

Calibrating: Accuracy & Precision

The two standard measurements used in determining volumetric instrument performance are accuracy and coefficient of variation.

What are the accuracy and coefficient of variation?

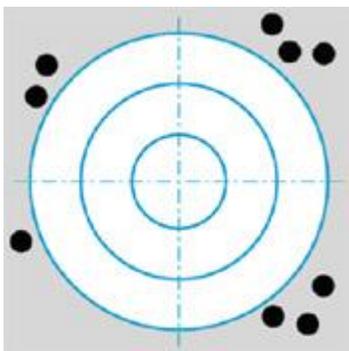
Accuracy:

Accuracy (A) is defined for the purposes here as the percent difference between the measured mean volume and the intended volume. Accuracy is what is adjusted when an instrument is calibrated.

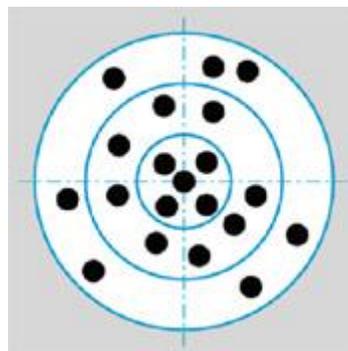
Coefficient of variation:

The coefficient of variation (CV, or precision) is a measure of the reproducibility, or closeness in value of repeated measurements. Poor CV values can be caused by poorly constructed or worn instruments; poor quality accessories, such as inferior pipette tips; or by poor pipetting technique.

The target pictures below illustrate the concepts of accuracy and precision (coefficient of variation). The center of the target represents the intended volume, and each hit on the target represents volumes actually measured by the instrument. There are four possible outcomes:



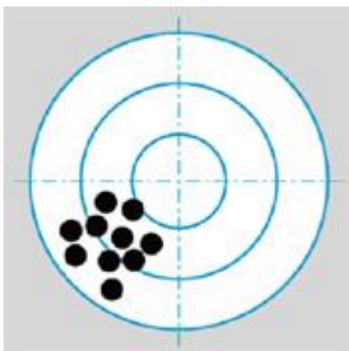
Poor reproducibility— hits widely scattered
Poor accuracy— hits far off center



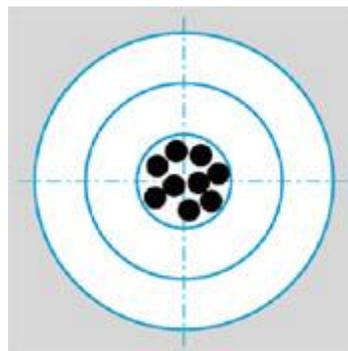
Poor reproducibility— no gross errors, but hits widely scattered
Good accuracy— on average, hits are evenly distributed around center.

These volumetric instruments are of inferior quality.

All deviations are “equally” probable. Instruments exceeding the permissible limit should be removed from service.



Good reproducibility— all hits are close together
Poor accuracy— although all hits are close together, the center (nominal value) is still missed.



Good reproducibility— all hits are close together.
Good accuracy— all hits are near the center, i.e., the nominal value.

Systematic error. Instruments exceeding the permissible limit should be removed from service until recalibrated.

Reliable results can be achieved with this instrument.