

## Ten to One or One to Ten

Many companies experience difficulties regarding product acceptance to specifications simply because they fail to utilize the ten to one rule when making the choice of a measurement instrument to determine adherence to specifications.

Simply stated the “Rule of Ten” or “one to ten” is that the discrimination (resolution) of the measuring instrument should divide the tolerance of the characteristic to be measured into ten parts. In other words, the gage or measuring instrument should be 10 times as accurate as the characteristic to be measured. Many believe that this only applies to the instruments used to calibrate a gage or measuring instrument when in reality it applies to the choice of instrument for any measuring activity. The whole idea here is to choose an instrument that is capable of detecting the amount of variation present in a given characteristic.

If we were to plot on a run chart the achieved values from a gage that has been selected that is one to one or even two to one resolution to the part tolerance, the graph would show almost a straight line. This is because the instrument is not capable of detecting the inherent normal variation that exists in the part.

In order to achieve reliable measurement, the instrument needs to be accurate enough to accept all good parts and reject all bad parts. Conversely the gage should not reject good parts nor accept bad ones. The real problem will arise when your company uses an instrument that is only accurate enough to measure in thousandths and accepts parts based upon that result and the customer uses gages that discriminate to ten-thousandths and reject parts sent to them for being “.0008” over the specification limit.

Any company that controls their processes through the use of statistical tools will have a very difficult task to meet SPC indices of acceptable levels if the data they collect is based upon numbers achieved with gages that will not reflect the normal variation present in the process.

One statistical tool that is used to test the worthiness of a gage to control the production process is called a Gage R&R Study (Repeatability & Reproducibility). Repeatability is the ability of one operator to achieve the same results when measuring the same dimension after repeated trials. Reproducibility is the ability of multiple operators to achieve the same results when using the same gage to measure the same dimension on the same parts after repeat trials.

Acceptance of the gage to perform the task at hand is determined when after performing the test (study) meets the following criteria:

- 10% of the total tolerance (or process variation) or less = the gage is acceptable
- 11-30% = acceptable only based upon the application, and must be closely monitored.
- 31% or over = the gage is unacceptable for use on this application.

Often it is quite difficult to pass the gage R&R study even when the ten to one rule is used. So, in order to give yourself the advantage to be begin with, start by choosing a gage that is accurate to 1/10<sup>th</sup> of tolerance of the characteristic to be measured.