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Why 5 items in the First Article Inspection can be a good thing

Companies might base their First Article Inspection (FAI)/dimensional report on only measuring and validating one item, not taking statistical methods into consideration. If the company also neglects to check the process capability later, the risk of producing out-of-dimension parts is quite significant. This is leading to assembly and quality issues, and in the worst-case field failures and customer returns.

Base the First Article Inspection on 5 items.

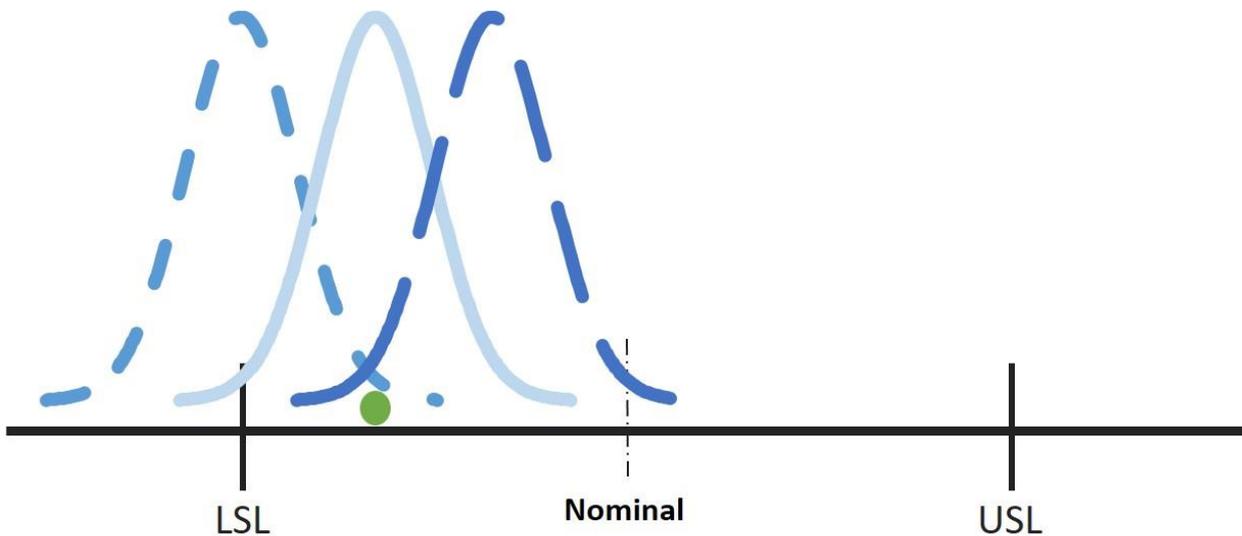
The FAI should be based on at least 5 items, taken after the required visual quality has been achieved.

This is particularly applicable to plastic molded items, where the dimensions and visual quality are interrelated. Therefore a FAI should not be approved unless the visual quality is also acceptable.

When basing your FAI verification on one item only, you basically have no idea of where the item measured is in the process variation. It is very common to presume that it off course is in the middle – but is it?



You will not know if you have a large or a small variation, whether the item is in the middle, the lower or the upper level of the variation. The only thing you do know, is if the item is inside the tolerance or not. And hopefully you have ensured a stable process before selecting the item. This is illustrated in the figure below, where it is presumed that the process is nominal distributed

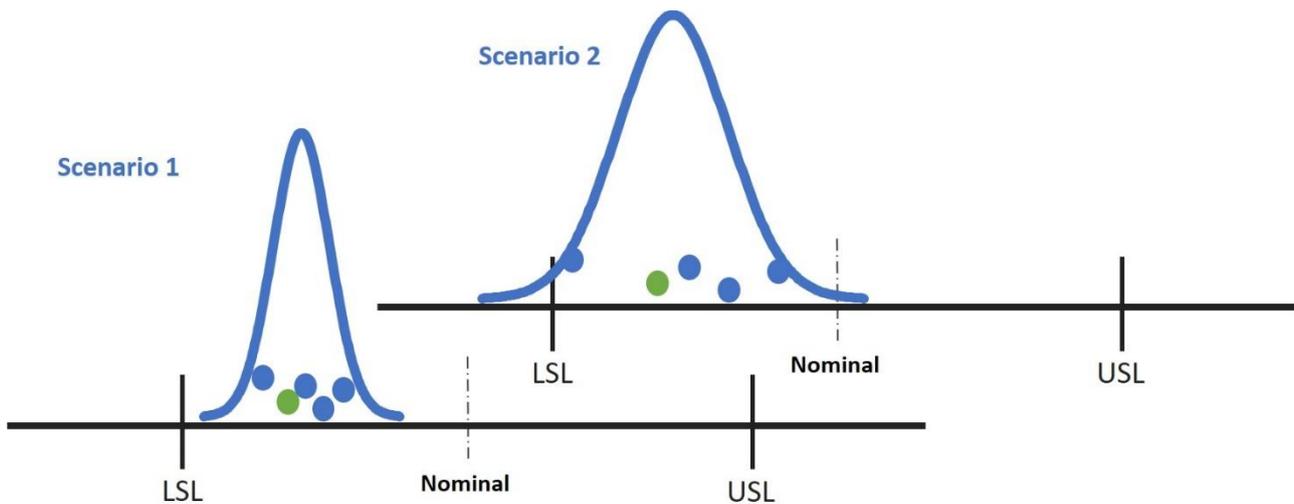


The figure illustrates the risk of approving a component that looks acceptable, but the process will in worse case produce primarily outside specification (Small dotted line blue curve). In best case, your selected item is in the low end of your process spread (Large dotted line). If you make capability analysis as part of your approval process, you will only catch this if the dimension is selected for the capability analysis.

By measuring 5 you increase your knowledge of the process, before you invest in an expensive capability analysis.

A capability process can be expensive and only done on few dimensions, typically only 3-10. By increasing your number of items in the FAI, you can enhance your process understanding before you make the capability analysis.

As illustrated in the figure below, 5 items will give you more certainty of where the process is and how it might be distributed. Of course, you still need to remember that the confidence in this is still low, but it is much higher than only basing it on one item.



This above illustration gives two possible scenarios, based on measuring 5 items instead of one. In the illustration, the green item is the first measured as in the first figure. In scenario 1 distribution is tight, giving an expectation of a narrow process where all items might stay within the tolerance field. In scenario 2, the distribution is wider, giving an expectation of a wider process, where there is greater risk of producing outside specification.

You now have more knowledge to answer the question; Can I approve this dimension? Should I start a capability analysis based on this dimension?

It can be discussed if all dimensions need to be measured on 5 parts, or only critical dimensions (expected to be subject for capability analysis). My own experience is, that if all or most dimensions can be measured in one or two set ups, semi or fully automated, then it is as easy to measure all dimensions on 5 parts, compared to only measuring some of the dimensions on 5 parts, and some on one part only. The benefits gained on measuring 5 parts usually outweighs the extra time needed to measure all dimensions.

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