# Basic Principle of Piece Counting
And the Most Common Problems

The Basic Principle of Piece Counting with a Scale

The concept of piece counting with a scale is quite simple, counting accurately is the challenge. In this note we look at the fundamental principle and the challenges associated with it.

0.0	grams
- -	PCS

50.0	grams
- -	PCS

50.0	grams
10	PCS

1030.0	grams
206	PCS

METTLER TOLEDO
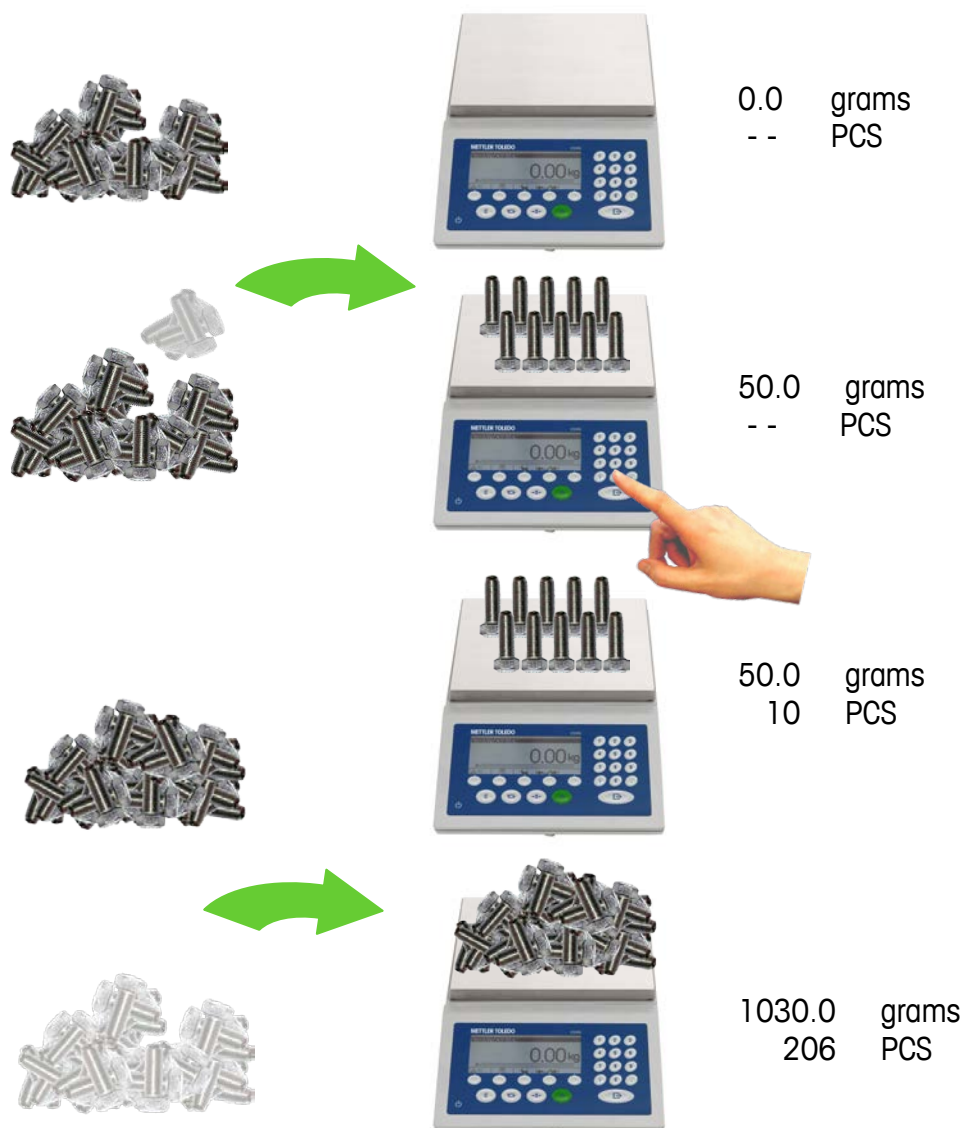
A closer look at the counting sequence on page 1

1. Ensure the scale is empty and showing zero weight.
2. Select 10 sample pieces from the bulk quantity.
3. Place the 10 selected pieces onto the scale platform.
4. After stabilizing the weight reading was 50.0 grams.
5. Touch the sample key to determine the average piece weight, this is called APW determination.

The **Average Piece Weight (APW)** is 5.0 grams: 50 grams / 10 pcs = 5.0 grams per piece

6. The scale display switches from weight to count and shows "10 PCS."
7. Place the bulk quantity of pieces on the scale, the bulk weight is 1030 grams. The bulk weight is divided by the average piece weight of 5 grams and the result is 206 PCS.
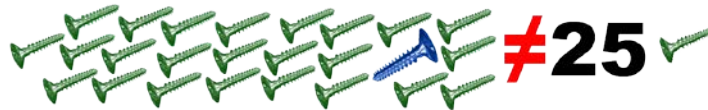
1030 grams / 5 grams = 206

Application challenges for accurate piece counting

1. **Operator error:** The operator can introduce a large error into the count.
   The operator must make sure
   - the scale is on zero before starting,
   - properly "tare" the weight of any container if used,
   - select the correct and representative sample pieces,

   - accurately hand count the sample pieces,

   - enter the proper sample size data into the scale and
   - make sure that all pieces are placed on the scale for counting.

   Do not use "standard sample pieces" stashed under the table. Use fresh samples to get better representation of the bulk quantity.

2. The scale should be designed to help the operator. Features such as user-prompting lamps, auto sampling, average piece weight optimization etc.

3. **Piece weight variance:** The weight of individual pieces will vary from piece to piece, that is why we sample with more than one piece. The greater the piece weight variance, the more likely to have count errors. 0.5 – 1.5% variance in individual piece weight is not uncommon. The selected samples must represent the bulk pieces being counted, the closer to matching the bulk quantity the closer or "more accurate" will be the counting result.

Examples:

Mean Weight **= 2.4 g**
Relative Standard Deviation **= 0.3%**

Mean Weight **= 6.3 g**
Relative Standard Deviation **= 1.26%**

Mean Weight **= 0.42 g**
Relative Standard Deviation **= 1.1%**

Mean Weight **= 5.2 g**
Relative Standard Deviation **= 0.3%**

Mean Weight **= 15.0 g**
Relative Standard Deviation **= 0.04%**

Mean Weight **= 5.9 g**
Relative Standard Deviation **= 0.33%**

See application note "Average Piece Weight Optimization" for detailed information on piece weights.

4. **Environmental conditions:** The workplace environment will affect the counting accuracy primarily as a result of reference determination. Any of the environmental conditions below will hinder the weighing performance of the scale and subsequently the accuracy of the count.

Stability: Scale must be on a stable table or bench.
Level: Scale must be calibrated and operated in a level condition.
Vibration: Avoid floor vibration from machinery and vehicle traffic (fork lifts).
Air currents: Avoid air currents from ventilation systems and fans.

5. **Scale error:** The accuracy of a scale affects the accuracy of the count. The proper scale must be selected for the pieces being counted. A large scale should not be used to count small quantities of small parts, and a small scale will not be able to count large quantities that exceed the scale platform size or weight capacity.

www.mt.com/count

For more information