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Specifications and Capability

by John J. Flaig, Ph.D.

The November issue of Quality Progress (Vol. 34, No. 11, pp. 10) contained a letter of mine to the Editor that I think you might find of interest. The letter with some additional comments went as follows:

In Dr. Hare's Statistical Round Table article, found in the August issue of Quality Progress, there is a breakout section entitled "Wide or Narrow Specifications?" that states, "A rule I've used successfully says that specifications can never be narrower than capability."

The argument given is that if this rule is violated, then the process will be adjusted unnecessarily and hence process variation will be increased. However, when a control chart signals we are supposed to look for assignable causes NOT automatically adjust the process. If the process is stable but incapable, the search will be fruitless and we should not adjust the process. The control limits, not specification limits, should be used to determine the need for adjustment. This is the reason many authors warn practitioners not to put specification limits on control charts.

Further, the rule might be misinterpreted to imply that specifications should be adjusted so that they satisfy Dr. Hare's criteria. Nothing could be further from the truth. Specifications should represent the values required to make the product meet customer or design requirements throughout its expected life. This is irrespective of the capability of the process that produces the product. Hence, there is NO relationship between control limits and specification limits. If the specifications are narrower than the capability, then the practitioner should validate the assumptions and computations underlying the specifications. If the specifications are validated, then actions must be taken to improve the capability of the process until it satisfies some acceptable criteria.

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A formal expression of Dr. Hare's criteria is that the process interval is a subset of the specification interval (i.e., expressed mathematically $[\mathrm{LCL},\ \mathrm{UCL}] \subseteq [\mathrm{LSL},\ \mathrm{USL}]$). This is certainly a desirable situation, but the practitioner needs to THINK about how the control limits are computed – are they 3 sigma limits, 2 sigma, or some other number? The standard is 3 sigma but Dr. Shewhart said that control limits should be determined based on economic considerations (i.e., the cost of looking for causes vs. the cost of failing to look). So in cases where the cost of looking is small and failing to look is high, it might be reasonable to use 2 sigma limits. Also, the practitioner needs to THINK about how the specification limits are computed. One test of their reasonableness might be to compare the proposed limits with the limits derived using economic analysis methods such as Dr. Taguchi's quadratic loss function or, the optimization technique used in my process capability optimization paper [Flaig, 2002]. The proper evaluation of these critical issues could save a company literally millions of dollars.

Flaig, J. J. (2002). Process Capability Optimization. Quality Engineering, Marcel Dekker, Vol. 15, No. 2.

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