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Application Note

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Cubis® II Ultra-High Resolution Semi-Micro Balance: From Data Sheet to Reality

Peak performance under your laboratory conditions

Introduction

The Cubis® II Ultra-High Resolution Semi-Micro Balances from Sartorius are precise analytical instruments designed for weighing of very small quantities of samples with high accuracy. In a laboratory environment, instrument specifications may deviate due to varying environmental conditions and influences from samples and users. It's crucial to note that our balances are optimized for normal lab conditions. While a balance might look impressive on a spec sheet, true performance is revealed under real lab conditions.

Recognizing the need for reliability in these conditions, our focus was on creating a balance that not only minimizes the impact of environmental effects but also delivers swift measurement times. This innovative design not only enhances precision but also accelerates weighing workflows, setting a new standard for semi-micro balances that seamlessly combine speed and accuracy in your laboratory operations. Welcome to a new era of efficient and precise weighing.

Aim: Prove excellent performance of the Cubis® II Semi-Micro Balances under real-world lab conditions

Focus:

- Determination of the Minimum sample weight according to USP41 over the entire weighing range
- Determination of the measuring time over the entire weighing range
- Elimination of electrostatic effects
- Compensation against air-pressure

Repeatability Test and Determination of Minimum Sample Weight According to USP Chapter 41

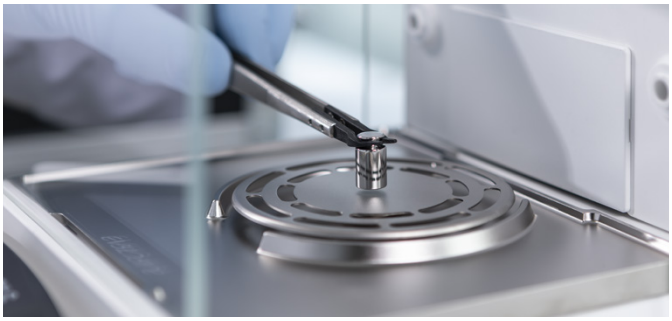

Figure 1: *Determining the minimum sample weight on a Cubis® II Ultra-High Resolution Semi-Micro Balance according to USP Chapter 41.*

Semi-micro balances play a crucial role in weighing small sample quantities into larger containers, introducing a specific preload to the measurement process. However, the determination of the minimum sample weight occurs without any preload, which may not accurately reflect real-world conditions. Therefore, it is essential to delve into how semi-micro balances address the minimum sample weight with such preloads across the entire weighing range.

This approach guarantees that the Cubis® II semi-micro balances not only meet but also exceed the necessary standards for precision, providing confidence in the reliability of the weighing process.

Test Setup: Repeatability tests with a Cubis® II MCA225S and a Cubis® II MCA226S were performed against their main competitor to define the minimum sample weight according to USP Chapter 41 with a test weight of 10 g at varius preloads.

Results: Values between 6.4 mg and 10.8 mg were measured with the Cubis® II MCA226S through the entire weighing range (yellow bar, Figure 2). The deviation over the entire weighing range is very low in comparison to the main competitor balance, which also showed rather larger minimum sample weights over the entire weighing range (black bar, Figure 2).

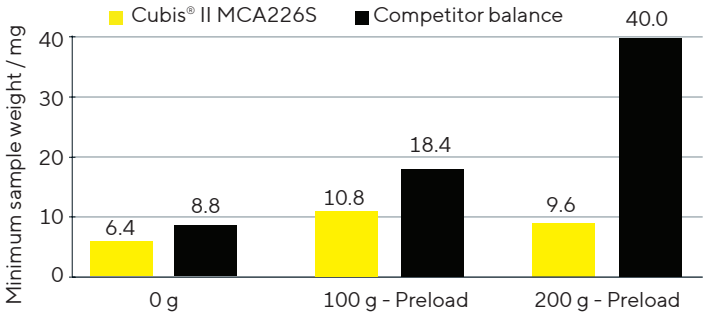

Figure 2: *Minimum sample weight test results for Cubis® II MCA226S and competitor balance at different preloads.*

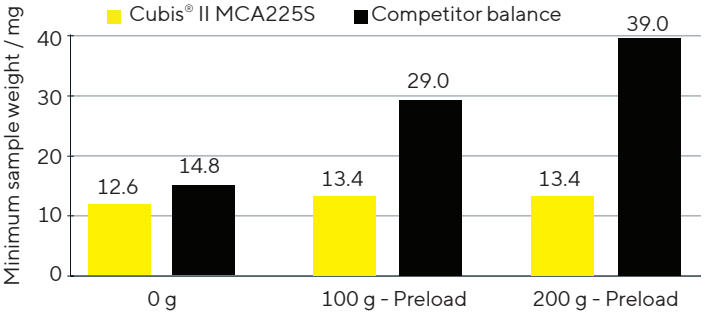

Figure 3: *Minimum sample weight test results for MCA225S and competitor balance at different preloads.*

The Cubis® II MCA225S exhibits exceptional performance in minimum sample weight measurements, ranging from 12.6 mg to 13.4 mg, as demonstrated across the entire weighing range (illustrated by the yellow bar in Figure 3). Impressively, the deviation over this range is remarkably low, registering at only 6%, a notable improvement when compared to our main competitor's balance (depicted by the black bar in Figure 3), which consistently displays larger minimum sample weights.

Furthermore, not only does the Cubis® II MCA225S maintain constant minimum sample weights, but it also outperforms competitors at every tested preload. This superior performance positions the Cubis® II MCA225S as the optimal choice for applications requiring precision in minimum sample weight measurements.

Conclusion: The semi-micro Cubis® II balances, MCA225S and MCA226S, not only demonstrate excellent repeatability and accuracy, ensuring constant and low minimum sample weight values across the entire weighing range, but they also outperform competitors at every tested preload. This superior performance, coupled with the low minimum sample weight, positions the semi-micro Cubis® II MCA225S and MCA226S as the optimal choice for applications requiring precision in minimum sample weight measurements. Moreover, the consistent and low minimum sample weight values contribute to significant cost savings by allowing the usage of less sample for each test.

Features & Benefits:

- Top of the class minimum sample weight values save precious materials
- Robust performance through the entire weighing range guarantee high level of accuracy and repeatability

Measuring Time Comparison Over Entire Weighing Range

A fast measuring time for semi-micro balances is crucial for customers seeking efficiency and productivity in their laboratory workflows. Rapid measurements not only enhance overall operational speed but also enable scientists and researchers to optimize their time and focus on critical analyses. With quicker results, customers can increase the throughput of their experiments, leading to faster decision-making processes and improved research outcomes. Investing in a semi-micro balance with fast measuring capabilities translates to a competitive edge, allowing laboratories to accomplish more within tight deadlines and ultimately accelerating scientific advancements.

Test Setup:
The measuring times were recorded at the same time as the minimum sample weight values were measured. Therefore the results of the measurement times for 0 g, 100 g and 200 g preload are shown. These tests were made for the Cubis® II MCA225S and the Cubis® II MCA226S against their corresponding main competitor model.

Results: Figure 4 shows the recorded measurement times for the Cubis® II MCA226S and the main competitor balance over the entire weighing range. The results for the Cubis® II MCA226S are all below 6 seconds over the entire weighing range. Making it 35 to 60 % faster than the competitor balance.

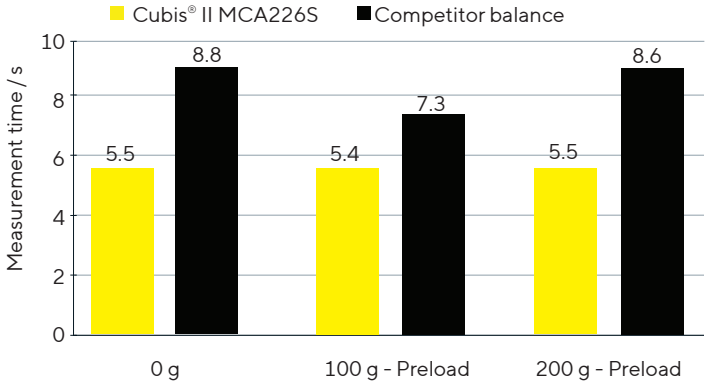

Figure 4: *Comparison of the measurement times for Cubis® II MCA226S and the corresponding main competitor balance.*

Figure 5 shows the recorded measurement times for the Cubis® II MCA225S and the main competitor balance over the entire weighing range. The results for the Cubis® II MCA225S are all below 5 seconds over the entire weighing range. Making it 110 to 160 % faster than the competitor balance. Meaning that you can measure your sample twice and the raw measurement time will still be faster than the competitor balance.

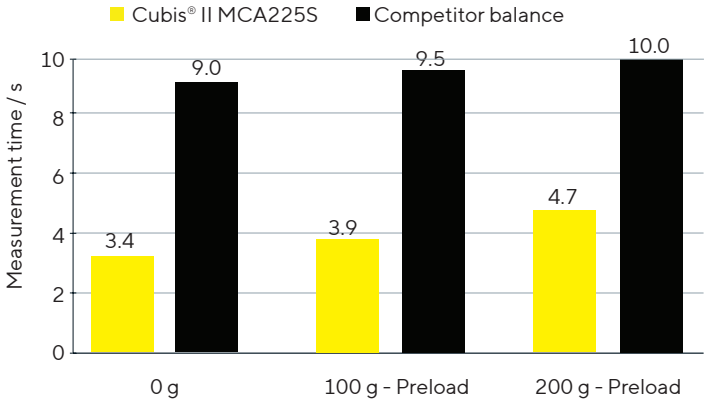

Figure 5: *Comparison of the measurement times for the Cubis® II MCA225S and the corresponding main competitor balance.*

Conclusion: The introduction of the new weighing modules in the Cubis® II MCA225S and MCA226S represents a significant leap in measurement times, ushering in a new era of efficiency in the laboratory. This advancement translates into :

- Substantial time savings
- Increased productivity
- Enhanced efficiency
- Higher throughput
- A greater number of experiments
- Quicker results
- Cost savings

Furthermore, the accelerated decision-making enabled by swift measurements ensures seamless compliance with tight schedules, making these instruments valuable assets for streamlined and agile laboratory operations.

Features & Benefits:
- Cutting-edge weighing modules allowing a significant leap in measurement times, revolutionizing the efficiency of your laboratory
- Substantial time savings allowing you to achieve higher throughput and conduct a greater number of experiments

Electrostatic Effects

Electrostatically charged samples or containers can be difficult to weigh. Static charges, which can occur e.g. when using gloves, weighing powders or at low humidity, can cause unstable balance readings and measurement drift leading to slow and inaccurate weighing results.

Figure 6: Weighing of charged samples is no problem thanks to the built-in ionizer in the Cubis® II Ultra-High Resolution Balances.

Test Setup: The samples, comprising a 10 mL beaker, a 100 mL beaker, and a watch glass, were charged prior to the measurement of their charges using a field mill. The charged samples were placed in the weighing chamber and the ionizer was activated. Once a stable value was shown, the sample was taken out and leftover charged was determined again.

In the case of Cubis® II Ultra-High Resolution Balances the built-in ionizer was tested with a setting to activate the ionizer by door opening. Since this option was not available for the competitor balance, the ionizer started after the sample was put into the weighing chamber and the doors were closed.

Additionally, both balances were tested against outter electronic static fields. The electronic static fields were produced through cellulose nitrate (CN) filters.

Results: Table 1 shows that the ionization of the different charged samples always led to a complete discharge for the Cubis® II Ultra-High Resolution Balance, which can be seen by scanning the QR-Code.

Vessel	Cubis® II Ultra-High Resolution	Competitor
Beaker 10 mL	✓ (full discharge)	✕ (charge left)
Beaker 100 mL	✓ (full discharge)	✕ (charge left)
Watch Glass	✓ (full discharge)	✕ (charge left)

Table 1: *Comparison of the built-in ionizer.*

The test against outer electrostatic fields showed that the Cubis® II Ultra-High Resolution Balances is not affected. The maximum deviation in digits is shown in table 2.

Tested Balances	Max. deviation / digits
MCA66S	0
Competitor balance	200

Table 2: *Comparison of the built-in ionizer.*

The optimal positioning of the four ionizing nozzles and the unique technological solution enables full discharge, even when inner-draft-shield is installed. The variety of setting options offer the preferred activation of the ionizer. For example, when the ionizer starts during draft-shield opening, this helps to efficiently neutralize any electrostatic charges that may have accumulated on the sample or container, powder, not only ensuring accurate results but also stable readouts.

Additionally, the conductive coating of all glass parts (draft-shields) of the Cubis® II Ultra-High Resolution Balances prevents from outer static effects

Conclusion: Cubis® II Ultra-High Resolution Balances have demonstrated exceptional performance in mitigating the effects of electrostatic charges by 100%. All tested vessels were fully discharged, and electrostatic charges were effectively neutralized.

The optimal positioning of the four ionizing nozzles and the unique technological solution enables full discharge, even when inner-draft-shield is installed. The variety of setting options offer the preferred activation of the ionizer. For example, when the ionizer starts during draft-shield opening, this helps to efficiently neutralize any electrostatic charges that may have accumulated on the sample or container, powder, not only ensuring accurate results but also stable readouts.

In addition, the Cubis® II Ultra-High Resolution Balances are designed to be highly resistant to external electrostatic fields. This feature ensures that even in environments where significant electrostatic activity is present, the balance system remains unaffected, allowing for accurate and reliable weighing results to be obtained.

Features & Benefits:

- Full discharge thanks to the optimal position of the 4 ionizing nozzles and the flexible setting options guarantees accurate results
- Protected from outer static effects thanks to the conductive coating of the draft-shields results in stable values without drift
- No cross-contamination because full discharge is guaranteed

Air Pressure

A change in the air pressure – e.g. because of the movement of atmospheric pressure areas – often results in deviations of the weighing result. The effect on the weighing result was tested here.

Figure 7: *Air pressure fluctuations (due to weather changes) have no effect on the weighing result of the Cubis® II Ultra-High Resolution Balance.*

Test Setup: Air pressure change of 100 mbar was simulated, and the drift of the weighing value was measured.

Results: Figures 8 and 9 show the air-pressure change test results for a change of 100 mbar.

The yellow bar in figure 8 represents the results for the Cubis® II Ultra-High Resolution Balance MCA226S, nearly no difference of the weighing value was measured.

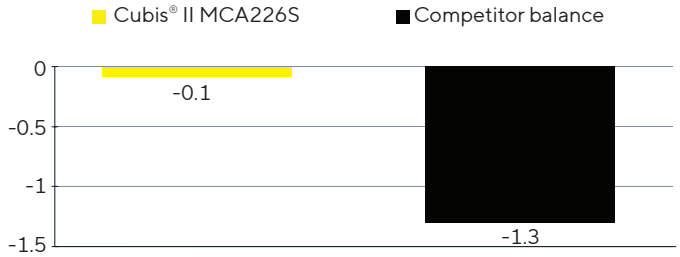

Figure 8: *Air-pressure change test results for the Cubis® II MCA226S and the competitor balance.*

The yellow bar in figure 9 shows the results for the Cubis® II Ultra-High Resolution Balance MCA225S, nearly no difference of the weighing value was measured.

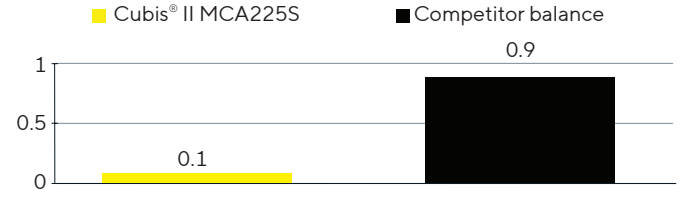

Figure 9: *Air-pressure change test results for the Cubis® II MCA225S and the competitor balance.*

Conclusion: The Cubis® II Ultra-High Resolution Balances MCA226S and MCA225S are highly resilient to changes in air pressure caused by weather changes and maintains its accuracy and precision.

Features & Benefits:

- Intelligent compensating system manages air-pressure ensuring stable results and undisturbed weighing workflows

Summary

In our extensive lab testing, the Cubis® II Ultra-High-Resolution Semi-Micro Balances MCA225S and MCA226S have proven to be the premium choice for customer seeking reliable measurement accuracy and precision. With its exceptional performance across the entire weighing range, it delivers impressive minimum sample weight results and very fast measurements regardless of the vessel or weight used for measurement. This is thanks to the next generation weighing system which ensures faster results and better specifications.

Static charges, one of the most often occurring problem, can be quickly and efficiently eliminated thanks to the novel de-ionizing technology. Protection from outer electrostatic influences is ensured due to specially coated draft-shields. Moreover, this balance is designed to deliver good repeatability in drafty conditions, with fast measurement times.

Intelligent compensating systems manage the fluctuations of air-pressure and humidity which further supports stable balance behavior.

No matter what your weighing needs are, the Cubis® II Ultra-High Resolution Semi-Micro Balances from Sartorius are the ultimate solution for unparalleled accuracy and precision.

Testing Conditions: Cubis® II Ultra-High Resolution Semi-Micro Balances were simultaneously and repetitively tested with a market-known comparable competitor model to allow direct comparison. In the laboratories there was no controlled temperature or humidity and other colleagues were occasionally entering for work on other devices.

Germany
Sartorius Lab Instruments GmbH & Co. KG
Otto-Brenner-Strasse 20
37079 Goettingen
Phone +49 551 308 0

USA
Sartorius Corporation
565 Johnson Avenue
Bohemia, NY 11716
Phone +1 631 254 4249
Toll-free +1 800 635 2906

For further contacts, visit
www.sartorius.com

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