Specification Limits and Costs

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An unnecessarily close distance between two specification limits can cause a considerable amount of additional costs. The measurement process should hardly contribute to the increase of costs which might lead to the fact that a higher quality and more expensive measuring instrument is required. However, the investment can be worth it as the following article shows.

When purchasing products customers and suppliers specify characteristics the supplier has to meet upon delivery. Generally, these characteristics are functional characteristics with a defined range in which the characteristic has to lie. This is why we talk about specification limits or tolerance limits. Such characteristics can be limited to both sides or even to one side in specific cases. There are two types of one-sided characteristics. The first type describes characteristics whose physical limit is zero. Typical examples are shape dimensions and positional dimensions. However, in case of characteristics like torque or coating thickness, a minimum limit differing from zero is generally demanded and must be met.

In principle, it is always a question of whether the specified limit makes sense or not. In most cases the specifications are defined based on the respective design of the product. After completion, this design is responsible for the proper functioning of the product according to specifications. As a consequence, you always tend to demand narrow limits for liability reasons. This requirement serves your own protection – a quite comprehensible fact. These tolerances are referred to as "anxiety tolerances" in practice.

On the contrary, you know that the production always includes a certain variation. No part is produced exactly in the same way as another. As long as the characteristics of two-sided tolerances lie in the center of the tolerance range, there normally will not be any problems. However, in case the characteristics are near the upper or lower specification limit the situation becomes critical. Now the uncertainty of the measurement process comes into play. Independent of the type of characteristic it is important to find out whether a delivered product stays within the demanded specification limits by means of suitable measurement processes. It is also clear that each measurement process incurs an uncertainty. There is no measurement process having an uncertainty of "zero", not even the PTB (German national metrology institute in Brunswick) is able to provide such a process. If you are able to evaluate the characteristic quantitatively – thus you are able to measure it – there are two options available to determine the specification limits for the respective design.

You calculate the expanded measurement uncertainty of the applied measurement process exactly and consider it at the specification limits as demanded by ISO 14253. This approach certainly provides the neatest solution. In case suppliers and customers know the measurement uncertainty of their measurement processes, there should not be any debates about the evaluation of product characteristics.

In case you do not think the supplier or manufacturer capable of knowing the expanded measurement uncertainty of the measurement process, you narrow the tolerance yourself (by an assumed measurement uncertainty).

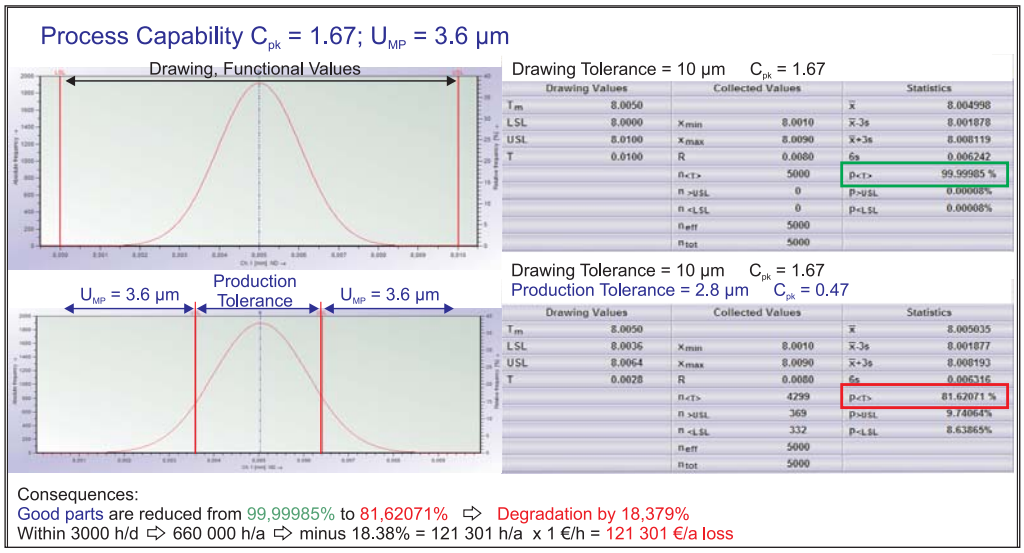

Figure 1: Far too high measurement uncertainty causes loss

Most people often do not think about the costs caused by narrowing the tolerance. Figure 1 shows a case study illustrating the additional costs caused by an uncertainty that is far too high. Thus it is reasonable that the buying and sales departments have sufficient knowledge about the applied measurement processes. In this case they can consider this knowledge in contractual agreements which might lead to the expanded specification limits.