

ภาคผนวกที่ 4

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สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพน้ำ



## Certificate of Calibration

**Certificate No. :** 68-400172-1

**Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co., Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Temperature controlled enclosure (Refrigerator)  
Manufacturer : Samchai Model : LD2 DC 70  
Range : N/A °C Resolution : 1 °C  
Serial No. : 85545 ID No. : N/A

**Environment :** On site calibration was carried out at the Laboratory,  
C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (27.0 to 28.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (223.0 to 225.0) V

**Date of Received :** 21 March 2025

**Date of Calibration :** 21 March 2025

**Date of Issue :** 22 March 2025

**Calibrated by :** Permpon Chanpu

**Calibration Method :** CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

**Reference Standard Instruments :** This certification is traceable to the International System of Units  
Standard Digital Thermometer with RTD Probe

| ID No.          | Cert. No.   | Due Date    | Traceability                                    |
|-----------------|-------------|-------------|-------------------------------------------------|
| 400046 & 400047 | 68-400007-2 | 29 Jul 2025 | National Institute of Metrology Thailand (NIMT) |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 68-400172-1

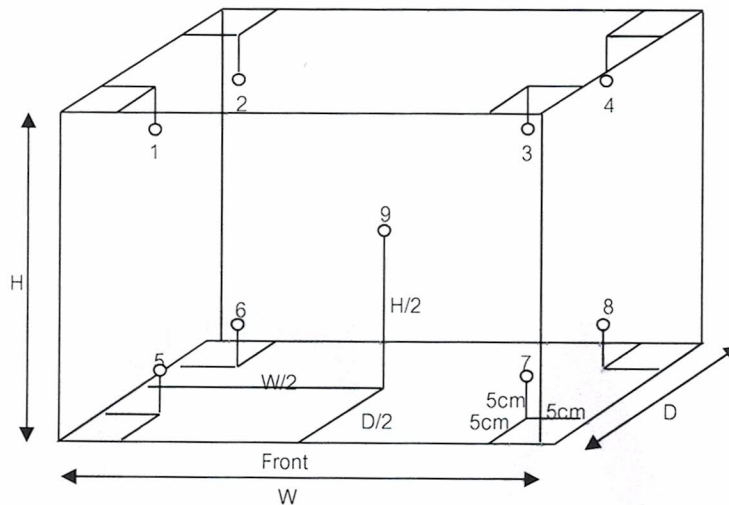
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 1.13 m

D = 0.51 m

H = 1.34 m

Capacity = 0.77 m<sup>3</sup>

| Test Point<br>( ° C ) | Setting Temperature<br>( ° C ) | Indicating Temperature<br>( ° C ) | Measured Temperature ( ° C ) @ Sensor No. |      |      |      |      |      |      |      |      | Uncertainty<br>( ± ° C ) |
|-----------------------|--------------------------------|-----------------------------------|-------------------------------------------|------|------|------|------|------|------|------|------|--------------------------|
|                       |                                |                                   | 1                                         | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |                          |
| 4                     | 4                              | 4                                 | 5.13                                      | 4.85 | 3.25 | 3.11 | 4.43 | 4.77 | 2.75 | 2.77 | 4.01 | 0.73                     |

| Test Point<br>( ° C ) | Setting Temperature<br>( ° C ) | Indicating Temperature<br>( ° C ) | Measured Uniformity<br>( ° C ) | Measured Stability<br>( ° C ) | Overall Variation<br>( ° C ) |
|-----------------------|--------------------------------|-----------------------------------|--------------------------------|-------------------------------|------------------------------|
| 4                     | 4                              | 4                                 | 1.29                           | 0.08                          | 2.55                         |

Remark The uncertainty is not combine uniformity of the air chamber

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

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

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## Certificate of Calibration

**Certificate No. :** 68-400089-2 **Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co., Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Temperature Indicator with Thermistor Probe  
Temperature Indicator

|                |                |              |           |
|----------------|----------------|--------------|-----------|
| Manufacturer : | XS Instruments | Model :      | PC 5      |
| Range :        | N/A °C         | Resolution : | 0.1 °C    |
| Serial No. :   | GB 0706/024    | ID No. :     | WW-23-001 |

Thermistor probe

|              |             |                   |           |
|--------------|-------------|-------------------|-----------|
| Model :      | N/A         | Sheath Material : | Plastic   |
| Diameter :   | 10 mm.      | Length :          | 65 mm.    |
| Serial No. : | GB 0706/024 | ID No. :          | WW-23-001 |

**Environment :** On site calibration was carried out at the Laboratory,  
C.E.M Technology (Thailand) Co., Ltd.

|                       |                      |
|-----------------------|----------------------|
| Ambient Temperature : | (26.0 to 27.0) °C    |
| Relative Humidity :   | (45 to 50) %         |
| Line Voltage :        | (224.5 to 226.0) VAC |

**Date of Received :** 11 February 2025  
**Date of Calibration :** 11 February 2025  
**Date of Issue :** 17 February 2025  
**Calibrated by :** Permpon Chanpu

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No.  | Due Date    | Traceability                                    |
|--------|------------|-------------|-------------------------------------------------|
| 400002 | TT-0095-24 | 01 Jul 2026 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date    | Traceability                                    |
|--------|-----------|-------------|-------------------------------------------------|
| 400033 | 24E633    | 21 Feb 2026 | National Institute of Metrology Thailand (NIMT) |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 68-400089-2

**Page :** 2 of 2

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

| Immersion Depth<br>( mm. ) | Standard Reading<br>( ° C ) | UUC Reading<br>( ° C ) | Correction<br>( ° C ) | Uncertainty<br>( ± ° C ) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 65                         | 15.002                      | 15.1                   | -0.1                  | 0.19                     |
| 65                         | 30.005                      | 30.0                   | 0.0                   | 0.19                     |
| 65                         | 45.004                      | 44.9                   | 0.1                   | 0.19                     |

### Remark

UUC : Unit Under Calibration

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

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

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## Certificate of Calibration

**Certificate No. :** 68-430004-1

**Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co.,Ltd.

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Digital Conductivity meter (Pocket)

Manufacturer : XS Instruments Model : PC 5

Serial No. : GB 0706/024 ID No. : WW-23-001

**Environment :** On site calibration was carried out at the Laboratory,

C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature (26.0 to 27.0) ° C

Relative Humidity (45 to 50) %

**Date of Received :** 11 February 2025

**Date of Calibration :** 11 February 2025

**Date of Issue :** 17 February 2025

**Calibrated by :** Permpon Chanpu

**Calibration Method :** In-house method CAL-M4301 direct measurement by conductivity buffer solution

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

Standard Buffer Solution

| <u>Material</u> | <u>Lot No.</u> | <u>Exp. Date</u> | <u>Traceability</u>                                                   |
|-----------------|----------------|------------------|-----------------------------------------------------------------------|
| 84 µS/cm        | 0300           | 01 June 2027     | National Institute of Standards and Technology (NIST), U.S.A., S.R.M. |
| 1413 µS/cm      | 970986         | 25 April 2025    | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025               |
| 12.88 mS/cm     | 970987         | 25 April 2025    | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025               |

Approved

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. : 68-430004-1**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Conductivity measurement

Before Adjustment

| Standard<br>Conductivity Solution | UUC Reading | Correction | Uncertainty ( ± ) | Unit  |
|-----------------------------------|-------------|------------|-------------------|-------|
| 84*                               | 79.7        | 4.3        | 1.1               | µS/cm |
| 1413                              | 1602        | -189       | 9.0               | µS/cm |
| 12.88                             | 12.81       | 0.07       | 0.082             | mS/cm |

After Adjustment : at 84, 1413 µS/cm 12.880 mS/cm

| Standard<br>Conductivity Solution | UUC Reading | Correction | Uncertainty ( ± ) | Unit  |
|-----------------------------------|-------------|------------|-------------------|-------|
| 84*                               | 84.0        | 0.0        | 1.1               | µS/cm |
| 1413                              | 1413        | 0          | 9.0               | µS/cm |
| 12.88                             | 12.88       | 0.00       | 0.082             | mS/cm |

Remark

UUC : Unit Under Calibration

\* This parameter are out of accreditation's scope.

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

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

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## เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชดถุกษ์) บริษัท ฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

### หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า



## ช่องทางการติดต่อ



DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)  
เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260  
เลขประจำตัวผู้เสียภาษี 010-555-001-4547 (สำนักงานใหญ่)



Call center 0 2 639 7000



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## Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี

ครั้งที่ ..1..วันที่ 14/05/2025.....

### รายละเอียดผู้รับบริการ

|          |                                                                                 |       |   |
|----------|---------------------------------------------------------------------------------|-------|---|
| หน่วยงาน | บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด                                    |       |   |
| ที่อยู่  | 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกะทู้มูบแบน จังหวัดสมุทรสาคร 74130 |       |   |
| โทรศัพท์ | 0869054664                                                                      | แฟกซ์ | - |

### ผู้ติดต่อ

|                |                           |          |   |       |   |
|----------------|---------------------------|----------|---|-------|---|
| ชื่อ - นามสกุล | คุณศิริภาพร พิมพ์         |          |   |       |   |
| ตำแหน่ง        | เจ้าหน้าที่ห้องปฏิบัติการ |          |   |       |   |
| โทรศัพท์       | 0869054664                | เบอร์ต่อ | - | แฟกซ์ | - |
| E-mail         | lab.cemtech1@gmail.com    |          |   |       |   |

### รายละเอียดผู้ให้บริการ

|                                                                         |                                |         |
|-------------------------------------------------------------------------|--------------------------------|---------|
| บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่) |                                |         |
| เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260            |                                |         |
| โทรศัพท์ 0 2 693 7000 Email: Jirayut.js@dksh.com                        |                                |         |
| เจ้าหน้าที่ประสานงาน : คุณจิรายุส สเลอาด                                |                                |         |
| เจ้าหน้าที่ผู้ให้บริการ                                                 | นายจิรายุส สเลอาด              |         |
| ตำแหน่ง                                                                 | Specialist, Technical Service. |         |
| โทรศัพท์                                                                | 0938138736                     | แฟกซ์ - |
| E-mail                                                                  | Jirayut.js@dksh.com            |         |

|                          |         |
|--------------------------|---------|
| ลงนามผู้รับบริการ        |         |
| ตัวบรรจง                 | (.....) |
| ตำแหน่ง                  |         |
| วันที่ / ประทับตราบริษัท |         |

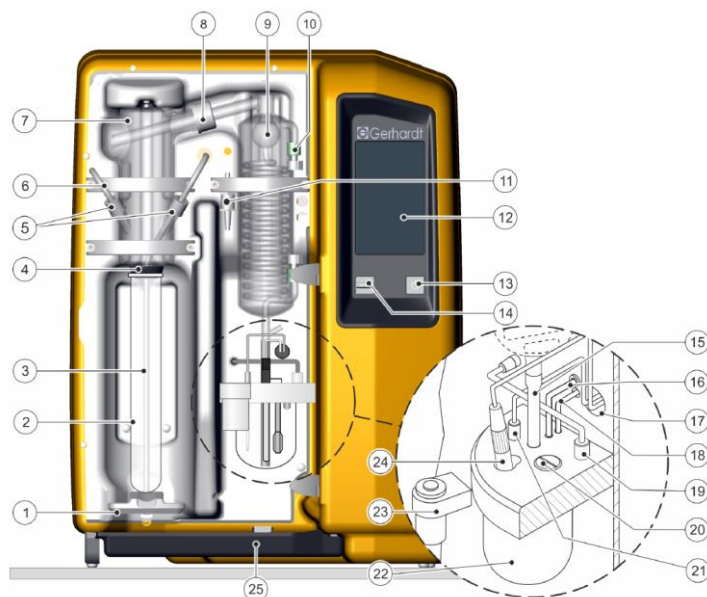
|                    |  |
|--------------------|--|
| ลงนามผู้ให้บริการ  |  |
| ตัวบรรจง           |  |
| ตำแหน่ง            |  |
| วันที่ / ประทับตรา |  |

JOB:WO-00070598.....MODEL:VAP.200.....S/N: GER5200180181.

## Operational Qualification (OQ)

ตรวจสอบสภาพเครื่อง

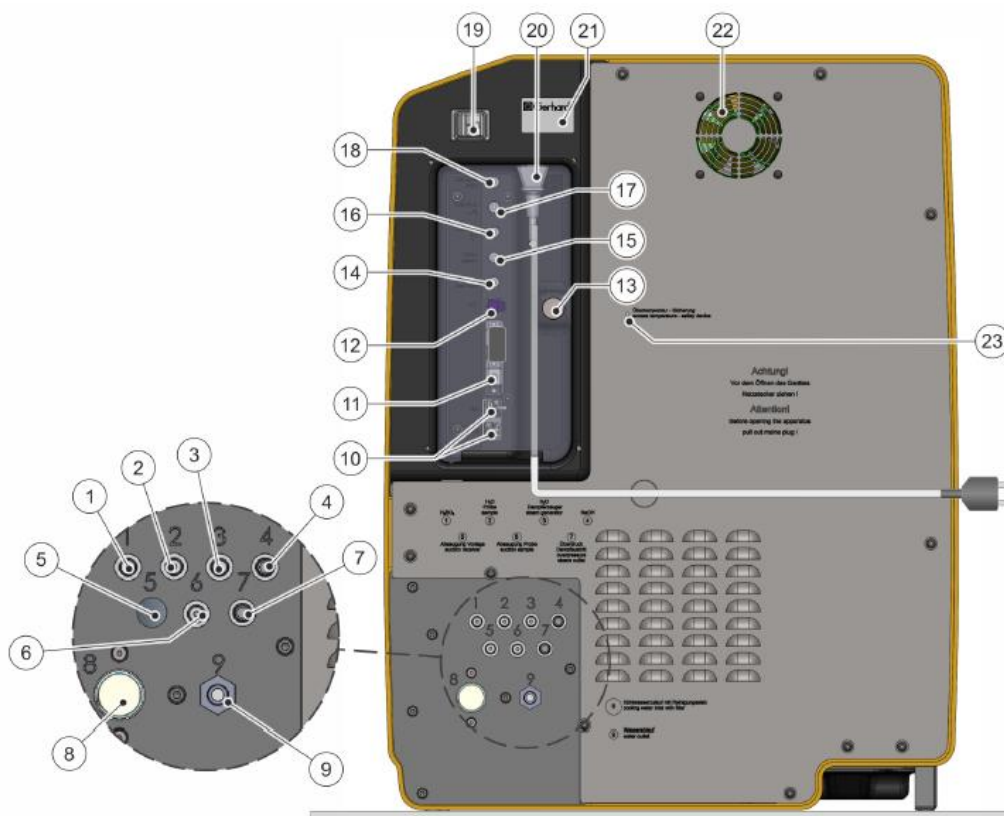
### FRONT



| No |                                                   | PASS                                | FAIL                     | N/A                                 |
|----|---------------------------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1  | Quick clamping device with clamping block         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 2  | Digestion tube 250/300 ml                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 3  | PTFE steam inlet tubing                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4  | Connection stopper , Viton                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5  | Screw cap GL18                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 6  | PTFE-inlet tubing NaOH                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 7  | Distribution head made of glass                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 8  | Screw cap GL32                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 9  | Distillation condenser made of glass              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 10 | Screw cap GL14                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 11 | Ventilation valve                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 12 | Control panel                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 13 | Operating Button                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 14 | USB interface (with protective cap)               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 15 | Silicone tubing 8/10 for distillate discharge **  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 16 | Verprene tubing 4/8 , receiver suction **         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 17 | Cable duct for electrode cable + titration tube** | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 18 | Silicone tubing 4/7 , boric acid inlet**          | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 19 | Sensor for level monitoring including connector** | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 20 | Agitator motor with propeller**                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 21 | Titration acid inlet tube **                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 22 | Receiver glass**                                  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 23 | Holder for pH electrode , removable**             | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 24 | pH electrode (combined electrode)**               | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 25 | Drip tray PP                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

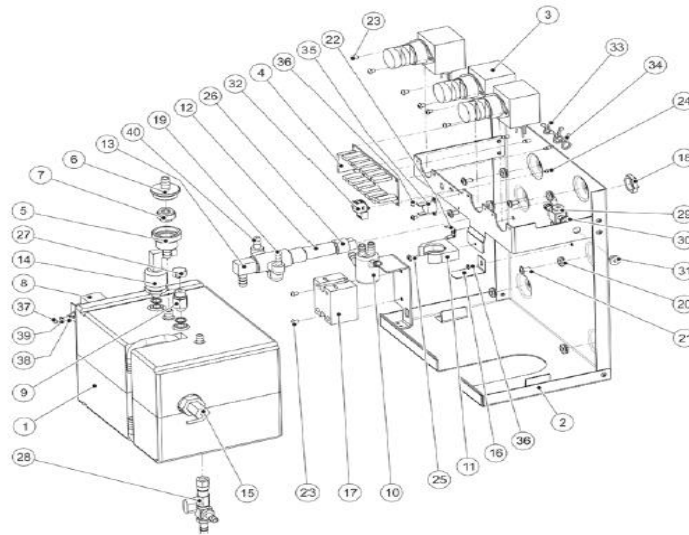
\*\* only VAP 450

## REAR



| No |                                                           | PASS                                | FAIL                     | N/A                                 |
|----|-----------------------------------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| 1  | Tube connection for sample H3BO3 supply                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2  | Tube connection for sample H2O supply                     | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3  | Tube connection for steam generator H2O supply            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4  | Tube connection for NaOH supply                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 5  | Tube connection for receiver glass extraction             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 6  | Tube connection for sample waste extraction               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 7  | Tube connection , overpressure steam outlet               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 8  | Connection for cooling water supply (with cleaning sieve) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 9  | Tube connection for cooling water outlet                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 10 | 4 X USB interface                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 11 | 1 X RS-232 Interface                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 12 | LAN Interface                                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 13 | Screw cap for Perspex cover                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 14 | Connection socket for sample waste tank level monitoring  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 15 | Connection (not used)                                     | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 16 | Connection socket for H2O tank level monitoring           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 17 | Connection socket for H3BO3 tank level monitoring         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 18 | Connection socket for NaOH tank level monitoring          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 19 | Overcurrent circuit breaker                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 20 | Apparatus socket (mains cable connection)                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 21 | Rating plate with serial number                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 22 | Exhaust air fan                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| 23 | Excess temperature switch                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

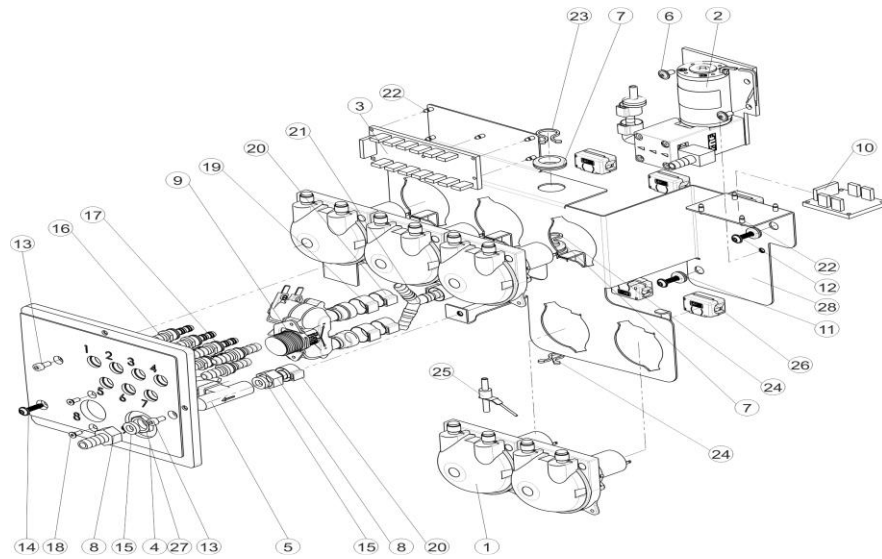
## Inside Steam generator



| No |                                                 | PASS                                | FAIL                     | N/A                      |
|----|-------------------------------------------------|-------------------------------------|--------------------------|--------------------------|
| 1  | Steam generator                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2  | Steam generator traverse                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3  | Pinch valve                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4  | Circuit board distributor                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5  | Valve tubing connection                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6  | Housing safety valve                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7  | Safety valve SKT                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8  | Excess temperature protection , steam generator | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9  | Safety valve G 1/8 0,5 bar                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Ventilation glass pinch valve VAPODEST          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Hose clamp for ventilation clamp                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Distributor PP                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Angle connection PP                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Pressure transmitter                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Level switch                                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Fixing bracket steam generator                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Relay HT+                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18 | VA Hexagon nut 1/2"                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | Angle connection 1/8"                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | Bushing nipple 6-10-14                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21 | VA Lens head screw M5 X 10                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Grounding connection , 2-pole                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23 | VA Lens head screw M4 X 6                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Spacer bolt 5 mm                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 | VA Lens head screw M4 X 10                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 | Tubing connection                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 | Hose clamp 14.5 mm                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 | Module ball valve with nozzles                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29 | Cross manifold with spout                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30 | Seal copper G 1/8                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31 | Locking screw 1/8"                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32 | Pin strip                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33 | Bundle clamp 12 H 4500                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34 | Bundle clamp 12 H 4502                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35 | Temperature switch 80°C                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36 | VA Lens head screw M3 X 6                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37 | VA Hexagon nut M4                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38 | Lins head screw M4 X 8                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39 | VA Spring washer                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40 | Angle connection , reduced , 1/8" PP            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



## Module Pump holder VAP200 - 450 V3



| No |                                            | PASS                                | FAIL                     | N/A                      |
|----|--------------------------------------------|-------------------------------------|--------------------------|--------------------------|
| 1  | Peristaltic pump                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2  | Diaphragm pump NaOH. with non-return valve | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3  | Circuit board                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4  | Tubing connection module                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5  | Flow controller                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6  | Lens head screw M5 x 10                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7  | Bushing nozzle                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8  | Screw in socket                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9  | Magnetic valve 2/2 way                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10 | Circuit board distributor                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11 | Bushing nozzle                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12 | Screw 5 x 25                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13 | Cylinder screw                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14 | Screw 5 x 20                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15 | Seal EPDM 15 x 4                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16 | Tubing connection piece 51x10x6,5          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17 | Tubing connection piece 51x10x10           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18 | Screw M4x10                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19 | Clamp                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20 | Clamp                                      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 21 | Y-tube connector                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 22 | Spacer bolt 5 mm                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 23 | Bundle clamp                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 24 | Bundle clamp                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 25 | Retrofit earthing pumpv                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26 | Snap ferrite                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27 | Nut G 3/8"                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28 | Pump holder plate                          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Control panel



| No |                                      | PASS                                | FAIL                     |
|----|--------------------------------------|-------------------------------------|--------------------------|
| 1  | Title bar                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2  | Status bar                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 3  | Navigation button                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4  | Smart switch with multiple functions | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 5  | USB interface                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

## รายละเอียดการตรวจสอบ

### ขั้นตอนการบริการ

#### ตรวจสอบระบบไฟฟ้า (Electrical Test)

- ความต้านทานทางไฟฟ้าของเครื่องกับกราวด์
- กระแสไฟฟ้าที่ใช้งาน

#### ตรวจสอบสภาพเครื่อง (Optical Test)

- Main cable
- Electric wiring
- Pumps
- Distribution Head
- Condensor
- Steam generator
- Tubing
- Viton cone

#### ตรวจสอบ Function การทำงาน (The Function Test)

- ระบบสร้างและควบคุมความดันของ Steam
- ระบบการเติมน้ำเข้า Sample Tube
- ระบบการเติม Na OH
- ระบบการเติม H<sub>3</sub>BO<sub>3</sub>

## รายงานผลการให้บริการ

### 1. TECHNICAL DATA

|                                              | Pass                                | Fail                     | N/A                      | Remark       |
|----------------------------------------------|-------------------------------------|--------------------------|--------------------------|--------------|
| Main Supply 220 volt + 10% 50 Hz with ground | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....        |
| Norminal current                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....8a..... |

#### 1.1 COOLING WATER BATH

|                      | Pass                                | Fail                     | N/A                      | Remark |
|----------------------|-------------------------------------|--------------------------|--------------------------|--------|
| Temperature 15-20 °C | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| Cooling Water Outlet | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| Control Temperature  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |

#### 1.2 OPTICAL TEST VAP200

|                              | Pass                                | Fail                                | N/A                                 | Remark            |
|------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------|
| Screw cap GL14               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Screw cap GL18               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Screw cap GL32               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Distillation Head            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Condensor                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | โดย condenser.113 |
| Viton Cone                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | เสื่อมสภาพ        |
| Ventilation Valve BV         | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Micro Switch Sample          | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/>            | .....             |
| Agitator motor for propeller | <input type="checkbox"/>            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | .....             |

### 2. SYSTEM COOLING WATER INLET

|                      | Pass                                | Fail                     | N/A                      | Remark |
|----------------------|-------------------------------------|--------------------------|--------------------------|--------|
| Cooling Water Inlet  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| Cooling Water Outlet | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| Flow control valve   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |

### 3.SYSTEM CONTROL

|                 | Pass                                | Fail                     | N/A                                 | Remark |
|-----------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Display         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Program         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Adding NaOH     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Adding H2O      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Adding H3BO3    | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Suction Sample  | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Suction Reciver | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |

### 4.SYSTEM DISTILLATION

|                            | Pass                                | Fail                                | N/A                      | Remark     |
|----------------------------|-------------------------------------|-------------------------------------|--------------------------|------------|
| Boiler                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Level Sensor               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Novopren                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | เสื่อมสภาพ |
| Solenoid Valve Shut-Off    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Solenoid Valve Steam       | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Solenoild Valve soft steam | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Ventilation Valve Premount | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Excess Pressure Detector   | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |
| Heating Element            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | .....      |

**5. PUMP**

|                              | Pass                                | Fail                     | N/A                                 | Remark |
|------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Pump H <sub>2</sub> O Steam  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| - Non-Return Valve           | -                                   | -                        | -                                   | .....  |
| Pump H <sub>2</sub> O Sample | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| - Non-Return Valve           | -                                   | -                        | -                                   | .....  |
| Pump NaOH                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| - Non-Ruturn Valve           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Pump H3BO3                   | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| - Non-Ruturn Valve           | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Pump suction                 | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Pump suction receiver        | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |

**6. The Following Program Run :**

|                             | Pass                                | Fail                     | N/A                                 | Remark |
|-----------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Addition H2O 0-999 ml.      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Addition NaOH 0-999 ml.     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Addition H3BO3 0-999 ml.    | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Reaction Time 0-108 min     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Distillation Time 0-108 min | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Steam Capacity 10%-100%     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Suction Sampe               | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| Suction Receiver            | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |

**7. Measured pumps**

|           |                          | Remark |
|-----------|--------------------------|--------|
| Pump NaOH | Volume : <u>13,33</u> ml | .....  |

Remark : .....ปลาย condensor เสื่อมสภาพ,viton cone เสื่อม,novoprean เสื่อม  
.....

## ข้อมูลสนับสนุนด้านเทคนิค (General Technical Support)

### การบำรุงรักษาทั่วไป (Basic maintenance)

#### Cleaning program

Glass parts and tubes must be rinsed daily before starting analysis in order to prevent clogging by crystallising chemicals.

The following settings are recommended for this:

| parameters                | Value  |
|---------------------------|--------|
| H <sub>2</sub> O addition | 150 ml |
| NaOH addition             | 0 ml   |
| Distillation time         | 7 min  |
| Steam power               | 100 %  |
| Reaction time             | 0 s    |
| Suction sample            | 30 s   |

➔ Insert a digestion tube (without sample) and start the program.

- ➔ All liquid carrying parts are cleaned. In the case of strong soiling, approx. 10 ml of sulphuric acid can also be added to the digestion tube.

#### General error message

| Fault description                        | Cause                               | Remedy                                                                                                                                                                                                                |
|------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 'Cooling water flow volume too low'      | Cooling water pressure under 1 bar  | <ul style="list-style-type: none"> <li>■ Open water tap.</li> <li>■ Check coolant pressure.</li> <li>■ Check coolant tube.</li> </ul> <p>Program continues automatically once error has been fixed.</p>               |
| 'Sample tube missing'                    | Sample tube missing.                | <ul style="list-style-type: none"> <li>■ Insert sample tube.</li> </ul> <p>Continue program or restart.</p>                                                                                                           |
| 'Distillation room protective door open' | Protection door not closed          | <ul style="list-style-type: none"> <li>■ Close protection door.</li> </ul> <p>Program continues automatically once error has been fixed.</p>                                                                          |
| 'Reagent storage/waste'                  | One or more storage tanks are empty | <ul style="list-style-type: none"> <li>■ Fill storage tank.</li> <li>■ Check correct seating of the universal sensors.</li> </ul> <p>The running program can be continued after rectification of the error.</p>       |
|                                          | The sample waste tank is full.      | <ul style="list-style-type: none"> <li>■ Empty sample waste tank.</li> <li>■ Check correct seating of the universal sensors.</li> </ul> <p>The running program can be continued after rectification of the error.</p> |



## Analytical errors

| Fault description                    | Cause                                                                                              | Remedy                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analysis results too high            | The chemicals used are contaminated with nitrogen compounds.                                       | <ul style="list-style-type: none"> <li>■ Detailed checking of the chemicals.</li> <li>■ Determination of a blank value.</li> <li>■ Replace the chemicals if necessary.</li> </ul>                                                                                                                                                                                                           |
|                                      | Violent reaction in the digestion tube, sodium hydroxide drops get into the receiver.              | <ul style="list-style-type: none"> <li>■ Increase of the water addition amount.</li> </ul>                                                                                                                                                                                                                                                                                                  |
|                                      | Glass bridge of the condenser is broken or worn out, sodium hydroxide drops get into the receiver. | <ul style="list-style-type: none"> <li>■ Replacement of the glass condenser.</li> </ul>                                                                                                                                                                                                                                                                                                     |
|                                      | Glass cleaning agents in the digestion tube.                                                       | <ul style="list-style-type: none"> <li>■ Clean digestion tube in advance with distilled water.</li> </ul>                                                                                                                                                                                                                                                                                   |
|                                      | Entrainment of ammonia from the previous sample.                                                   | <ul style="list-style-type: none"> <li>■ Increase distillation time.</li> <li>■ Check whether the sample was previously sufficiently alkalisied.</li> </ul>                                                                                                                                                                                                                                 |
| Analysis result too low or no result | Incomplete distillation; distillation time too short.                                              | <ul style="list-style-type: none"> <li>■ No quantitative expulsion of the ammonia content.</li> <li>■ The distillation amount should be 100 ml.</li> </ul>                                                                                                                                                                                                                                  |
|                                      | Ammonia escapes at leaking places.                                                                 | <ul style="list-style-type: none"> <li>■ Soiled or defective Viton plugs; clean or replace.</li> <li>■ Check seals (GL screw connections) on the distribution head; replace if necessary.</li> <li>■ Check valve at the condenser is gummed up; clean or replace.</li> <li>■ Digestion tube is damaged at the neck extension.</li> <li>■ Distribution head glass leaks; replace.</li> </ul> |
|                                      | Addition amount of the sodium hydroxide too little; no ammonia development.                        | <ul style="list-style-type: none"> <li>■ Check the constant flow rate of the NaOH pump (see Technical Data).</li> </ul>                                                                                                                                                                                                                                                                     |
|                                      | Too low boric acid amount in the receiver; escaping ammonia is not completely bonded.              | <ul style="list-style-type: none"> <li>■ Increase of the boric acid amount.</li> </ul>                                                                                                                                                                                                                                                                                                      |
|                                      | Tube not completely immersed in the acid receiver.                                                 | <ul style="list-style-type: none"> <li>■ Increase of the acid amount.</li> </ul>                                                                                                                                                                                                                                                                                                            |
|                                      | Formation of stable ammonia compounds which are not destroyed with sodium hydroxide.               | <ul style="list-style-type: none"> <li>■ This problem only occurs with catalysts containing mercury. Sodium sulphate solution destroys these compounds.</li> </ul>                                                                                                                                                                                                                          |

การดูแลบำรุงรักษาเชิงป้องกัน

**Preventive Maintenance**



**บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด**

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## เงื่อนไขการให้บริการ Preventive Maintenance

บริษัทฯ จะส่งวิศวกรผู้ชำนาญ เพื่อให้บริการตามขอบข่ายของการบริการ เฉพาะ ในวันและเวลา ราชการ หากมีความประสงค์ที่จะรับบริการนอกเหนือจากวัน เวลา ราชการ (วันหยุดเสาร์ – อาทิตย์ หรือวันหยุด นักชัตตฤกษ์) บริษัทฯ จะคิดค่าบริการเพิ่มเติมตามอัตราที่กฎหมายแรงงานกำหนดไว้

### ขอบข่ายการบริการ

- ตรวจสอบสภาพการทำงานต่าง ๆ ของเครื่องมือ
- ทดสอบประสิทธิภาพการทำงานของเครื่องมือ
- รายการผลการตรวจสอบเครื่องมือ

### หมายเหตุ

- ราคานี้ไม่รวมถึงค่าบริการซ่อม หรือ เปลี่ยนอะไหล่ที่ชำรุดเสียหาย หรือหมดสภาพการใช้งาน
- ในกรณีที่ผู้รับบริการอยู่นอกเขตพื้นที่ให้บริการ บริษัทฯ จำเป็นต้องคิดค่าใช้จ่ายเพิ่มเติม ได้แก่ ค่าเดินทาง เป็นต้น
- บริษัท ฯ ขอสงวนสิทธิ์ในการเปลี่ยนแปลงราคา โดยไม่แจ้งให้ทราบล่วงหน้า

## ช่องทางการติดต่อ



**DKSH Technology Limited (บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด)**

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## Preventive Maintenance Contract

จำนวนในการทำสัญญาบริการ ...1...ครั้งต่อปี

ครั้งที่ .1.. วันที่ 14/05/2025.....

### รายละเอียดผู้รับบริการ

|          |                                                                                |       |   |
|----------|--------------------------------------------------------------------------------|-------|---|
| หน่วยงาน | บริษัท ซี.อี.เอ็ม เทคโนโลยี (ไทยแลนด์) จำกัด                                   |       |   |
| ที่อยู่  | 219/43 หมู่ 12 ถนนเพชรเกษม ตำบลอ้อมน้อย อำเภอกระทุ่มแบน จังหวัดสมุทรสาคร 74130 |       |   |
| โทรศัพท์ | 0869054664                                                                     | แฟกซ์ | - |

### ผู้ติดต่อ

|                |                           |          |   |       |   |
|----------------|---------------------------|----------|---|-------|---|
| ชื่อ - นามสกุล | คุณศิริภาพร พิมพา         |          |   |       |   |
| ตำแหน่ง        | เจ้าหน้าที่ห้องปฏิบัติการ |          |   |       |   |
| โทรศัพท์       | 0869054664                | เบอร์ต่อ | - | แฟกซ์ | - |
| E-mail         | lab.cemtech1@gmail.com    |          |   |       |   |

### รายละเอียดผู้ให้บริการ

|                                                                                                                                                                                                                                                                                  |                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด (ฝ่ายบริการหลังการขาย) (สำนักงานใหญ่)<br>เลขที่ 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260<br>โทรศัพท์ 0 2 693 7000 Email: <a href="mailto:Jirayut.js@dksh.com">Jirayut.js@dksh.com</a><br>เจ้าหน้าที่ประสานงาน : คุณจิรายุช สเลอาด |                                |
| เจ้าหน้าที่ผู้ให้บริการ                                                                                                                                                                                                                                                          | นายจิรายุช สเลอาด              |
| ตำแหน่ง                                                                                                                                                                                                                                                                          | Specialist, Technical Service. |
| โทรศัพท์                                                                                                                                                                                                                                                                         | 0938138736 แฟกซ์ -             |
| E-mail                                                                                                                                                                                                                                                                           | Jirayut.js@dksh.com            |

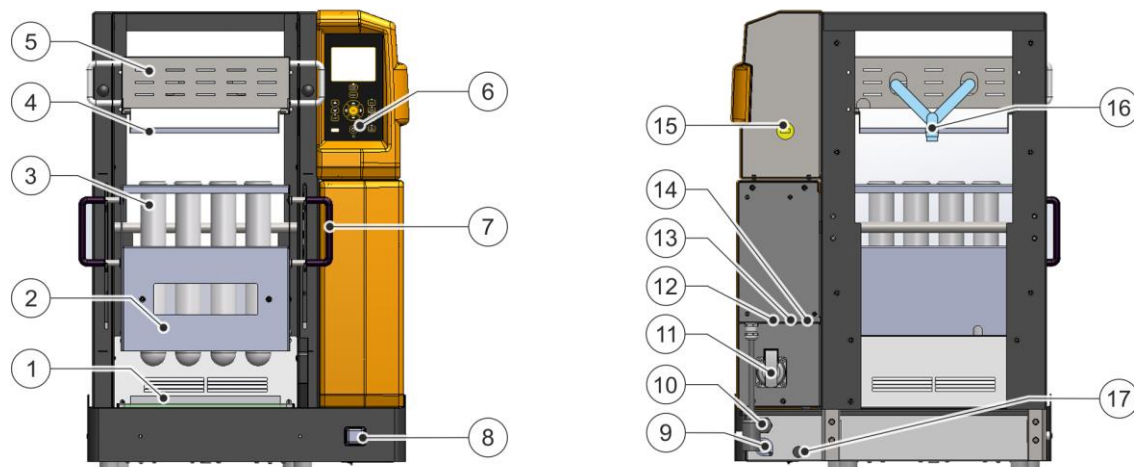
|                          |         |
|--------------------------|---------|
| ลงนามผู้รับบริการ        |         |
| ตัวบรรจง                 | (.....) |
| ตำแหน่ง                  |         |
| วันที่ / ประทับตราบริษัท |         |

|                    |  |
|--------------------|--|
| ลงนามผู้ให้บริการ  |  |
| ตัวบรรจง           |  |
| ตำแหน่ง            |  |
| วันที่ / ประทับตรา |  |

JOB No: WO-00070598.....MODEL: KT 20s.....S/N: GER5720180118

Part 3: ตรวจสอบเช็คสภาพเครื่อง

Front and rear view of KT-L version



| No. |                                                        | PASS                                | Fail                     | N/A                                 | Remark     |
|-----|--------------------------------------------------------|-------------------------------------|--------------------------|-------------------------------------|------------|
| 1   | KJELDATHERM digestion block                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | เสื่อมสภาพ |
| 2   | Insert rack                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 3   | Digestion tube                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 4   | Stainless steel drip tray                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 5   | Exhaust manifold                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 6   | Controls module, removable                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 7   | Handle for insert rack                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 8   | Mains switch with overcurrent protection function      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 9   | Connection for lift unit                               | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 10  | Mains cable with plug                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 11  | Power supply for TURBOSOG                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 12  | Connects controller module to block                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 13  | Connection for fan for cooling samples (optional)      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |            |
| 14  | Connection for external cooling water valve (optional) | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |            |
| 15  | Connects controller module to block                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 16  | Connection for Iso-Versinic hose (extraction)          | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 17  | Excess temperature fuse                                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |
| 18  | Lift                                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |            |

## Part 4: สะเอียดและรายงานผลการให้บริการ Preventive Maintenance

### 4.1 ตรวจเช็คระบบไฟฟ้า

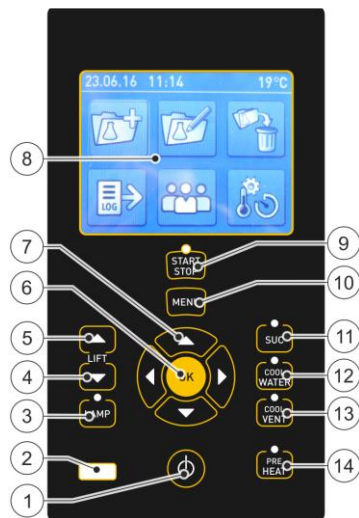
|                           | Pass                                | Fai                      | N/A                      | Remark |
|---------------------------|-------------------------------------|--------------------------|--------------------------|--------|
| ใช้ไฟ 220 V 50 Hz         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |
| กระแสไฟฟ้าตามพิกัดเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | .....  |

### 4.2 ตรวจสอบสภาพอุปกรณ์ภายนอก

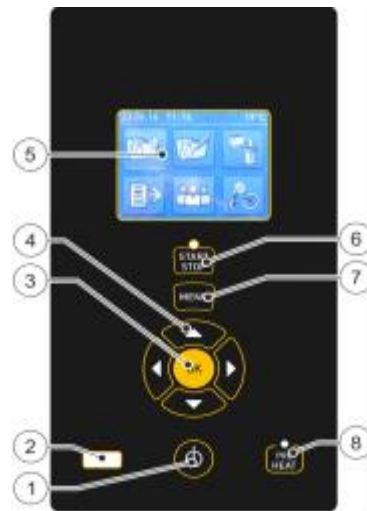
|                             | Pass                                | Fail                     | N/A                                 | Remark     |
|-----------------------------|-------------------------------------|--------------------------|-------------------------------------|------------|
| สายไฟของเครื่อง             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| ท่อแก๊วรวมไอรกด             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| สายยางต่อกับท่อแก๊วรวมไอรกด | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| สภาพของ Aluminum block      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | เสื่อมสภาพ |
| การขึ้นลงของ Lift           | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....      |
| Light                       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....      |
| Current Switch              | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |
| Thermostat                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....      |



#### 4.3 ตรวจสอบระบบการทำงาน



☐ KT-L



☒ KT

|                                                     | Pass                                | Fail                     | N/A                                 | Remark |
|-----------------------------------------------------|-------------------------------------|--------------------------|-------------------------------------|--------|
| Switch controller on or off.                        | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| USB port                                            | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| LAMP button                                         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| LIFT down button                                    | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| LIFT up button                                      | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| OK button                                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Navigation buttons                                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| Display                                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| START/STOP button                                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| MENU button                                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| SUC button                                          | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| COOLWATER button (optional)                         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| COOL VENT button (optional)                         | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | .....  |
| PRE HEAT button                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การขึ้นของอุณหภูมิมากกว่า10องศาต่อหน้าที่ที่250องศา | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การทำงานของตัวป้องกันอุณหภูมิสูงเกิน                | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |
| การทำงานของระบบควบคุมอุณหภูมิ                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | .....  |

## การบำรุงรักษาทั่วไป (Basic maintenance)

1. การย่อยตัวอย่างเกิดการเดือดที่รุนแรงอันเนื่องมาจากตัวอย่างนั้นสามารถป้องกันได้โดยแนะนำให้ย่อยด้วยการตั้งการเพิ่มอุณหภูมิเป็นระดับเช่น ย่อยที่ระดับอุณหภูมิ 250 C ครบเวลา 15 นาทีจึงเปลี่ยนเป็นอุณหภูมิ 380 C เพื่อป้องกันการล้นออกมา
2. เมื่อใช้เสร็จไม่ควรปล่อยให้ Tube เย็นกับตัวเครื่อง
3. ต้องนำถาดรองไอกรดใส่ทุกครั้งหลังจากใช้งานเสร็จ เพื่อป้องกันการหยดของไอกรดที่จะหยดลงมาที่ตัวเครื่อง
4. ทำความสะอาดตัวหลุมย่อยด้วยน้ำหรือผ้าชุบน้ำในกรณีที่มีคราบกรดหยดลงมาติดอยู่ในหลุม  
เพื่อป้องกันไม่ให้คราบดังกล่าวไปกั้นการแผ่อุณหภูมิ



# Certificate of Calibration

|                           |                              |                           |                  |
|---------------------------|------------------------------|---------------------------|------------------|
| <b>Equipment:</b>         | Cooled Incubator             | <b>Certificate No.:</b>   | C31250348        |
| <b>Model:</b>             | KB 240                       | <b>Issued Date:</b>       | 10 February 2025 |
| <b>Serial No.(or ID):</b> | 20180000012164 ( WW-16-001 ) | <b>Job No.:</b>           | WO-00060640      |
| <b>Manufacturer:</b>      | Binder                       | <b>Page:</b>              | 1 of 3           |
| <b>Condition:</b>         | In Condition                 | <b>Ventilation Valve:</b> | Closed           |
| <b>Shelves(pc.):</b>      | 3                            |                           |                  |

**Customer:** C.E.M Technology (Thailand) Co., Ltd.  
219/43 Moo 12 Petchkasem Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Environment Condition:**

|              |         |   |         |
|--------------|---------|---|---------|
| Temperature: | 22 °C   | ± | 1.8 °C  |
| Humidity:    | 61 %RH  | ± | 5.3 %RH |
| Voltage:     | 230 VAC | ± | 1.5 VAC |

**Calibration Place:** C.E.M Technology (Thailand) Co., Ltd. ( Laboratory Room )  
219/43 Moo 12 Petchkasem Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Calibration By:** Mr. Tweewong Thaithiang

**Calibration Date:** 10 February 2025

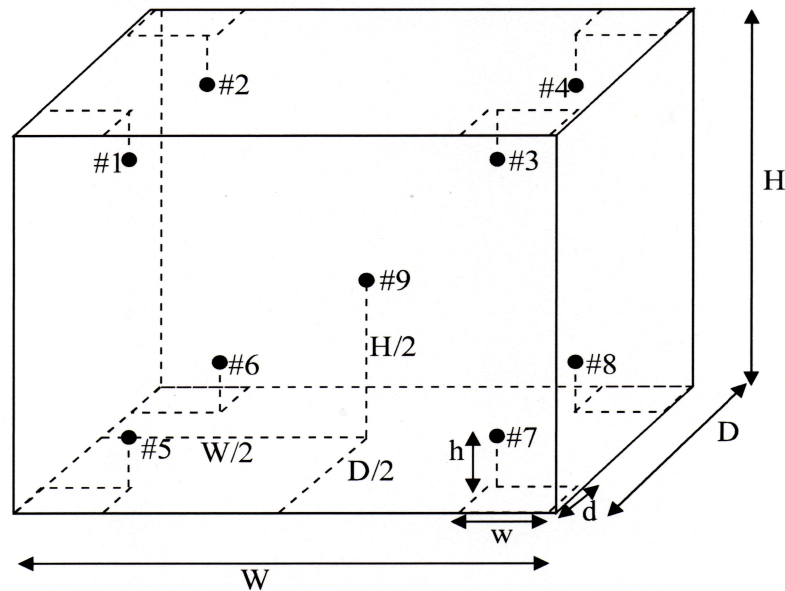
**The Method used:** In house method, CAL-WI-16, base on TLAS-G20

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10240018

The [redacted] the International System [redacted]  
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.



### Standard Installation Locations

Volume (Calibration Zone)= 122 (Liters)

|                                      |             |             |             |
|--------------------------------------|-------------|-------------|-------------|
| Inside chamber:                      | W = 65 (cm) | D = 50 (cm) | H = 76 (cm) |
| Standard Locations (#1, #2, #3, #4): | w = 7 (cm)  | d = 5 (cm)  | h = 8 (cm)  |
| Standard Locations (#5, #6, #7, #8): | w = 7 (cm)  | d = 5 (cm)  | h = 8 (cm)  |

#9: Geometric center of the chamber

| Position of Std   | #1  | #2  | #3  | #4  | #5  | #6  | #7  | #8  | #9  |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Channel of Logger | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 |

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

**Measured Temperature:** The average reading of standards at any positions or location.

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.

**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.



## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ) .  
; PFA – Probability of False Accept

### Without adjustment

Desired Temperature : 20.0°C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

| Locations | Measured<br>(°C) | Correction*<br>(°C) | Guard band<br>(W)<br>(± °C) | Tolerance<br>(± °C) | Conformity |
|-----------|------------------|---------------------|-----------------------------|---------------------|------------|
| #1        | 20.14            | 0.14                | 0.33                        | 1.0                 | Pass       |
| #2        | 20.14            | 0.14                | 0.34                        | 1.0                 | Pass       |
| #3        | 19.96            | -0.04               | 0.38                        | 1.0                 | Pass       |
| #4        | 20.14            | 0.14                | 0.35                        | 1.0                 | Pass       |
| #5        | 20.11            | 0.11                | 0.33                        | 1.0                 | Pass       |
| #6        | 20.17            | 0.17                | 0.34                        | 1.0                 | Pass       |
| #7        | 20.00            | 0.00                | 0.37                        | 1.0                 | Pass       |
| #8        | 20.06            | 0.06                | 0.35                        | 1.0                 | Pass       |
| #9        | 20.38            | 0.38                | 0.33                        | 1.0                 | Pass       |

Correction\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

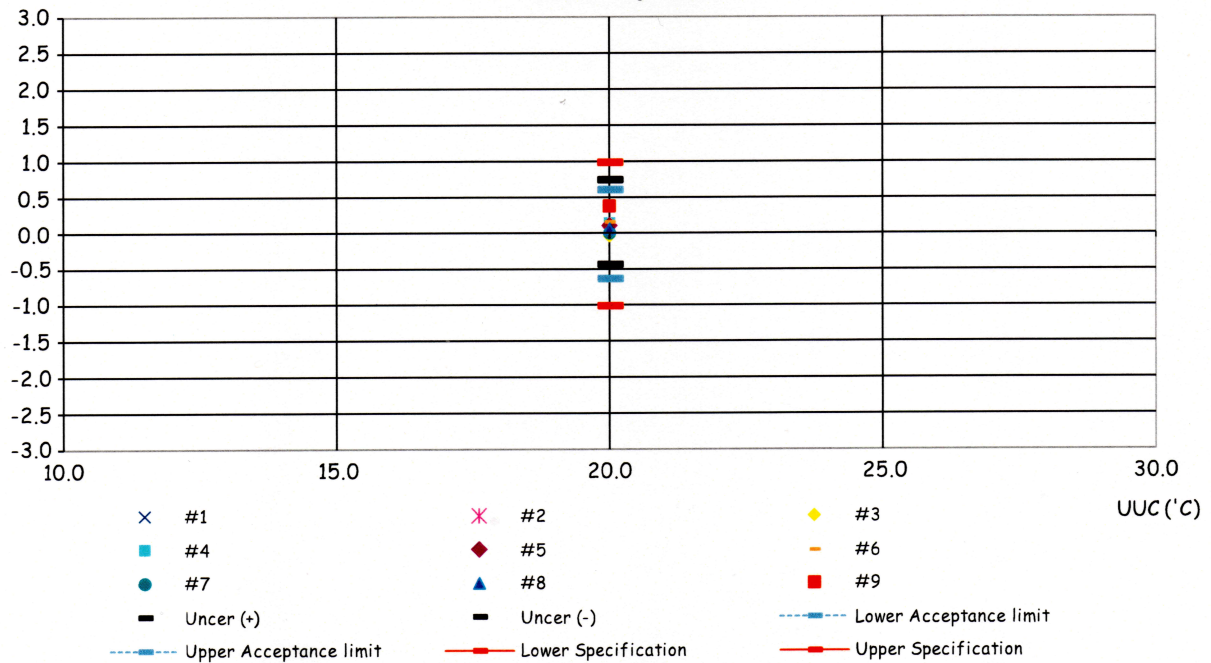
### The End of Statements of Conformity

### Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. WO-00060640

Without adjustment

Correction ('C)

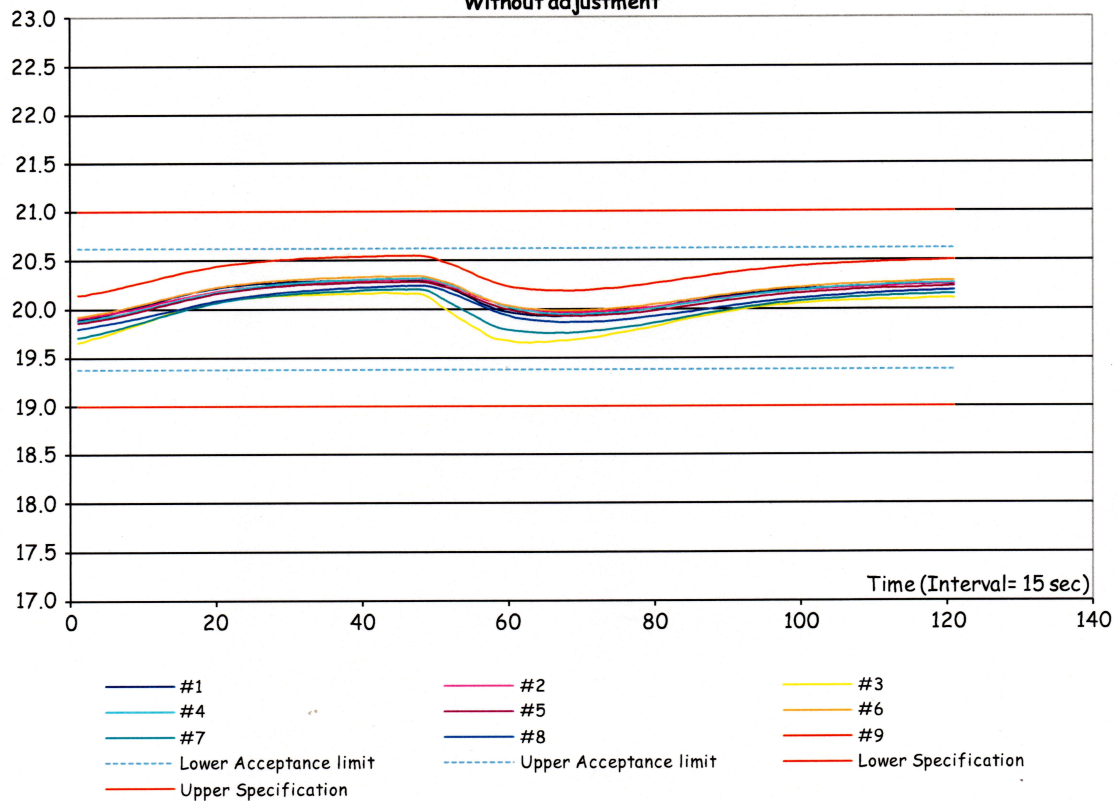


### Temperature Distribution @ 20.0°C

Job\_No. WO-00060640

Without adjustment

Std('C)





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00060640

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164 ( WW-16-001 )

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                       | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|--------------------------------------|-------------------------------------|--------------------------|----------|
| 10 Feb 2025                         |                          |                                      | 10 Feb 2025                         |                          |          |
| ปกติ                                | ไม่ปกติ                  |                                      | ปกติ                                | ไม่ปกติ                  |          |
|                                     |                          | General                              |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ                             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. การทำงาน Main Switch              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Selector Key             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การแสดงผล Display                 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทำงาน พัดลม                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 6. สภาพ Lever of Ventilation valve   | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพ Lever door open / close      | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาพ Door seal                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของระบบ Safety            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. การทำงานของระบบทำความเย็น        | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 11. การทำงานของระบบทำความร้อน        | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. สภาพตัวเครื่อง                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

ข้อแนะนำ :

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Mr. Tweewong Thaihiang

Service Engineer

## Calibration Results:

### Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

| Locations | Measured Temperature<br>(°C) | Correction of UUC.<br>(°C) | Uncertainty<br>(± °C) |
|-----------|------------------------------|----------------------------|-----------------------|
| #1        | 20.14                        | 0.14                       | 0.33                  |
| #2        | 20.14                        | 0.14                       | 0.34                  |
| #3        | 19.96                        | -0.04                      | 0.38                  |
| #4        | 20.14                        | 0.14                       | 0.35                  |
| #5        | 20.11                        | 0.11                       | 0.33                  |
| #6        | 20.17                        | 0.17                       | 0.34                  |
| #7        | 20.00                        | 0.00                       | 0.37                  |
| #8        | 20.06                        | 0.06                       | 0.35                  |
| #9        | 20.38                        | 0.38                       | 0.33                  |

### Temperature Distribution

| Desired<br>(°C) | Setting<br>(°C) | Indicating<br>(°C) | Measured Temperature at Spread Locations (°C) |       |       |       |       |       |       |       |       | Uncertainty<br>(± °C)* |
|-----------------|-----------------|--------------------|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------|
|                 |                 |                    | #1                                            | #2    | #3    | #4    | #5    | #6    | #7    | #8    | #9    |                        |
| 20.0            | 20.0            | 20.0               | 20.14                                         | 20.14 | 19.96 | 20.14 | 20.11 | 20.17 | 20.00 | 20.06 | 20.38 | 0.38                   |

### Chamber Characterization

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 20.0               | 0.57                        | 0.26                         | 0.89                      |

Note: \* Maximum uncertainty of the each position

**The End of Certificate**





# Certificate of Calibration

|                           |                         |                           |                  |
|---------------------------|-------------------------|---------------------------|------------------|
| <b>Equipment:</b>         | Hot Air Oven            | <b>Certificate No.:</b>   | C31250347        |
| <b>Model:</b>             | UF 55                   | <b>Issued Date:</b>       | 10 February 2025 |
| <b>Serial No.(or ID):</b> | B219.0142 ( WW-05-002 ) | <b>Job No.:</b>           | WO-00060640      |
| <b>Manufacturer:</b>      | Memmert                 | <b>Page:</b>              | 1 of 4           |
| <b>Condition:</b>         | In Condition            | <b>Ventilation Valve:</b> | Closed           |
| <b>Shelves(pc.):</b>      | 2                       |                           |                  |

**Customer:** C.E.M Technology (Thailand) Co., Ltd.  
219/43 Moo 12 Petchkasem Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Environment Condition:**

|              |         |   |         |
|--------------|---------|---|---------|
| Temperature: | 28 °C   | ± | 1.0 °C  |
| Humidity:    | 61 %RH  | ± | 5.3 %RH |
| Voltage:     | 230 VAC | ± | 1.5 VAC |

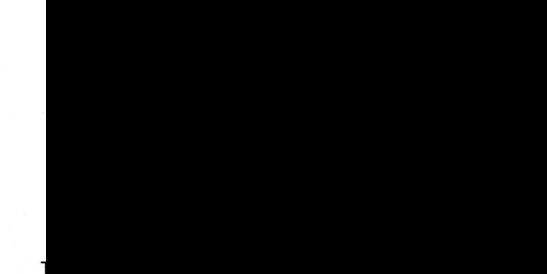
**Calibration Place:** C.E.M Technology (Thailand) Co., Ltd. ( Laboratory Room )  
219/43 Moo 12 Petchkasem Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Calibration By:** Mr. Tweewong Thaithiang

**Calibration Date:** 10 February 2025

**The Method used:** In house method, CAL-WI-16, base on TLAS-G20

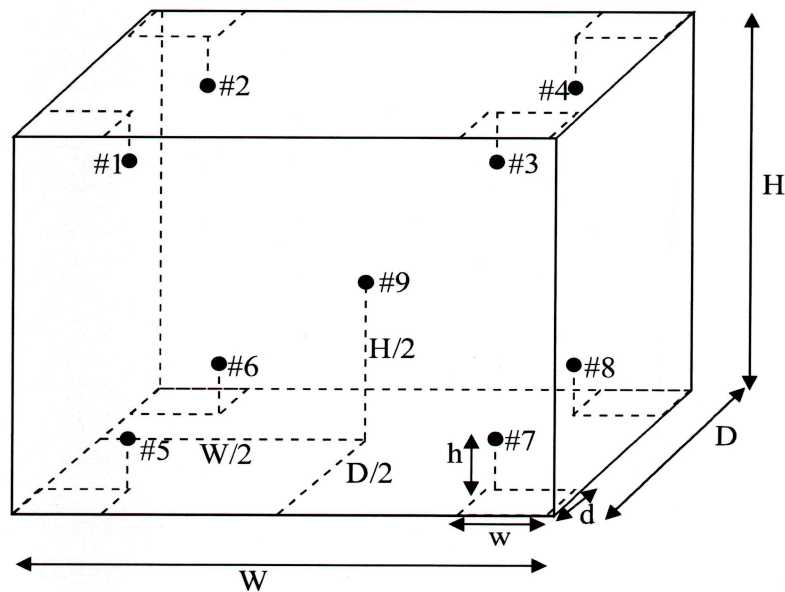
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.  
Certificate No. C10240018



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.



### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber:  $W = 40 \text{ (cm)}$   $D = 33 \text{ (cm)}$   $H = 40 \text{ (cm)}$

Standard Locations (#1, #2, #3, #4):  $w = 5 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 5 \text{ (cm)}$

Standard Locations (#5, #6, #7, #8):  $w = 5 \text{ (cm)}$   $d = 5 \text{ (cm)}$   $h = 5 \text{ (cm)}$

#9: Geometric center of the chamber

| Position of Std   | #1  | #2  | #3  | #4  | #5  | #6  | #7  | #8  | #9  |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Channel of Logger | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 |

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

**Measured Temperature:** The average reading of standards at any positions or location.

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.

**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

## Calibration Results:

### Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

| Locations | Measured Temperature<br>(°C) | Correction of UUC.<br>(°C) | Uncertainty<br>(± °C) |
|-----------|------------------------------|----------------------------|-----------------------|
| #1        | 104.29                       | 0.29                       | 0.40                  |
| #2        | 104.01                       | 0.01                       | 0.40                  |
| #3        | 104.34                       | 0.34                       | 0.40                  |
| #4        | 104.23                       | 0.23                       | 0.39                  |
| #5        | 104.43                       | 0.43                       | 0.40                  |
| #6        | 104.19                       | 0.19                       | 0.40                  |
| #7        | 103.78                       | -0.22                      | 0.40                  |
| #8        | 104.21                       | 0.21                       | 0.40                  |
| #9        | 104.47                       | 0.47                       | 0.41                  |

### Temperature Distribution

| Desired<br>(°C) | Setting<br>(°C) | Indicating<br>(°C) | Measured Temperature at Spread Locations (°C) |        |        |        |        |        |        |        |        | Uncertainty<br>(± °C)* |
|-----------------|-----------------|--------------------|-----------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|------------------------|
|                 |                 |                    | #1                                            | #2     | #3     | #4     | #5     | #6     | #7     | #8     | #9     |                        |
| 104.0           | 104.0           | 104.0              | 104.29                                        | 104.01 | 104.34 | 104.23 | 104.43 | 104.19 | 103.78 | 104.21 | 104.47 | 0.41                   |

### Chamber Characterization

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 104.0              | 0.76                        | 0.18                         | 1.04                      |

Note: \* Maximum uncertainty of the each position



**Without adjustment (Cont.)**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

| Locations | Measured Temperature<br>(°C) | Correction of UUC.<br>(°C) | Uncertainty<br>(± °C) |
|-----------|------------------------------|----------------------------|-----------------------|
| #1        | 180.20                       | 0.20                       | 0.43                  |
| #2        | 179.54                       | -0.46                      | 0.43                  |
| #3        | 180.39                       | 0.39                       | 0.43                  |
| #4        | 180.09                       | 0.09                       | 0.43                  |
| #5        | 180.62                       | 0.62                       | 0.43                  |
| #6        | 179.97                       | -0.03                      | 0.43                  |
| #7        | 179.53                       | -0.47                      | 0.48                  |
| #8        | 180.27                       | 0.27                       | 0.43                  |
| #9        | 180.57                       | 0.57                       | 0.43                  |

**Temperature Distribution**

| Desired<br>(°C) | Setting<br>(°C) | Indicating<br>(°C) | Measured Temperature at Spread Locations (°C) |        |        |        |        |        |        |        |        | Uncertainty<br>(± °C)* |
|-----------------|-----------------|--------------------|-----------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|------------------------|
|                 |                 |                    | #1                                            | #2     | #3     | #4     | #5     | #6     | #7     | #8     | #9     |                        |
| 180.0           | xxx             | 180.0              | 180.20                                        | 179.54 | 180.39 | 180.09 | 180.62 | 179.97 | 179.53 | 180.27 | 180.57 | 0.48                   |

**Chamber Characterization**

| Indicating<br>(°C) | Measured Uniformity<br>(°C) | Measured Stability<br>(± °C) | Overall Variation<br>(°C) |
|--------------------|-----------------------------|------------------------------|---------------------------|
| 180.0              | 1.26                        | 0.19                         | 1.39                      |

Note: \* Maximum uncertainty of the each position

**The End of Certificate**

## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.
- ☒ Choice B Non-binary statement with guard band ( $w = 1 U$ ), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
- ☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r U$ ) .  
; PFA – Probability of False Accept

### Without adjustment

**Desired Temperature : 104.0°C Tolerances : 1.0 °C**

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

| Locations | Measured<br>(°C) | Correction*<br>(°C) | Guard band<br>(W)<br>(± °C) | Tolerance<br>(± °C) | Conformity |
|-----------|------------------|---------------------|-----------------------------|---------------------|------------|
| #1        | 104.29           | 0.29                | 0.40                        | 1.0                 | Pass       |
| #2        | 104.01           | 0.01                | 0.40                        | 1.0                 | Pass       |
| #3        | 104.34           | 0.34                | 0.40                        | 1.0                 | Pass       |
| #4        | 104.23           | 0.23                | 0.39                        | 1.0                 | Pass       |
| #5        | 104.43           | 0.43                | 0.40                        | 1.0                 | Pass       |
| #6        | 104.19           | 0.19                | 0.40                        | 1.0                 | Pass       |
| #7        | 103.78           | -0.22               | 0.40                        | 1.0                 | Pass       |
| #8        | 104.21           | 0.21                | 0.40                        | 1.0                 | Pass       |
| #9        | 104.47           | 0.47                | 0.41                        | 1.0                 | Pass       |

Correction\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

**Statements of conformity:(Cont.)****Without adjustment (Cont.)****Desired Temperature : 180.0°C Tolerances : 2.0 °C****Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C**

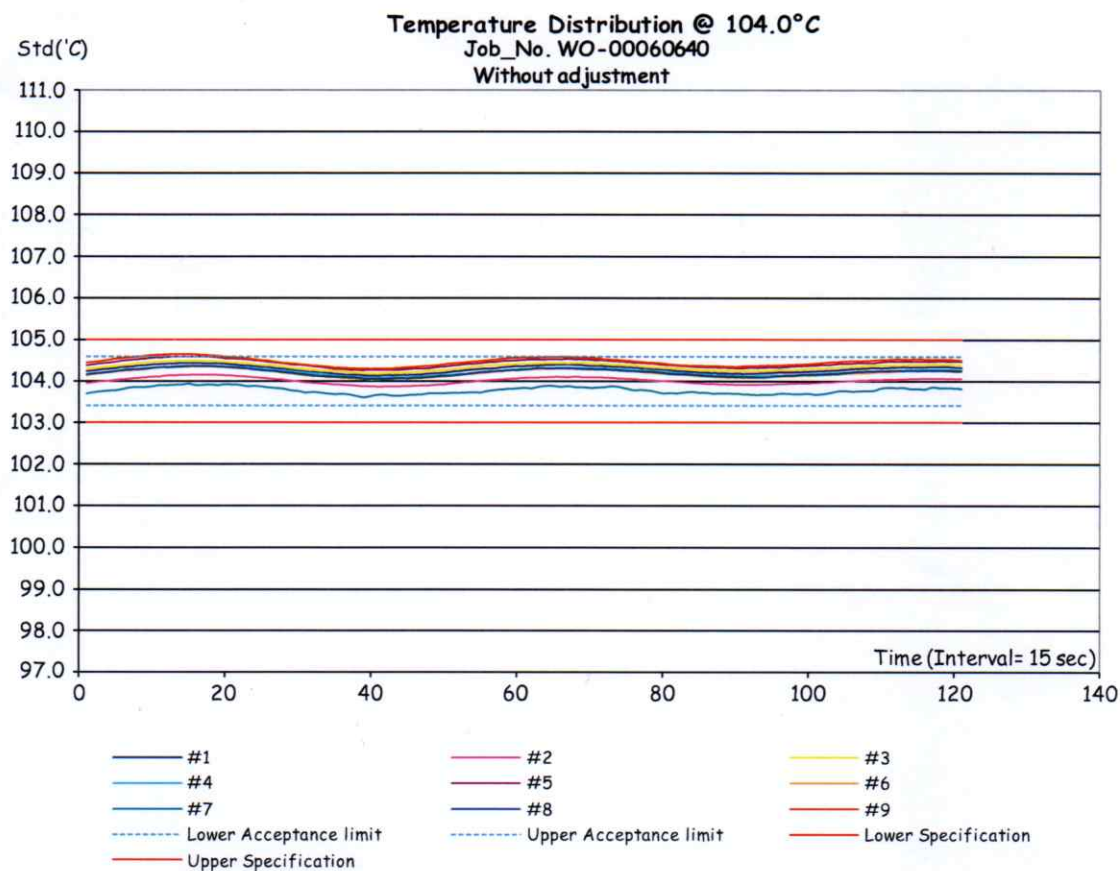
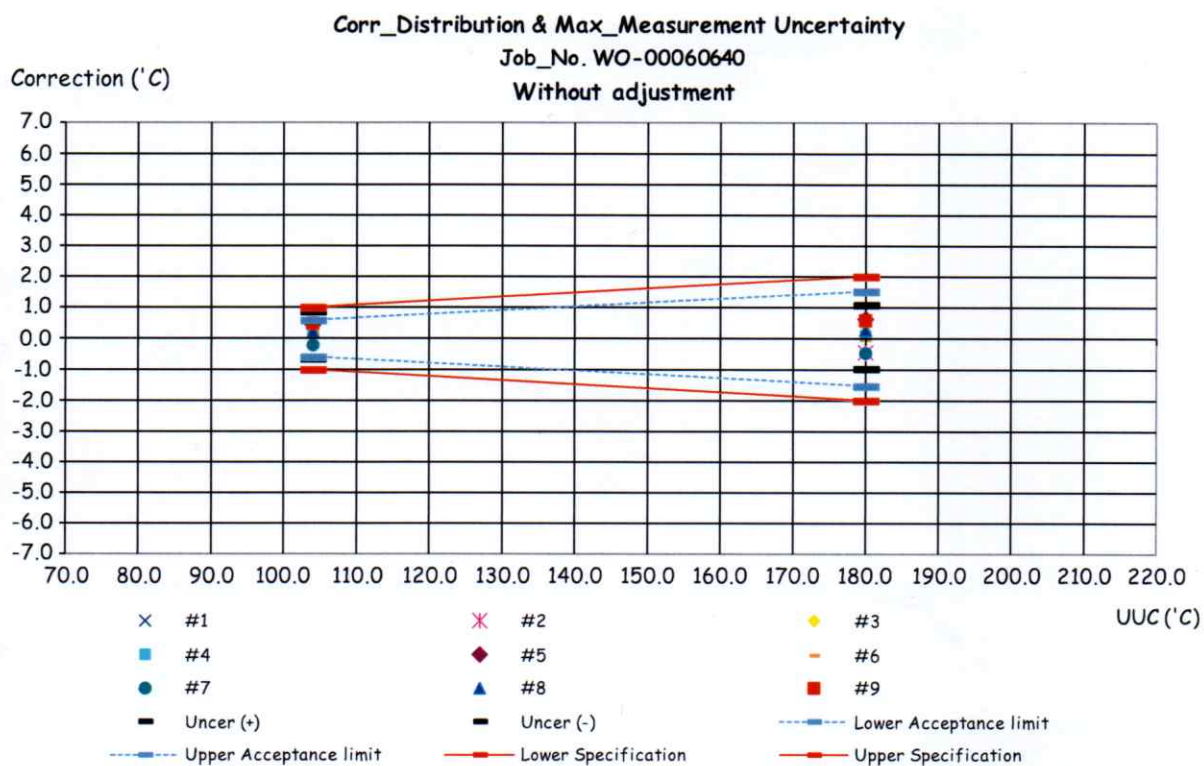
| Locations | Measured<br>(°C) | Correction*<br>(°C) | Guard band<br>(W)<br>(± °C) | Tolerance<br>(± °C) | Conformity |
|-----------|------------------|---------------------|-----------------------------|---------------------|------------|
| #1        | 180.20           | 0.20                | 0.43                        | 2.0                 | Pass       |
| #2        | 179.54           | -0.46               | 0.43                        | 2.0                 | Pass       |
| #3        | 180.39           | 0.39                | 0.43                        | 2.0                 | Pass       |
| #4        | 180.09           | 0.09                | 0.43                        | 2.0                 | Pass       |
| #5        | 180.62           | 0.62                | 0.43                        | 2.0                 | Pass       |
| #6        | 179.97           | -0.03               | 0.43                        | 2.0                 | Pass       |
| #7        | 179.53           | -0.47               | 0.48                        | 2.0                 | Pass       |
| #8        | 180.27           | 0.27                | 0.43                        | 2.0                 | Pass       |
| #9        | 180.57           | 0.57                | 0.43                        | 2.0                 | Pass       |

Correction\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

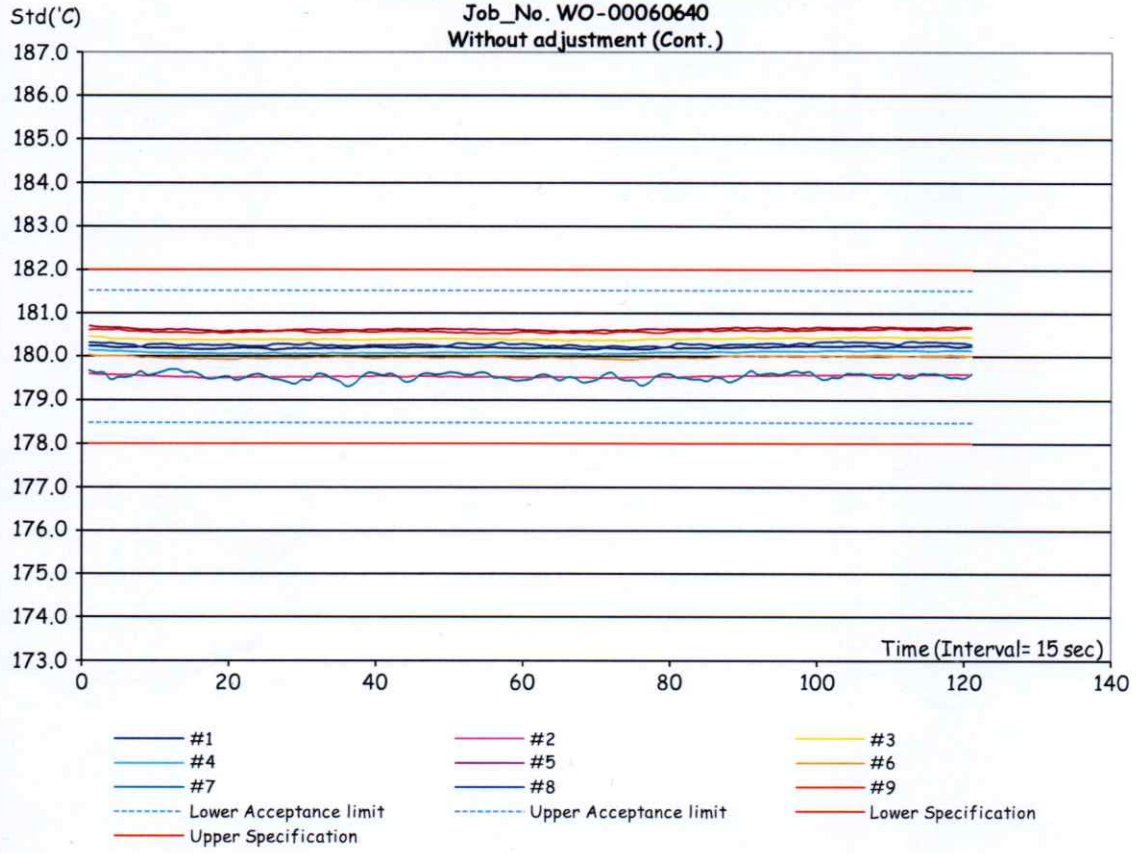
**The End of Statements of Conformity**





# Temperature Distribution @ 180.0°C

Job\_No. WO-00060640  
Without adjustment (Cont.)



## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00060640

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 55

หมายเลขเครื่อง: B219.0142 ( WW-05-002 )

| ตรวจสอบ (รับ)                       |                          | รายการตรวจเช็ค                        | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|---------------------------------------|-------------------------------------|--------------------------|----------|
| 10 Feb 2025                         |                          |                                       | 10 Feb 2025                         |                          |          |
| ปกติ                                | ไม่ปกติ                  |                                       | ปกติ                                | ไม่ปกติ                  |          |
|                                     |                          | General                               |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ                              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. การทำงาน Main Switch               | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Selector Key              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การแสดงผล Display                  | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทำงาน พัดลม                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. สภาพ Lever of Ventilation valve    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพ Lever door open / close       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาพ Door seal                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของระบบ Safety             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input type="checkbox"/>            | <input type="checkbox"/> | 10. การทำงานของระบบทำความเย็น         | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input type="checkbox"/>            | <input type="checkbox"/> | 11. การทำงานของระบบทำความร้อน         | <input type="checkbox"/>            | <input type="checkbox"/> | ไม่มี    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. สภาพตัวเครื่อง                    | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

ข้อแนะนำ :



## Certificate of Calibration

**Certificate No. :** 68-400089-3

**Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co.,Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Temperature Indicator with Thermistor Probe  
Temperature Indicator

|                  |                  |                   |           |
|------------------|------------------|-------------------|-----------|
| Manufacturer :   | Apera            | Model :           | PC 910    |
| Range :          | N/A °C           | Resolution :      | 0.1 °C    |
| Serial No. :     | PC910X1220811001 | ID No. :          | WW-03-002 |
| Thermistor probe |                  |                   |           |
| Model :          | N/A              | Sheath Material : | Stainless |
| Diameter :       | 4.8 mm.          | Length :          | 100 mm.   |
| Serial No. :     | N/A              | ID No. :          | WW-03-002 |

**Environment :** On site calibration was carried out at the Laboratory,  
C.E.M Technology (Thailand) Co., Ltd.

|                       |                      |
|-----------------------|----------------------|
| Ambient Temperature : | (26.0 to 27.0) °C    |
| Relative Humidity :   | (45 to 50) %         |
| Line Voltage :        | (224.5 to 226.0) VAC |

**Date of Received :** 11 February 2025

**Date of Calibration :** 11 February 2025

**Date of Issue :** 17 February 2025

**Calibrated by :** Permpoon Chanpu

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4003  
by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

| <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> | <u>Traceability</u>                             |
|---------------|------------------|-----------------|-------------------------------------------------|
| 400002        | TT-0095-24       | 01 Jul 2026     | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> | <u>Traceability</u>                             |
|---------------|------------------|-----------------|-------------------------------------------------|
| 400033        | 24E633           | 21 Feb 2026     | National Institute of Metrology Thailand (NIMT) |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 68-400089-3

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

| Immersion Depth<br>( mm. ) | Standard Reading<br>( ° C ) | UUC Reading<br>( ° C ) | Correction<br>( ° C ) | Uncertainty<br>( ± ° C ) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 100                        | 25.003                      | 25.2                   | -0.2                  | 0.19                     |

### Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -

## Certificate of Calibration

**Certificate No. :** 68-420017-3

**Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co., Ltd.

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Apera

Model : PC 910

Range : N/A

pH

Resolution : 0.01 pH

Serial No. : PC910X1220811001

ID No. : WW-03-002

Electrode

Model : LabSen 211

Serial No. : 2110009/213

ID No. : WW-03-002

**Environment :** On site calibration was carried out at the Laboratory,

C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (26.0 to 27.0) °C

Relative Humidity : (45 to 50) %

**Date of Received :** 11 February 2025

**Date of Calibration :** 11 February 2025

**Date of Issue :** 17 February 2025

**Calibrated by :** Permpon Chanpu

**Calibration Method :** In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

### 1. Multiproduct Calibrator

| ID No. | Cert. No.     | Due Date    | Traceability                                    |
|--------|---------------|-------------|-------------------------------------------------|
| 400005 | SG-E-00307/66 | 23 Aug 2025 | National Institute of Metrology Thailand (NIMT) |

### 2. Standard Buffer Solution

| pH     | Cert. No. | Lot No. | Exp. Date   | Traceability                                            |
|--------|-----------|---------|-------------|---------------------------------------------------------|
| 4.008  | 61293328  | 1027612 | 15 Sep 2026 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 6.987  | 61297593  | 1027614 | 15 Sep 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 10.010 | 61306165  | 1027613 | 15 Sep 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |

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The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. : 68-420017-3**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Electrical measurement

pH meter

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

| Adjustment Curve<br>at nominal pH | Applied Voltage<br>( mV ) | Nominal Value<br>( pH ) | UUC Reading |        | Correction<br>( mV ) | Uncertainty<br>( ± mV ) |
|-----------------------------------|---------------------------|-------------------------|-------------|--------|----------------------|-------------------------|
|                                   |                           |                         | ( pH )      | ( mV ) |                      |                         |
| 4, 7, 10                          | 177.4800                  | 4                       | 4.00        | 177    | 0                    | 0.59                    |
|                                   | 0.0000                    | 7                       | 7.00        | 0      | 0                    | 0.58                    |
|                                   | -177.4800                 | 10                      | 10.00       | -178   | 1                    | 0.59                    |

**Function :** pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

| Adjustment Curve<br>at nominal pH | Standard Buffer<br>( pH ) | UUC Reading<br>( pH ) | Correction<br>( pH ) | Uncertainty<br>( ± pH ) |
|-----------------------------------|---------------------------|-----------------------|----------------------|-------------------------|
| 4, 7, 10                          | 4.008                     | 4.00                  | 0.01                 | 0.0097                  |
|                                   | 6.987                     | 7.00                  | -0.01                | 0.011                   |
|                                   | 10.010                    | 10.01                 | 0.00                 | 0.014                   |

Remark

UUC : Unit Under Calibration

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

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

- 000 -

## Certificate of Calibration

**Certificate No. :** 68-430004-2 **Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co., Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Digital Conductivity meter with probe  
 Manufacturer : Apera Model : PC 910  
 Serial No. : PC910X1220811001 ID No. : WW-03-002  
 Electrode  
 Model : N/A Serial No. : N/A  
 ID No. : WW-03-002

**Environment :** On site calibration was carried out at the Laboratory.  
 C.E.M Technology (Thailand) Co., Ltd.  
 Ambient Temperature (26.0 to 27.0) °C  
 Relative Humidity (45 to 50) %

**Date of Received :** 11 February 2025

**Date of Calibration :** 11 February 2025

**Date of Issue :** 17 February 2025

**Calibrated by :** Permpoon Chanpu

**Calibration Method :** In-house method CAL-M4301 direct measurement by conductivity buffer solution

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

Standard Buffer Solution

| Material    | Lot No. | Exp. Date     | Traceability                                                         |
|-------------|---------|---------------|----------------------------------------------------------------------|
| 84 µS/cm    | 0300    | 01 June 2027  | National Institute of Standards and Technology (NIST), U.S.A., S.R.M |
| 1413 µS/cm  | 970986  | 25 April 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025              |
| 12.88 mS/cm | 970987  | 25 April 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025              |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. : 68-430004-2**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Conductivity measurement

Before Adjustment

| Standard<br>Conductivity Solution | UUC Reading | Correction | Uncertainty ( ± ) | Unit  |
|-----------------------------------|-------------|------------|-------------------|-------|
| 84*                               | 81.9        | 2.1        | 1.1               | μS/cm |
| 1413                              | 1444        | -31        | 9.0               | μS/cm |
| 12.88                             | 12.41       | 0.47       | 0.082             | mS/cm |

After Adjustment : at 25.000, 84, 147, 1413 μS/cm 12.880, 80, 111.80 mS/cm

| Standard<br>Conductivity Solution | UUC Reading | Correction | Uncertainty ( ± ) | Unit  |
|-----------------------------------|-------------|------------|-------------------|-------|
| 84*                               | 84.0        | 0.0        | 1.1               | μS/cm |
| 1413                              | 1413        | 0          | 9.0               | μS/cm |
| 12.88                             | 12.88       | 0.00       | 0.082             | mS/cm |

Remark

UUC : Unit Under Calibration

\* This parameter are out of accreditation's scope.

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

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

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## Certificate of Calibration

**Certificate No. :** 68-400089-1 **Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co.,Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Temperature Indicator with Thermistor Probe  
Temperature Indicator  
Manufacturer : Thermo Scientific Model : VERSA STAR PRO  
Range : N/A °C Resolution : 0.1 °C  
Serial No. : 12260 ID No. : WW-03-001  
Thermistor probe  
Model : N/A Sheath Material : Stainless  
Diameter : 6.5 mm. Length : 120 mm.  
Serial No. : PT1-18812 ID No. : WW-03-001

**Environment :** On site calibration was carried out at the Laboratory,  
C.E.M Technology (Thailand) Co., Ltd.  
Ambient Temperature : (26.0 to 27.0) °C  
Relative Humidity : (45 to 50) %  
Line Voltage : (224.5 to 226.0) VAC

**Date of Received :** 11 February 2025  
**Date of Calibration :** 11 February 2025  
**Date of Issue :** 17 February 2025  
**Calibrated by :** Permpon Chanpu  
**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No.  | Due Date    | Traceability                                    |
|--------|------------|-------------|-------------------------------------------------|
| 400002 | TT-0095-24 | 01 Jul 2026 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date    | Traceability                                    |
|--------|-----------|-------------|-------------------------------------------------|
| 400033 | 24E633    | 21 Feb 2026 | National Institute of Metrology Thailand (NIMT) |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 68-400089-1

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

| Immersion Depth<br>( mm. ) | Standard Reading<br>( ° C ) | UUC Reading<br>( ° C ) | Correction<br>( ° C ) | Uncertainty<br>( ± ° C ) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 130                        | 25.004                      | 25.1                   | -0.1                  | 0.19                     |

Remark

UUC : Unit Under Calibration

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

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

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## Certificate of Calibration

**Certificate No. :** 68-420017-1

**Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co., Ltd.

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

Serial No. : 12260 ID No. : WW-03-001

Electrode

Model : 9156BNWP Serial No. : VV1-15843

ID No. : WW-03-001

**Environment :** On site calibration was carried out at the Laboratory,

C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (26.0 to 27.0)° C

Relative Humidity : (45 to 50) %

**Date of Received :** 11 February 2025

**Date of Calibration :** 11 February 2025

**Date of Issue :** 17 February 2025

**Calibrated by :** Permpon Chanpu

**Calibration Method :** In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

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

### 1. Multiproduct Calibrator

| ID No. | Cert. No.     | Due Date    | Traceability                                    |
|--------|---------------|-------------|-------------------------------------------------|
| 400005 | SG-E-00307/66 | 23 Aug 2025 | National Institute of Metrology Thailand (NIMT) |

### 2. Standard Buffer Solution

| pH     | Cert. No. | Lot No. | Exp. Date   | Traceability                                            |
|--------|-----------|---------|-------------|---------------------------------------------------------|
| 4.008  | 61293328  | 1027612 | 15 Sep 2026 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 6.987  | 61297593  | 1027614 | 15 Sep 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |
| 10.010 | 61306165  | 1027613 | 15 Sep 2025 | CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025 |

App

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. : 68-420017-1**

**Page : 2 of 2**

**Result of Calibration :**

**UUC Condition As-Received :** Good

**Function :** Electrical measurement

pH meter

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

| Adjustment Curve<br>at nominal pH | Applied Voltage<br>( mV ) | Nominal Value<br>( pH ) | UUC Reading |        | Correction<br>( mV ) | Uncertainty<br>( ± mV ) |
|-----------------------------------|---------------------------|-------------------------|-------------|--------|----------------------|-------------------------|
|                                   |                           |                         | ( pH )      | ( mV ) |                      |                         |
| 4, 7, 10                          | 177.4800                  | 4                       | 4.00        | 177.4  | 0.1                  | 0.12                    |
|                                   | 0.0000                    | 7                       | 7.00        | 0.0    | 0.0                  | 0.086                   |
|                                   | -177.4800                 | 10                      | 10.00       | -177.4 | -0.1                 | 0.12                    |

**Function :** pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

| Adjustment Curve<br>at nominal pH | Standard Buffer<br>( pH ) | UUC Reading<br>( pH ) | Correction<br>( pH ) | Uncertainty<br>( ± pH ) |
|-----------------------------------|---------------------------|-----------------------|----------------------|-------------------------|
| 4, 7, 10                          | 4.008                     | 4.01                  | 0.00                 | 0.0097                  |
|                                   | 6.987                     | 7.00                  | -0.01                | 0.011                   |
|                                   | 10.010                    | 10.01                 | 0.00                 | 0.014                   |

Remark

UUC : Unit Under Calibration

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

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

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## Certificate of Calibration

**Certificate No. :** 68-400089-1 **Page : 1 of 2**

**Submitted by :** C.E.M Technology (Thailand) Co.,Ltd.  
219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

**Equipment :** Temperature Indicator with Thermistor Probe  
Temperature Indicator  
Manufacturer : Thermo Scientific Model : VERSA STAR PRO  
Range : N/A °C Resolution : 0.1 °C  
Serial No. : 12260 ID No. : WW-03-001  
Thermistor probe  
Model : N/A Sheath Material : Stainless  
Diameter : 6.5 mm. Length : 120 mm.  
Serial No. : PT1-18812 ID No. : WW-03-001

**Environment :** On site calibration was carried out at the Laboratory,  
C.E.M Technology (Thailand) Co., Ltd.  
Ambient Temperature : (26.0 to 27.0) °C  
Relative Humidity : (45 to 50) %  
Line Voltage : (224.5 to 226.0) VAC

**Date of Received :** 11 February 2025  
**Date of Calibration :** 11 February 2025  
**Date of Issue :** 17 February 2025  
**Calibrated by :** Permpon Chanpu

**Calibration Method :** This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the dry-well calibrator at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

| ID No. | Cert. No.  | Due Date    | Traceability                                    |
|--------|------------|-------------|-------------------------------------------------|
| 400002 | TT-0095-24 | 01 Jul 2026 | National Institute of Metrology Thailand (NIMT) |

2. Standard Digital Thermometer

| ID No. | Cert. No. | Due Date    | Traceability                                    |
|--------|-----------|-------------|-------------------------------------------------|
| 400033 | 24E633    | 21 Feb 2026 | National Institute of Metrology Thailand (NIMT) |

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 68-400089-1

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

| Immersion Depth<br>( mm. ) | Standard Reading<br>( ° C ) | UUC Reading<br>( ° C ) | Correction<br>( ° C ) | Uncertainty<br>( ± ° C ) |
|----------------------------|-----------------------------|------------------------|-----------------------|--------------------------|
| 130                        | 25.004                      | 25.1                   | -0.1                  | 0.19                     |

Remark

UUC : Unit Under Calibration

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

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

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# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raking 30 Puttamonton 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2503003S

page 1 of 2

**Customer :** C.E.M TECHNOLOGY (THAILAND) CO., LTD.  
219/43 Moo 12 Petchkasem Road, Omnoi,  
Krathumban, Samutsakorn 74130

|                               |                                                           |                                   |                                 |
|-------------------------------|-----------------------------------------------------------|-----------------------------------|---------------------------------|
| <b>Equipment :</b>            | Non-automatic weighing instrument (Electronic instrument) | <b>Order No. :</b>                | 68S0877-1                       |
| <b>Manufacturer :</b>         | Sartorius                                                 | <b>Ambient temperature :</b>      | $(20.2 \pm 5.0) ^\circ\text{C}$ |
| <b>Model :</b>                | BSA224S-CW                                                | <b>Relative humidity :</b>        | $(54.5 \pm 10.0) \%$            |
| <b>Accuracy class :</b>       | -                                                         | <b>Received date :</b>            | 01-Mar-2025                     |
| <b>Capacity :</b>             | 220 g                                                     | <b>Date of calibration :</b>      | 01-Mar-2025                     |
| <b>Resolution :</b>           | 0.0001 g                                                  | <b>Date of issue :</b>            | 01-Mar-2025                     |
| <b>Serial No. :</b>           | 3139614148                                                | <b>Condition of the balance :</b> | Good working conditions         |
| <b>ID No. :</b>               | CI-01-003                                                 |                                   |                                 |
| <b>Place of calibration :</b> | ห้องเครื่องชั่ง                                           |                                   |                                 |

### Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

### Condition of reference standard weight

| Instrument            | Nominal value | Serial No.  | Certificate No. | Due-date   | Density (kg/m <sup>3</sup> ) |
|-----------------------|---------------|-------------|-----------------|------------|------------------------------|
| 1 Standard weight set | 1 mg to 2 kg  | 15885+15849 | M2410001S       | 5-Oct-2025 | 7950                         |

### Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By : Sathaporn Rueangpluppla  
Technician

Approved Signatory

This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2503003S

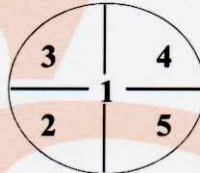
page 2 of 2

### The repeatability of indication

| Nominal Value<br>( g ) | Standard Deviation of reading<br>( g ) | Maximum difference between<br>successive reading ( g ) | n |
|------------------------|----------------------------------------|--------------------------------------------------------|---|
| 200                    | 0.00000                                | 0.0000                                                 | 5 |

### The effect of eccentric application of a load on the indication (test load : 100 g)

| Position        | Balance Reading<br>( g ) |
|-----------------|--------------------------|
| Point 1         | 100.0000                 |
| Point 2         | 100.0000                 |
| Point 3         | 99.9999                  |
| Point 4         | 99.9998                  |
| Point 5         | 100.0000                 |
| Eccentric Value | 0.0002                   |



### The error of indication

| Nominal Value<br>( g ) | Value of Reference<br>Standard Weight<br>( g ) | Balance Reading<br>( g ) | Correction<br>( g ) | Uncertainty (±)<br>( g ) | k    |
|------------------------|------------------------------------------------|--------------------------|---------------------|--------------------------|------|
| Unload                 | 0.0000                                         | 0.0000                   | 0.0000              | 0.000082                 | 2.00 |
| 1                      | 1.0000                                         | 1.0000                   | 0.0000              | 0.000085                 | 2.00 |
| 2                      | 2.0000                                         | 2.0000                   | 0.0000              | 0.000087                 | 2.00 |
| 5                      | 5.0000                                         | 5.0001                   | -0.0001             | 0.000090                 | 2.00 |
| 10                     | 10.0000                                        | 10.0000                  | 0.0000              | 0.000094                 | 2.00 |
| 20                     | 20.0000                                        | 20.0000                  | 0.0000              | 0.00011                  | 2.00 |
| 50                     | 50.0000                                        | 50.0000                  | 0.0000              | 0.00013                  | 2.00 |
| 100                    | 100.0000                                       | 100.0000                 | 0.0000              | 0.00019                  | 2.00 |
| 120                    | 120.0000                                       | 120.0001                 | -0.0001             | 0.00024                  | 2.00 |
| 150                    | 150.0000                                       | 150.0000                 | 0.0000              | 0.00027                  | 2.00 |
| 200                    | 200.0002                                       | 200.0000                 | +0.0002             | 0.00033                  | 2.00 |

Remark : Adjustment, Internal weight

### Uncertainty of measurement

The reported expanded uncertainty of measurement 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% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--



# CALIBRATION CERTIFICATE

Certificate No.S2505043S

page 1 of 2

**Customer :** C.E.M. TECHNOLOGY (THAILAND) CO., LTD.  
219/43 Moo 12, Petchkasem Rd., Omnoi,  
Krathumban, Samutsakorn 74130

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Sartorius

**Order No. :** 68S1799-1

**Model :** QUINTIX224-1S

**Ambient temperature :**  $(23.9 \pm 1.0) ^\circ\text{C}$

**Accuracy class :** -

**Relative humidity :**  $(38.9 \pm 5.0) \%$

**Capacity :** 220000 mg

**Received date :** 30-Apr-2025

**Resolution :** 0.1 mg

**Date of calibration :** 30-Apr-2025

**Serial No. :** 0035009070

**Date of issue :** 03-May-2025

**ID No. :** CI-01-002

**Condition of the balance :** Good working conditions

**Place of calibration :** ห้องเครื่องชั่ง

## Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

## Condition of reference standard weight

| <u>Instrument</u>     | <u>Nominal value</u> | <u>Serial No.</u> | <u>Certificate No.</u> | <u>Due-date</u> | <u>Density (kg/m<sup>3</sup>)</u> |
|-----------------------|----------------------|-------------------|------------------------|-----------------|-----------------------------------|
| 1 Standard weight set | 1 mg to 2 kg         | 15885+15849       | M2410001S              | 5-Oct-2025      | 7950                              |

## Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By : Aekhasak Silarut  
Technician

Approved Signature

This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.



# CALIBRATION CERTIFICATE

Certificate No.S2505043S

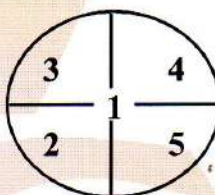
page 2 of 2

## The repeatability of indication

| Nominal Value<br>( mg ) | Standard Deviation of reading<br>( mg ) | Maximum difference between<br>susccessive reading ( mg ) | n |
|-------------------------|-----------------------------------------|----------------------------------------------------------|---|
| 200000                  | 0.04                                    | 0.1                                                      | 5 |

## The effect of eccentric application of a load on the indication (test load : 100000 mg)

| Position        | Balance Reading<br>( mg ) |
|-----------------|---------------------------|
| Point 1         | 99999.8                   |
| Point 2         | 99999.8                   |
| Point 3         | 99999.8                   |
| Point 4         | 99999.6                   |
| Point 5         | 99999.6                   |
| Eccentric Value | 0.2                       |



## The error of indication

| Nominal Value<br>( mg ) | Value of Reference<br>Standard Weight<br>( mg ) | Balance Reading<br>( mg ) | Correction<br>( mg ) | Uncertainty (±)<br>( mg ) | k    |
|-------------------------|-------------------------------------------------|---------------------------|----------------------|---------------------------|------|
| Unload                  | 0.0                                             | 0.0                       | 0.0                  | 0.14                      | 2.21 |
| 100                     | 100.0                                           | 100.0                     | 0.0                  | 0.14                      | 2.21 |
| 200                     | 200.0                                           | 200.1                     | -0.1                 | 0.14                      | 2.21 |
| 500                     | 500.0                                           | 500.0                     | 0.0                  | 0.14                      | 2.20 |
| 1000                    | 1000.0                                          | 1000.0                    | 0.0                  | 0.14                      | 2.20 |
| 2000                    | 2000.0                                          | 2000.0                    | 0.0                  | 0.14                      | 2.20 |
| 5000                    | 5000.0                                          | 5000.1                    | -0.1                 | 0.14                      | 2.18 |
| 10000                   | 10000.0                                         | 10000.0                   | 0.0                  | 0.14                      | 2.16 |
| 20000                   | 20000.0                                         | 20000.0                   | 0.0                  | 0.15                      | 2.13 |
| 50000                   | 50000.0                                         | 50000.0                   | 0.0                  | 0.16                      | 2.08 |
| 100000                  | 100000.0                                        | 99999.8                   | +0.2                 | 0.21                      | 2.00 |
| 200000                  | 200000.2                                        | 199999.7                  | +0.5                 | 0.34                      | 2.00 |

Remark : Without adjustment

## Uncertainty of measurement

The reported expanded uncertainty of measurement 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% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--