УДК 621.791.019

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ACCOUNTING FOR POSSIBLE DISPLACEMENTS OF THE PROCESS ADJUSTMENT CENTER WHEN DETERMINING THE PERFORMANCE INDEX

The range of natural dispersion of the controlled indicator x contains 99.73% of all possible values and has a width of 3σ from the center of the manufacturing process setting (μ) towards the upper allowable value (*USL*) and 3σ from the average towards the lower allowable value (*USL*). A traditional approach to ensuring the acceptability of a production process is to maintain a process operability index of at least 1.66. At the same time, the performance index of the production process (C_{pk}) is defined as the minimum of the values of the performance indexes at the lower (C_{pl}) and upper limit (C_{pu}) of the range of permissible values of the controlled quality indicator:

$$C_{pk} = min\left(\frac{USL-\mu}{3\sigma}; \frac{\mu-LSL}{3\sigma}\right), \quad (1)$$

where μ is the mathematical expectation of the controlled indicator, which is usually taken to be equal to the average value ($\bar{x}$) and used as the actual value of the center of adjustment of the process.

Maintaining the operational efficiency index of the production process at a level of at least 1.66 provides a "reserve" in terms of the ability to meet the requirements, that is, the distance from the limit of permissible values to the limit of the range of natural dispersion is at least 1.98σ. But this approach does not take into account the possibility of a shift (drift, fluctuations) of the arithmetic mean value. Meanwhile, such shifts can be quite significant even under conditions of relative stability or statistical controllability of the production process [1]. The range of possible fluctuations of the arithmetic mean value, provided that there is no influence of special reasons, is determined by the control limits of the statistical process control map and is σ , where the value of the coefficient k depends on the volume of the sample, by which the arithmetic mean value is determined. Possible shifts of the arithmetic mean within the control limits are proposed to be taken into account by the corresponding ($k\sigma$) correction for (μ):

$$C_{pk} = min\left(\frac{USL-(\mu+k\sigma)}{3\sigma}; \frac{(\mu-k\sigma)-LSL}{3\sigma}\right). \quad (2)$$

Determining the serviceability index, taking into account possible shifts in the process adjustment center, allows you to significantly limit the risks of non-fulfillment of product quality requirements. The reduction of risks is facilitated by the provision of a "stock" for the ability to meet requirements, taking into account the possibility of shifting the center of the production process setting according to the controlled indicator of product quality. The effectiveness of the proposed approach is determined on the example of the welding wire manufacturing process.

References

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