

OUR SIX SIGMA CHALLENGE

WHAT IS SIX SIGMA?

Six Sigma is the required capability level to approach the Standard. The Standard is Zero Defects. Our goal is to be best-in-class in Product, Sales and Service.

WHY SIX SIGMA?

The performance of a product is determined by how much margin exists between the design requirements of its characteristics (and those of its parts/steps), and the actual value of those characteristics. These characteristics are produced by processes in the factory, and at the suppliers.

Each process attempts to reproduce its characteristics identically from unit to unit, but within each process some variation does occur. For some processes, such as those which use real-time feedback to control the outcome, the variation is quite small, and for others it may be quite large.

Variation of the process is measured in Standard Deviations (Sigma) from the Mean. The normal variation, defined as process width, is ± 3 Sigma about the mean.

Approximately 2,700 parts per million parts/steps will fall outside the normal variation of ± 3 Sigma. This, by itself, does not appear disconcerting. However, when we build a product containing 1,200 parts/steps, we can expect 3.24 defects per unit ($1200 \times .0027$), on an average. This would result in a rolled yield of less than 4%, which means fewer than 4 units out of every hundred would go through the entire manufacturing process without a defect.

Thus, we can see that for a product to be built virtually defect-free, it must be designed to accept characteristics which are significantly more than ± 3 Sigma away from the Mean.

It can be shown that a design which can accept *twice the normal variation* of the process, or ± 6 Sigma, can be expected to have no more than 3.4 parts per million defective for each characteristic, even if the process mean were to shift by as much as ± 1.5 Sigma. To quantify this, Capability Index (Cp) is used; where:

$$C_p = \frac{\text{design specification width}}{\text{process width}}$$

A design specification width of ± 6 Sigma and a process width of ± 3 Sigma yields a Cp of $12/6 = 2$. However, the process mean can shift. When the process mean is shifted with respect to the design mean, the Capability Index is adjusted with a factor k, and becomes Cpk. $C_{pk} = C_p(1 - k)$, where:

$$k = \frac{\text{process shift}}{\text{design specification width}/2}$$

The k factor for ± 6 Sigma design with a 1.5 Sigma process shift = $\frac{1.5}{12/2} = 0.25$ and the $C_{pk} = 2(1 - 0.25) = 1.5$.

In the same case of a product containing 1,200 parts/steps, we would now expect only 0.0041 defects per unit (1200×0.0000034). This would mean that 996 units out of 1,000 would go through the entire manufacturing process without a defect.

It is, therefore, our five year goal to achieve ± 6 Sigma capability in Product, Sales and Service.

