

Balances 101

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Whether hopping on the scale in the morning or stopping by the market to pick up some veggies for dinner, balances play an integral role in our lives. Balances have improved immensely from the first ones developed by the Egyptians in 5000 B.C., when a need for measuring the exchange of products was deemed necessary. Balances are one of the most critical pieces of equipment use when working in a laboratory. We all know that AASHTO R 18 requires balances be calibrated at least every 12 months; however, there are additional factors that need to be considered in order to ensure that balances are kept in the best possible working condition. Knowledge of proper calibration procedures and balance maintenance is the responsibility of the laboratory. The handling and care of balances can change based on the use of the balance, so this article will address factors to consider when using a top-loading direct reading lab scale or balance.

Words to Know

- *Balance*: an instrument for determining the weight of an object
- *Mass*: the quantity of matter in a body regardless of its volume of any forces acting on it
- *Weight*: a measurement of the gravitational force acting on an object

For information regarding terms related to calibration review the [International Vocabulary of Metrology](#) (VIM).



Why can't I send my balance away for calibration?

You can, if you're careful and do it correctly. A balance is a very sensitive instrument and can be impacted by small changes. Differences in local gravity acceleration, a change in environmental conditions, or any mechanical or thermal changes during transportation can cause the calibration to become invalid. For instance, a balance may be left outside in an uncontrolled environment during the shipping process, and there is no way for you to ensure that the balance was not affected by the temperature change. Similarly, this is why you are required to submit new calibration records for a balance if it is relocated. In addition, remember that balances that are designed for a lab setting should not be taken out in the field once they are calibrated.

Does it really matter where my balance is in my laboratory?

The location of balances in your laboratory is very important to ensure proper weighing. Balances need to be in areas free of excessive vibration and air currents to ensure stabilization. Additionally, balances are affected by rapid changes in temperature and humidity, so it is ideal that balances are located away from large bay doors. Furthermore, the floor in the area that the balance is located must be rigid enough to minimize vibrations and prevent any fluctuations in readings. A floor on the second story of a small lab might be prone to vibrations and should be accounted for when placing the balance.

Are there any conditions that need to be met prior to calibration?

Prior to calibration there are many factors that need to be met. You must ensure that the balance is uniquely identified with a serial number or lab ID and is free of visible damage and debris. Laboratories are not always a sterile environment but it is essential that the weight value readout is clear of any material and working properly. Additionally, the balance must be level and warmed up according to the manufacturer's instructions.

Do I need to consider anything before starting the calibration?

The calibration of balances can be performed in-house or by an outside calibration company. Before beginning the calibration, it is recommended that the internal mechanisms are warmed up by loading the balance to the service load or maximum capacity, and unloading, several times. The range of calibration should extend from zero to the maximum capacity of the balance unless otherwise specified. If a balance is only calibrated over a portion of the range, then this should be noted on the calibration record and directly on the balance. Keep in mind that measurements made in the lowest 10 percent of a balance's capacity may not be as accurate as those measurements made mid-range; a balance with a smaller capacity would be a better choice for a smaller measurement. Additionally, always ensure that calibrated weights are used during balance calibration.

When calibrating, why can't I just place the weight on the center of the pan?

An eccentricity test must be performed to ensure that the balance is weighing all samples the same regardless of positioning on scale. This test should be performed on all balances during calibration. The test involves placing a weight that is at least 30% of the maximum capacity of the balance in several positions, then verifying the balance can return to indicating zero mass after each reading. In Figure 1, you can see the positions to evaluate eccentricity are center, front left, back left, back right, and front right.



Figure 1

What other references are there for me?

When it is time to calibrate your balances, ASTM standard E898 is a very good reference for additional information on calibrating lab balances. Even if calibration is being performed by an outside agency, it is the lab's responsibility to ensure that the calibration company is calibrating the balances correctly. [Selecting Competent Subcontractors and Vendors](#) discusses the steps to take to ensure that your laboratory has verified the competency of the calibration company. If your lab would like additional information on choosing the correct balance, AASHTO standard M 231 and ASTM standard D4753 are great places to start.

Sources

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