand) Ltd. | HIT-2312-0342 | 10 Mar 23 | 9 Mar 24 | - |
| 11 | COD Reactor (Heating Block) | | Hanna | HI839800 / 1147807 | Hanna Instruments (Thailand) Ltd. | HIT-2318-0547 | 28 Apr 23 | 26 Apr 24 | - |

รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration * | Remark |
|-----|--------------------------|--|----------------------|-------------------------------|-----------------------|-------------------|---------------------|---------------------------|--------|
| 12 | UV-VIS Spectrophotometer | ไนโตรเจน-ไนโตรเจน (NO ₃ as N) ซีโอดี (COD) | Agilent Technologies | Cary60 G6860A / MY15410009 | DOE Services Co.,Ltd. | SP23-021 | 20 May 23 | 18 May 24 | - |
| 13 | UV-VIS Spectrophotometer | | Hitachi | U-1900 / 2021-064 | DOE Services Co.,Ltd. | SP23-007 | 6 Jan 23 | 5 Jan 24 | - |

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Calibration Certificate

Certificate No.: 2301846-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udumuk 41, Sukhumvit Road, Bangchack, Prakanong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2301846
Operation No.: 2301846-001
Date of Receipt: 17 February 2023
Date of Calibration: 24 February 2023

Calibrated by: Mr.Worapob Booktong, Scientist
Approved by: (Mr.Nuttapol Niyomchart), Specialist, Division of Calibration Laboratory
Date of Issue: 24 February 2023, Responsible for the Technical Management Team

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...

F-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Page 2 of 5

Date of Calibration: 24 February 2023
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (25.1 ± 1.5) °C, Relative Humidity: (50 ± 5) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method: In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards / Certified Reference Material
3. This certification is traceable to The International System of Unit (SI Unit)
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: Mettler Toledo
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Page 3 of 5

Date of Calibration: 24 February 2023
Calibration Results: 1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Table with 6 columns: Nominal pH, DC Voltage Standard (mV), Average Indicator Reading (mV, pH), Uncertainty (±mV), Coverage Factor (k). Rows show data for pH values from 0 to 14.

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode, Type: Combined Electrode
Manufacturer: Mettler Toledo, Model: InLab Solids
Serial No.: 9018311, ID.No.: N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Table with 5 columns: Certified Value @25 °C (pH), Average Indicator Reading (pH, mV), Relative Slope (%), Uncertainty (± pH), Coverage Factor (k). Rows show data for pH values 4.008, 6.865, 10.008, 6.865.

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C
Model: SevenEasy TM S20 pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Manufacturer: Mettler Toledo

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: 25 °C ± 1 °C, Relative Humidity: 48 % ± 3 %

Condition of this results of Calibration:

- 1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Table with 6 columns: Instrument, Model, Serial No., Certificate No., Due Date, Through. Rows show data for HANDHELD THERMOMETER and Platinum Resistance Thermometer (PRT).

Support Equipment : - Low Temperature Bath (Micro Bath), Model: 7103, S/N: A39538,AN65 A85181.

- 3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated Item : Good
7. Result of Calibration : [X] Without adjustment [] After adjustment

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2301846-001-01
Equipment: Digital Thermometer with RTD
Resolution: 0.1 °C Model: SevenEasy TM S20 pH
Serial No.: 1231155210 ID No.: UAE.WAT.010/2553
Manufacturer: Mettler Toledo
Date of Calibration: 24 February 2023 Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:
- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : - S/N : -
Dimension of probe : Diameter 9 mm., Length 120 mm.,
Sheath material : Stainless Steel

| UUC* Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|-------------------|---------------------------|-----------------------|--------------------|
| 15.1 | 15.015 | - 0.1 | 0.11 |
| 25.0 | 25.014 | 0.0 | 0.11 |
| 35.1 | 35.016 | - 0.1 | 0.11 |

Note

- UUC* : Unit Under Calibration

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Certificate

Certificate No.: 2302181-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230525212
ID No.: UAE.WAS.003/2553
Order No.: 2302181
Operation No.: 2302181-001
Date of Receipt: 14 March 2023
Date of Calibration: 24 March 2023

Calibrated by Mr.Pheraphat Tuanjit **Approved by** [Signature]
Scientist (Mr.Nutaporn Niyomchart)
Specialist, Division of Calibration Laboratory
Date of Issue: 24 March 2023 **Responsible for the Technical Management Team**

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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1230525212 Type: Bench top
ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023 Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (52 ± 3) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

- Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
- Reference Standards / Certified Reference Material

| Instruments | Serial / ID No. | Manufacturer | Certificate No. | Due Date |
|---------------------------|-----------------|--------------|-----------------|-------------------|
| 2.1 DC Voltage Calibrator | 2709007 | Fluke | 22E1959 | 17 June 2023 |
| 2.2 Digital Thermometer | 2709007 | Fluke | CC-650557-01 | 30 October 2023 |
| 2.3 Thermo-Hygro Meter | NFLBTH003/17 | PONPE | TE 650555-01 | 21 September 2023 |

| Certified Reference Material | Lot No. | Manufacturer | Ref N | Expire Date |
|--|---------|--------------|----------|------------------|
| 2.4 pH buffer 4.008 (Primary pH buffer Solution) | 873608 | CPAchem | PH216.L5 | 16 February 2025 |
| 2.5 pH buffer 6.865 (Primary pH buffer Solution) | 873609 | CPAchem | PH217.L5 | 16 February 2025 |
| 2.6 pH buffer 10.01 (Primary pH buffer Solution) | 873611 | CPAchem | PH220.L5 | 16 February 2024 |
| 2.7 pH buffer 7.00 (Standard pH buffer Solution) | 873612 | CPAchem | PH107.L5 | 16 February 2024 |
- This certification is traceable to The International System of Unit (SI Unit)
 - Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
 - Instruments No.2.2 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
 - Instruments No.2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
 - Certified Reference Material No. 2.4 to 2.6 traceable to Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter.The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
 - Certified Reference Material No.2.7 traceable to BSM ReN Hi-13 LotN 25.05.2022; BSM ReN Hi-16 LotN 02.06.2022; BSM ReN Hi-13 LotN 25.05.2022; BSM ReN Hi-16 LotN 02.06.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO Model: SevenEasy pH
Serial No.: 1230525212 Type: Bench top
ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023 Page 3 of 5

Calibration Results:
1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

| Nominal pH | DC Voltage Standard (mV) | Average Indicator Reading | | Uncertainty (± mV) | Coverage Factor (k) |
|------------|----------------------------|---------------------------|-------|----------------------|-----------------------|
| | | mV | pH | | |
| 0 | 414.120 | 414 | 0.00 | 0.58 | 2.00 |
| 2 | 295.814 | 296 | 2.00 | 0.58 | 2.00 |
| 4 | 177.464 | 178 | 4.00 | 0.58 | 2.00 |
| 6 | 59.160 | 59 | 6.00 | 0.58 | 2.00 |
| 7 | 0.000 | 0 | 7.00 | 0.58 | 2.00 |
| 8 | -59.158 | -59 | 8.00 | 0.58 | 2.00 |
| 10 | -177.460 | -177 | 10.00 | 0.58 | 2.00 |
| 12 | -295.811 | -296 | 12.00 | 0.58 | 2.00 |
| 14 | -414.117 | -414 | 14.00 | 0.58 | 2.00 |

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode **Type:** Combined Electrode
Manufacturer: METTLER TOLEDO **Model:** InLab Solids
Serial No.: 1156883 **ID No.:** N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

| Certified Value (±25 °C (pH) | Average Indicator Reading | | Relative Slope (%) | Uncertainty (± pH) | Coverage Factor (k) |
|------------------------------|---------------------------|------|--------------------|----------------------|-----------------------|
| | pH | mV | | | |
| 4.008 | 4.01 | 187 | - | 0.0071 | 2.00 |
| 6.865 | 6.86 | 22 | 97.66 | 0.0075 | 2.00 |
| 10.010 | 10.01 | -160 | 97.66 | 0.0086 | 2.00 |
| 6.985 | 6.99 | 14 | - | 0.0083 | 2.00 |

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1230525212 ID No.: UAE.WAS.003/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 24 March 2023 **Page 4 of 5**

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 25 °C ± 1 °C
Relative Humidity 55 % ± 5 %

Condition of this results of Calibration:

1. Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|---------------------------------------|-------|------------|-----------------|-----------|-------------------------|
| HANDHELD THERMOMETER | 1521 | A85997 | TE 660039-01 | 10-Dec-23 | NATIONAL FOOD INSTITUTE |
| Platinum Resistance Thermometer (PRT) | 385 | 509201 | | | |

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2302181-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No.: 1230525212 ID No.: UAE.WAS.003/2553
Manufacturer: METTLER TOLEDO
Date of Calibration: 24 March 2023 **Page 5 of 5**

Calibration point: 15.0, 25.0 and 30.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : N/A S/N : N/A
- Dimension of probe : Diameter 3 mm., Length 120 mm., Sheath material : N/A

| UUC* Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|-------------------|---------------------------|-----------------------|--------------------|
| 15.2 | 14.999 | - 0.2 | 0.12 |
| 25.2 | 24.999 | - 0.2 | 0.12 |
| 30.2 | 29.999 | - 0.2 | 0.12 |

Note

- UUC* : Unit Under Calibration

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

20039 ซอยสุขุมวิท 35 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร **เอกสารไม่ควบคุม**
20039 Soi 35, Asoke Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel +66(0) 2462 8588 Fax +66(0) 2462 8545

20039 ซอยสุขุมวิท 35 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร **เอกสารไม่ควบคุม**
20039 Soi 35, Asoke Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel +66(0) 2462 8588 Fax +66(0) 2462 8545



Certificate of Calibration

Certificate No.: C24230059 Page: 2 of 2

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID.): 16300356
Manufacturer: SI Analytics
Electrode Serial No. 16070067
Condition: In Condition
Certificate No.: C24230059
Issued Date: 16 March 2023
Job No.: KSPR2304472
Page: 1 of 2
Model : LF413T **Brand :** SI Analytics

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr.Atachai Ngamchanat

Calibration Date: 16 March 2023

The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 838312, 838313, 838316

Calibration Results:

Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|-------------|-----------------------|-------------------|
| 25.000 µS/cm | 24.5 µS/cm | 0.500 µS/cm | 2.00 | 0.21 µS/cm |
| 1413.0 µS/cm | 1403 µS/cm | 10.0 µS/cm | 2.00 | 9.0 µS/cm |
| 111.3 mS/cm | 108.5 mS/cm | 2.80 mS/cm | 2.00 | 0.67 mS/cm |

After Adjustment ; at 1413 µS/cm

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|--------------------------------|--------------------------------|-------------|-----------------------|-------------------|
| 25.000 µS/cm | 24.8 µS/cm | 0.200 µS/cm | 2.00 | 0.21 µS/cm |
| 1413.0 µS/cm | 1413 µS/cm | 0.0 µS/cm | 2.00 | 9.0 µS/cm |
| 111.3 mS/cm | 108.8 mS/cm | 2.50 mS/cm | 2.00 | 0.67 mS/cm |

The End of Certificate

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded 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).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.
บริษัท ดิกซ์ เทคโนโลยี จำกัด (มหาชน)
DKSH Technology Limited
2533 สุขุมวิท 35 แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022

บริษัท ดิกซ์ เทคโนโลยี จำกัด (มหาชน)
DKSH Technology Limited
2533 สุขุมวิท 35 แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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เอกสารไม่ควบคุม

CAL-FM-C24-09: 12 Sep 2022

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม



เลขที่ใบงาน: KSPR2304472

| ชนิดเครื่องมือ: CONDUCTIVITY METER | | | | รุ่น: Lab 955 | | หมายเลขเครื่อง: 16300356 | | |
|-------------------------------------|--------------------------|--|--|---------------|--|-------------------------------------|--------------------------|----------|
| ตรวจสอบ (วัน) | | รายการตรวจเช็ค | | | | ตรวจสอบ (ตั้ง) | | หมายเหตุ |
| 16 Mar 2023 | | | | | | 16 Mar 2023 | | |
| ปกติ | ไม่ปกติ | | | | | ปกติ | ไม่ปกติ | |
| | | General | | | | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. ความสมบูรณ์เครื่อง | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสะอาด (ข้อได้ตัวอย่าง, ภายใน-นอกเครื่อง) | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. สวิทช์ ปิด - เปิด เครื่อง (On-Off Switch) | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. ปุ่มกด (Keypad) | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. หน้าจอ (Display, Screen Contrast) | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | | Spectrophotometer | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. ช่องวัดหลายตัวอย่าง (Carousel Module) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | pH Meter and Conductivity Meter | | | | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. อิเล็กโทรด (Electrode and Connection Cable) | | | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. ระดับสารละลายใน Electrode (Level KCl) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Turbidimeter | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นิรันดร์ 3.0) | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Automatic titrator | | | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 18. สภาพ Piston Burettes | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 19. Function Rinsing and Dosing | | | | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ | | | | <input type="checkbox"/> | <input type="checkbox"/> | |

ข้อแนะนำ: Electrode วัดอุณหภูมิได้ 25.1°C โดย Control Waterbath ที่ 25.0 \pm 0.1°C

Mr. Atachai Ngamchanat
Service Engineer

เอกสารไม่ควบคุม

CAL-FM-R31-03: 20 Jul 2022

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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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



Cert.No.: 23MM112
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai
Issue Date : 2 May 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.

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1
Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

| Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

| Range capacity : | 0 g to 81 g | Resolution | 0.00001 g |
|------------------|---------------|------------|-----------|
| | 81 g to 220 g | Resolution | 0.0001 g |

Before Adjustment :

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (\pm mg) | (k) |
| 80 | 80.00005 | -0.00005 | 0.15 | 2.00 |
| 200 | 199.9999 | +0.0001 | 0.29 | 2.00 |

After Adjustment :

1. Determination of the standard deviation of weighing machine

(n = 10)

| Applied Weight | Standard Deviation of Reading (g) |
|----------------|-------------------------------------|
| (g) | (g) |
| 80 | 0.000007 |
| 200 | 0.000006 |

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 | Maximum difference between off-center and central loading |
|------------|------------|------------|------------|------------|---|
| (g) | (g) | (g) | (g) | (g) | (g) |
| -0.0001 | -0.0001 | 0.0000 | -0.0001 | -0.0001 | 0.0001 |

3. Departure from nominal value

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (\pm mg) | (k) |
| Unload | 0.00000 | 0.00000 | 0.014 | 2.13 |
| 0.05 | 0.05001 | -0.00001 | 0.015 | 2.09 |
| 0.1 | 0.10001 | -0.00001 | 0.015 | 2.09 |
| 1 | 1.00001 | -0.00001 | 0.018 | 2.04 |
| 5 | 5.00003 | -0.00003 | 0.026 | 2.00 |
| 20 | 20.00006 | -0.00006 | 0.045 | 2.00 |
| 50 | 50.00006 | -0.00006 | 0.080 | 2.00 |
| 80 | 80.00004 | -0.00004 | 0.15 | 2.00 |
| 100 | 100.00000 | 0.00000 | 0.16 | 2.00 |
| 150 | 150.00000 | 0.00000 | 0.29 | 2.00 |
| 200 | 200.00000 | 0.00000 | 0.29 | 2.00 |

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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เอกสารไม่ควบคุม



Cert.No.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C210685394
ID No. : UAE.WAO.010/2565
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai
Issue Date : 2 May 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.

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2
Procedure used :-

Cert.No.: 23MM113
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

| Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053 | 70RC007 | MM-0010-22 | 20 Jan 2024 |

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

| Range capacity : | 0 g to 81 g | Resolution | 0.00001 g |
|------------------|---------------|------------|-----------|
| | 81 g to 220 g | Resolution | 0.0001 g |

Before Adjustment :

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| 80 | 79.99992 | +0.00008 | 0.15 | 2.00 |
| 200 | 199.9995 | +0.0005 | 0.29 | 2.00 |

After Adjustment :

1. **Determination of the standard deviation of weighing machine** (n = 10)

| Applied Weight | Standard Deviation of Reading (g) |
|----------------|-------------------------------------|
| (g) | |
| 80 | 0.000007 |
| 200 | 0.00004 |

เอกสาร



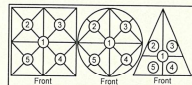
Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between off-center and central loading
(g)
0.0001

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 |
|------------|------------|------------|------------|------------|
| (g) | (g) | (g) | (g) | (g) |
| -0.0001 | -0.0001 | 0.0000 | -0.0001 | -0.0001 |

3. Departure from nominal value

| Applied Weight | Balance Reading | Correction | Measurement Uncertainty | Coverage Factor |
|----------------|-----------------|------------|-------------------------|-----------------|
| (g) | (g) | (g) | (± mg) | (k) |
| Unload | 0.00000 | 0.00000 | 0.014 | 2.11 |
| 0.05 | 0.04999 | +0.00001 | 0.015 | 2.09 |
| 0.1 | 0.09999 | +0.00001 | 0.015 | 2.07 |
| 1 | 1.00000 | 0.00000 | 0.018 | 2.04 |
| 5 | 5.00000 | 0.00000 | 0.026 | 2.00 |
| 20 | 20.00002 | -0.00002 | 0.045 | 2.00 |
| 50 | 50.00002 | -0.00002 | 0.080 | 2.00 |
| 80 | 80.00002 | -0.00002 | 0.15 | 2.00 |
| 100 | 100.00000 | 0.00000 | 0.17 | 2.00 |
| 150 | 150.00000 | 0.00000 | 0.29 | 2.00 |
| 200 | 199.99999 | +0.00001 | 0.29 | 2.00 |

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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เอกสาร



Cert. No.: 23TM373
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 11 - 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
(✓) Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2304-01560C-1
Cert. No.: 23TM373
Page : 2 of 3

Procedure Used :-
Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.
The temperature scale used was based on ITS-90.

Condition of this result of calibration
1. Reference standard instrument:-
Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34972A MY59003411 22LM165 26 Nov 2023

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

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

Environment during calibration
Temp. (°C) Beginning Finished
REL.Humid. (%) 45 44
AC Supply (Volt) 221 220

Ref. Std. ID No.: @ Calibration Point
Position : (120 to 180) °C (104) °C

Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

เอกสารไม่ควบคุม
a 1158261

Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2304-01560C-1
Cert. No.: 23TM373
Page : 3 of 3

Result of Calibration :- (*) Without Adjustment
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 |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 104.0 | 104.0 | 104.0 | 0.054 | 0.59 | 0.95 | 2 |
| 120.0 | 120.0 | 120.0 | 0.12 | 0.89 | 1.5 | 2 |
| 180.0 | 180.0 | 180.0 | 0.12 | 1.5 | 2.5 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|--------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|----------------------|
| | Position | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 104.0 | 104.512 | 104.016 | 104.542 | 104.407 | 103.704 | 103.729 | 104.167 | 104.158 | 104.001 | 0.42 |
| 120.0 | 120.317 | 119.768 | 120.524 | 120.232 | 119.363 | 119.209 | 119.888 | 119.797 | 119.735 | 1.1 |
| 180.0 | 180.878 | 179.819 | 181.357 | 180.871 | 179.303 | 179.139 | 180.230 | 180.055 | 179.960 | 1.1 |

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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เอกสารไม่ควบคุม
a 1158260

Calibration Certificate

Certificate No.: 2302827-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udumsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
ID No.: UAE.WAS.012/2564
Order No.: 2302827
Operation No.: 2302827-001
Date of Receipt: 10 May 2023
Date of Calibration: 10 May 2023

Calibrated by Mr.Manas Somsak
Specialist
Date of Issue: 18 May 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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Page 2 of 4

Date of Calibration: 10 May 2023
Environment Condition: Ambient Temperature: 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %
Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

| Reference Standard | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|--------------------------|-------------|------------|---------------|-----------------|--------------|
| Standard Weight Class E2 | 1mg to 200g | 8505557572 | TCS | M23040535 | 8 April 2024 |

| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|--------------------|--------|---------------|----------------|-----------------|------------------|
| Thermo-Hygro Meter | 608-H1 | NFLBTH 016/23 | Quality Reborn | QR23-0489 | 21 February 2024 |

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

Calibration Results:

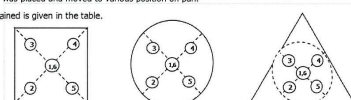
1. Repeatability of Reading:

| Nominal Value (g) | Standard Deviation of Reading (g) |
|---------------------|-------------------------------------|
| 100 | 0.000032 |
| 200 | 0.000032 |

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



| 1 (g) | 2 (g) | 3 (g) | 4 (g) | 5 (g) | 6 (g) | (Maximum Difference) (g) |
|----------|----------|----------|----------|----------|----------|----------------------------|
| 100.0002 | 100.0002 | 100.0002 | 100.0002 | 100.0003 | 100.0002 | 0.00001 |

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (± g) | Coverage Factor k |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|----------------------|
| Unload | 0.00000 | 0.0000 | 0.0000 | 0.000085 | 2.00 |
| 0.01 | 0.01000 | 0.0100 | 0.0000 | 0.000085 | 2.00 |
| 0.02 | 0.02001 | 0.0200 | 0.0000 | 0.000085 | 2.00 |
| 0.05 | 0.05000 | 0.0500 | 0.0000 | 0.000085 | 2.00 |
| 0.1 | 0.10001 | 0.1000 | 0.0000 | 0.000085 | 2.00 |
| 0.2 | 0.20001 | 0.2000 | 0.0000 | 0.000085 | 2.00 |
| 0.5 | 0.50002 | 0.5000 | 0.0000 | 0.000085 | 2.00 |
| 1 | 1.00000 | 1.0000 | 0.0000 | 0.000086 | 2.00 |
| 2 | 2.00002 | 2.0000 | 0.0000 | 0.000086 | 2.00 |
| 3 | 3.00003 | 3.0000 | 0.0000 | 0.000087 | 2.00 |
| 5 | 5.00002 | 5.0000 | 0.0000 | 0.000087 | 2.00 |
| 10 | 10.00001 | 10.0000 | 0.0000 | 0.000088 | 2.00 |
| 20 | 20.00003 | 20.0000 | 0.0000 | 0.000092 | 2.00 |
| 30 | 30.00004 | 30.0000 | 0.0000 | 0.000098 | 2.00 |
| 40 | 40.00007 | 40.0000 | 0.0000 | 0.00011 | 2.00 |
| 45 | 45.00009 | 45.0001 | 0.0000 | 0.00013 | 2.00 |

FC-S-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (± g) | Coverage Factor k |
|------------------------|-------------------------|--------------------------|---------------------|------------------------|----------------------|
| 50 | 50.00003 | 50.0000 | 0.0000 | 0.00011 | 2.00 |
| 55 | 55.00005 | 55.0000 | 0.0000 | 0.00012 | 2.00 |
| 60 | 60.00004 | 60.0000 | 0.0000 | 0.00012 | 2.00 |
| 65 | 65.00005 | 65.0000 | 0.0000 | 0.00013 | 2.00 |
| 70 | 70.00006 | 70.0001 | -0.0001 | 0.00013 | 2.00 |
| 75 | 75.00008 | 75.0002 | -0.0001 | 0.00013 | 2.00 |
| 80 | 80.00007 | 80.0002 | -0.0001 | 0.00014 | 2.00 |
| 85 | 85.00009 | 85.0002 | -0.0001 | 0.00014 | 2.00 |
| 90 | 90.00010 | 90.0002 | -0.0001 | 0.00015 | 2.00 |
| 100 | 100.00006 | 100.0002 | -0.0001 | 0.00016 | 2.00 |
| 120 | 120.00009 | 120.0002 | -0.0001 | 0.00018 | 2.00 |
| 150 | 150.00009 | 150.0002 | -0.0001 | 0.00021 | 2.00 |
| 200 | 200.00016 | 200.0003 | -0.0001 | 0.00028 | 2.00 |

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 %.

----- End -----

FC-S-012 Revision: 01 Date: 20-04-65

2008 บล๊อกบูธเลขที่ 35 ถนนสุขุมวิท แขวงคลองตัน เขตวัฒนา กรุงเทพมหานคร 107
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8545



2008 บล๊อกบูธเลขที่ 35 ถนนสุขุมวิท แขวงคลองตัน เขตวัฒนา กรุงเทพมหานคร 107
2008 Soi 35, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8545



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 23TM249
Page: 1 of 3

Certificate of Calibration

Equipment: BOD Incubator
Manufacturer: Arco
Model: UCA-1320
Serial No.: 13URC4S013201
ID No.: UAE.WAO.015/2561
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangcheik, Phrekanong,
Bangkok 10260
Location: Lab Floor 2
Received Order: 15 February 2023
Calibration Date: 15 February 2023
Ambient Temperature: (26 ± 1) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Preecha Hiahb
Approved by: [Signature]
() Ponthippa Tameyakul
(✓) Malee Bulkruea
() Suwit Imjai

Issue Date: 24 February 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.

เอกสารไม่ควบคุม

A 0051476



Equipment: BOD Incubator
Condition As-Received: Used Item
Reference: 2302-0297OC-1

Cert. No.: 23TM249
Page: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|----------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY57013711 | 22LM93 | 02 Jul 2023 |

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

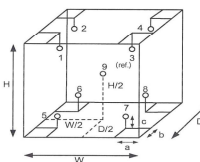
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: Not Available

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 29 | 31 |
| REL.Humid. (%) | 63 | 67 |
| AC Supply (Volt) | 220 | 220 |



Probe Installation Details:

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

Dimension of Chamber:

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 22-18RTD-2/1 |
| 2 | 18RTD-2/2 |
| 3 | 18RTD-2/3 |
| 4 | 18RTD-2/4 |
| 5 | 18RTD-2/5 |
| 6 | 18RTD-2/6 |
| 7 | 18RTD-2/7 |
| 8 | 18RTD-2/8 |
| 9 (ref.) | 18RTD-2/9 |

เอกสารไม่ควบคุม

1440547



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM249
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-------------------------|-----------------------------|
| 20.0 | 20.0 | 19.3 | 0.32 | 0.57 | 1.0 | 0.60 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | |
|-----------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|
| | Position | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 20.0 | 20.086 | 19.916 | 20.386 | 19.976 | 19.973 | 19.838 | 19.837 | 19.821 | 19.949 |

Average* : The average of 30 values in each position.
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration
Note : The reported uncertainty of measurement was included stability and excluded uniformity .
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

-o0o-

เอกสารไม่ควบคุม

a 1149512




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.: 23TM375
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UR-1320
Serial No. : -
ID No. : UAE.WAO.018/2551
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 April 2023
Calibration Date : 12 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by : 
() Ponthippa Tameyakul
(✓) Malee Bulkrusa
() Suwit Imjai
Issue Date : 24 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

เอกสารไม่ควบคุม

A 0053360



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2

Cert. No.: 23TM375
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

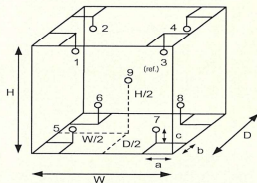
| Instrument | Model | Serial No. | Cert. No. | Due Date |
|---------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34972A | MY59003411 | 22LM165 | 26 Nov 2023 |

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

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

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 28 | 27 |
| REL.Humid. (%) | 42 | 45 |
| AC Supply (Volt) | 219 | 220 |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 20RTD-2/1 |
| 2 | 20RTD-2/2 |
| 3 | 20RTD-2/3 |
| 4 | 20RTD-2/4 |
| 5 | 20RTD-2/5 |
| 6 | 20RTD-2/6 |
| 7 | 20RTD-2/7 |
| 8 | 20RTD-2/8 |
| 9 (ref.) | 20RTD-2/9 |

เอกสารไม่ควบคุม

a 1158259



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0156OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM375
Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor <i>k</i> |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|--------------------------|
| 20.0 | 20.0 | 20.0 | 0.48 | 0.42 | 1.2 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|-----------------------------|
| | Position | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 20.0 | 20.040 | 20.170 | 20.263 | 20.093 | 19.749 | 19.704 | 19.920 | 20.191 | 20.020 | 0.66 |

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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เอกสารไม่ควบคุม

a 1158258

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 Serial No. : H0185001
Tube Heater : 25 Vial Capacity Accuracy : $\pm 2^{\circ}\text{C}$
Temperature Range : -10°C to 160°C Temperature of Reaction : 150°C
Ambient Temperature : $(25 \pm 2)^{\circ}\text{C}$ Relative Humidity : $(50 \pm 15)\%$ RH
Manufacturer : Hanna Instruments Made in : Romania
Condition As-Received : Used Product Reference : RE230392
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 8 March 2023
Calibrate date : 10 March 2023
Issue date : 20 March 2023
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Jakkapob Pentisan
☐ Mr. Channarong Soinak

Approved by :



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Condition of this calibration result

Reference Standard Instruments:

| Instruments | Model | Serial No. | Certificate No. | Traceable |
|---------------------------------|--------|------------|-----------------|-----------------------|
| Data Acquisition Switch Unit | 34970A | MY44065265 | WK2207-065-1 | WK Electric Co., Ltd. |

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

| Capacity (Vial) | Nominal Value ($^{\circ}\text{C}$) | Average Value ($^{\circ}\text{C}$) | \pm Uncertainty ($^{\circ}\text{C}$) | \pm Tolerance of UUC ($^{\circ}\text{C}$) | Acceptance Criteria |
|--------------------|---|---|---|--|------------------------|
| 25 Vial | 150.0 | 150.3 | 0.59 | 2 | Pass |

Figure: Shows the location of the temperature source.

| | | | | |
|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| (1A) | (2A) | (3A) | (4A) | (5A) |
| 149.78 $^{\circ}\text{C}$ | 150.31 $^{\circ}\text{C}$ | 150.63 $^{\circ}\text{C}$ | 149.93 $^{\circ}\text{C}$ | 150.31 $^{\circ}\text{C}$ |
| (1B) | (2B) | (3B) | (4B) | (5B) |
| 150.35 $^{\circ}\text{C}$ | 150.18 $^{\circ}\text{C}$ | 149.93 $^{\circ}\text{C}$ | 150.18 $^{\circ}\text{C}$ | 150.21 $^{\circ}\text{C}$ |
| (1C) | (2C) | (3C) | (4C) | (5C) |
| 150.24 $^{\circ}\text{C}$ | 151.10 $^{\circ}\text{C}$ | 150.80 $^{\circ}\text{C}$ | 150.36 $^{\circ}\text{C}$ | 150.86 $^{\circ}\text{C}$ |
| (1D) | (2D) | (3D) | (4D) | (5D) |
| 150.16 $^{\circ}\text{C}$ | 149.77 $^{\circ}\text{C}$ | 150.22 $^{\circ}\text{C}$ | 150.67 $^{\circ}\text{C}$ | 150.43 $^{\circ}\text{C}$ |
| (1E) | (2E) | (3E) | (4E) | (5E) |
| 149.94 $^{\circ}\text{C}$ | 150.44 $^{\circ}\text{C}$ | 150.06 $^{\circ}\text{C}$ | 150.63 $^{\circ}\text{C}$ | 149.29 $^{\circ}\text{C}$ |

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not
More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **

เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 Serial No. : 1147807
Tube Heater : 25 Vial Capacity Accuracy : $\pm 2^{\circ}\text{C}$
Temperature Range : -10°C to 160°C Temperature of Reaction : 150°C
Ambient Temperature : $(25 \pm 2)^{\circ}\text{C}$ Relative Humidity : $(50 \pm 15)\%$ RH
Manufacturer : Hanna Instruments Made in : Romania
Condition As-Received : Used Product Reference : RE230642
Customer name : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 21 April 2023
Calibrate date : 28 April 2023
Issue date : 2 May 2023
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference material

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Jakkapob Pentisan
☐ Mr. Channarong Soinak

Approved by :



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand).

เอกสารไม่ควบคุม

Condition of this calibration result

Reference Standard Instruments:

| Instruments | Model | Serial No. | Certificate No. | Traceable |
|---------------------------------|--------|------------|-----------------|-----------------------|
| Data Acquisition Switch Unit | 34970A | MY44065265 | WK2207-065-1 | WK Electric Co., Ltd. |

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor

| Capacity (Vial) | Nominal Value ($^{\circ}\text{C}$) | Average Value ($^{\circ}\text{C}$) | \pm Uncertainty ($^{\circ}\text{C}$) | \pm Tolerance of UUC ($^{\circ}\text{C}$) | Acceptance Criteria |
|--------------------|---|---|---|--|------------------------|
| 25 Vial | 150.0 | 150.1 | 0.60 | 2 | Pass |

Figure: Shows the location of the temperature source.

| | | | | |
|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| (1A) | (2A) | (3A) | (4A) | (5A) |
| 149.32 $^{\circ}\text{C}$ | 150.07 $^{\circ}\text{C}$ | 150.50 $^{\circ}\text{C}$ | 149.79 $^{\circ}\text{C}$ | 150.07 $^{\circ}\text{C}$ |
| (1B) | (2B) | (3B) | (4B) | (5B) |
| 149.68 $^{\circ}\text{C}$ | 149.85 $^{\circ}\text{C}$ | 150.84 $^{\circ}\text{C}$ | 150.52 $^{\circ}\text{C}$ | 149.69 $^{\circ}\text{C}$ |
| (1C) | (2C) | (3C) | (4C) | (5C) |
| 149.99 $^{\circ}\text{C}$ | 150.71 $^{\circ}\text{C}$ | 151.35 $^{\circ}\text{C}$ | 151.05 $^{\circ}\text{C}$ | 150.46 $^{\circ}\text{C}$ |
| (1D) | (2D) | (3D) | (4D) | (5D) |
| 150.00 $^{\circ}\text{C}$ | 150.50 $^{\circ}\text{C}$ | 150.08 $^{\circ}\text{C}$ | 149.90 $^{\circ}\text{C}$ | 149.85 $^{\circ}\text{C}$ |
| (1E) | (2E) | (3E) | (4E) | (5E) |
| 149.44 $^{\circ}\text{C}$ | 150.06 $^{\circ}\text{C}$ | 150.56 $^{\circ}\text{C}$ | 150.11 $^{\circ}\text{C}$ | 149.51 $^{\circ}\text{C}$ |

Remark: The Acceptance criteria is the error value plus or minus the Measurement Uncertainty, and then Not
More than the Tolerance value of UUC, therefore concluded that pass.

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

** End of certificate **


เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP23-021Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 20 May 2023

Calibration Date : 20 May 2023

Issue Date : 23 May 2023

Condition Instrument : Good

Calibrated by : Approved by :

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

FM-708-02 R01 1/11/2021


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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP23-021Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 95935 | 22 October 2023 |
| Absorbance Standard set | 25757 | 95929 | 22 October 2023 |
| Wavelength Standard set | 25806 | 95916 | 22 October 2023 |
| Wavelength Standard set | 25758 | 95915 | 22 October 2023 |

Traceability This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.
Wavelength 0.1 nm.

FM-708-02 R01 1/11/2021


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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP23-021Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 420 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5787 | 0.5742 | 0.0045 | 0.0031 | 2.00 |
| | 1.0490 | 1.0423 | 0.0067 | 0.0029 | 2.00 |
| | 2.1900 | 2.1847 | 0.0053 | 0.0075 | 2.00 |
| 440 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5607 | 0.5577 | 0.0030 | 0.0034 | 2.00 |
| | 1.0247 | 1.0234 | 0.0013 | 0.0035 | 2.00 |
| 465 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5236 | 0.5184 | 0.0052 | 0.0029 | 2.00 |
| | 0.9634 | 0.9607 | 0.0027 | 0.0029 | 2.00 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5191 | 0.5159 | 0.0032 | 0.0031 | 2.00 |
| | 1.0003 | 0.9980 | 0.0023 | 0.0033 | 2.00 |
| | 1.9987 | 1.9917 | 0.0070 | 0.0087 | 2.00 |
| 590 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5523 | 0.5501 | 0.0022 | 0.0030 | 2.00 |
| | 1.0809 | 1.0808 | 0.0001 | 0.0030 | 2.00 |
| 635 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5601 | 0.5585 | 0.0016 | 0.0031 | 2.00 |
| 635 | 1.0512 | 1.0485 | 0.0027 | 0.0030 | 2.00 |
| | 1.9294 | 1.9317 | -0.0023 | 0.0083 | 2.00 |

FM-708-02 R01 1/11/2021


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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP23-021Page 4 of 5

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7478 | 0.7436 | 0.0042 | 0.0058 | 2.00 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8686 | 0.8648 | 0.0038 | 0.0064 | 2.00 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2912 | 0.2908 | 0.0004 | 0.0052 | 2.00 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6448 | 0.6398 | 0.0050 | 0.0058 | 2.00 |

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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 15189:2013

LABORATORY 0454

REPORT OF CALIBRATION

Certificate No. : SP23-021

Page 5 of 5

Wavelength Accuracy :

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor k |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| 241.72 | 242.0 | -0.28 | 0.18 | 2.00 |
| 279.45 | 279.5 | -0.05 | 0.18 | 2.00 |
| 287.81 | 287.5 | 0.31 | 0.18 | 2.00 |
| 334.06 | 333.5 | 0.56 | 0.18 | 2.00 |
| 360.93 | 360.3 | 0.63 | 0.18 | 2.00 |
| 418.59 | 418.0 | 0.59 | 0.18 | 2.00 |
| 445.94 | 445.3 | 0.64 | 0.18 | 2.00 |
| 453.66 | 453.0 | 0.66 | 0.18 | 2.00 |
| 460.02 | 459.6 | 0.42 | 0.18 | 2.00 |
| 536.59 | 536.4 | 0.19 | 0.18 | 2.00 |
| 637.98 | 638.3 | -0.32 | 0.18 | 2.00 |
| 431.38 | 431.0 | 0.38 | 0.18 | 2.00 |
| 472.50 | 472.5 | 0.00 | 0.18 | 2.00 |
| 513.47 | 513.5 | -0.03 | 0.18 | 2.00 |
| 528.88 | 529.0 | -0.12 | 0.18 | 2.00 |
| 573.17 | 573.0 | 0.17 | 0.18 | 2.00 |
| 585.35 | 585.0 | 0.35 | 0.20 | 2.00 |
| 684.40 | 684.5 | -0.10 | 0.18 | 2.00 |
| 740.72 | 741.0 | -0.28 | 0.20 | 2.00 |
| 748.55 | 748.5 | 0.05 | 0.18 | 2.00 |
| 807.03 | 807.0 | 0.03 | 0.18 | 2.00 |
| 879.28 | 879.5 | -0.22 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021


เอกสารไม่ควบคุม

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 15189:2013

LABORATORY 0454

CERTIFICATE OF CALIBRATION

Certificate No. : SP23-007

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064


ID No. : UAE.WAS.006/2552

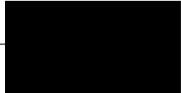
Received Date : 6 January 2023

Calibration Date : 6 January 2023

Issue Date : 10 January 2023

Condition Instrument : Used

Calibrated by : 

Approved by : 

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



ISO 15189:2013

LABORATORY 0454

REPORT OF CALIBRATION

Certificate No. : SP23-007

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 95935 | 22 October 2023 |
| Absorbance Standard set | 25757 | 95929 | 22 October 2023 |
| Wavelength Standard set | 25806 | 95916 | 22 October 2023 |
| Wavelength Standard set | 25758 | 95915 | 22 October 2023 |

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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ISO 15189:2013

LABORATORY 0454

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Calibration Results : Without adjustment

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 420 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5787 | 0.575 | 0.0037 | 0.0031 | 2.00 |
| | 1.0490 | 1.044 | 0.0050 | 0.0029 | 2.00 |
| | 2.1900 | 2.181 | 0.0090 | 0.0080 | 2.00 |
| 440 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5607 | 0.558 | 0.0027 | 0.0034 | 2.00 |
| | 1.0247 | 1.021 | 0.0037 | 0.0035 | 2.00 |
| | 2.1229 | 2.115 | 0.0079 | 0.0081 | 2.00 |
| 465 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5236 | 0.520 | 0.0036 | 0.0030 | 2.00 |
| | 0.9634 | 0.961 | 0.0024 | 0.0029 | 2.00 |
| | 1.9763 | 1.968 | 0.0083 | 0.0070 | 2.00 |
| 546.1 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5191 | 0.518 | 0.0011 | 0.0031 | 2.00 |
| | 1.0003 | 1.000 | 0.0003 | 0.0033 | 2.00 |
| | 1.9987 | 1.993 | 0.0057 | 0.0084 | 2.00 |
| 590 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5523 | 0.552 | 0.0003 | 0.0030 | 2.00 |
| | 1.0809 | 1.082 | -0.0011 | 0.0030 | 2.00 |
| | 2.0391 | 2.031 | 0.0081 | 0.0080 | 2.00 |
| 635 | 0.0000 | 0.000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5601 | 0.562 | -0.0019 | 0.0032 | 2.00 |
| | 1.0512 | 1.052 | -0.0008 | 0.0030 | 2.00 |
| | 1.9294 | 1.923 | 0.0064 | 0.0079 | 2.00 |

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ISO 9001:2015

ISO 17025

ISO 17025

ISO 9001:2015

ISO 17025

ISO 17025

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor <i>k</i> |
|---------------------|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 235 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7478 | 0.743 | 0.0048 | 0.0057 | 2.00 |
| 257 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8686 | 0.861 | 0.0076 | 0.0059 | 2.00 |
| 313 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2912 | 0.291 | 0.0002 | 0.0051 | 2.00 |
| 350 | 0.0000 | 0.000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6448 | 0.639 | 0.0058 | 0.0055 | 2.00 |

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32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com

ISO 9001:2015

ISO 17025

ISO 17025

ISO 9001:2015

ISO 17025

ISO 17025

REPORT OF CALIBRATION

Certificate No. : SP23-007

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Wavelength Accuracy :

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor <i>k</i> |
|----------------------|----------------------|---------------------|----------------------|-----------------------------|
| 241.54 | 240.8 | 0.74 | 0.18 | 2.00 |
| 279.40 | 278.5 | 0.90 | 0.18 | 2.00 |
| 288.70 | 288.0 | 0.70 | 0.18 | 2.00 |
| 334.22 | 333.5 | 0.72 | 0.18 | 2.00 |
| 361.26 | 360.5 | 0.76 | 0.18 | 2.00 |
| 418.48 | 417.8 | 0.68 | 0.21 | 2.00 |
| 446.70 | 445.9 | 0.80 | 0.18 | 2.00 |
| 453.20 | 452.5 | 0.70 | 0.18 | 2.00 |
| 460.06 | 459.5 | 0.56 | 0.18 | 2.00 |
| 536.90 | 536.0 | 0.90 | 0.18 | 2.00 |
| 637.94 | 637.1 | 0.84 | 0.18 | 2.00 |
| 440.74 | 440.0 | 0.74 | 0.18 | 2.00 |
| 472.22 | 471.5 | 0.72 | 0.18 | 2.00 |
| 513.70 | 513.0 | 0.70 | 0.18 | 2.00 |
| 528.72 | 528.0 | 0.72 | 0.18 | 2.00 |
| 574.60 | 574.0 | 0.60 | 0.18 | 2.00 |
| 585.48 | 584.6 | 0.88 | 0.20 | 2.00 |
| 684.63 | 684.0 | 0.63 | 0.18 | 2.00 |
| 740.27 | 740.0 | 0.27 | 0.20 | 2.00 |
| 748.28 | 747.5 | 0.78 | 0.18 | 2.00 |
| 807.16 | 806.5 | 0.66 | 0.18 | 2.00 |
| 879.70 | 879.0 | 0.70 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor *k* ,
which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|-------|----------------------|--------------|--------------|-------------------------|--|-------------------|---------------------|-------------------------|--------|
| Water | | | | | | | | | |
| 1 | pH Meter | pH | Horiba | LAQUA-PH210 HA0D0081 | Technology Promotion Association (Thailand-Japan) | 23CH6 | 5 Jan 23 | 4 Jan 24 | - |
| 2 | DO Meter | DO | Horiba | LAQUA-DO210 HE0G0017 | Technology Promotion Association (Thailand-Japan) | 23TW9 | 16 Jan 23 | 15 Jan 24 | - |
| 3 | Conductivity Meter | Conductivity | Horiba | LAQUA-EC210 HC0J0016 | Technology Promotion Association (Thailand-Japan) | 23CH7 | 5 Jan 23 | 4 Jan 24 | - |



Cert.No.: 23CH6
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0D0081
ID No. : UAE.EFM.074/2564(EFM.pH.07/64)
Condition As-Received: Used Item
Received Date : 04 January 2023
Calibration Date : 05 January 2023
Reference : 2301-0060WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Saitip Meangmai

Approved by :

(/) Malee Butkruea
() Saitip Meangmai
() Warakorn Lemgagrakul

Issue Date : 10 January 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.

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Cert.No.: 23CH6
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

| Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 54030049 | 130RC116 | 22E2769 | 24 Aug 2023 |
| 2) Ref. Standard Thermometer | 4982054 | 110RC044 | 2211306 | 27 Oct 2023 |

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

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

| Buffer Solution | Manufacturer | Lot No. | Exp. date |
|-----------------|--------------|---------|--------------|
| pH 4.008 | CPA chem | 826588 | 09 July 2024 |
| pH 6.987 | CPA chem | 823322 | 20 June 2023 |
| pH 10.008 | CPA chem | 826590 | 09 July 2023 |

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

Calibration Results

Function : mV Measurement

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

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor k |
|----------------------------|---------------|------------------------|----------------|-------|---------------------------------------|----------------------|
| | | | mV | pH | | |
| pH Meter S/N.: HA0D0081 | 4.00 | 177.48 | 177.4 | 4.01 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.1 | 6.98 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.1 | 6.98 | 0.058 | 2.00 |
| | 10.00 | -177.48 | -177.4 | 10.01 | 0.058 | 2.00 |

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Cert.No.: 23CH6
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(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 S/N.: 990C0039 | 4.008 | 4.01 | 138.5 | 0.0085 | 2.05 |
| | 6.987 | 6.98 | -32.1 | 0.011 | 2.00 |
| | 6.987 | 7.00 | -33.1 | 0.011 | 2.00 |
| | 10.008 | 10.03 | -205.2 | 0.0096 | 2.00 |

Function : Temperature Measurement

(°) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 990C0039
Dimension of probe;
- Length : 102 mm.
- Diameter : 15.5 mm.
- Immersion Depth : 85 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor k |
|--------------------------|-----------------------------|---------------------|--------------|-------------------------------------|-------------------|
| 25.0 | 25.004 | 25.0 | -0.004 | 0.13 | 2.00 |
| 30.0 | 30.001 | 30.0 | -0.001 | 0.13 | 2.00 |
| 35.0 | 35.003 | 35.0 | -0.003 | 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 %.

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Cert.No.: 23TW9
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE0G0017
ID No. : UAE.EFM.082/2564(EFM.DO.01/64)
Received Date : 13 January 2023
Test Date : 16 January 2023
Reference : 2301-0434WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
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 :

(/) Malee Butkruea
() Saitip Meangmai
() Warakorn Lemgagrakul

Issue Date : 18 January 2023

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Cert.No.: 23TW9
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).

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

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 9K0E0163

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|---|-------------------------------|------------------------------|
| 8.14 | 8.15 | 0.012 |

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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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.: 23LM9
Page.: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE0G0017
ID No. : UAE.EFM.082/2564(EFM.DO.01/64)
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA Onsite Calibration Laboratory
Received Order : 13 January 2023
Calibrated Date : 17 January 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Malee Butkruea
Approved by :
() Ponthippa Tameyakul
(✓) Suwit Imjai
Issue Date : 19 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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A 0050104



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2301-0434WSC-2

Cert. No.: 23LM9
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|------------------------|-------|------------|-----------|-------------|
| 1) Digital Thermometer | 1523 | 2188080 | 2211285 | 21 Oct 2023 |

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 9K0E0163

| Calibration Point (°C) | Immersion Depth (mm) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty (± °C) | Coverage Factor k |
|-----------------------------|---------------------------|--------------------------------|------------------------|-----------------|-------------------------|----------------------|
| 25.0 | 100 | 25.004 | 25.0 | -0.004 | 0.16 | 2.00 |
| 30.0 | 100 | 29.996 | 30.0 | 0.004 | 0.16 | 2.00 |
| 35.0 | 100 | 34.995 | 35.0 | 0.005 | 0.16 | 2.00 |

UUC* : Unit Under Calibration

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

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



Cert.No.: 23CH7
Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : LAQUA-EC210
Serial No. : HC0J0016
ID No. : UAE.EFM.076/2564(EFM.SCT.02/64)
Condition As-Received: Used Item
Received Date : 04 January 2023
Calibration Date : 05 January 2023
Reference : 2301-0059WSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer
Calibrated by : Walalak Sirithean
Approved by :
(✓) Malee Butkruea
() Saitip Meangmai
() Warakorn Lemgagtrakul
Issue Date : 10 January 2023

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 23CH7

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

| Instrument | Serial No. | ID No. | Certificate No. | Due date |
|--------------------------|------------|----------|-----------------|-------------|
| 1) Thermometer | 9549224 | 130RC003 | 221484 | 17 Apr 2023 |
| 2) Ref. Std. Thermometer | 4982054 | 110RC044 | 2211306 | 27 Oct 2023 |

This certification is traceable to the International System of Unit maintained at:-

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| Conductivity Solution | Manufacturer | Lot No. | Exp. date |
|-----------------------|--------------|---------|--------------|
| 1413.0 μ S/cm | CPA Chem | 823328 | 20 June 2023 |
| 12.880 mS/cm | CPA Chem | 823329 | 20 June 2023 |

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}$ C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 μ S/cm

Conductivity Electrode Serial No.: 9B0K0160

| Standard Conductivity Solution | Before Adjustment UUC* Reading | After Adjustment UUC* Reading | Uncertainty of Measurement (\pm) | Coverage factor k |
|--------------------------------|--------------------------------|-------------------------------|--------------------------------------|-------------------|
| 1413.0 μ S/cm | 1375 μ S/cm | 1413 μ S/cm | 9.2 μ S/cm | 2.00 |
| 12.880 mS/cm | 12.43 mS/cm | 12.70 mS/cm | 0.086 mS/cm | 2.00 |

Remark - UUC* = Unit Under Calibration

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Cert.No.: 23CH7

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

| | |
|----------------|----------|
| - Model : | 9383 |
| - Serial No. : | 9B0K0160 |

Dimension of probe;

| | |
|---------------------|---------|
| - Length : | 104 mm. |
| - Diameter : | 16 mm. |
| - Immersion Depth : | 90 mm. |

| Calibration Point ($^{\circ}$ C) | Standard Temperature ($^{\circ}$ C) | UUC* Reading ($^{\circ}$ C) | Error ($^{\circ}$ C) | Uncertainty of Measurement (\pm $^{\circ}$ C) | Coverage factor k |
|-----------------------------------|--------------------------------------|------------------------------|-----------------------|--|-------------------|
| 25.0 | 25.000 | 25.0 | 0.000 | 0.13 | 2.00 |
| 30.0 | 29.999 | 30.1 | 0.101 | 0.13 | 2.00 |
| 35.0 | 34.999 | 35.1 | 0.101 | 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 %.

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