XBAR Chart

In quality control, observations are typically made in "lots", that is, a number of observations are made on some product's manufacturing process or the product itself at periodic intervals. For example, in the manufacture of metal bolts, the length of bolts being turned out may be sampled each hour of the day. The means and standard deviation of these sample lots may then be calculated and plotted with lines drawn to show the overall mean and upper and lower "control limits" indicating whether or not a process may be "out of control". One area of confusion that exists is the language used by industrial people in indicating their level of process control. You may hear the expression that "we employ control to 6 sigmas." They **do not mean** they use 6 standard deviations as their upper and lower control limits but rather that the probability of being out of control is that associated with the normal curve probability of a value being 6 standard deviations or greater (a very small value.) This confusion of standard deviations (sigmas) and the probability associated with departures from the mean under the normal distribution assumption is unfortunate. When you select the sigma values for control limits, the limits for 1 sigma are much closer to the mean that for 3 sigma. You may, of course, select your own limits that you feel are practical for your process control. Since variation in raw materials, tool wear, shut-down costs for replacement of worn tool parts, etc. may be beyond your control, limits must be set that maximize quality and minimize costs.

An Example

We will use the file labeled boltsize.LAZ to demonstrate the XBAR Chart procedure. Load the file and select the option Analyses / Statistical Process Control / XBAR Chart from the menu. The file contains two variables, lot number and bolt length. These values have been entered in the specification form which is shown below. Notice that the form also provides the option to enter and use a specific "target" value for the process as well as specification levels which may have been provided as guidelines for determining whether or not the process was in control for a given sample.

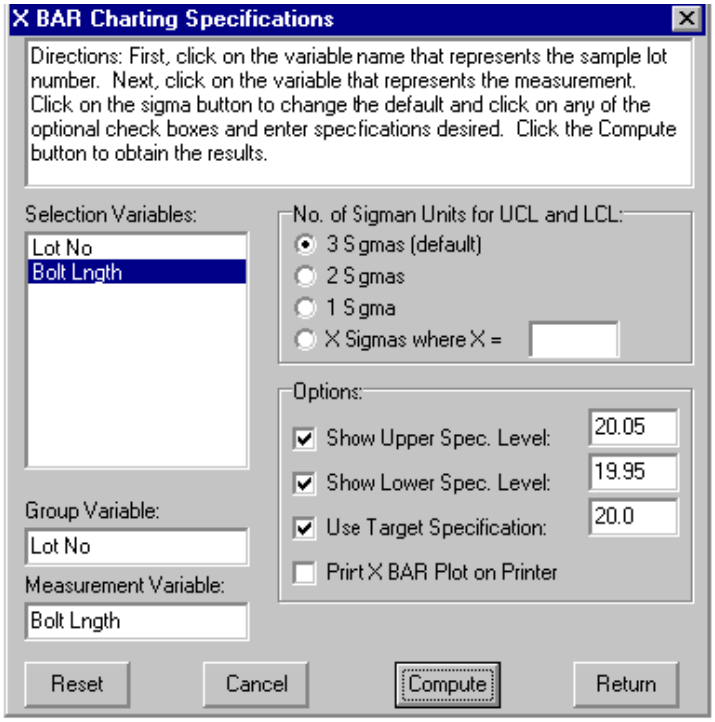

Figure 1 Specification Dialog for the XBar Chart

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Group Size Mean      Std.Dev.
_____ ____ ________ _________
   1   5    19.88      0.37
   2   5    19.90      0.29
   3   5    20.16      0.27
   4   5    20.08      0.29
   5   5    19.88      0.49
   6   5    19.90      0.39
   7   5    20.02      0.47
   8   5    19.98      0.43
Grand Mean =    19.97, Std.Dev. =    0.359, Standard Error of Mean =     0.06
Lower Control Limit =   19.805, Upper Control Limit =   20.145
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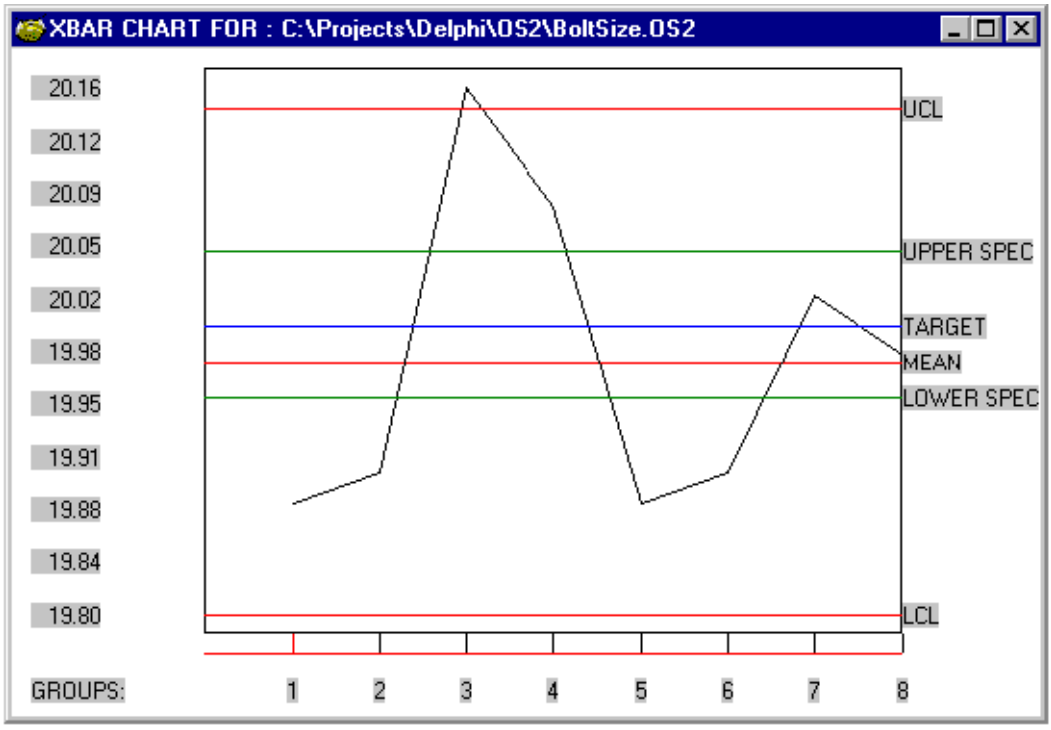

Figure 2 The XBar Chart

Notice that several groups exceeded the upper specifications for the bolt size and one group exceeded the upper control limit.