

ภาคผนวก ข

## เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์





QUALITY CALIBRATION CO., LTD.  
235 Petchkasem 63/2 Road, Laksoeng, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



CERTIFICATE No : 2318798  
REFERENCE No : 70515-6

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
SERIAL No : G508.0791  
ID No : EQL-128  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 11-Sep-23

APPROVED BY :   
PONGK K. J.  
ISSUED DATE : 15-Sep-23  
RECEIVED DATE : 11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
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F-C010 REV : 03



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CERTIFICATE No : 2318798

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
ID No : EQL-128  
RECEIVED DATE : 11-Sep-23  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH  
S/N : G508.0791  
CALIBRATION DATE : 11-Sep-23

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLA5 G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

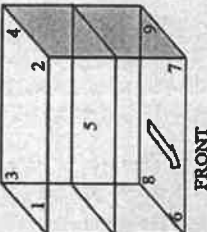
### 2. REFERENCE STANDARD INSTRUMENTS :-

- 1) DATA LOGGER WITH RTD HYDRA 2655A 7301307 23176636 10-Jul-24
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1  
Overall Line Voltage (V) variation : 10  
Instrument Condition : Normal  
Chamber Size (W\*L\*H) : 56\*40\*48 cm



#### CHAMBER PERFORMANCE

| Calibrate Point (°C) | Average All Position Temp. (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|----------------------|---------------------------------|-----------------------------|-----------------------------|------------------------|
| 104.0                | 104.49                          | 0.28                        | 0.66                        | 0.93                   |
| 180.0                | 180.25                          | 0.32                        | 0.62                        | 1.11                   |

#### TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations |        |        |        |        |        |        |        |        | Uncertainty (± °C) |
|----------------------|----------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
|                      |                      | #1  | #2     | #3     | #4     | Ref. 5 | #6     | #7     | #8     | #9     |                    |
| 104.0                | 104.0                | 104.46  | 104.13 | 104.45 | 104.28 | 104.57 | 104.67 | 104.60 | 104.58 | 104.67 | 0.38               |
| 180.0                | 180.0                | 180.27  | 179.85 | 180.41 | 179.93 | 180.19 | 180.54 | 180.41 | 180.51 | 180.13 | 1.1                |

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA. THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G010 REV : 03



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CERTIFICATE No : 23T8799  
REFERENCE No : 70515-7

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
SERIAL No : G512.2005  
ID No : EQL-161  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 11-Sep-23

APPROVED BY :   
ISSUED DATE : 15-Sep-23  
RECEIVED DATE : 11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
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F-G010 REV : 03

ภาพผนวก ข-2



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CERTIFICATE No : 23T8799

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UFE 500  
ID No : EQL-161  
RECEIVED DATE : 11-Sep-23  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
SN : G512.2005  
CALIBRATION DATE : 11-Sep-23  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TIAS G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

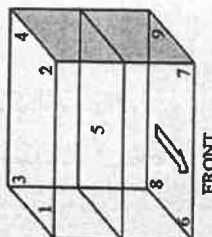
### 2. REFERENCE STANDARD INSTRUMENTS :

- 1) DATA LOGGER WITH RTD : HYDRA 2635A  
2) THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
3. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
4. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1  
Overall Line Voltage (V) variation : 10  
Instrument Condition : Normal  
Chamber Size (W\*L\*H): 56\*40\*48 cm



#### CHAMBER PERFORMANCE

| Calibrate Point (°C) | Average All Position Temp. (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|----------------------|---------------------------------|-----------------------------|-----------------------------|------------------------|
| 104.0                | 103.96                          | 0.14                        | 0.58                        | 0.73                   |
| 180.0                | 179.55                          | 0.22                        | 0.93                        | 1.47                   |

#### TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations |        |        |        |        |        |        |        |        | Uncertainty (± °C) |
|----------------------|----------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
|                      |                      | #1  | #2     | #3     | #4     | Ref. 5 | #6     | #7     | #8     | #9     |                    |
| 104.0                | 104.0                | 104.16  | 104.13 | 104.20 | 103.98 | 103.76 | 104.06 | 103.71 | 103.93 | 103.93 | 0.38               |
| 180.0                | 180.0                | 179.73  | 179.89 | 180.04 | 179.54 | 179.30 | 178.98 | 179.75 | 178.97 | 179.77 | 1.1                |

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA. THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.  
END OF CALIBRATION REPORT

F-G010 REV : 03



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CERTIFICATE No : 23TR797  
REFERENCE No : 70515-5

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UF 110  
SERIAL No : B414.0764  
ID No : EQL-169  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30/32 RAMA II SOI 63, RAMA II RD., SAMAEDAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : CHAICHARN CH.  
CALIBRATION DATE : 11-Sep-23

APPROVED BY :   
PONGSAK J.  
ISSUED DATE : 15-Sep-23  
RECEIVED DATE : 11-Sep-23

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F-G010 REV : 03



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CERTIFICATE No : 23TR797

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : HOT AIR OVEN  
MANUFACTURER : MEMMERT  
MODEL : UF 110  
ID No : EQL-169  
RECEIVED DATE : 11-Sep-23  
AMBIENT TEMPERATURE : 24 °C ± 1 °C  
S/N : B414.0764  
CALIBRATION DATE : 11-Sep-23  
RELATIVE HUMIDITY : 51 %RH ± 10 %RH

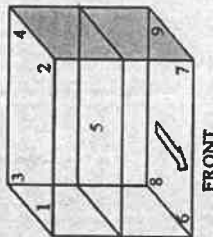
### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLA5 G-20 BY COMPARISON WITH CALIBRATED RTD Pt100 UNDER NO LOAD CONDITION. THE TEMPERATURE PROBES WERE PLACED ON NINE POINTS AND LOCATED ONE THERMOMETER PROBE IN EACH OF THE EIGHT CORNERS OF THE CHAMBER AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE NINTH THERMOMETER PROBE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.
- REFERENCE STANDARD INSTRUMENTS :-
  - 1) DATA LOGGER WITH RTD HYDRA 2635A 23T6636
  3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
  4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
  5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

#### GENERAL INFORMATION

Overall Ambient Temperature around the Chamber (°C) variation : 1  
Overall Line Voltage (V) variation : 3  
Instrument Condition : Normal  
Chamber Size (W\*L\*H): 56\*40\*48 cm



#### CHAMBER PERFORMANCE

| Calibrate Point (°C) | Average All Position Temp. (°C) | Temperature Stability (±°C) | Temperature Uniformity (°C) | Overall Variation (°C) |
|----------------------|---------------------------------|-----------------------------|-----------------------------|------------------------|
| 104.0                | 104.04                          | 0.10                        | 0.55                        | 1.06                   |
| 120.0                | 120.10                          | 0.11                        | 0.65                        | 1.20                   |
| 140.0                | 140.03                          | 0.14                        | 0.77                        | 1.33                   |
| 150.0                | 150.05                          | 0.14                        | 0.79                        | 1.48                   |

#### TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations |        |        |        |        |        |        |        |        | Uncertainty (± °C) |
|----------------------|----------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
|                      |                      | #1  | #2     | #3     | #4     | #5     | #6     | #7     | #8     | #9     |                    |
| 104.0                | 104.0                | 104.34  | 104.25 | 104.10 | 104.00 | 104.05 | 103.61 | 103.93 | 103.57 | 104.54 | 0.38               |
| 120.0                | 120.0                | 120.39  | 120.38 | 120.27 | 120.06 | 120.13 | 119.57 | 119.98 | 119.52 | 120.56 | 0.46               |
| 140.0                | 140.0                | 140.47  | 140.39 | 140.24 | 139.99 | 140.01 | 139.39 | 139.94 | 139.30 | 140.54 | 0.46               |
| 150.0                | 150.0                | 150.55  | 150.49 | 150.32 | 150.00 | 149.98 | 149.35 | 149.97 | 149.25 | 150.57 | 0.46               |

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

NOTE 2 : LOCATION 5 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

P-G010 REV : 03



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CERTIFICATE No : 23M6754  
REFERENCE No : 69854-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BP210S  
SERIAL No : S0736477  
ID No : EQL-008  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD.,  
SAMAEDAM, BANGKHUNTHIAN, BANGKOK  
10150

CALIBRATED BY : PRASERT D.  
CALIBRATION DATE : 13-Jul-23  
APPROVED BY :   
PONGCHAI K. J.  
ISSUED DATE : 17-Jul-23  
RECEIVED DATE : 13-Jul-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
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F-C010 REV 03



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CERTIFICATE No : 23M6754

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BP210S  
ID No : EQL-008  
SERIAL No : S0736477  
AIR PRESSURE : 101 Imbar ± Imbar  
AMBIENT TEMPERATURE : 23° C ± 1° C  
RECEIVED DATE : 13-Jul-23  
CALIBRATION DATE : 13-Jul-23  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING INTERNAL WEIGHT TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN. THE INTERNAL WEIGHT WAS CHECKED BY USING 2. REFERENCE STANDARD INSTRUMENTS :

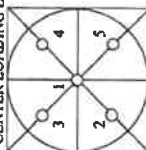
1) STANDARD WEIGHT SET : QK-1-151  
2) STANDARD WEIGHT : E2  
3) THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT  
1. ZERO SETTING FUNCTION : NORMAL  
2. TARE FUNCTION : NORMAL  
3. REPEATABILITY OF READING AT 200 g WAS 0 g  
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (± g) |
|-------------------|---------------------|----------------|-------------------|
| 0.0               | 0.0000              | 0.0000         | 0.000082          |
| 0.1               | 0.1000              | 0.0000         | 0.000083          |
| 0.2               | 0.2000              | 0.0000         | 0.000083          |
| 0.5               | 0.5000              | 0.0000         | 0.000083          |
| 1.0               | 1.0000              | 0.0000         | 0.000084          |
| 2.0               | 2.0000              | -0.0000        | 0.000084          |
| 5.0               | 5.0000              | 0.0000         | 0.000086          |
| 10.0              | 10.0000             | 0.0000         | 0.000089          |
| 20.0              | 20.0001             | -0.0001        | 0.000094          |
| 50.0              | 49.9999             | 0.0001         | 0.00012           |
| 100.0             | 99.9999             | 0.0001         | 0.00019           |
| 200.0             | 199.9997            | 0.0003         | 0.00032           |

### 5. OFF CENTER LOADING ERROR



| POINT              | READING (g) |
|--------------------|-------------|
| 1                  | 99.9998     |
| 2                  | 99.9997     |
| 3                  | 99.9998     |
| 4                  | 99.9998     |
| 5                  | 99.9998     |
| OFF-CENTER LOADING | 0.0001      |

6. INTERNAL WEIGHT ERROR : 0.000499999999998177 g  
NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-C010 REV 03



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CERTIFICATE No : 23M8800  
REFERENCE No : 70515-8

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : AND  
MODEL : GR-200  
SERIAL No : 14243876  
ID No : EQL-130  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD., SAMAEADAM,  
BANGKHUNTHIAN, BANGKOK 10150

CALIBRATED BY : PRASERT P.  
CALIBRATION DATE : 11-Sep-23

APPROVED BY :   
ISSUED DATE : 15-Sep-23  
RECEIVED DATE : 11-Sep-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
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CERTIFICATE No : 23M8800

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : AND  
MODEL : GR-200  
ID No : EQL-130  
SERIAL No : 14243876  
AIR PRESSURE : 1011mbar ± 1mbar  
RECEIVED DATE : 11-Sep-23  
AMBIENT TEMPERATURE : 24°C ± 1°C  
CALIBRATION DATE : 11-Sep-23  
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 62019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE  
1) STANDARD WEIGHT SET E2 QK-1151 M23020138 02-Feb-25  
2) STANDARD WEIGHT E2 15843 M23020145 02-Feb-25

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

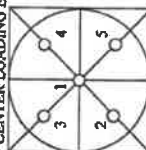
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (±g) |
|-------------------|---------------------|----------------|------------------|
| 0.0               | 0.0000              | 0.0000         | 0.000082         |
| 0.1               | 0.1000              | 0.0000         | 0.000083         |
| 0.2               | 0.2000              | 0.0000         | 0.000083         |
| 0.5               | 0.5000              | 0.0000         | 0.000083         |
| 1.0               | 1.0000              | 0.0000         | 0.000084         |
| 2.0               | 2.0000              | 0.0000         | 0.000086         |
| 5.0               | 5.0000              | 0.0000         | 0.000089         |
| 10.0              | 10.0000             | 0.0000         | 0.000094         |
| 20.0              | 20.0000             | 0.0000         | 0.00012          |
| 50.0              | 50.0000             | 0.0000         | 0.00019          |
| 100.0             | 100.0000            | 0.0000         | 0.00032          |
| 200.0             | 200.0000            | 0.0000         | 0.00032          |

5. OFF CENTER LOADING ERROR



NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A  
COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%  
END OF CALIBRATION REPORT

F-C010 REV 01





QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com



ANALYTICAL SERVICES  
CALIBRATION 0009

CERTIFICATE No : 23M11118  
REFERENCE No : 71185-2

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BCA32021-IS  
SERIAL No : 0039407364  
ID No : EQL-257  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : TEST TECH CO., LTD.  
30,32 RAMA II SOI 63, RAMA II RD.,  
SAMAEDAM, BANGKHUNTHIAN, BANGKOK  
10150

CALIBRATED BY : PRASERT D.  
CALIBRATION DATE : 09-Nov-23  
APPROVED BY :   
ISSUED DATE : 13-Nov-23  
RECEIVED DATE : 09-Nov-23

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

F-Q010 REV 03



QUALITY CALIBRATION CO.,LTD.  
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160  
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584  
www.qcalibration.com

CERTIFICATE No : 23M11118

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE  
MANUFACTURER : SARTORIUS  
MODEL : BCA32021-IS  
ID No : EQL-257  
SERIAL No : 0039407364  
RECEIVED DATE : 09-Nov-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar  
AMBIENT TEMPERATURE : 23° C  $\pm$  1° C  
RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 62019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

### 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE  
1) STANDARD WEIGHT SET -- -- 23M1296 07-Feb-24  
2) STANDARD WEIGHT -- -- 23M1297 07-Feb-24  
3) STANDARD WEIGHT -- -- M2302003S 01-Feb-25  
4. THIS CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
NATIONAL INSTITUTE OF METROLOGY (THAILAND)

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

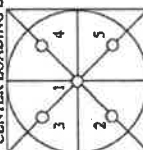
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 2500 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (±g) |
|-------------------|---------------------|----------------|------------------|
| 0.0               | 0.00                | 0.00           | 0.012            |
| 10.0              | 10.00               | 0.00           | 0.012            |
| 20.0              | 20.00               | 0.00           | 0.012            |
| 50.0              | 50.00               | 0.00           | 0.012            |
| 100.0             | 100.00              | 0.00           | 0.012            |
| 200.0             | 200.00              | 0.00           | 0.012            |
| 500.0             | 500.00              | 0.00           | 0.012            |
| 700.0             | 700.00              | 0.00           | 0.012            |
| 1000.0            | 1000.00             | 0.00           | 0.012            |
| 2000.0            | 2000.00             | 0.00           | 0.012            |
| 3000.0            | 3000.00             | 0.00           | 0.012            |

### 5. OFF CENTER LOADING ERROR



| POINT              | READING (g) |
|--------------------|-------------|
| 1                  | 1000.00     |
| 2                  | 1000.00     |
| 3                  | 1000.00     |
| 4                  | 1000.00     |
| 5                  | 1000.00     |
| OFF-CENTER LOADING | 0.00        |

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-Q010 REV 03





## Certificate of Calibration

**Equipment:** Balance  
**Model:** BCA2241-1S  
**Serial No. (or ID.):** 0043402017 (EQL - 268)  
**Manufacturer:** Sartorius  
**Condition:** New

**Certificate No.:** C01232449  
**Issued Date:** 08 July 2023  
**Job No.:** KSPR2310693  
**Page:** 1 of 2

**Customer:** TEST TECH CO., LTD.  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkhuntien Bangkok 10150 Thailand.

**Environment Condition:** Temperature 23 °C ± 0.4 °C  
Humidity 59 %RH ± 4.2 %RH

**Calibration Place:** TEST TECH CO., LTD. ( 302 Room )  
30,32 Rama II Soi 63, Rama II Rd.,  
Samaedam, Bangkhuntien Bangkok 10150 Thailand.

**Calibration By:** Mr. Hattapong Pumnit  
**Calibration Date:** 07 July 2023  
**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02220533

  
(Mr. Hattapong Pumnit)  
Person in charge

  
(Mr. Rungrod Jenkitrakulchai)  
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI), it provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 2088 7000 Email: info@dksh.com Website: www.dksh.com/thailand

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CAL-FM-C01-14; 12 Sep 20;



Certificate No.: C01232449 Page: 2 of 2

### Calibration Results:

Without Adjustment

Excentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

| Nominal Test Value (g) | Reference Points (g) |        |        |         |         |
|------------------------|----------------------|--------|--------|---------|---------|
|                        | A                    | B      | C      | D       | E       |
| -                      | 0.0000               | 0.0000 | 0.0000 | -0.0001 | -0.0001 |

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 20                     | 0.00004            |
| 200                    | 0.00005            |

Error of Indication from nominal or conventional mass value., Readability 0.0001 (g)

| Nominal Value (g) | Conventional Mass (g) | Displayed Value (g) | Error of Indication (g) | Uncertainty (g) | k    |
|-------------------|-----------------------|---------------------|-------------------------|-----------------|------|
| 0.001             | 0.00100               | 0.0010              | 0.0000                  | 0.00010         | 2.03 |
| 0.01              | 0.01000               | 0.0100              | 0.0000                  | 0.00010         | 2.03 |
| 0.1               | 0.10001               | 0.1000              | 0.0000                  | 0.00010         | 2.03 |
| 0.5               | 0.50000               | 0.5000              | 0.0000                  | 0.00010         | 2.03 |
| 1                 | 1.00001               | 1.0000              | 0.0000                  | 0.00010         | 2.03 |
| 2                 | 2.00002               | 2.0000              | 0.0000                  | 0.00010         | 2.03 |
| 5                 | 5.00002               | 5.0000              | 0.0000                  | 0.00011         | 2.03 |
| 10                | 10.00002              | 10.0000             | 0.0000                  | 0.00011         | 2.03 |
| 20                | 20.00000              | 20.0000             | 0.0000                  | 0.00011         | 2.02 |
| 25                | 25.00003              | 25.0000             | 0.0000                  | 0.00012         | 2.02 |
| 50                | 49.99996              | 50.0000             | 0.0000                  | 0.00013         | 2.01 |
| 100               | 100.00002             | 100.0000            | 0.0000                  | 0.00017         | 2.00 |
| 120               | 120.00002             | 120.0000            | 0.0000                  | 0.00021         | 2.00 |
| 150               | 149.99998             | 150.0000            | 0.0000                  | 0.00023         | 2.00 |
| 200               | 200.00004             | 200.0000            | 0.0000                  | 0.00029         | 2.00 |

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
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CAL-FM-C01-14; 12 Sep 20

