An Inquiry about Calculating the Cpk

On an American Society for Quality (ASQ) web site, a question was posted about calculating the process capability index (Cpk). A group member asked, "What's the minimum data to be taken to calculate Cpk? [I'm] starting to get confused…"

The post led to several responses, among them:

- I would suggest a subgroup size of 5 and a minimum of 25 subgroups. Of course other methods exist, but using an X-bar and R Chart will allow you to first determine if the subject characteristic is in control.

- Think of it with the Central Limit Theorem in mind. The larger the sample size, the more closely the sample means will be normally distributed (x-bar chart) and the UCL and LCL will more accurately represent the process.

- This is an easy topic about which to be confused. Some say 20-25 samples while others say 125. [But] the more data you have the more accurately it will represent the process…

I started to get concerned that the respondents were only addressing the number of measurements, but not how to collect the data to make sure it represents the true process variation. So, I pitched in with the following post:

I agree with the previous posts about the number of subgroups and subgroup sizes; but you also have to consider your sampling frequency. For example, I can walk into a production area at Gillette Razor and tell them I need 125 blades (25 subgroups of size n = 5) so I can measure their thickness for my X-bar and R charts. They'll blast out the 125 blades in a matter of seconds. Statistically, I'll have sufficient data for my charts' control limits; but the data will not tell me anything about my process.

Therefore, you should spread out your subgroup data collection over a sufficient period of time to allow set up, batch change, shift change, and other sources of common cause variation to be in play. Then your charts will reflect your process. If the process is stable, you can calculate a valid Cpk. If the process is not stable, your software might give you a Cpk value – but it won't be valid!