Introduction to SPC and Weld Checkers® and Monitors

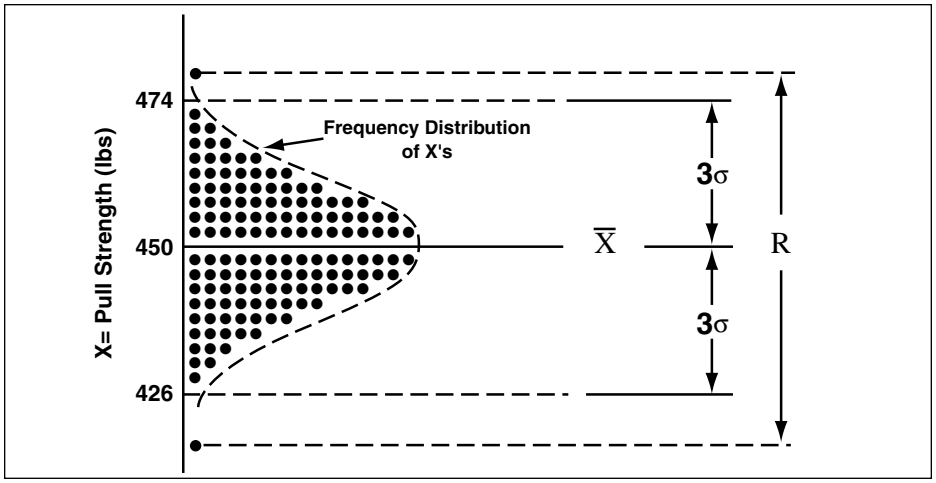
BACKGROUND

Statistical Process Control (SPC) and Statistical Quality Control (SQC), are the buzzwords for manufacturing today. Most large manufacturers and many small ones are using these terms interchangeably to represent a method to improve quality, reduce rejects and improve yield.

Weld Checkers and monitors are SPC devices. What is SPC and how does it relate to the Weld Checkers and Monitors and the Resistance Welding process? SPC is a method which uses the concepts of probability and statistics to determine a normal and acceptable pattern of variation in a process. The process is then monitored in order to identify unacceptable variations and to eliminate the causes. Weld Checkers and monitors measure voltage and/or current during the resistance welding process. Their basic functions are to provide data to be used in statistical determinations and to monitor the ongoing process and alert the user to unacceptable variations in a voltage or current-based parameter.

STATISTICAL DEFINITIONS

Certain accepted statistical patterns determine the allowable amount of variation in a process. The graph above illustrates how data on weld pull strengths is used.



Frequency Distribution- an arrangement of data showing the number of times that a value has occurred.

Normal Distribution- a predictable tendency for data to form a "bell curve" frequency distribution.

Sample Size (n)- number of observations in a group of data. A minimum sample size of 100 is advised when collecting Weld Sentry data, some customers use 200.

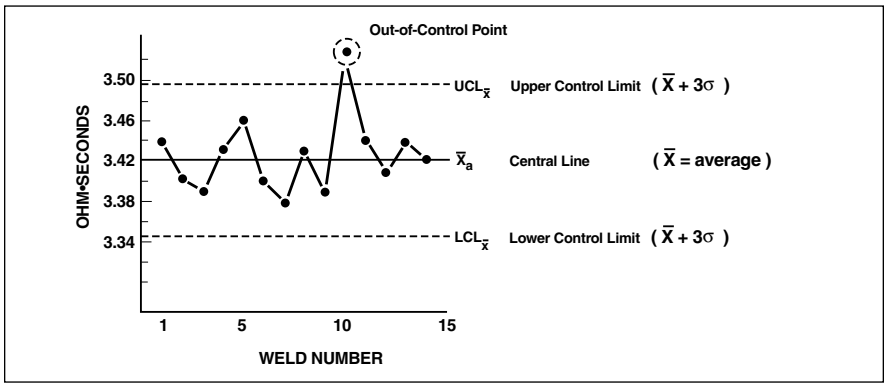
Mean (Average, $\bar{X}$)- for a group of data, the sum of observations divided by the number of observations.

Range, R- difference between the largest and the smallest values in a group of data, amount of dispersion.

Standard Deviation (Sigma, σ)- measures the uncertainty of the data to spread out from the mean.

PROCESS

Some of the process components of resistance welding include development of weld schedules, tooling and fixturing, equipment maintenance, proper materials, and operator training. It is expected that any of these could vary to a slight degree. No two parts are ever exactly the same even if they are of acceptable quality. However, process variations such as power fluctuations, misalignment of parts, electrode wear, material differences, or operator error could cause serious variation and produce unacceptable parts. When this variation is discovered, the "assignable cause" must be determined and remedied.



CONTROL

In SPC, Control Charts, such as $\bar{X}$ or R Charts, provide a graphic method to chart process variation and a means to evaluate the data in order to evaluate the performance of the process.

Central Line, $\bar{X}$- line on the control chart indicating the average, or mean, value of the data.

Control Limits- the range of observed values between which variation is allowed to occur. Typically, control limits are set at +/-3 σ(sigma), [Average +/- 3 times the standard deviation]. There is a 99.73% probability that chance variations will occur within +/-3 σ Control Limits. The 6 σ(sigma) commonly referred to by SPC/SQC is simply the acceptable range of values based on these limits.

Upper Control Limit, UCL = $\bar{X}$ + 3 σ(sigma)

Lower Control Limit, LCL = $\bar{X}$ - 3 σ(sigma)

When variation occurs outside the control limits the process has gone “out of control” and the cause must be investigated. It is for this reason that, even through exceptional weld strength may not be undesirable, the fact that it falls outside of control limits makes it unacceptable. A Weld Strength Profile should be developed and control limits maintained. If the process is not controlled it would be just as likely that an unacceptable part could be produced. The probability that a chance variation would fall outside of the limits is only 0.27%.

Historically, the common method for determining acceptability of a welded part has been the Destructive Pull Test and the data used for SPC has been the weld strength. Of course this Destructive Weld Test cannot be performed on all parts. Today, with Weld Checkers and Monitors, data can be collected for every weld, without destroying the weld, and can be acted upon immediately to modify the process as required.

SUMMARY

This Nugget has been a simplified introduction to the use of SPC which has been shown to be a valuable tool in controlling the production process for resistance welding. System variables, which tend to change over time, can be monitored and compared to established parameters to maintain production requirements. As a leader in the measurement of resistance welding parameters, AMADA WELD TECH has developed a complete line of Weld Checkers which offer SPC capability. Please contact your local AMADA WELD TECH distributor for more information or visit our web site at www.amadaweldtech.com.

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