

Application of Environmental Stress Screening in Equipment Repair

Xu Li¹, Xiangfeng Zhang¹, Hui Liu¹, Kaihong Ge²

¹Second Military Representative Office in Shijiazhuang, Shijiazhuang, China;

²Hebei Second Machinery Industry Company, Shijiazhuang, China.

Abstract

Firstly, through the comparison of the advantages and disadvantages of environmental stress screening and environmental routine test, this paper introduces the application effect of environmental stress screening on equipment, especially the significant advantages in the process of equipment repair, and further expounds the matters needing attention in the application of environmental stress screening in equipment repair.

Keywords

Environmental stress screening equipment repair application.

1. The Importance and Superiority of Environmental Stress Screening

A large number of data at home and abroad show that the most important factor affecting the quality and reliability of equipment is the environmental conditions, among which the proportion of defects caused by the environment in the coastal hot zone is similar to the data provided by the US Army. After some equipment is delivered to the army, due to poor environmental adaptability and low reliability, it not only brings huge logistics support costs, but also greatly increases the life cycle cost. What's more, it may delay the aircraft at the critical moment. Therefore, how to improve the environmental adaptability and reliability of equipment has become the current focus.

1.1. Environmental Routine Test and Its Disadvantages

A series of development and validation tests are carried out to ensure that the product can withstand the damage of the expected extreme environment. All the previous environmental tests are routine. However, with the improvement of the complexity of the equipment and the requirement of multiple varieties, small batch, development and delivery of weapons and equipment put forward in China, the shortcomings of environmental routine test become more and more prominent, which are embodied in the following aspects: Environmental routine test is a sampling inspection, with great risks; environmental routine test is a post inspection, which can not be found in time due to production process fluctuations and other factors The change of product consistency; some environmental routine tests are arranged according to a certain number of products, which can not be connected with the scientific evaluation methods of the manufacturer's risk and the user's risk; environmental routine tests are consumptive tests, and the tested products can not be delivered to the army for use, so this kind of tests are not applicable to expensive or small batch products; environmental routine tests are inspections The influence of production process stability on the batch production products after design finalization is not applicable to the products to be delivered in the development stage.

1.2. Environmental Stress Screening and Its Advantages

In order to improve the reliability of the equipment, environmental screening was first used in the equipment production stage in foreign countries, and was introduced into China in the mid-

1980s. The broad definition of environmental stress screening is a kind of technological means to rapidly develop hidden potential defects into detectable faults by applying various environmental stresses to components, products, equipment, etc., and then take measures to eliminate these potential defects. In theory, compared with environmental routine test, the main advantages of environmental stress screening are: environmental stress screening should be carried out on 100% of the products, the parts that fail to pass the screening cannot be installed on the components, the components that fail to pass the screening cannot be installed on the whole machine, and the whole machine that fails to pass the screening cannot be delivered to the user. Therefore, there is no situation of receiving and rejecting unqualified products; environmental stress screening is a part of the production process of products. By analyzing the performance of products in screening, we can find the fluctuation of production process in time. When the unqualified rate of products in screening increases, it means that the product process fluctuates greatly. On the one hand, the reasons can be analyzed in time to take measures to reduce the fluctuation and reduce the unqualified rate. On the other hand, when the process fluctuates greatly, the products that pass the screening can still be assembled to the higher level products or delivered for use. The reasonable screening scheme is through constant exploration in the development stage. In the process of production, screening will hardly affect the effective life of products. Moreover, the potential defects that may become early failures can be excited in advance through screening, which improves the reliability of the product; environmental stress screening is not only applicable to the products delivered in batches after the design is finalized, but also can guarantee the quality of the products delivered in the development stage; environmental stress screening is also suitable for the products with small batches and high value.

1.3. Advantages of Environmental Stress Screening in Equipment Repair

Environmental stress screening has been widely used in the production process of equipment. It has obvious effect on improving the reliability of equipment and eliminating early fault defects. However, there is no precedent for environmental stress screening in the history of large and medium-sized maintenance of general electronic equipment in our army. It is not difficult to find that the application of environmental stress screening in equipment repair has great advantages, mainly in three aspects:

- a. Environmental stress screening can not only eliminate the potential defects in the early failure period of equipment, but also deal with the potential defects near the loss failure. The old and new parts coexist in the repair equipment. The defect mechanism and distribution of the new parts are basically the same as that of the development and manufacturing equipment, while the defect mechanism and distribution of the old parts are totally different from that of the new parts. The application of environmental stress screening, on the one hand, enables new parts to pass the early failure period as soon as possible to enter the service life period, on the other hand, also enables the core parts close to the loss to be found and replaced in time, to ensure that the repaired equipment is completely kept within the service life period.
- b. Environmental stress screening can fully expose the new defects and potential defects introduced by disassembly and assembly process, and improve the quality and reliability of the equipment.
- c. It can make up for the lack of reliability and environmental test of overhaul equipment, and ensure the quality and reliability of equipment after repair.

In equipment manufacturing, usually in a production batch, according to the sampling plan determined by mathematical statistics theory, several samples are taken for environmental test and reliability test. However, equipment repair does not constitute a batch, and the theoretical basis of statistical sampling is wavering. As a special process, environmental stress screening is

required to be 100% applied in equipment repair process. There is no sampling problem, which can effectively eliminate various potential defects.

To sum up, environmental stress screening has many advantages in the application of equipment overhaul, but there are many points needing attention in the implementation process.

2. Key Points of Environmental Stress Screening

2.1. Environmental Stress Screening Procedure

In order to carry out environmental stress screening, we should first make a plan, and then implement it step by step according to the plan. It mainly includes three parts: initial operation, environmental stress screening and final operation.

In the initial operation stage, the appearance, mechanical and electrical performance of the screened products are monitored and recorded in accordance with the sensitive documents, and the products are guaranteed to operate and work normally.

Environmental stress screening stage, which is the main body, consists of two parts: defect free pre test and defect free operation. The purpose of defect free pre test is to find potential defects and repair them. The failure of this stage is permitted or even expected, which can not affect the evaluation of screening. The purpose of flawless operation is to verify the effectiveness of screening.

In the final operation stage, the main purpose of this stage is to inspect and record the products item by item according to the relevant technical documents, at the same time, compare with the data in the initial stage, then evaluate the screening results, process the screened data, analyze the faults, find out the causes of the faults and take corrective measures to form the fault report. When the filter fails to pass the final detection and operation, cause analysis shall be conducted to determine whether to re filter. If it is caused by equipment, the screening is generally conducted after troubleshooting. If it is caused by over stress, not only the screening cannot be conducted, but also the environmental stress screening scheme shall be revised.

2.2. Selection of Environmental Stress

Environmental stress in environmental stress screening mainly refers to random vibration, temperature cycle and electrical stress. According to the national military standard, environmental stress screening procedures are required to be applied in turn. However, there are many types of electronic equipment structure, even in the same equipment, there are also mechanical combination, electrical combination, mechanical and electrical mixed installation and mechanical and electrical composite combination. If two kinds of stresses are applied to each combination, the repair amount of each equipment and dozens of combinations each year will undoubtedly make environmental stress screening a very large project in the repair process.

According to the data of environmental stress screening at home and abroad, the efficiency of temperature cycling on electrical components or devices is about 90%, and that of random vibration on mechanical components or devices is about 85%. From the perspective of "cost effect" ratio and the application of screening effect, not all the screened products must be subject to random vibration and temperature cycle.

When choosing environmental stress, we should grasp several points:

a. According to the characteristics of random vibration, there should be some restrictions on the test piece, such as the filament of the electronic tube, the hairspring in the head, etc., all belong to the structure with poor rigidity, so random vibration is not suitable. Single temperature cyclic stress can be used. If random vibration must be done, it must be removed before the test.

- b. When selecting all transistor (including integrated circuit) equipment, temperature cycling and random vibration should be selected at the same time.
- c. Single random vibration stress can be selected for mechanical combination.
- d. The environmental stress makes the people without defects stand the test and the people with defects are exposed. The test conditions such as temperature, time, vibration frequency, etc. shall be determined according to the conditions of the equipment, and shall not be extended at will, especially the vibration test, so as to avoid over stress damage of the equipment.

2.3. Selection of Screening Mode

There are two modes of environmental stress screening, diagnostic mode and confirmatory mode. The diagnostic mode can be used to diagnose the fault and defect parts of the equipment to be repaired, determine the repair mode of the equipment, improve the quality and reliability of the function, and reform the equipment repair process. After the verification mode is used for equipment assembly, its function is to find out and eliminate potential defects and adjacent loss defects, in order to improve the repair quality and product reliability, it needs to run without defects to verify.

In the actual operation, we should choose the appropriate environmental stress screening mode according to the different conditions and repair requirements.

3. Conclusion

The application of environmental stress screening in equipment repair is a pioneering work, which needs to be tried boldly and step by step. In the preparation of environmental stress screening program, it should be appropriate for the equipment, not too harsh, otherwise it is easy to cause over stress damage of the equipment; it should not be too loose, otherwise it can not achieve the purpose of screening. In the initial stage, a dynamic screening scheme should be prepared, which can be adjusted at any time, and a formal scheme can be formed after sufficient data and failure analysis.

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