

ภาคผนวก 7

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์

รายการใบรับรองสอบเทียบ ทวนสอบเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

รายการใบรับรองสอบเทียบ ทวนสอบเครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* | Remark |
|--|---|--|-----------------|----------------------------------|--|-------------------|---------------------|--------------------------|--------|
| Laboratory Instrument/Equipmen for Water Quality Analysis. | | | | | | | | | |
| 1 | pH Meter | pH | Mettler-Toledo | Seven Easy S20 / 1230525212 | National Food Institute, Ministry of Industry, Thailand | 2202093-001-01 | 16 Mar 22 | 15 Mar 23 | - |
| 2 | pH Meter | | Mettler-Toledo | SevenCompact S220/ C113432421 | National Food Institute, Ministry of Industry, Thailand | 2203527-001-01 | 5 Jul 22 | 4 Jul 23 | - |
| 3 | Analytical Balance (Readability 0.01 mg) | SUSPENDED SOLIDS TOTAL DISSOLVED SOLIDS | Mettler-Toledo | XSR205DU / C009071872 | Technology Promotion Association (Thailand-Japan) | 22MM210 | 26 Apr 22 | 25 Apr 23 | - |
| 4 | Hot Air Oven | | Memmert | UF55 / B216.1666 | Technology Promotion Association (Thailand-Japan) | 22TM1490 | 19 Oct 22 | 18 Oct 23 | - |
| 5 | Analytical Balance (Readability 0.1 mg) | FAT, OIL & GREASE | Mettler-Toledo | XSR204 / C117635043 | National Food Institute, Ministry of Industry, Thailand | 2202934-001-01 | 13 May 22 | 12 May 23 | - |
| 6 | BOD Incubator | BIOCHEMICAL OXYGEN DEMAND | Arco | UC4-1320 / (UAE.WAO.015/2561) | Technology Promotion Association (Thailand-Japan) | 22TM90 | 17 Feb 22 | 16 Feb 23 | - |
| 7 | BOD Incubator | | Arco | UR-1320 / (UAE.WAO.018/2551) | Technology Promotion Association (Thailand-Japan) | 22TM305 | 7 Apr 22 | 6 Apr 23 | - |
| 8 | Digestor Unit | TOTAL KJELDAHL NITROGEN | FOSS TECATOR | 2520auto / 91794469 | National Food Institute, Ministry of Industry, Thailand | 2202361-001-01 | 4 Apr 22 | 3 Apr 23 | - |
| 9 | Distillation Unit (Kjeldahl Method) | | FOSS TECATOR | KT8100/ 91889052 | FOSS South East Asia | 6623 | 25 Jul 22 | 24 Jul 23 | - |

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

Calibration Certificate

Certificate No.: 2202093-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, 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.: 2202093
Operation No.: 2202093-001
Date of Receipt: 11 March 2022
Date of Calibration: 16 March 2022

Calibrated by Mr.Manas Somsak
Specialist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 21 March 2022

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.

Calibration Report

Certificate No.: 2202093-001-01

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: 16 March 2022

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: **Ambient Temperature:** (23.0 ± 1.5) °C **Relative Humidity:** (49.5 ± 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

| <u>Instruments</u> | <u>Serial / ID No.</u> | <u>Manufacturer</u> | <u>Certificate No.</u> | <u>Due Date</u> |
|---------------------------|------------------------|---------------------|------------------------|------------------|
| 2.1 DC Voltage Calibrator | 2709007 | Fluke | SCL-21F-0687 | 24 June 2022 |
| 2.2 Digital Thermometer | 2709007 | Fluke | CC-640599-01 | 30 October 2022 |
| 2.3 Thermo-Hygro Meter | สคณ.ฟป. BTH 005/58 | PONPE | QR21-2787 | 15 November 2022 |

| <u>Certified Reference Material</u> | <u>Lot. No.</u> | <u>Manufacturer</u> | <u>Ref N</u> | <u>Expire Date</u> |
|--|-----------------|---------------------|--------------|--------------------|
| 2.4 pH buffer 4.008 (Primary pH buffer Solution) | 780012 | CPAchem | PH216.L5 | 21 November 2023 |
| 2.5 pH buffer 6.865 (Primary pH buffer Solution) | 780013 | CPAchem | PH217.L5 | 21 November 2023 |
| 2.6 pH buffer 10.01 (Primary pH buffer Solution) | 780015 | CPAchem | PH220.L5 | 21 November 2022 |
| 2.7 pH buffer 7.00 (Standard pH buffer Solution) | 776840 | CPAchem | PH107.L5 | 8 November 2022 |

3. This certification is traceable to The International System of Unit (SI Unit)

| | | |
|---|--------------|--|
| 3.1 Instruments No.2.1 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075 |
| 3.2 Instruments No.2.2 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061 |
| 3.3 Instruments No.2.3 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292 |
| 3.4 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 |
| 3.5 Certified Reference Material No. 2.7 | traceable to | BIM RefN HI-7 LotN 30.04.2020; BIM RefN HI-9 LotN 28.05.2020; BIM RefN HI-8 LotN 30.04.2020; BIM RefN HI-10 LotN 28.05.2020. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025 |

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 Report

Certificate No.: 2202093-001-01

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: 16 March 2022

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 | 414.117 | 414 | 0.00 | 0.58 | 2.00 |
| 2 | 295.811 | 296 | 2.00 | 0.58 | 2.00 |
| 4 | 177.462 | 178 | 4.00 | 0.58 | 2.00 |
| 6 | 59.159 | 59 | 6.00 | 0.58 | 2.00 |
| 7 | -0.001 | 0 | 7.00 | 0.58 | 2.00 |
| 8 | -59.159 | -59 | 8.00 | 0.58 | 2.00 |
| 10 | -177.463 | -177 | 10.00 | 0.58 | 2.00 |
| 12 | -295.812 | -296 | 12.00 | 0.58 | 2.00 |
| 14 | -414.119 | -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.: 9453943

ID.No.: N/A

Performance of Electrode system

(Three-Point Calibration at pH4, pH7 and pH10)

| Certified Value @25 °C (pH) | Average Indicator Reading | | Relative Slope (%) | Uncertainty (± pH) | Coverage Factor (k) |
|-----------------------------|---------------------------|------|--------------------|----------------------|-----------------------|
| | pH | mV | | | |
| 4.008 | 4.01 | 172 | 98.1 | 0.0071 | 2.00 |
| 6.866 | 6.87 | 6 | - | 0.0074 | 2.00 |
| 10.015 | 10.01 | -175 | 97.4 | 0.0090 | 2.00 |
| 6.983 | 6.98 | -3 | - | 0.0092 | 2.00 |

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2202093-001-01

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: 16 March 2022

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Location: Chemical Calibration Laboratory, National Food Institute.

Environment Condition: Ambient Temperature (23.0 ± 1.0) °C

Relative Humidity (50 ± 4) %

Condition of this results of Calibration:

- 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 | 1523 | 2118154 | PSL-T 0851/64 | 24-Jun-22 | TISTR |
| Platinum Resistance Thermometer (PRT) | 5627A | 877332 | | | |

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

- This certificate is traceable to International System of Units (SI Units).
- 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.

6. Condition of Calibrated item : Good

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

Calibration Report

Certificate No.: 2202093-001-01

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: 16 March 2022

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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 : N/A S/N : N/A

Dimension of probe : Diameter 3.5 mm., Length 135 mm.,

Sheath material : Stainless Steel

| UUC* Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|-------------------|---------------------------|-----------------------|--------------------|
| 15.2 | 15.001 | -0.2 | 0.099 |
| 25.2 | 25.002 | -0.2 | 0.099 |
| 35.2 | 35.002 | -0.2 | 0.099 |

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 -----


Calibration Certificate

Certificate No.: 2203527-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Order No.: 2203527
Operation No.: 2203527-001
Date of Receipt: 30 June 2022
Date of Calibration: 5 July 2022

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 5 July 2022

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.: 2203527-001-01

Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Date of Calibration: 5 July 2022

Page 2 of 5

Location: Calibration Laboratory, National Food Institute

Environment Condition: **Ambient Temperature:** (23.5 ± 1.5) °C **Relative Humidity:** (53 ± 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

| 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-640599-01 | 30 October 2022 |
| 2.3 Thermo-Hygro Meter | NFI.BTH005/18 | PONPE | QR22-0351 | 18 February 2023 |
| Certified Reference Material | Lot. No. | Manufacturer | Ref N | Expire Date |
| 2.4 pH buffer 4.008 (Primary pH buffer Solution) | 805203 | CPAchem | PH216.L5 | 21 April 2024 |
| 2.5 pH buffer 6.865 (Primary pH buffer Solution) | 805204 | CPAchem | PH217.L5 | 21 April 2024 |
| 2.6 pH buffer 10.01 (Primary pH buffer Solution) | 805205 | CPAchem | PH220.L5 | 21 April 2023 |
| 2.7 pH buffer 7.00 (Standard pH buffer Solution) | 805206 | CPAchem | PH107.L5 | 21 April 2023 |

3. This certification is traceable to The International System of Unit (SI Unit)

| | | |
|---|--------------|---|
| 3.1 Instruments No.2.1 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0075 |
| 3.2 Instruments No.2.2 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061 |
| 3.3 Instruments No.2.3 | through | NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0292 |
| 3.4 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 |
| 3.5 Certified Reference Material No.2.7 | traceable to | BIM RefN HI-27 LotN 04.06.2021; BIM RefN HI-28 LotN 28.05.2021; BIM RefN HI-27 LotN 04.06.2021; BIM RefN HI-28 LotN 28.05.2021, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025 |

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 Report

Certificate No.: 2203527-001-01

Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: Seven Compact S220
Serial No.: C113432421
Type: Bench top
ID No.: UAE.WAT.009/2564

Date of Calibration: 5 July 2022

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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 | 414.117 | 414 | 0.00 | 0.58 | 2.00 |
| 2 | 295.811 | 296 | 2.00 | 0.58 | 2.00 |
| 4 | 177.462 | 177 | 4.00 | 0.58 | 2.00 |
| 6 | 59.159 | 59 | 6.00 | 0.58 | 2.00 |
| 7 | -0.001 | 0 | 7.00 | 0.58 | 2.00 |
| 8 | -59.159 | -59 | 8.00 | 0.58 | 2.00 |
| 10 | -177.463 | -177 | 10.00 | 0.58 | 2.00 |
| 12 | -295.812 | -296 | 12.00 | 0.58 | 2.00 |
| 14 | -414.119 | -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 Expert Pro-ISM
Serial No.: 2210418
ID.No. N/A

Performance of Electrode system (Three-Point Calibration at pH4, pH7 and pH10)

| Certified Value @25 °C (pH) | Average Indicator Reading | | Relative Slope (%) | Uncertainty (± pH) | Coverage Factor (k) |
|-----------------------------|---------------------------|------|--------------------|----------------------|-----------------------|
| | pH | mV | | | |
| 4.008 | 4.010 | 182 | - | 0.0071 | 2.00 |
| 6.865 | 6.850 | 14 | 100.0 | 0.0075 | 2.00 |
| 10.008 | 10.010 | -169 | 97.9 | 0.0093 | 2.00 |
| 6.985 | 6.990 | 6 | - | 0.0087 | 2.00 |

Handwritten signature

Calibration Report

Certificate No.: 2203527-001-01

Equipment: Digital Thermometer with RTD

Resolution: 0.1 °C Model: Seven Compact S220

Serial No.: C113432421 ID No.: UAE.WAT.009/2564

Manufacturer: METTLER TOLEDO

Date of Calibration: 5 July 2022

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Location: Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 25 °C ± 1 °C

Relative Humidity 48 % ± 3 %

Condition of this results of Calibration:

- 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 650057-01 | 10-Dec-22 | 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

- This certificate is traceable to International System of Units (SI Units).
- 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.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

Handwritten signature: AH



Calibration Report

Certificate No.: 2203527-001-01

Equipment: Digital Thermometer with RTD

Resolution: 0.1 °C Model: Seven Compact S220

Serial No.: C113432421 ID No.: UAE.WAT.009/2564

Manufacturer: METTLER TOLEDO

Date of Calibration: 5 July 2022

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 | 15.038 | - 0.1 | 0.12 |
| 25.1 | 25.038 | - 0.1 | 0.12 |
| 35.2 | 35.024 | - 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






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



Cert.No.: 22MM210
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 2022 |
| Calibration Date : | 26 April 2022 |
| Ambient Temperature : | 15 °C to 40 °C |
| Relative Humidity : | 30 % to 90 % |
| Calibrated by : | Kunchit Promprat |
| Approved by : |  Approved Signatory |
| () Pornthippa Tameyakul | |
| (<input checked="" type="checkbox"/>) Malee Butkruea | |
| () Suwit Imjai | |
| Issue Date : | 29 April 2022 |

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0040716



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1

Cert.No.: 22MM210
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:-

| <u>Instruments</u> | <u>Model</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Test report No.</u> | <u>Due date</u> |
|-----------------------------|--------------|-------------------|---------------|------------------------|-----------------|
| 1) Standard Weight Set (E2) | 15884 | - | 70RC138 | MM-0009-21 | 3 Feb 2023 |

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 :

| <u>Applied Weight</u> | <u>Balance Reading</u> | <u>Correction</u> | <u>Measurement Uncertainty</u> | <u>Coverage Factor</u> |
|-----------------------|------------------------|-------------------|--------------------------------|------------------------|
| (g) | (g) | (g) | (\pm mg) | (k) |
| 80 | 80.00004 | -0.00004 | 0.15 | 2.00 |
| 200 | 199.9999 | +0.0001 | 0.35 | 2.00 |

After Adjustment :

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

| <u>Applied Weight</u> | <u>Standard Deviation of Reading (g)</u> |
|-----------------------|--|
| (g) | |
| 80 | 0.000008 |
| 200 | 0.00005 |

Malu .



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0542OC-1

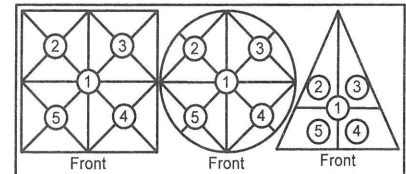
Cert.No.: 22MM210

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)
0.0002

| Position 1 | Position 2 | Position 3 | Position 4 | Position 5 |
|------------|------------|------------|------------|------------|
| (g) | (g) | (g) | (g) | (g) |
| -0.0002 | -0.0001 | 0.0000 | -0.0002 | -0.0002 |

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 | 0.016 | 2.13 |
| 0.05 | 0.05001 | -0.00001 | 0.016 | 2.13 |
| 0.1 | 0.10001 | -0.00001 | 0.017 | 2.11 |
| 1 | 1.00002 | -0.00002 | 0.019 | 2.05 |
| 5 | 5.00003 | -0.00003 | 0.026 | 2.00 |
| 20 | 20.00008 | -0.00008 | 0.049 | 2.00 |
| 50 | 50.00010 | -0.00010 | 0.080 | 2.00 |
| 80 | 80.00014 | -0.00014 | 0.15 | 2.00 |
| 100 | 100.0001 | -0.0001 | 0.21 | 2.00 |
| 150 | 150.0001 | -0.0001 | 0.29 | 2.00 |
| 200 | 200.0001 | -0.0001 | 0.35 | 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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Maku.

เอกสารไม่ควบคุม
a 1106342



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



Cert. No.: 22TM1490

Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B216.1666

ID No. : UAE.WAO.027/2559

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 : 19 October 2022

Calibration Date : 19 October 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Approved Signatory

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

Issue Date : 31 October 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0046800



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2210-0575OC-1

Cert. No.: 22TM1490

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 | 34970A | MY41021843 | 22LM4 | 10 Jan 2023 |

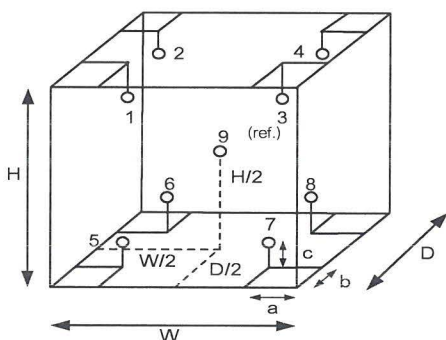
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 29 | 30 |
| REL.Humid. (%) | 47 | 40 |
| AC Supply (Volt) | 221 | 220 |

| Probe Installation Details : | | Dimension of Chamber : | |
|------------------------------|--------|------------------------|----------------------|
| a = | 5.0 cm | D = | 0.33 m |
| b = | 5.0 cm | W = | 0.40 m |
| c = | 5.0 cm | H = | 0.40 m |
| | | Capacity = | 0.053 m ³ |

| Ref. Std. ID No.: @ Calibration Point | | |
|---------------------------------------|-------------|----------------|
| Position : | (104) °C | (140,180) °C |
| 1 | 18-04RTD-01 | 21-04TC-01 |
| 2 | 18-04RTD-02 | 21-04TC-02 |
| 3 | 18-04RTD-03 | 21-04TC-03 |
| 4 | 18-04RTD-04 | 21-04TC-04 |
| 5 | 18-04RTD-05 | 21-04TC-05 |
| 6 | 18-04RTD-06 | 21-04TC-06 |
| 7 | 18-04RTD-07 | 21-04TC-07 |
| 8 | 18-04RTD-08 | 21-04TC-08 |
| 9 (ref.) | 18-04RTD-09 | 21-04TC-09 |

เอกสารไม่ควบคุม



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2210-0575OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 22TM1490

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> |
|-----------------------------|---------------------------|---------------------------|--------------------------------------|-------------------------------------|--------------------------------|-------------------------|--------------------------------|
| 104.0 | 104.0 | 104.0 | 0.061 | 1.3 | 1.7 | 0.42 | 2 |
| 140.0 | 140.0 | 140.0 | 0.14 | 2.3 | 2.4 | 1.1 | 2 |
| 180.0 | 180.0 | 180.0 | 0.21 | 3.5 | 3.6 | 1.3 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | |
|-----------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|
| | Position | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 104.0 | 103.076 | 103.876 | 103.777 | 104.124 | 104.667 | 104.426 | 104.012 | 103.928 | 104.370 |
| 140.0 | 138.199 | 139.189 | 138.808 | 139.550 | 140.266 | 139.622 | 139.293 | 139.385 | 140.369 |
| 180.0 | 177.930 | 179.267 | 178.643 | 179.753 | 181.011 | 180.093 | 179.496 | 179.743 | 181.278 |

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 1133251


Calibration Certificate

Certificate No.: 2202934-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, 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.: 2202934
Operation No.: 2202934-001
Date of Receipt: 13 May 2022
Date of Calibration: 13 May 2022

Calibrated by Mr.Manas Somsak
Specialist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 25 May 2022

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.: 2202934-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 13 May 2022

Page 2 of 4

Environment Condition: Ambient Temperature 22.3 ± 0.1 °C Relative Humidity: 47 ± 3 %

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 | B505567572 | TCS | M2204137S | 23 April 2023 |

| Instrument | Model | Serial No | Calibrated By | Certificate No. | Due Date |
|--------------------|-----------|----------------|----------------|-----------------|------------------|
| Thermo-Hygro Meter | PONPE 490 | NFI.BTH 010/18 | Quality Reborn | QR22-0350 | 18 February 2023 |

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:

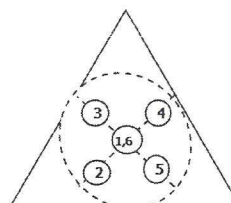
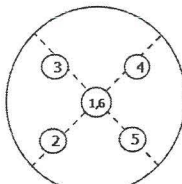
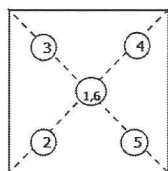
1. Repeatability of Reading:

| Nominal Value (g) | Standard Deviation of Reading (g) |
|---------------------|-------------------------------------|
| 100 | 0.000033 |
| 200 | 0.000032 |

2. Off-Center Error:

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

The balance reading obtained is given in the table.



| 1 | 2 | 3 | 4 | 5 | 6 | (Maximum Difference) |
|--------|--------|--------|--------|--------|--------|----------------------|
| (g) | (g) | (g) | (g) | (g) | (g) | (g) |
| 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 50.000 | 0.000 |

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

Handwritten signature



Calibration Report

Certificate No.: 2202934-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 13 May 2022

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 | 0.02000 | 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 | 1.00001 | 1.0000 | 0.0000 | 0.000086 | 2.00 |
| 2 | 2.00003 | 2.0000 | 0.0000 | 0.000086 | 2.00 |
| 3 | 3.00004 | 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 | 20.00004 | 20.0000 | 0.0000 | 0.000092 | 2.00 |
| 30 | 30.00005 | 30.0001 | -0.0001 | 0.00010 | 2.00 |
| 40 | 40.00008 | 40.0001 | 0.0000 | 0.00011 | 2.00 |
| 45 | 45.00010 | 45.0001 | 0.0000 | 0.00013 | 2.00 |



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



Calibration Report

Certificate No.: 2202934-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 13 May 2022

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 | 50.00004 | 50.0001 | -0.0001 | 0.00011 | 2.00 |
| 55 | 55.00006 | 55.0001 | 0.0000 | 0.00012 | 2.00 |
| 60 | 60.00005 | 60.0001 | -0.0001 | 0.00012 | 2.00 |
| 65 | 65.00007 | 65.0002 | -0.0001 | 0.00013 | 2.00 |
| 70 | 70.00008 | 70.0002 | -0.0001 | 0.00013 | 2.00 |
| 75 | 75.00010 | 75.0002 | -0.0001 | 0.00013 | 2.00 |
| 80 | 80.00009 | 80.0002 | -0.0001 | 0.00014 | 2.00 |
| 85 | 85.00011 | 85.0002 | -0.0001 | 0.00014 | 2.00 |
| 90 | 90.00012 | 90.0002 | -0.0001 | 0.00015 | 2.00 |
| 100 | 100.00008 | 100.0003 | -0.0002 | 0.00016 | 2.00 |
| 120 | 120.00011 | 120.0003 | -0.0002 | 0.00018 | 2.00 |
| 150 | 150.00012 | 150.0004 | -0.0003 | 0.00021 | 2.00 |
| 200 | 200.00015 | 200.0004 | -0.0003 | 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 -----



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





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



Cert. No.: 22TM90

Page.: 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 17 February 2022

Calibration Date : 17 February 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Kunchit Promprat

Approved by :

Malee

Approved Signatory

(☒) Pornthippa Tameyakul

(☒) Malee Butkruea

(☐) Suwit Imjai

Issue Date : 22 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0038099



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1
Procedure Used :-

Cert. No.: 22TM90

Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Model | Serial No. | Cert. No. | Due Date |
|----------------------|--------|------------|-----------|-------------|
| 1) Data Acquisition | 34970A | MY44035217 | 21LM30 | 23 Dec 2022 |

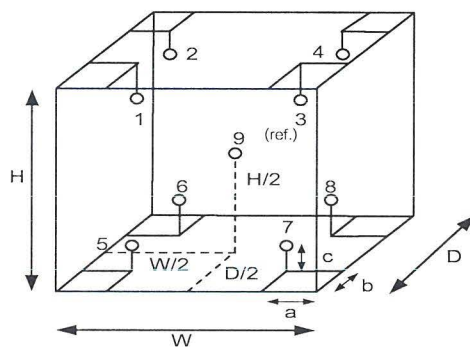
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 28 | 28 |
| REL.Humid. (%) | 68 | 75 |
| AC Supply (Volt) | 226 | 226 |

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 | 18-10RTD-01 |
| 2 | 18-10RTD-02 |
| 3 | 18-10RTD-03 |
| 4 | 18-10RTD-04 |
| 5 | 18-10RTD-05 |
| 6 | 22-10RTD-10 |
| 7 | 18-10RTD-07 |
| 8 | 18-10RTD-08 |
| 9 (ref.) | 18-10RTD-09 |

เอกสารไม่ควบคุม

a 1096042



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2202-0446OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM90

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 | 19.5 | 19.4 | 0.30 | 0.58 | 1.0 | 0.55 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | |
|-----------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|
| | Position | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 20.0 | 20.154 | 20.013 | 20.356 | 19.939 | 19.834 | 19.761 | 19.817 | 19.824 | 19.922 |

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-

Wala .

เอกสารไม่ควบคุม

a 1096041



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



Cert. No.: 22TM305

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 : 7 April 2022

Calibration Date : 7 April 2022

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

Malu.

Approved Signatory

- (☒) Pornthippa Tameyakul
(☒) Malee Butkruea
(☐) Suwit Imjai

Issue Date : 18 April 2022

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0040246



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Procedure Used :-

Cert. No.: 22TM305
Page.: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|----------------------|--------------|-------------------|------------------|-----------------|
| 1) Data Acquisition | 34970A | MY41021843 | 22LM4 | 10 Jan 2023 |

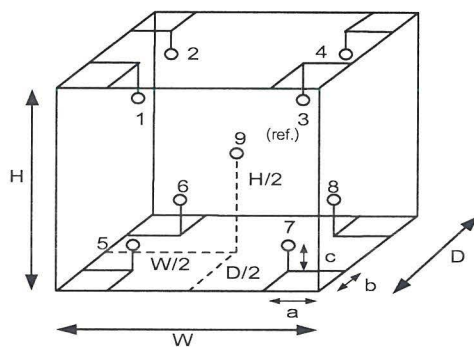
2. This certificate is valid only to the item calibrated on date and place of calibration.

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) | 27 | 27 |
| REL.Humid. (%) | 56 | 59 |
| AC Supply (Volt) | 222 | 221 |

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 | 18-04RTD-01 |
| 2 | 18-04RTD-02 |
| 3 | 18-04RTD-03 |
| 4 | 18-04RTD-04 |
| 5 | 18-04RTD-05 |
| 6 | 18-04RTD-06 |
| 7 | 18-04RTD-07 |
| 8 | 18-04RTD-08 |
| 9 (ref.) | 18-04RTD-09 |

เอกสารไม่ควบคุม

a 1104314



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2204-0015OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 22TM305

Page.: 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-------------------------|-----------------------------|
| 20.0 | 20.0 | 20.0 | 0.50 | 0.44 | 1.1 | 0.64 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | |
|-----------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|
| | Position | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) |
| 20.0 | 20.080 | 20.056 | 19.866 | 19.826 | 19.655 | 19.656 | 19.819 | 19.979 | 19.899 |

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

Malu.

เอกสารไม่ควบคุม

a 1104313

Verification Certificate

Page 1 of 4

Certificate No.: 2202361-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakanong, Bangkok 10260

Equipment: HEATING BLOCK DIGESTION

Manufacturer: FOSS

Model: 2520

Serial No.: 91794469

ID No.: UAE.WAS.011/2560


Order No.: 2202361

Operation No.: 2202361-001

Date of Receipt: 4 April 2022

Date of Calibration: 4-6 April 2022

Calibrated by Mr.Nuttapol Niyomchat
Specialist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 11 April 2022

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.

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022

Page 2 of 4

Location: Laboratory Room, NATIONAL FOOD INSTITUTE
Environment Condition: Ambient Temperature (25 ± 3) °C
Relative Humidity (55 ± 15) %
Line Voltage (220 ± 10) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
 - The temperature scale used was based on ITS - 90 .
 - All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|---------------------------------------|---------------|-------------------------|-----------------|-------------|----------------------------------|
| Digital Thermometer with Thermocouple | 34970A/34901A | MY44045576/MY41194453 | TC21/0041 | 24-Apr-2022 | N.M. Technical Center Laboratory |
| | Type R | TC#101-103 / CH#101-103 | | | |

- This certificate is traceable to international system of units (SI Units).
- 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.
- Condition of Calibrated item : Good

UUC* Description

Time of Record - Hour 30 Minute At 380 °C

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
 Model: 2520 Serial No.: 91794469
 Resolution: 1 °C ID No.: UAE.WAS.011/2560
 Manufacturer: FOSS

Date of Calibration: 4-6 April 2022

Page 3 of 4

Calibration point: 380 °C

Calibration result:

Reporting of Temperature

| Block No. | UUC* Setting (°C) | UUC* Reading (°C) | Stability (±°C) | Standard Thermometer (°C) | Uncertainty (±°C) |
|-----------|-------------------|-------------------|-----------------|---------------------------|-------------------|
| 1 | 380 | 380 | 0.13 | 376.48 | 1.5 |
| 2 | 380 | 380 | 0.12 | 376.58 | 1.5 |
| 3 | 380 | 380 | 0.12 | 376.51 | 1.5 |
| 4 | 380 | 380 | 0.14 | 376.70 | 1.6 |
| 5 | 380 | 380 | 0.18 | 376.81 | 1.6 |
| 6 | 380 | 380 | 0.12 | 377.23 | 1.6 |
| 7 | 380 | 380 | 0.12 | 377.37 | 1.5 |
| 8 | 380 | 380 | 0.13 | 376.68 | 1.5 |
| 9 | 380 | 380 | 0.14 | 376.72 | 1.5 |
| 10 | 380 | 380 | 0.18 | 378.97 | 1.6 |
| 11 | 380 | 380 | 0.25 | 378.79 | 1.6 |
| 12 | 380 | 380 | 0.11 | 377.14 | 1.6 |
| 13 | 380 | 380 | 0.19 | 379.65 | 1.6 |
| 14 | 380 | 380 | 0.16 | 379.61 | 1.6 |
| 15 | 380 | 380 | 0.16 | 378.66 | 1.6 |
| 16 | 380 | 380 | 0.15 | 379.18 | 1.6 |
| 17 | 380 | 380 | 0.23 | 377.39 | 1.6 |
| 18 | 380 | 380 | 0.11 | 377.71 | 1.6 |
| 19 | 380 | 380 | 0.22 | 376.64 | 1.6 |
| 20 | 380 | 380 | 0.16 | 376.56 | 1.6 |

Note:

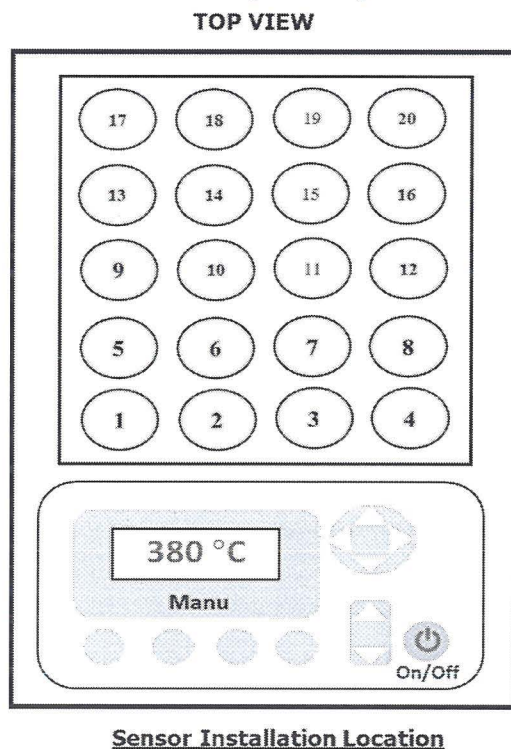
- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

Verification Report

Certificate No.: 2202361-001-01
Equipment: HEATING BLOCK DIGESTION
Model: 2520 Serial No.: 91794469
Resolution: 1 °C ID No.: UAE.WAS.011/2560
Manufacturer: FOSS
Date of Calibration: 4-6 April 2022
Calibration point: 380 °C
Calibration result: Continued

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit



Note:

- UUC* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors, for at least half an hour after reaching steady state.

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 -----

FOSS

Customer Service Report

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Report No:

6623

Date:

July 26, 2022

Customer:

United Analyst and Engineering

Address:

กรุงเทพฯ

Instrument:

KT8100

Serial:

31889052

Hours

Travel To Customer

Start

8.00

Finish

8.30

30 mins.

Labour

8.00-12.00

3+3

13.00-16.00 = 6 hrs.

Travel From Customer

16.30

17.30

1 hrs.

Job Type

| Application | | Special | | Standard | | | |
|-----------------|-------------------------------------|----------------|-------------------------------------|--------------|-------------------------------------|----------|-------------------------------------|
| Normal | <input checked="" type="checkbox"/> | Courtesy Visit | <input checked="" type="checkbox"/> | Installation | <input checked="" type="checkbox"/> | Training | <input checked="" type="checkbox"/> |
| Distributor | <input checked="" type="checkbox"/> | PMA Onboarding | <input checked="" type="checkbox"/> | Quote | <input checked="" type="checkbox"/> | In House | <input checked="" type="checkbox"/> |
| Internal | <input checked="" type="checkbox"/> | Warranty | <input checked="" type="checkbox"/> | Repair | <input checked="" type="checkbox"/> | PM | <input checked="" type="checkbox"/> |
| Digital Service | <input checked="" type="checkbox"/> | Sales Support | <input checked="" type="checkbox"/> | Remote | <input checked="" type="checkbox"/> | Other | <input checked="" type="checkbox"/> |

PO/Quote Number:

If applicable

PMA Type

If applicable

Contract No.

If applicable

Details of Work / Test

Condition / Status

- Unpack ตรวจสอบเครื่อง ไม่พบความเสียหาย

OK

- ตรวจสอบ Accessory kit

OK

- ตรวจสอบ น้ำยาละลาย ที่อัลคาไล, ที่น้ำยาล้าง และเครื่อง

OK

- ตรวจสอบ เครื่อง ตาม IQ, OQ, PQ

OK

Instrument Ready for Use

OK

Not OK

If OK, Comment

Part No:

Batch

Description

Qty

I confirm this report is accurate and complete

Signed FOSS

Pannipa O.

Signed Customer

Karnphong

Name

Pannipa Onnom

Name

Karnphong Boonpiang

Would you be willing to participate in a brief survey in order to tell us how we performed?

Email

เอกสารไม่ควบคุม

FOSS

Customer Service Report

FOSS South East Asia

3388 Sirinrat Building, 25th – 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton , Klongtoey, Bangkok, Thailand 10110

Report No:

6534

Date:

25/7/2022

Customer:

United Analyst and Engineering

Address:

10194

Instrument:

KT 9100

Serial:

91889052

Hours

Travel To Customer

Labour

Travel From Customer

Start

9-5-2

9-12 am

i h...

Finish

30

1-4 on

Q. 30

4

| Job Type | | | | | | | |
|-----------------|---|----------------|---|--------------|---|----------|---|
| Application | | Special | | Standard | | | |
| Normal | ☒ | Courtesy Visit | ☒ | Installation | ☒ | Training | ☒ |
| Distributor | ☒ | PMA Onboarding | ☒ | Quote | ☒ | In House | ☒ |
| Internal | ☒ | Warranty | ☒ | Repair | ☒ | PM | ☒ |
| Digital Service | ☒ | Sales Support | ☒ | Remote | ☒ | Other | ☒ |

PO/Quote Number:

Application:

PMA Type

Introduction

Contract No.

Application

| Details of Work / Test | | Condition / Status |
|--|--|--------------------|
| ANALIS 1076 - Software - Program Editor - MP Setting - Manual Run - User maintenance - Run Blank - Run Recovery | | Done |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| Instrument Ready for Use | <input checked="" type="radio"/> OK <input type="radio"/> Not OK | Blank OK Comment |

[illegible]

I confirm this report is accurate and complete

Signed FOSS

Signed Customer

Name

Name

Would you be willing to participate in a brief survey in order to tell us how we performed?

1000

เอกสารไม่ควบคุม

Kjeltec™ 8100 Distillation Unit

This IQ applies to Kjeltec™ 8100 Distillation Unit manufactured by FOSS Analytical. The installation is performed by FOSS trained service personnel.

1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical AB's Application Notes.

2 Purpose

This installation Qualification is designed to assure that:

- The Kjeltec instrument is received complete, with all required parts in good condition.
- The location of the instrument is environmentally and ergonomically suitable
- The instrument is assembled and configured correctly
- Suitable electricity and water are supplied to the instrument, see table 2 for requirements.

3 Identification

| Description | Serial Number |
|--------------------------------|---------------|
| Kjeltec 8100 Distillation Unit | 918 89052 |

Dedicated Analytical Solutions

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DK-3400 Hillerød
Denmark

Tel +45 7010 3370
Fax +45 7010 3371
E-mail support@foss.dk
Web www.foss.dk

FOSS Analytical AB
Box 70
SE-263 21 Höganäs
Sweden

Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

4 Control of Received Equipment

4.1 Verify that the correct instrument type and accessory kit items are received and in proper condition

The packing list (shipped with the instrument) specifies all the items. The installer will verify that all items are received as shipped on the packing list. For each item listed, verify that the acceptance criteria are met. If so, write “Y” in the right column of the table immediately following.

| Packing List Item | Acceptance Criteria | Pass/Y/N) |
|---|--|-----------|
| Kjeltec 8100 Distillation Unit | No visible damage, received in undamaged FOSS Analytical's standard shipping container | Y |
| Accessory kit, according to packing list | Included. No visible damage, received in undamaged FOSS Analytical's standard shipping container | Y |
| Handling device for digestion tube | Included. No visible damage. | Y |
| Tanks with level sensors for Waste, Alkali and Water | Included. No visible damage. | Y |
| Receiver flask | Included. No visible damage. | Y |
| One digestion tube 250ml One digestion tube 100 ml | Included. No visible damage. | Y |
| Tube adapter | Included. No visible damage. | Y |
| User manual | Kjeltec 8100 Distillation Unit | Y |
| Owners guide | Kjeltec 8100 Distillation Unit | Y |
| Quick guide | Kjeltec 8100 Distillation Unit | Y |
| Spare parts manual | Kjeltec 8100 Distillation Unit | Y |
| Application notes | AN 300 included AN 303 included | Y |

5 Installation

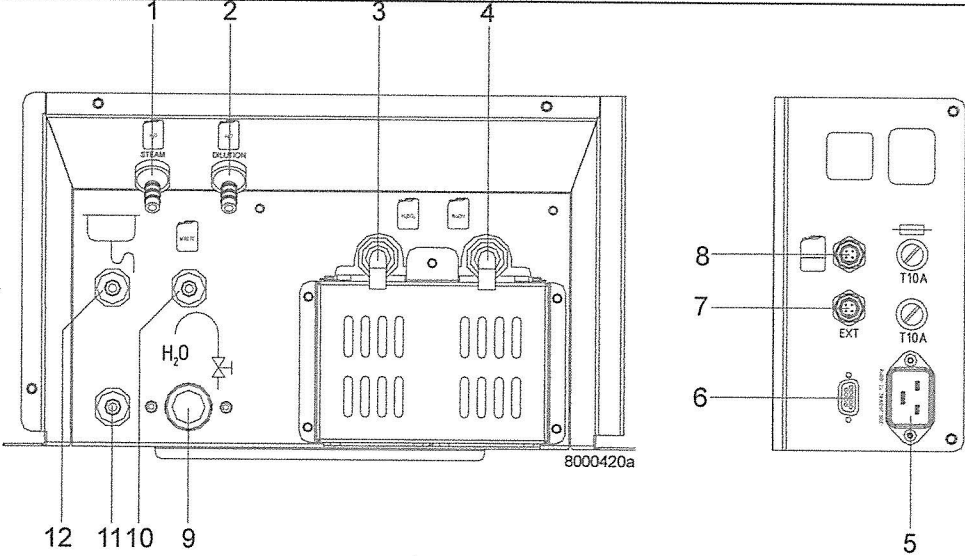
5.1 The equipment must be installed in a suitable location with power, water and draining available

Verify that the instrument installation site meets the acceptance criteria given in the table below. If so, write “Y” in the right column of the table immediately following.

| Location Requirements | Acceptance Criteria | Pass (Y/N) |
|------------------------------------|---|------------|
| Adequate space for instrument | Dimensions 48x58x69 cm | Y |
| AC supply available for instrument | 200-240 V 50/60Hz | Y |
| Current | 10 A | Y |
| Cold water supply available | 2 L/min at 30°C | Y |
| Drain | For cooling water and waste (depending on local waste disposal legislation) | Y |
| Ambient temperature | Max. 40°C | Y |
| Ambient humidity | Max. 80% relative | Y |
| Internal fuses | T10A AH | Y |

5.2 The instrument must be assembled correctly

Verify that all tubes are correct connected. If so, write “Y” in the right column of the table immediately following.

| Instrument Tubing Connections | Acceptance Criteria | Pass (Y/N) |
|--|----------------------------------|------------|
|  <p>1. Deionised water in (steam generator)</p> <p>2. Deionised water in (dilution water)</p> <p>3. *) Receiver solution in</p> <p>4. Alkali in</p> <p>5. Power</p> <p>6. Not used</p> <p>7. External titration module</p> <p>8. Level sensors</p> <p>9. Cooling water in (tap water)</p> <p>10. Waste water out (tube drain vessel)</p> <p>11. Drain</p> <p>12. Cooling water out (tap water)</p> <p>*) Only on Kjelttec 8200</p> | Visual verification by installer | Y |

5.3 The instrument should be assembled and powered up

Connect the distilling unit to the power supply. Perform the start up procedure and check that the expected response is obtained. If so, write “Y” in the right column of the table immediately following.

| Action | Expected Response | Pass (Y/N) |
|--|---|------------|
| Switch on the power | The instruments start up and the self test will run. The sample counter shows the number of analysed samples since first power and the Software Version shows the version of the instruments software. | Y |
| | After start-up, Program 1 is loaded and the Analyse menu is displayed. | Y |
| Turn on the cold water tap | No visible reaction | Y |
| Press the “Manual” view | The Manual menu is opened | Y |
| Open the door with the handle, place the test tube and receiver flask in position. Close the door. | | Y |
| Select Dilution and press Start | Water is added to the tube | Y |
| Select Alkali and press Start | Alkali is added to the tube | Y |
| Select Steam and press start | After heating up, steam is entering the tube | Y |
| Select Drain and press Start | The tube is drained | Y |

6 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

| Deviation | Action | Comment |
|-----------|--------|---------|
| | | |
| | | |
| | | |
| | | |
| | | |

7 IQ Documentation

Upon successful completion and recording of all instructions above, sign and date this sheet below.
If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Installed By: Pannipa Onnom

Company: Foss SEA

Customer Name: United Analyst and Engineering

Company: United Analyst and Engineering

Date completed: July 25, 2022

Kjeltec™ 8100 Distillation Unit

This OQ applies to Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The operation qualification is performed by FOSS trained service personnel.

1 Intended Use

Kjeltec 8100 is intended for laboratory use analyzing parameters as specified in FOSS Analytical Application Notes.

2 Purpose

This procedure is designed to test the function of the instrument according to factory test specifications:

- Alkali volume
- Distillation Accuracy
- Distillation Repeatability

3 Identification

| Description | Serial Number |
|--|---------------|
| Kjeltec 8100 Distillation Unit, 200-240 V 50/60 Hz | 91889052 |

Dedicated Analytical Solutions

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Web www.foss.dk

4 Performance

4.1 Verify the dispensed volumes of reagents

Note! To verify the dispensed volumes of reagents a triple test should be done to be statistic correct. Then calculate a mean value.

1. Choose “Manual” in the menu. (When starting up the instrument Program 1 is loaded)
2. Open the safety door by pressing **Open** and place a tube in the instrument. Close the safety door.

Water

1. Press **Dilution** and then press **Start**. 80 ml of water will be filled into the tube.
2. Measure the collected water in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Note! If the water volume needs to be calibrated, go to 4.8.5 Dilution Pump Calibration in the User Manual.

Alkali

1. Press **Alkali** and then press **Start**. 50 ml of alkali will be filled into the tube.
2. Measure the collected alkali in a graduated measuring glass and note the result in table 1 below.
3. Check acceptance criteria in the table and make the judgment if passed or not.

Table 1 Volume control

| Test | Result | Expected result | Passed (Y/N) |
|---------------|--|-----------------|--------------|
| Water volume | <u>83</u> ml <u>83</u> ml <u>82</u> ml Mean <u>82.67</u> ml | 76- 84 ml | Y |
| Alkali volume | <u>52</u> ml <u>52</u> ml <u>53</u> ml Mean <u>52.33</u> ml | 47- 54 ml | Y |

4.2 Verify the distillation procedure, accuracy and precision

The distillation principle is to convert ammonium (NH_4^+) into ammonia (NH_3) by using an alkali (NaOH) and thereafter steam distil it into a receiver flask containing boric acid and titrate with standard acid solution using colorimetric end-point detection. Ammonium sulphate, a substance with known ammonia content, can be used to check the accuracy of the distillation. The recovery is calculated from obtained result.

The way to perform this test will be described in the following.

Chemical Check

Use ammonium sulphate ($(\text{NH}_4)_2\text{SO}_4$, purity > 99.5 % *)

Mol. weight = 132.14 g/mol, Nitrogen content in ammonium sulphate (99.5 %) = 21.09% *)

Analysis conditions according to AN 300

| | |
|-------------------|-----------------------|
| Water | 80 ml |
| Alkali | 50 ml NaOH (40%w/w) |
| Receiver solution | 30 ml boric acid (4%) |
| Distillation time | 5 minutes |
| SAfE | 5 seconds |
| Titrant | 0.2N HCl |

For reagent preparation see Appendix A

1. Start the instrument and run two blanks without chemicals according to above analysis conditions, distil into a receiver flask containing boric acid. Titrate with a standard acid solution using colorimetric end-point detection. If the blanks are less than 0,2 ml continue with the recovery tests:
2. Weigh 0.15 g ammonium sulphate into a tube. Prepare 6 samples (tubes).
3. Run the six samples according to above analysis conditions. Titrate with a standard acid solution using colorimetric end-point detection.
4. Calculate the recovery according to below equations. Expected results of recovery should be 100%±1%.

| Recovery test | Result | Expected result | Passed (Y/N) |
|---------------------------|--|-----------------|--------------|
| Blank value (water blank) | 1. <u>0.08</u> ml 2. <u>0.14</u> ml | 0.05-0.20 ml | Y |
| Recovery | 1. <u>100.20</u> % 2. <u>100.30</u> % 3. <u>100.63</u> % 4. <u>99.01</u> % 5. <u>99.97</u> % 6. <u>100.09</u> % | | |
| Accuracy | Mean Value: <u>100.03</u> | 99-101% | Y |
| Precision | SD: <u>0.557</u> | SD <1% | Y |

*) **Note!** Please also note that the below calculations must be adjusted if other purity levels of ammonium salts are used. A certificate for the chemical supplier should be available

| Purity | Nitrogen content |
|--------|------------------|
| 99,5% | 21.09% |
| 99,6% | 21.12% |
| 99,7% | 21.14% |
| 99,8% | 21.16% |
| 99,9% | 21.18% |

$$\% \text{ Nitrogen} = \frac{(ml_{\text{sample}} - ml_{\text{blank}}) \times N \times 14,007 \times 100}{mg_{\text{sample}}} \quad \begin{matrix} \nearrow 0.1005 \\ 21.72 \end{matrix}$$

N = Normality of titrant to 4 places of decimal.

$$\% \text{ Recovery} = \frac{\% \text{ Nitrogen}}{21.09} \times 100$$

mg sample

- ① ~~0.1592~~ 23.56
- ②
- ③
- ④
- ⑤
- ⑥

5 Summary of Deviations/Comments

Deviations from above requirements are specified below and any corrective actions are noted.

| Deviation | Action | Comment |
|-----------|--------|---------|
| | | |
| | | |
| | | |
| | | |

6 OQ Documentation

Upon successful completion of tests above, sign and date this sheet below. If required by customer, leave one signed copy with instrument.

If customer's internal procedures require further reporting or witnessing of results, execute those procedures as required.

Performed By: _____

Company: _____

Customer Name: _____

Company: _____

Date completed: _____

7 Appendix A

7.1 Preparation of Reagents

7.1.1 Alkali

To convert ammonium into ammonia an excess of sodium hydroxide is necessary.

Use 400 g NaOH per litre of solution. Commercially available in concentrations up to 50 %. Do not use concentrations above 40 % as this will lead to crystal formation impairing the function of the pumps. If you can only buy concentrations > 40 %, dilute it before use.

7.1.2 Titrant acid, determination of concentration

To be able to achieve accurate nitrogen / protein results, one must be quite sure that the HCl (hydrochloric acid) concentration is what it is supposed to be. A titration against a predetermined solution of sodium carbonate as described below is thus necessary. Incorrect HCl concentration can otherwise cause substantial errors.

- **Standard substance**

Weigh approx. 10 g of anhydrous sodium carbonate (Na_2CO_3). Use a mortar to make a fine powder. Dry it for 1 h at 265 °C or 2 h at 200 °C. After cooling in a desiccator, transfer the sodium carbonate to a beaker with a tight lid. Store it in a desiccator.

- **Indicator solutions**

Dissolve 0.1 g methyl red in 100 ml methanol. Dissolve 0.1g bromocresol green in 100 ml methanol.

- **Procedure**

Weigh approx. 0.4 g of the standard substance, using an analytical balance, note the weight (W_1). Transfer the sodium carbonate to a receiver flask and add 40 ml of H_2O (distilled or deionized). Add 8 drops from each of the indicator solutions. Titrate to pink. Note the amount in ml used (A_1). Boil this solution for a few minutes. The solution will turn green. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour change occurs. Note also this volume

(A_2). Boil the solution for a few minutes. Cool rapidly to room temperature under running water. Continue the titration until the next pink colour occurs. Note also this volume (A_3)

Note! Temperature changes will influence the volume and the concentration of the titrant solution. The working temperature of the titrant should approximate that of its temperature during standardization. If temperature corrections are necessary, sufficient accuracy may be obtained by use of a correction table. (AOAC 942.25)

7.2 Calculation

$$\text{Molarity (M)} = \frac{18,870 \times W_1}{(A_1 + A_2 + A_3)}$$

Note! Concentration must be accurate to four digits, i.e. 0.2000 M.

Note! The colour change of this official procedure (AOAC 936.15) may be difficult to see, therefore a pH meter or a mixed indicator (e.g. 0.1 g Methyl red and 0.1 g Bromocresol green in 100 ml methanol) will make it much easier to perform.

7.3 Receiver Solution

Boric acid 4 % with bromocresol green / methyl red indicator solution

In order to obtain accurate results the receiver solution is adjusted so that a small (0.05-0.20 ml) positive blank is obtained when running a blank sample. The 4 % boric acid receiver solution is prepared by dissolving 400 g of boric acid in about 5-6 l very hot deionized water. Mix and add more hot deionized water to a volume of about 9 l. Cool the solution to room temperature and add 100 ml of bromocresol green solution (100 mg in 100 ml methanol) and 70 ml of methyl red solution (100 mg in 100 ml of methanol). Dilute to 10 l with deionized water and mix carefully.

Note! The addition of alkali is to achieve a positive blank value. This should, however, be kept between 0.05 - 0.20 ml titrant, to obtain good repeatability when testing blanks.

Adjustment of the boric acid is made by the following procedure:

1. Transfer 25 ml boric acid solution to a receiver flask and add 100 ml of distilled water. If the solution in the flask is still red, titrate with 0.1 M sodium hydroxide solution until a neutral grey colour is obtained. Calculate the amount of sodium hydroxide solution necessary to adjust the boric acid solution in the 10 l flask with the formula: ml 1.0 M alkali = ml titrant x 40
2. Add the calculated amount of 1.0 M alkali solution to the boric acid solution. Mix.
3. To check proceed as follows using 25 ml of the boric acid solution. Run a blank. If the value of this blank is high (0.5 ml of 0.2 M HCl) the boric acid is incorrectly adjusted. This might create irregular blanks. For correction add HCl directly into the boric acid tank, mix it carefully and repeat until a reading of 0.05 - 0.20 ml HCl is obtained. If a positive blank is not achieved, add further small quantities of 1 M NaOH and repeat the check until a satisfactory value is achieved.

Kjeltec™ 8100 Distillation Unit Tecator™ 2508/2520 Digester

1 Scope

This PQ applies to the Digestion system 2508/2520 (including exhaust and scrubber unit) and Kjeltec 8100 Distillation Unit manufactured by FOSS Analytical. The user of the instrument performs the PQ.

2 Intended Use

The Digestion system (including exhaust and scrubber) and Kjeltec 8100 Distillation Unit are intended for laboratory use analyzing parameters as specified in FOSS Application Notes.

3 Purpose

The guidelines are intended to assist the user in successfully developing Performance Qualifications for the specific application(s) to which the instrument is applied.

The Performance Qualification (PQ) includes the process of demonstrating that the Digestion system 2508/2520 (including exhaust and scrubber unit) and the Kjeltec 8100 Distillation unit consistently perform according to a specification appropriate for its routine use. Main activities in the PQ phase are:

- Preventive maintenance
- On-going verification tests

This document suggests routines to fulfill the requirements for an acceptable PQ but the final procedure should be adapted to local routines for similar equipment.

4 Definition of Test Procedures

4.1 Preventive Maintenance

Maintenance of the Kjeltec 8100 should be performed according to the instructions in manual, see User Manual Kjeltec 8100/8200 Distillation Unit, chapter 5. Maintenance. A yearly service is recommended (service agreement).

Maintenance of the Digestion block (including exhaust and scrubber) should be performed according to instruction in the user manual, see User Manual Tecator Digester, chapter 5. Maintenance.

Dedicated Analytical Solutions

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SE-263 21 Höganäs
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Tel +46 42 361500
Fax +46 42 340349
E-mail support@foss.dk
Web www.foss.dk

4.2 Ongoing Qualification Tests

Block Temperature

The temperature for the digestion is limited by the boiling point for the sulphuric acid, this can be increased by adding a salt (K_2SO_4) to the digestion mixture. It's important that the optimal ratio between acid and salt is kept; please follow recommendation in AN 300 or suggested procedures for a specific kind of sample material.

The block temperature itself can be controlled external by inserting a temperature probe in the intended hole in the aluminium block (front row of holes).

Use the reagents and method procedure specified in AN 300. Use only reagents of recognized analytical grade, unless otherwise specified and distilled or demineralised water or water of equivalent purity.

Suggested standard material for internal quality control:

Ammonium sulphate $[(NH_4)_2SO_4]$, min. 99.5 % (mass fraction), with certified purity.

Note: The above chemical is usually readily available with a certificate specifying the purity.

Alternatively ammonium iron(II) sulphate, $(NH_4)_2 Fe (SO_4)_2 \times 6 H_2O$, with certified purity may be used.

Tryptophan ($C_{11}H_{12}N_2O_2$), minimum assay 99 % (mass fraction). Nitrogen content 137.2 g/kg. Do not dry in an oven before use.

Acetanilide (C_8H_9NO), minimum assay 99 % (mass fraction). Nitrogen content 103.6 g/kg. Do not dry in an oven before use.

Sucrose, ($C_{12}H_{22}O_{11}$), with a nitrogen content of not more than 0.002 % (mass fraction). Do not dry in an oven before use.

Blank Tests

Carry out a blank test following the currently used procedure for digestion, distillation and titration taking 2 ml of water and about 0.7 g of sucrose instead of the test portion. Keep a record of blank values. If blank values change, identify the cause.

Note: The amount of titrant used in the blank test should always be greater than 0.0 ml. Blanks within the same laboratory should be consistent across time.

4.3 Recovery Tests

Regularly run recovery studies to check the accuracy of procedure and equipment:

- *Nitrogen loss.* - Use 0.12 g ammonium sulphate and 0.67 g sucrose per flask weighted to the nearest 0.1 mg. Add all other reagents as stated in the method currently used (Kjeltabs, H_2SO_4 , etc). Digest and distil under same conditions as for sample. Recoveries shall be >99 %.
- *Digestion efficiency* - Use a test portion of minimum 0.15 g of tryptophan or acetanilide and 0.67 g sucrose per flask weighed to the nearest 0.1 mg. Determine the nitrogen content according to the current procedure in use. The recoveries of tryptophan shall be >98.5 %; the recoveries of acetanilide shall be >99.5 %.
- *Distillation and titration efficiency* – Distil 0.10 – 0.15 g ± 0.0001 g ammonium sulphate, omitting the digestion step. The recoveries should be >99.5 %.

Note: Results less than 98.5 % or more than 101.0 % in either of the recovery tests indicate failures in the procedure and/or inaccurate concentration of the standard volumetric hydrochloric acid solution (should be adjusted to four decimals accuracy according to procedure in AN 300)

External Quality Control Program

It is recommended to participate in an external quality control program, such a proficiency program or ring test, with equivalent sample material as analysed within the laboratory.

Calculation and Expression of Results

$$w_n = \frac{14.007(V_s - V_b)N \times 100\%}{m}$$

Where:

- w_n is the nitrogen content of the sample, expressed as a percentage by mass.
- V_s is the numerical value of the volume of the hydrochloric acid standard volumetric solution) used in the sample test, in milliliters, expressed to the nearest 0.05 ml.
- V_b is the numerical value of the volume of the hydrochloric acid standard volumetric solution used in the blank test, in milliliters, expressed to the nearest 0.05 ml.
- N is the numerical value of the exact normality of the hydrochloric acid standard volumetric solution, expressed to four decimal places.
- m is the numerical value of the mass of the test portion , in milligrams, expressed to the nearest 1 mg for sample weights >1 g or to the nearest 0.1 mg for sample weights <1 g.

5 Maintenance

5.1 Maintenance Kjeltex™ 8100

See instructions in User Manual - Kjeltex 8100/8200, chapter 5 Maintenance.

5.2 Maintenance Tecator™ Digestor

See instructions in User Manual - Tecator Digestor, chapter 5 Maintenance.

6 The Maintenance Record Charts

This record charts are provided to assist you in keeping your system in good working order. Please make copies and use them regularly as they can often help us to help you in the unlikely event a system malfunction.