

Weighing the Right Way



Experience
Improved Weighing
Flawless Operation
Precise Results

Guide Book

Proper Weighing with Laboratory Balances

METTLER TOLEDO

Proper Weighing with Laboratory Balances

Introduction	5
Location of the Balance	6
Operation of the Balance	8
Physical Influences	12
Technical Terms	20
GWP® – Good Weighing Practice™	30

Introduction

Weighing is one of the most common tasks in the laboratory. Advanced micro, semi-micro, analytical and precision balances have now been perfected to such a degree that, in general, no special weighing rooms are needed.

Technological advances in electronics have considerably simplified the operation of balances, drastically cut weighing times, and made the balances so adaptable that they can now be integrated directly into a production process.

The risk inherent in this progress, however, is that not enough care will be taken to prevent disturbing influences from the surrounding area. These usually involve physical effects which are measurable for micro, semi-micro and analytical balances, and which analytical balances cannot suppress because they result in measurable weight changes (e.g. through slow evaporation, moisture uptake), or forces which act on the weighing pan and weighing sample (e.g. magnetism, electrostatics) and which are interpreted by the balance as weight changes.

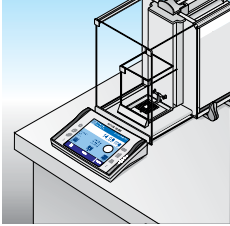
The purpose of these instructions is to explain the most important points to be noted when working with micro, semi-micro and analytical balances if high-quality results are required.

After some brief pointers concerning the location and proper operation of the balances, the disturbing influences on weighing will be discussed in detail. Most of these influences are recognizable by a slow change in the weight display (drift).

Since correct interpretation of the technical data is also of immense importance in the assessment of a weighing result, the most common technical terms are explained at the end.

Location of the Balance

The precision and reproducibility of weighing results is closely associated with the location of the balance. To ensure that your balance can work under the best conditions, please observe the following guidelines:



Weighing bench

- Stable (lab bench, lab table, stone bench).

Your weighing bench should not sag when work is carried out on it and should transfer as few vibrations as possible.

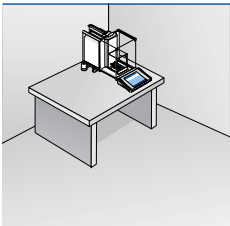
- Antimagnetic (no steel plate).
- Protected against electrostatic charges (no plastic or glass).
- Wall or floor installation

The weighing bench should be fixed either to the floor or on the wall. Mounting the bench on both places at once transfers vibrations from wall and floor.

- Reserved for the balance.

The place of installation and the weighing bench must be stable enough that the balance display does not change when someone leans on the table or steps up to the weighing station. Do not use soft pads underneath, such as writing mats.

It is better to position the balance directly over the legs of the bench, since the area is subject to the fewest vibrations.



Work room

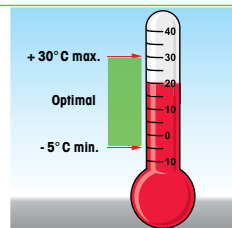
- Vibration-free
- Free from drafts

Place the weighing bench in a corner of a room. These are the most vibration-free areas of a building. Ideally, the room should be accessed through a sliding door to reduce the influence of door movements.

Temperature

- Keep the temperature of the room as constant as possible. Weighing results are influenced by temperature! (Typical drift: 1-2 ppm/°C).
- Do not weigh near radiators or windows.

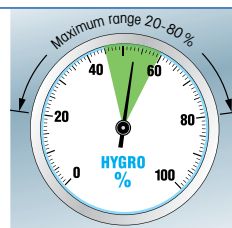
METTLER TOLEDO balances with “FACT” (fully automatic motorized self-calibration) can compensate virtually all the remaining temperature drift. For this reason, “FACT” should always be switched on.



Atmospheric humidity

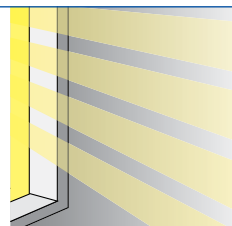
- Ideally, the relative humidity (% RH) should be between 45 and 60 %. Balances should never be operated above or below the measuring range of 20 to 80 % RH.

Constant monitoring is advisable with micro balances. Changes should be corrected whenever possible.



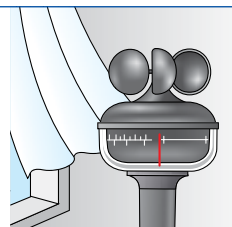
Light

- If possible, place the balance on a window-free wall. Direct sunlight (heat) will influence the weighing result.
- Place the balance a significant distance from lighting fixtures to avoid heat radiation. This especially applies to light bulbs. Use fluorescent tubes.



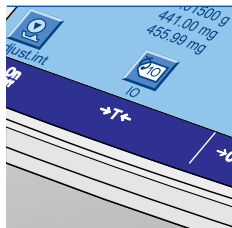
Air

- Do not place the balance in the air flow of air conditioners or devices with ventilators, such as computers or large laboratory devices.
- Place the balance a sufficient distance from radiators. In addition to the potential temperature drift, strong currents of air could interfere with operation of the balance.
- Do not place the balance next to a door.
- Avoid places with high traffic. Passersby will usually create a draft at the weighing location.



Operation of the Balance

Micro, semi-micro, analytical and precision balances are measuring instruments of the highest precision. The following points will help you obtain reliable weighing results.



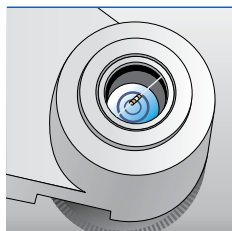
Switching on

- Do not disconnect the balance from the power supply and always leave it switched on. This allows the balance to reach thermal equilibrium.
- When you switch the balance off, use the display key (on older models the tare key). The balance is now in standby mode. The electronics are still energized and no warm-up period is necessary.

 **TIP:** We recommend a different warm-up time for each balance when it is first connect to the power supply. These are:

- Up to 12 hours for micro balances
- Approximately 6 hours for semi-micro and analytical balances
- Approximately 3 hours for precision balances

Apart from these guidelines, always observe the minimum times specified in the operating instructions.



Leveling

- Align the balance.

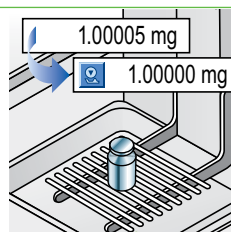
To do this, check that the air bubble is in the center of the level indicator. Use the leveling feet to make adjustments. You must then adjust the sensitivity of the balance. The exact procedure is described in the operating instructions for the balance.

-  **TIP:** To ensure and document that the balance is correctly leveled every time for example, to comply with GxP¹⁾ we recommend the Excellence Plus family of balances with the built-in automatic warning function "LevelControl".
- "LevelControl".

¹⁾ GxP Good Laboratory Practice (GLP) or Good Manufacturing Practice (GMP)

Adjustment

- Adjust the sensitivity of the balance regularly, especially
 - when you operate the balance for the first time
 - when you change the location of the balance
 - after leveling the balance
 - after major changes in temperature, humidity or air pressure.



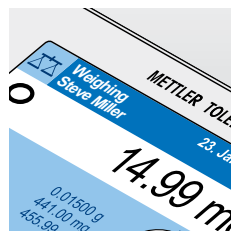
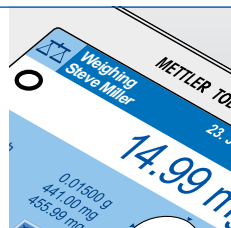
TIP: If a fully automatic calibration following, for example, a temperature change is important to you, it would be worthwhile to acquire balances with “FACT,” which calibrate automatically. These models also allow you

- to extend the time interval for routine checks.

Reading

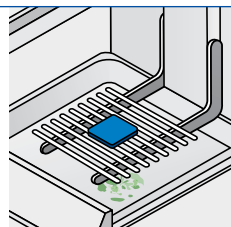
- Check that the balance displays exactly zero at the start of each weighing. Tare, if needed, to avoid zero errors.
- Read off the result only after the small round circle in the upper left of the balance display has faded. The weighing result is released through this stability detector.

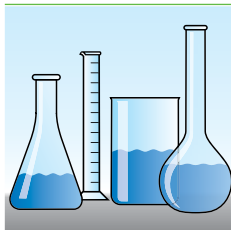
TIP: The Excellence Plus line offers an advanced stability detector. These balances display unstable measurement values in **blue**. Once stability is regained, the display immediately changes to **black** and the circle in the upper left disappears. This allows you to identify a stable weighing result faster, safer and more reliably.



Weighing pan

- Always place the weighing sample in the middle of the weighing pan. This will prevent corner load errors.
- With micro and semi-micro balances, the weighing pan should first be loaded once briefly after a relatively long pause (>30 min) to deactivate the “initial weighing effect”.





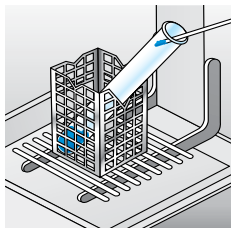
Weighing vessel

- Use the smallest possible weighing vessel.
- Avoid weighing vessels made of plastic when atmospheric humidity is below 30–40 %. These conditions increase the risk of electrostatic charge.

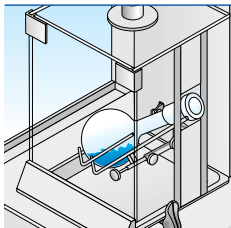
Materials with a high degree of electrical insulation, such as glass and plastic, can become electrostatically charged. This can drastically distort the weighing result. For this reason, make sure you take the appropriate corrective measures (for more, see page 14: Electrostatics)

- The weighing vessel and the sample it contains should have the same temperature as the surroundings. Temperature differences can lead to air currents that distort the weighing result (see page 7: Temperature). After removing the weighing vessel from a drying oven or dishwasher, allow it time to cool before placing it on the balance.
- If possible, do not use your hands to place the weighing vessel in the weighing chamber. You could alter the temperature and atmospheric humidity of the weighing chamber and the weighing vessel, which would have an adverse effect on the measurement process.

The "ErgoClip Basket" taring container holder.



TIP: Different taring container holders offer optimal conditions for error-free and safe weighing (see illustrations).



Round bottomed flasks on special taring container holders "ErgoClip Flask" and "MinWeigh Door".

Draft shield

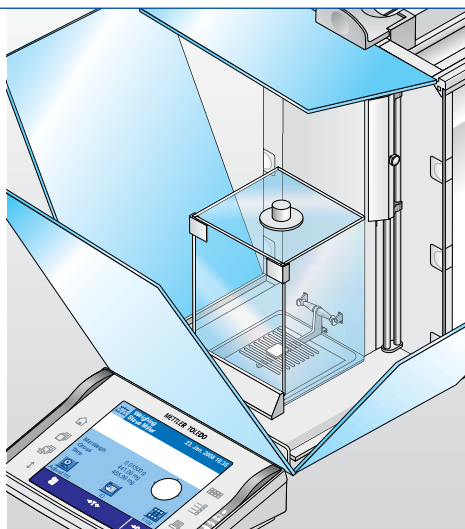
- Open the draft shield only as far as necessary. This will keep the climate in the weighing chamber constant, and the weighing result will not be influenced.
- Adjust balances that have an automatic and configurable draft shield, such as the instruments of the Excellence Plus family, so that the opening of the draft shield is minimal.

TIP: To make weighing simpler and more precise, even under the most challenging conditions, we recommend specific accessories for our Excellence and Excellence Plus families of balances. These balances will yield the best results, even when you are weighing extremely small samples with narrow tolerances under unfavorable ambient conditions. Our special draft shield “MinWeigh Door,” for example, is designed to be perfect for use in weighing cabinets. But it also offers advantages for “normal” weighing conditions. It can improve the repeatability of the net reading by a factor of about two!

Using “SmartGrid,” a weighing pan with a special grid structure, stabilizes weighing so well that the draft shield doors for 4-digit analytical balances can normally be left open during weighing.

Care of the balance

- Keep the weighing chamber and weighing pan clean.
- Use only clean vessels for weighing.
- The balance can be cleaned with conventional window-cleaning fluid.
- Do not use cloths that contain fusel oil.
- Do not brush contaminants into potential openings.
- Before cleaning, remove all removable parts, such as the weighing pan.



TIP: On Excellence and Excellence Plus analytical balances, each of the draft shield panes can be removed for cleaning in a dishwasher.