

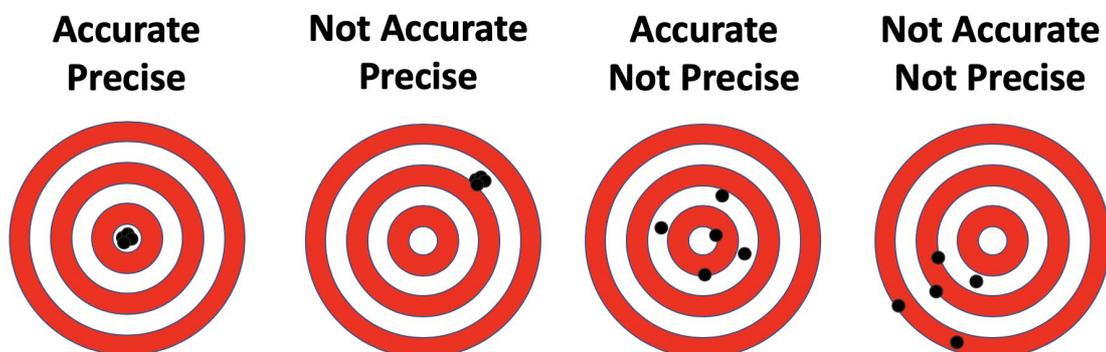
What is the difference between Accuracy & Precision?

Accuracy and Precision are critical factors in the evaluation of measuring equipment. However, both terms are often used synonymously, although they are clearly defined technically. This article gives you an overview of the two terms and a brief guide to the assessment of measuring equipment.

Nils Reinke, co-CEO coatmaster AG

Let's start with a brief description. Accuracy refers to how close a measurement is to its true or expected value, while precision refers to the consistency of two or more measurements namely how close these measurements are to each other. Rifle shots at a target are an excellent way to illustrate accuracy and precision. As illustrated in figure 1, we can distinguish four shot-scenarios that depend on different influencing factors such as the quality of the rifle, the ammunition used, the wind speed and the skills of the shooter.

Starting from left to right, in the best case, the hits are both accurate and precise. Here all shots are close to the center and the scattering is low. In the case that the shots are not accurate but precise, all hits are close together but away from the center. In the case of accurate but not precise shots, the hits are distributed around the center but are more scattered. In the worst case, the hits scatter around a position that is outside the center.



1 Differentiation between precision and accuracy of different rifle shots

Production control demands for a measuring gauge that is sufficiently accurate and precise. The technical parameters to be considered are the mean value, the standard deviation, and the tolerance range. A gauge is accurate if the mean value from repetitive measurements corresponds to the mean value of the reference measurements. A gauge is sufficiently precise if its standard deviation is smaller than 1/40th of the width of the tolerance window. For instance, a tolerated thickness range of 60µm to 100µm results in a maximum tolerable standard deviation of 1µm.

Let's show it with a practical example. In video 1 a non-contact thickness gauge (coatmaster Flex) is tested on an e-coating. On the one hand, the thickness gauge is accurate since the relative deviation of the mean value of repetitive measurements from the reference is small. On the other hand, the thickness gauge is precise at a standard deviation of 0.07µm with respect to the tolerance window of 5-15µm.

Author

Prof. Dr. N. A. Reinke
Co-founder, co-CEO
coatmaster AG
CH-Winterthur
Tel. +41 52 2120277
info@coatmaster.com
www.coatmaster.com



2 Video: coatmaster Flex measures the coating thickness of an e-coat on sheet metal accurately and precisely (test of repeatability)

<https://www.youtube.com/watch?v=45cOmmKZFds>