

Mass Standards Handbook — Good Measurement Practices

There are numerous steps that one can take in order to improve the quality of a mass measurement system. However, they usually fall within three main categories: the equipment, the environment, and the operator. If even one of these areas is neglected, it can have a dramatic negative impact on your results. Although these suggestions are not meant to be all encompassing or all-inclusive, the improvements that can be made following these simple guidelines are extraordinary.

Equipment –

- Select weights that have a tolerance that is one third or better than the accuracy you require for your application. This way the error of the weight will not dramatically impact the quality of your measurements. For more information, see Weight Selection Guidelines section on page 72.
- The equipment must be of sufficient readability to calibrate or measure the weight or sample under test. (Please review the Tolerance Table on page 66).
- The balance should be placed on a stable platform free from the effects of vibration. The most common type of setup involves placing the instrument onto a balance table that is constructed of marble or granite.
- Never use a balance or scale as soon as it is turned on. The internal electronic components need to stabilize and “warm-up” for at least twenty-four hours once the equipment has been energized. Troemner recommends that you leave this instrument plugged in twenty-four hours a day, seven days a week.



- Never use a balance that has been idle for several hours without first “exercising it” and calibrating it. A balance is exercised by repeatedly placing and removing weights from the balance pan. We recommend that this be done at least ten times each with a weight that is 100% of the maximum capacity of the balance. After exercising, the balance should be calibrated. If these two techniques are consistently employed, a noticeable improvement will result in both linearity and stability of the measurement.
- When weights are not in use, store them in the case(s) in which they are supplied. If the weights were not supplied with a case, either purchase one or use a clean container to protect the surface(s) – this will keep airborne particles from getting on your weights between uses. Weights should be in thermal equilibrium with the balance so store weights near your balance(s). Another option is to leave calibration masses commonly used inside the weighing chamber when not in use – this assures your weights are in thermal equilibrium with the balance producing a better measurement.



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Environment –

- The more stable your environment, the better your measurement results. Changes in temperature, pressure and humidity affect balance performance and weight stability. Ideal room conditions are 20°C with a relative humidity between 45% and 60%. Fluctuations in temperature should not exceed 1°C per hour. Humidity fluctuations should not exceed 10% per hour.
- Balances should not be placed in close proximity to anything that shakes, vibrates, or stirs violently. Avoid placing your equipment near centrifuges, vortexers, or shakers.
- Do not place your balance and/or scale near anything that generates heat. Heat will cause the balance chamber to warm and due to the effects of the thermal expansion introduce large errors into your measurement. Do not place the balance near a window. Sunlight can penetrate the window, warm the balance chamber at different rates during the day, and affect the quality of your work.
- Avoid placing the balance near sources of drafts, extreme air currents, or near air conditioning vents. These positions can cause your readings to be unstable and can dramatically cool the balance chamber when the air-conditioning system begins to run.
- The measurement environment should be clean and free of excessive contaminants. Contaminants such as dirt and grease can adversely affect the weight of an object.

Operator –

- **Never touch a weight with your bare hands!** Oils and contaminants from your hand will be transferred to the weight and introduce a significant error. It is recommended that all weights be manipulated with gloved hands or forceps. The two types of gloves that are commonly used and accepted are either latex (powderless) or cotton. Avoid any metal to metal contact when handling or storing weights – this will cause scratches that may introduce error. All weight forceps and weight lifters should be either nonmetallic (plastic or wood) or if metal, covered with a soft protective coating or material to avoid scratches.
- Place the weight or sample near the center of the balance pan. A small offset from center can have a pronounced effect and introduce undue variation.
- Take special care not to breathe onto the weight or into the balance chamber. Back away from the instrument. This will prevent any thermal transfer of heat from your breath or body to the balance, the weight or sample.
- Time your measurements. Consistent sample times will provide more consistent measurements.

