EXPERIMENTAL STUDY OF THE REPAIRS OF HYDROPNEUMATIC PARTS OF COMPLEX TECHNICAL OBJECTS

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ABSTRACT

Hydropneumatic part of each complex technical object has its own specifics. It determines the specifics of the repair work on that part. Based on possesses collected information from experimental study about the failures in hydropneumatic part of a typical complex technical subject - machine tool by CNC. Synthesized are conclusions and recommendations for enhancing the effectiveness of using recreational events.

Keywords: operational reliability, complex technical object, machine tool by CNC, hydropneumatic part, repair

1. INTRODUCTION

Each user of complex technical objects explores a system called organized restoration measures. Typically, this system can be improved significantly in a direction of advanced its efficiency [3, 4, 5]. For this purpose it is necessary to obtain information on the reliability behavior of objects in a real operation. Obtaining statistics on refusals is long and costly. Process different approaches are used to gathering information about failures - depending on the goals and opportunities of the search [1].

The accumulated information on failures of objects is a unique feedback to consumers of machinery and manufacturers of the objects [2]. The users have the opportunity to improve operations, as well as working efficiency of the machines. Producers have the opportunity to identify corrective activities to improve the operational reliability of the objects.

The aim of the present study is to search for reserves in the organization of repair work hydropneumatic of the machine and to determine certain measures to improve this organization.

2. METHODOLOGICAL FEATURES

The statistical information needed for reliability behavior of objects can be collected in several major directions.

Using service documentation of repair services is a relatively accessible source of such information. The main advantages of this method are that it is relatively inexpensive and the already available documentation does not require significant time resource. The main disadvantage - limited range of information available on the major directions: conditions of breach of the working capacity, the most likely reason for the failure; duration of the individual components of downtime due to failures, the process that led to the failures.

These shortcomings are largely not presented in the other method of gathering information - monitored operation. Object of study is operated in real conditions. The staff is instructed and in special forms reflects records the information for the failures. The main advantage of this method - comprehensiveness of the information collected. Data are collected both for immediate use and for the elements of renovation work. Main disadvantages are - expensive method, prolonged, distortion of information from the staff.

Another method which substantially eliminates these drawbacks is the method of laboratory studies - in laboratory or production conditions, information is collected for the failures by reliable

specialists in strict compliance with the conditions of exploitation. The main advantage is the high credibility. Main disadvantages are the need for diverting objects from real operation, the need of laboratory conditions, and lack of continuous research.

Besides these basic methods of gathering information about failures there are others - eg the accelerated tests. They are used when dealing with specific problems on the reliability of the objects.

In this study, the preferred method is the one of laboratory studies for the following main reasons:

- This method provides the most reliable information about the failures of the objects, in particular - the organization of restoration measures;
- It gives the opportunity to conduct research under production conditions without the machine removed from production. The requirements of the manufacturer's operating are and in the process of testing the machine does not deviate from the production program;
- The effectiveness of the study is increased by the fact that, simultaneously other studies of reliability behavior of the object conducted.

3. STUDY RESULTS

To obtain results in a form convenient for analysis the accumulated statistics on failures is preliminary processed. This statistical information is been affixed in pre-forms in which the data are plotted for each failure: time of occurrence, time of commencement of the recovery time waiting for repair staff, manifestation of failure, the failure location - subsystem and element.

The processed information is presented in Figures 1, 2 and 3.

In Figures 2 and 3 are plotted on the ordinate the relative frequencies of the timing t_R and $t_{D.F.}$.

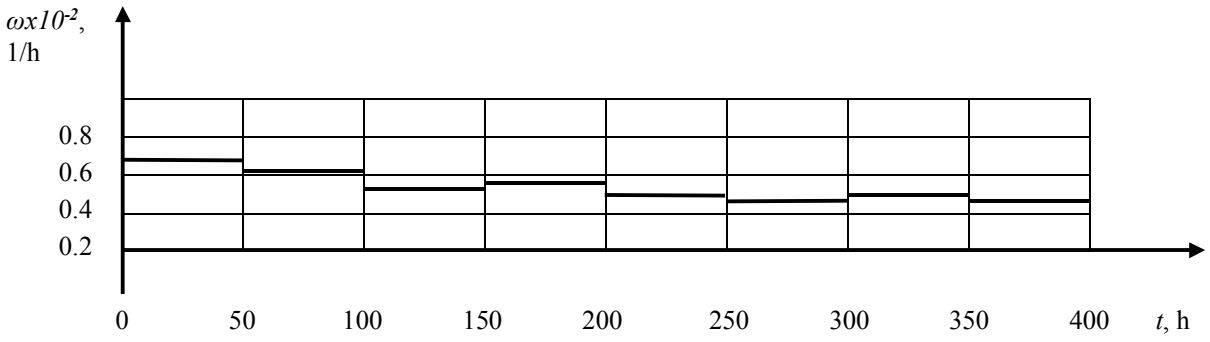

Figure 1. Parameter of flow of failures – ω in the part Hydropneumatic of a complex technical object

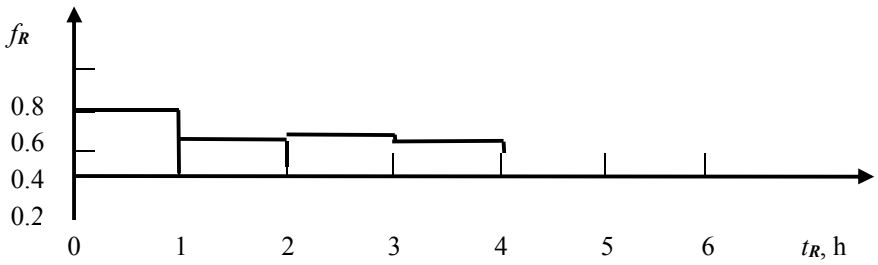

Figure 2. Distribution of the time recovery failures – t_R in the part hydropneumatic of a complex technical object

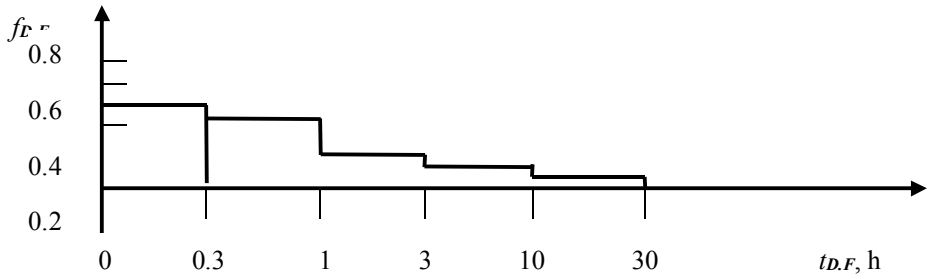

Figure 3. Distribution of the time downtime due to failures – $t_{D.F}$ in the part hydropneumatic of a complex technical object

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the presented results of the study we can point to the following conclusions and recommendations for improving the organization of the restoration measures:

1. As shown in Figure 1 parameter of flow of failures – ω is the failure with relatively uniform distribution. This means that no one or two main factors determine the frequency of occurrence of failures. To increase the mean time between failures (MTBF) there is a necessity of complex activities aimed at the overall organization of repairs, but not its individual elements.

2. In Figure 2 it is shown that there are relatively large periods of time to recover the failure t_R. Make additional analysis shows that the main factors for this are the lack of available spare parts in stock and use of universal tools instead specialized. Available is a substantial margin for increasing the effectiveness of the restoration measures.

3. The shown in Figure 3 downtime because of failures in hydropneumatic part lasts 10 ÷ 30 hours is a sign of considerable reserves for increasing the effectiveness of the restoration measures. This fact is reinforced by registered stays 3 ÷ 10 hours, which are many and relative terms - about 10%. In practice stays of 3 ÷ 10 hours and 10 ÷ 30 hours form many more than half of summary downtime due to failures in hydropneumatic of the machine. The analysis shows that the main reason for this is relatively long periods of waiting for recovery. Because of this main recommendation here is the maintenance of hydropneumatic of the machine to change from external the service, which at the moment of the study performed it, to repair service of the user the it self. The choice of a particular embodiment of this corrective measure is subject for further analysis.

5. CONCLUSION

Within the survey a potential is registered for increasing the effectiveness of the restoration measures of hydropneumatic part of the surveyed machine, respectively - to increase the efficiency of the its exploitation. Apparently serious compromises are made in this direction. Even partial implementation of the above recommendations will make a significant impact.

Finally, the presented approach is applicable also to other complex technical objects different from the machine tool with CNC, since the latter is a typical complex technical object.

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