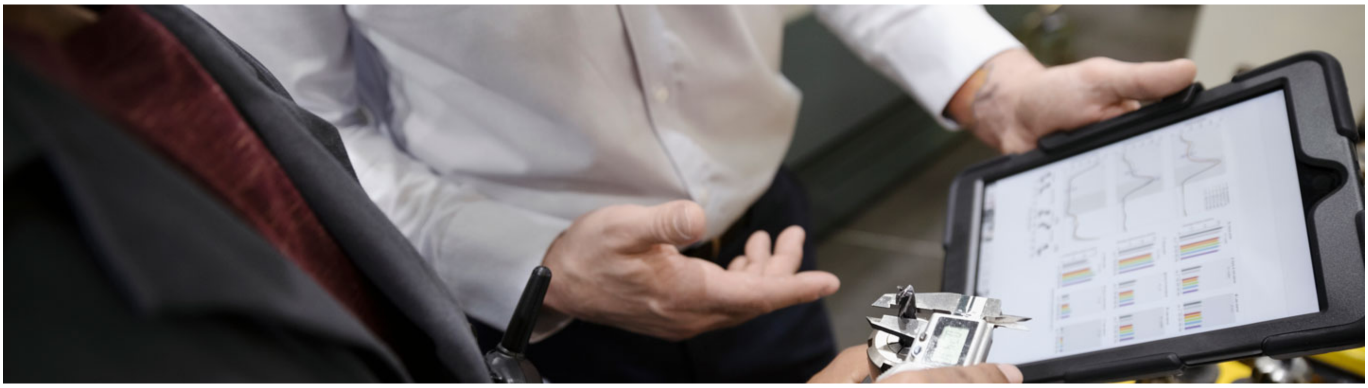

Metrology

What Is SPC: How Manufacturers Stabilize Machining Production

Kip Hanson | Dec 17, 2019

SPC is an oft-overlooked and underappreciated tool for improving any manufacturing process. What is it? How is it used in today's job shops to make a difference?

Scrap. Rework. Downtime. These are the leading efficiency killers in most manufacturing operations. The question is, how do production managers and process engineers help to avoid these problems and help reduce waste on the shop floor or assembly line?

Perhaps the best approach is to minimize process variability—and that is accomplished by studying and isolating problem areas and gathering data. Enter statistical process control, or "SPC."

Long considered a function of the quality assurance department, SPC is also an oft-overlooked and underappreciated tool for improving any manufacturing process. SPC augments traditional quality control methods, providing the data needed to spot trends and detect potential problems early on, rather than correcting them after the fact.

All it takes is a little knowledge, a little additional effort and the right software and metrology equipment for SPC to generate significant opportunities in large—and especially small—shops.

What Is Statistical Process Control?

What is SPC, how does ***it work*** and what's involved? SPC is the collection of dimensional part data and its subsequent analysis. When properly executed, it allows shops to predict when and how a machining, bending, forming, lasing or assembly process will begin to produce out-of-tolerance parts—and help ascertain whether said process is stable.

Most machinists would rather make parts and leave statistics and analytics to other fields. Any good machinist or sheet metal fabricator will have a firm grip on their processes anyway, so why bother writing things down?

Well, think about it this way: You might study passing yards, interceptions and other NFL performance figures to help make you more likely to win this year's fantasy football league. Analyzing quality-related data can make your manufacturing processes more successful.

Like many tools, metrology has gone digital. Learn about the benefits in "Precision Measuring Tools: The Rise of Digital Metrology and Data."

SPC Terms to Know: Xbar, R Charts and More

We're not going to examine all the mathematical formulae here. That's for SPC seminars. But we will cover the basic terminology so that you can at least get a grip on SPC and understand how it might help improve your operations. Here are the four main terms to understand.

What is attribute data?

If you were written up three times this year for being late, those events could be recorded as attribute data related to attendance performance. It represents the number of times something occurs during a process—in this case, your employment record for the year.

What is variable data?

One way to improve this value would be to collect variable data on your arrival time, that is, how many minutes late (or early) you were each day. You could then study this process variation to determine the root cause of each unfavorable event.

What is an Xbar?

This represents the average value of a subgroup recorded in an Xbar chart. In our attendance scenario, you might measure your arrival time each day and average it by week—after 50 weeks, you would see 50 values spread out like a mountain range across the chart's X-axis, hence the name.

What is a range chart?

The range chart complements the Xbar, which is why you'll frequently hear the terms Xbar and R chart in SPC-land. It illustrates the range between the data values for each corresponding point in the Xbar chart—for example, the earliest and latest arrival times in any given week.

If you show up at 6:37 a.m. on Monday, the earliest time that week, and 7:02 a.m. on Thursday, the range for that variable data subset would be 25 minutes.

Because a certain amount of data is needed to do the calculations, the meat and potatoes of SPC doesn't happen right away. But we would ultimately use these values to determine upper and lower control limits (say 6:47 a.m. and 6:53 a.m.), as well as a mean target value (6:50 a.m. would be a good value).

If you show up one day at 6:55 a.m., you're certainly not going to hear about it from the boss, but it does indicate that you might need a new alarm clock or a more reliable car. In other words, control limits represent the minimum acceptable quality level for whatever is being measured, beyond which corrective actions must be taken.

SPC Helps Manufacturers Get to the Root of the Problem

No one is going to use SPC to measure employee attendance, but you could certainly use it to track the measurements on a challenging bore, the pitch diameter of an external thread, the bend radius on a computer housing—and many other areas.

And like occasional tardiness, values that stray beyond the upper or lower control limits indicate that something has gone awry, such as an insert may have chipped or the laser lens needs cleaning.

Either one is not a big deal to fix, but better to do so now than to wait for a scrap part.

If the range seems excessive relative to the part feature—for instance, averaging 0.009" on a tolerance of +/- 0.005" (0.01" total)—then that aspect of the machining process is out of control.

Time to get to the root of the problem.

Deviations represent an opportunity to improve the manufacturing process. If your bore diameter starts to hit the control limits after 50 pieces, you know it's time to change the insert. If it happens unexpectedly or more often than you'd like, it might be time for a more capable ***boring tool***.

Be sure to document any unplanned process or tooling changes directly on the SPC chart. Doing so will help steer you down the correct path and avoid repeating past mistakes.

Anyone who routinely uses SPC will not only become better attuned to their manufacturing processes but come to appreciate other methods of continuous improvement as well. Success begets additional success. When processes are stable, machinists and fabricators will have extra time for tooling and machine maintenance.

Some might pursue setup time reduction initiatives using offline ***tool presetting***. Unstable processes can be made less so with ***hydraulic clamping systems*** or shrink-fit ***toolholders***.

Changing customer demands might be addressed with zero-point locating systems, standardized ***tool turrets*** and magazines—and quick-change tooling.

Whatever the improvement strategy, it's sure to reduce process variability and improve part quality. And best of all, SPC will be there to help measure it.

How is your shop using SPC today? Talk about it in the ***metalworking forum***.

