UDC 621

METHODOLOGY OF CREATING A UNIVERSAL INTEGRATED QUALITY CONTROL SYSTEM AT MACHINE-BUILDING ENTERPRISES OF THE OIL AND GAS INDUSTRY

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Machine-building is one of the key sectors of the national economy, and its development is decisive for improving the quality of products of other sectors of the national economy, for example, the oil and gas processing industries. Modern machine-building is characterized by a decrease in serial production, an expansion of the range of products, and an increase in the accuracy of their manufacturing due to high technologies using high-precision equipment and, quite often, nano-metric measuring equipment. To control the quality of products, information is needed on its parameters (indicators) at all stages of the life cycle, which is especially important at the manufacturing stage. It should be noted that at present the most frequently used methods for collecting and processing information about quality, as well as methodological and regulatory support of manufacturing technologies, as a rule, are focused on mass production, that is, they are designed for a relatively large amount of statistical information. This makes them ineffective in modern, most often small-scale and individual production, since it requires large material and time costs. For effective quality control while reducing the serial production of products and increasing its accuracy, more advanced and economical methods of collecting and processing information are needed. Thus, there is an objectively arisen scientific and applied problem, which consists in the need to improve the quality control system of modern diversified machine-building products manufactured under conditions of small-scale production. This problem is of great national economic importance since its solution will make it possible to create high-quality competitive products with minimal costs. The proposed solution to the specified scientific and technical problem of quality control of machine-building products is a logical continuation of the work of many domestic and foreign scientists who solved the problems of assessing and predicting product quality using statistical methods based, as a rule, on relatively large samples. At the same time, the analysis showed that in its overwhelming majority of works there are practically no recommendations with the help of which it is possible to establish patterns associated with the rational use of statistical information in the conditions of relatively small samples, which is typical for multi-nomenclature small-scale industries that produce machine-building products for the oil and gas industry, such as pumps, compressors, etc. One of the reasons for this is the

absence of both effective methods for determining the distribution laws of real values of quality indicators, which, as a rule, are random variables, and methods for obtaining effective and unbiased estimates of their parameters.

The paper developed a methodology for creating an integrated quality control system for products manufactured at machine-building enterprises of the oil and gas industry in the context of a decrease in production seriality and an increase in dimensional accuracy while ensuring the implementation of requirements for its quality at all stages of the life cycle.

For this, the work proposes a universal integrated product quality control system based on the use of the "theory of ordinal statistics" and the use of "asymptotic" and "symmetric" distributions of extreme values of random size of the control sample, which allows to reduce the serial production and increase the dimensional accuracy, based on obtaining information from a small volume of the control sample to save time and costs at machine-building enterprises (Table 1).

Table 1 - Universal integrated quality control system for products and processes

Assessment type	Level of importance	Quality indicators	
		Individual	Composite
Pointwise	High	$L_h(x) = \exp(-\exp(-x))$	$\frac{1}{L} = \frac{1}{m}\sum_{j=1}^{m}\frac{1}{L_{hj}}$
	Average	$L_a(x) = [\exp(-\exp(-x))] + [1-\exp(-\exp(x))]/2$	$L = \sqrt[m]{\prod_{j=1}^{m} L_{aj}}$
	Low	$L_l(x) = 1-\exp(-\exp(x))$	$L = \frac{1}{m}\sum_{j=1}^{m} L_{lj}$
Interval	General	$L_g(x) = [\exp(-\exp(-x))] - [1-\exp(-\exp(x))]$	$L = \sqrt[m]{\prod_{j=1}^{m} L_{ij}}$

It is shown that the creation of such a system makes it possible to synthesize the necessary and sufficient regulatory documentation in the field of statistical methods of quality control, to prioritize the development of documents, and to ensure the relationship of their requirements. Thus, the effectiveness of product quality management in machine-building, in conditions of a small amount of statistical information, for example, in manufacturing of devices and machines for the oil and gas industry, is ensured by a system of regulatory documents built on a modular-adaptive principle, in which quality control is supported by a single universal integrated assessment system for products and processes at all stages of their life cycles.

The paper proves that the system of relevant standards should be built on a modular-adaptive principle and based on a systemic and process approach.

The paper proposes methodological principles for creating a normative document, which is an integral, ordered, and structured object that regulates the requirements, norms, and rules for forecasting and controlling product quality, as well as managing it, in conditions of multi-nomenclature small-scale production with minimal material, time and labor costs.