

CONTROL CHARTS

Of all the tools for analyzing data, the control chart is the most useful. No other tool captures the voice of your process better. Control charts are used to determine whether your process is operating in statistical control. Until it is, any improvement efforts are, at best, mere process tampering. Basically, a control chart is a run chart (described earlier) that includes statistically generated upper and lower control limits.

The purpose of a control chart is to detect any unwanted changes in your process. These changes will be signalled by *abnormal* points on the graph. Extensive research by Dr. Shewhart indicated that by establishing upper and lower limits at three times the standard deviation of the process (plus and minus, respectively), 99.73% of the common cause variation would fall within these limits.

A process is said, therefore, to be in “statistical control” when the process measurements vary randomly within the control limits; that is, the variation present in the process is consistent and predictable over time.

The upper and lower control limits are not the same as tolerance or specification limits.

Control limits are a function of the way your process actually performs over time. Specification, or tolerance, limits are a function of what your process may have been designed to do and may not necessarily have any direct relationship to the actual performance of the process.

BENEFITS OF CONTROL CHARTS

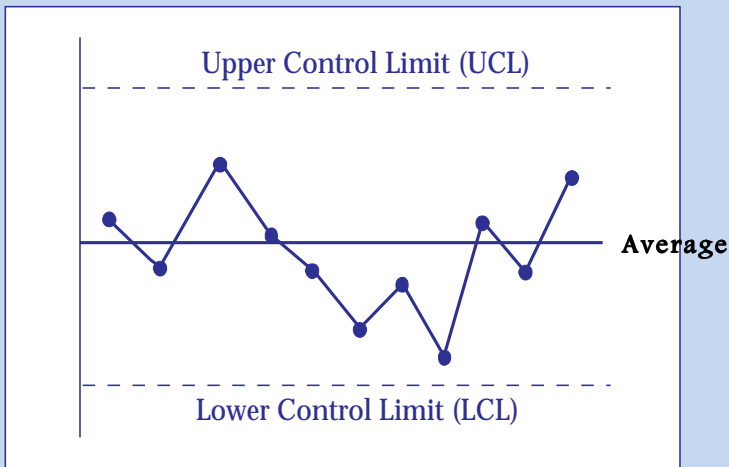
- Help you recognize and understand variability and how to control it
- Identify “special causes” of variation and changes in performance
- Keep you from fixing a process that is varying randomly within control limits; that is, no “special causes” are present. If you want to improve it, you have to objectively identify and eliminate the root causes of the process variation
- Assist in the diagnosis of process problems
- Determine if process improvement effects are having the desired affects

How to use it:

Use the figure on the next page to determine the type of control chart you need.

Control charts use two types of data: variables data and attributes data. In general, if you want to use variables data, you have to take measurements in units such as length, temperature, etc. On the other hand, attributes data requires a good/bad or go/no-go decision and counting (for example, number of defects, percent late, etc.).

Construct the control charts. Once you have determined the type of data to collect, follow the appropriate chart construction techniques described elsewhere in this section.



TYPICAL CONTROL CHART

HOW TO DETERMINE WHICH CONTROL CHART TO USE

STEP ONE: Is a Control Chart the appropriate tool to use?

STEP TWO: Determine type of data (**Attribute or Measurement**)?

STEP THREE: If **Measurement** use:

X-R Chart (if subgroups of five or more)

X Chart (if subgroups of five or less)

If **Attributes** (Good/Bad, Discrete Data), use one of the following charts:

If attributes are DEFECTS: Ask, Is a constant sample size used?

If YES: np - Chart If NO: p - Chart

If attributes are DEFECTIVES: Ask, Is constant sample size used?

If YES: c - Chart If NO: u - Chart

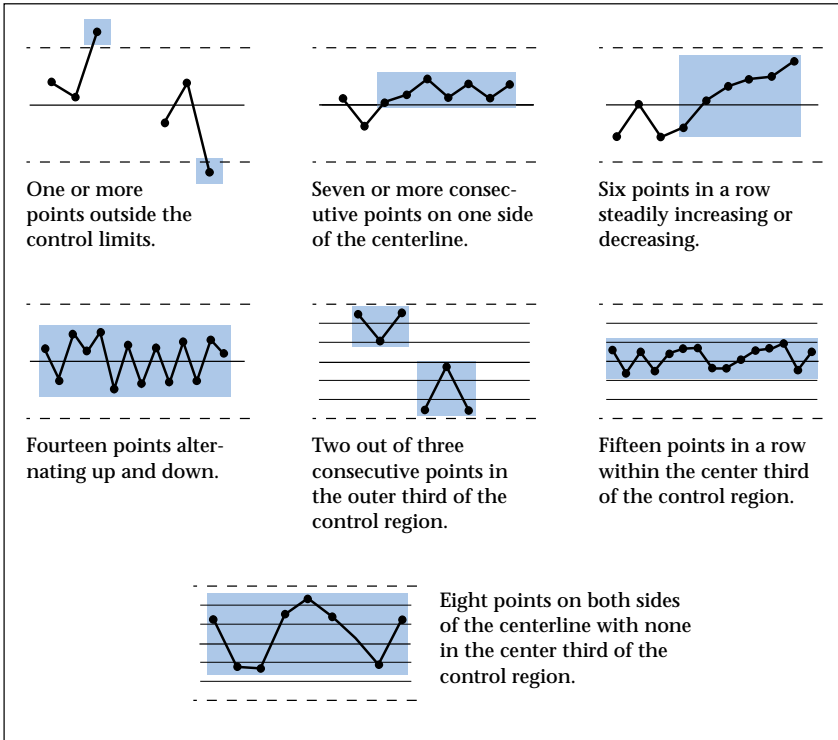
DEFECT: A failure to meet one part of an acceptance criteria

DEFECTIVE: A unit that fails to meet acceptance criteria due to one or more defects

Identify and eliminate any special or assignable causes of variation. To determine whether these causes exist, look for one or more of the seven “signals” shown on the next page. The probability that any of these seven events will occur **at random** is very small. That’s why they’re a signal that something has changed in your process.

Reduce overall variability. After you have eliminated all special causes, try to reduce the remaining variability in your process. This usually requires fundamental changes to the process, and these changes require management assistance. *To achieve continuous process improvement, it’s essential to reduce variability.*

Indications That Special Causes of Variation Are Present



Common cause variations within a process are, by definition, random. Therefore, any non-randomness indicates the influence of special causes.

Points to Remember:

- Upper and lower control limits are not specification limits. They have a mathematical relationship to the process outputs. Specification limits are based on product or customer requirements.
- Be sure you have selected the correct control chart for the type of data you are collecting.
- Having a data point fall outside the control limits is only one of many different “signals” that indicate a process is out of control. If all the data points *are* within the control limits, be sure to check the other signals that indicate a “special” cause of variation.