

Technological methods of ensuring reliability in the production of computers

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Abstract

In the modern control systems and computer systems at the level of reliability $\lambda = 10^{-7} - 10^{-8}$, the reliability of all products is largely determined by structural and technological factors.

When assessing the reliability, the engineer-developer has to take into account many structural and technological factors of the process, so that the quantitative indicators of structural integrity were accurate and consistent. However, it's impossible to reach it without assessing and ensuring the reliability of the entire process of the production of computers and systems.

It should be noted that the problem of reliability of computing systems has many aspects.

One important aspect is technological, particularly in ensuring reliability in the production and delivery of goods for use.

The most important factors of the technological process in the production, especially on-board control computers (for the aircraft) are the following:

- The technology and the printed wired assembly,
- The design and manufacture of printed circuit boards and compounds,
- The completeness of the control and localization of emerging defects.

As a result of the analysis and tests in the workplace, the authors suggest the methods for ensuring the reliability of technology in various stages of the cycle: - development - production.

The article describes the technique of controlling the operation of the on-board control computer in the production process.

There is built a queueing system, which allows one to determine not only the reliability of individual components, assemblies and units, but also indicators of a completed product at the time of delivery and acceptance as well as the testing of work. This system is protected by copyright certificates.

The authors have also developed a technique which allows one to compare the intensity λ of the flow of failures with the current state of the elements and the system as a whole, on the basis of which the technological process of lowering the reliability of the product is determined. As a result a program of impacts on technology and (or) production factors for improving the reliability of the product is compiled. The authors analyzed the frequency of the impact on reliability data, and (or) if needed, a new manufacturing process should be elaborated.

As a result of this method the level of technological process and the number of failures in the manufacture of multilayer printed circuit boards – MCB were evaluated.

The results obtained by using this method showed that within the time interval $[T_0, T_1]$ requirements to the level of security at the output of the system exceeded the maximum limit of attainability in this process.

On this basis, it was required to develop a new technology: the so - called the manufacturing process of printed circuit boards using the relief method – RCBs – Relief Circuit Boards.

The authors developed the technology and the article provides comparative techno-economic characteristics of relief circuit boards and multilayer printed circuit boards – MCB.

The methods described in the article and technological benefits of relief of printed circuit boards were used in the production of on-board control computers for some aircraft.