Weighing Requirements - Repeatability

Repeatability definition

Repeatability is the closeness of measured values between repeated measurements of the same weight, carried out under the same conditions as follows.

- At the same place
- By the same person
- By the same Method
- On the same equipment
- Over short period of time.

In simple words, Repeatability is variation in readings when the same person measures the same part many times using the same equipment and method under the same conditions.

Repeatability in balances

Repeatability is one of the most important performance indicators of a balance. It is generally determined by measuring a single weight 10 times.

The quantitative indication of repeatability is achieved using the standard deviation.

Internal or official regulation will define weights, number of repetitions and acceptance criteria.

Most important regulations:

Standard	Weight	number of repetitions
USP	weighing range	≥ 10
OMIL	appr. 50%-100%	10
Euramet	>=50% - 100%	≥ 3

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Step-by-Step guide

If there is no other specific information in the regulation that should be followed, then take a test weight near the maximum weight of the balance, but always a single weight.

To determine minimum sample weight, according USP (United States Pharmacopeia), a smaller weight might be reasonable.

1. Tare the balance
2. Place the test weight on the centre of the weighing pan, print or note the value.
3. Lift the test weight from the pan, press tare.
4. Repeat Steps 2 and 3 for the next 9 weighing steps.
5. Calculate the standard deviation

Standard Deviation (calculation)

The quantitative indication of repeatability is achieved using the standard deviation.

$$s = \sqrt{\frac{1}{n-1} \cdot \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

n : Number of measurements

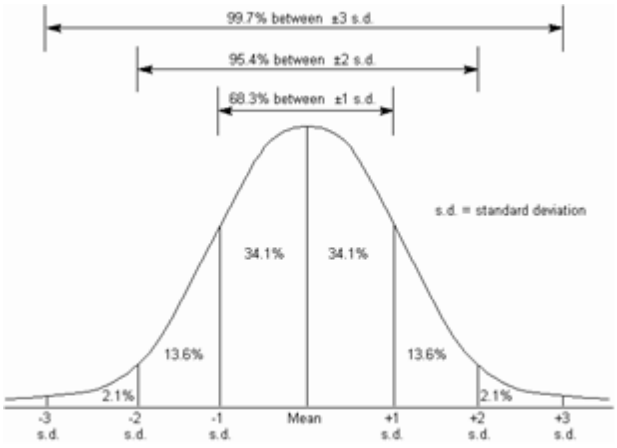
x_i : Single value

$\bar{x}$: mean value

You will find automatic calculation of the standard deviation e.g. in Excel.

Standard Deviation (interpretation)

With an increased number of measurements, the probability function approaches the Gauss curve (normal distribution).



So "only" 68.3 % of values will be expected within +/- one standard deviation, but 99.7 % within +/- 3 times standard deviations. This is the reason that you will find acceptance criteria for 2 or 3 times the standard deviation in some regulations.

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