The Frontiers of Society, Science and Technology

ISSN 2616-7433 Vol. 1, Issue 3: 96-100, DOI: 10.25236/FSST.20190315

Electrical automation equipment, the optimal maintenance strategy research and analysis

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ABSTRACT. *This article from the aspects of electrical automation of whole life cycle cost minimum, plans for electrical automation testing on the problem of the optimal arrangement of maintenance carried out comparatively systematic research, according to the theory such as bad, in order to deduce the detection of the maintenance model of the relationship between the failure rate, it is concluded that two groups of different equipment inspection maintenance mode, in determining the overhaul reasonable plan or the number of minor repairs.*

KEYWORDS: *electrical automation; Whole life cycle; Testing and maintenance; Such as bad theory*

1. Introduction

Electric company in recent years, not only pay attention to the investment costs also pay attention to the late in the cost of operation and maintenance cost and so on a series of problems, from the perspective of electrical automation of the whole life cycle to consider the costs and economic benefits. Considering the electrical automation in the detection and maintenance on the one hand, influence the maintenance mode and frequency of detection, so as to determine the detection of the consumption of the cost of maintenance. Can affect the reliability of the equipment on the other hand, working in the equipment failure rate in operation, which can determine the cost of the equipment[1]. According to the different detection method for different maintenance maintenance mode to achieve the optimal effect.

2. Electrical Automation Maintenance Problems

Maintenance process refers to the close and maintenance a whole life cycle cost of the corresponding detection process, most companies in our country in the

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process of electrical automation maintenance detection, there exists a corresponding strong fragmentation and closed relative to the teaching problem.This study found that the main purpose is to hide some of the growth of the company and the condition of the equipment[2].

The result can't help equipment in maintenance inspection and maintenance of the equipment plays a great important role, will be in the process of using cannot long service life. At this point, closed or experience in electrical automation maintenance inspection process from purchase to the processing of the damaged a closed process, because each department consider too much when management department is its quota and economic benefits as well as some department rules and regulations, so in the different degree of relative departments have different management system, the most important thing is not care about the use of electrical automation long life problems and adapt to save on costs.

Based on the low level of work on maintenance detection equipment is one of the important factors that affected. A lot of people know to take on the data of in electrical automation control and management requirements, so this reflects this work based on the technology of can't better dealing with electrical automation in the whole life of governance, there is no method now on test maintenance efficiency. Want to better, more accurate data, for example, workers in the data on the technology is better at the same time to improve the construction of data and the accuracy of the standard database, the data accumulated preserved, as reference for later in the development of electrical automation, is a very good foundation.

State inspection also lead to low efficiency of maintenance of electric automation maintenance in the process of the need to consider one of the important reasons. In general electronic assets life cycle management completely need a lot of information means strongly encouraged. There are a lot of companies are influenced by the condition of deficiency of impeded, in the information system of collection and is not very good, will be showed in the process of gathering data has the obvious difficulty. At this point, the efficiency of detecting state maintenance low at the same time reflect a lot of companies in electrical automation in the construction of information system is not perfect, in varying degrees between the management information system has a lot of problems[3].

3. Electrical Automation Of Whole Life Cycle Cost The Optimal Maintenance Strategy

In the range of mechanical engineering, such as bad theory think equipment in the work, its own reliability and running various performance can throughout the change with the change of different groups, show has been bad, the direction of the two similar testing maintenance time basically no defect on the speed of working hours MTBF bad to basically the same, using mathematical formula is: which is suitable for bad rate, r value area (0, 1), for all kinds of equipment can be based on data information before running condition of a specified value. Degradation such as theoretical model can well reflect trival the reliability of the equipment in the real

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work performance standards and performance change of standard procedures, that result in common use and cognitive.

Can further step, I believe, the reasonable use of to the existence of overhaul minor repairs: in equipment overhaul time literally two similar minor repair time are no problem working cycle MTBF bad in speed, similar overhaul time corresponding to the two minor repair time no problem working time also meet the degradation speed of the program. Using the mathematical formula is shown as:

$$MTBF_{i(j+1)} = MTBF_{ij} \times (1 - r_1) \quad (1)$$

$$MTBF_{(i+1)j} = MTBF_{ij} \times (1 - r_2) \quad (2)$$

Because of the weibull distribution model can describe the life-span of equipmen t good, at the same time are analyzed. This paper adopted two data weibull distributi on model; Maintenance detection (2) in each period of time, the time of the occurren ce of equipment fault is independent of the individual, for different minor repair tim e, equipment are there is nothing wrong with working time according to the uniform distribution, but has a number of data has similarities and differences, especially for weibull distribution, the shape of the data for the same number, the location data on t he number and scale data have similarities and differences.(3) ignore equipment insp ection maintenance time, thought to be associated with small comparing to the norm al operation time of the equipment. There are data parameters of weibull distribution model embodies equipment go wrong number density is:

$$f(t) = \frac{m}{\eta^m} t^{m-1} \times e^{-(\frac{t}{m})^m} \quad (3)$$

Using weibull distribution value, MTBF draw:

$MTBF = \int_0^{+\infty} f(t)dt = \int_0^{+\infty} \frac{m}{\eta} t^{m-1} \times e^{-(\frac{t}{m})^m} dt$ (4) the order, $u = e^{-(\frac{t}{m})^m}$ the draw of the ith alternative transformation overhaul time of the first j a minor repairs in terms of time, $MTBF_{ij} = \eta_{ij} \times \Gamma(1 + \frac{1}{m_{ij}})$ and combined with previous analysis and theoretical formula is: $MTBF_{ij} = MTBF_{11} \times (1 - r)^{i+j-2}$ (6)according to the assumption conditions (2) that the shape of the inspection maintenance time number data is m, $\eta ij = \eta_{11} \times (1 - r)^{i+j-2}$ (7)is the relationship between the two group of number of location data.From bibliography, obey weibull distribution equipment failure can be embodied in:, and so on various inspection maintenance come to the relation between the ratio of time appear problem, $\lambda = \frac{m \times t^{m-1}}{\eta^m}$ according to a series of calculations that first expected and m,

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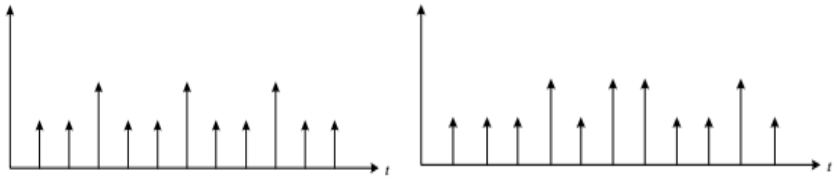
$$\lambda_{ij} = \frac{m \times t^{m-1}}{\eta_{ij}{}^{m}} = \frac{m \times t^{m-1}}{(1-r)^{(i+j-2)m} \eta_{ij}{}^{m}} = \frac{1}{(1-r)^{(i+j-2)m}} \times \lambda_{11} \quad (8)$$

and other equipment trouble rate within budget can be according to the formula to calculate.

Traditional way of inspection maintenance mainly includes electrical department plan maintenance inspection and repair after accident, plans to overhaul and maintenance detection can also be divided into minor repairs.

Basis of traditional way of inspection maintenance in this article referred to the two groups of different maintenance detection model, one is on a regular basis for large, minor repairs, similar to the two overhaul cycle in basically the same time, another maintenance detection mode is literally to two adjacent two maintenance detection at the same time, but according to need to choose the type of each maintenance, is to choose the overhaul or minor repairs. In figure 1, figure 2 can intuitive see two maintenance detection modes, long arrow represents overhaul, short arrow on behalf of the minor repairs.



Such as the amount of each in an overhaul of electrical automation, for minor repairs, maintenance detection amount is after failure, failure loss amount is, the number of overhaul, minor repairs is the number of times, equipment plan to use for t years, no one time starting from testing the repaired equipment, testing the repaired differences embodied in the aspect of failure rate.

$$\min w_1 = C_d \times n_d + C_x \times n_x + (C_i + C_{loss}) \times n_i \quad (9)$$

Reflect's goal is to use equipment plan cost and t years appear problem of minimizing the sum of the cost of inspection and maintenance for the first, make the appropriate changes, the pending variables for n1 and n2, respectively overhaul times and each time the number of minor repair, overhaul time at the same time, according to former people mentioned by bad words theory formula, such as failure rate is: $\min w_1 = C_d \times n_1 + C_x \times (n_1 + 1) \times n_2 + \cdots$

$$(cf + Closs) \times \frac{\Delta t^m}{\eta_{11}^m} \sum_{i=1}^{n_1+1} \sum_{j=1}^{n_2+1} \frac{1}{(1-r)^{(i+j-2)+m}} \qquad \Delta t = \frac{T}{(n_1+1)(n_2+1)},$$

Remove overhaul times the number of minor repair and overhaul time is uncertain, the number of the number of the rest are all know.

Maintenance mode for the first set of detection, in determining the overhaul in the overhaul times and each time the number of minor repair the number of the two

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groups are not clear, take its value as an integer in a certain scope, so can be directly used for ways to get the optimal results.Of inspection and maintenance, test and maintenance for the second time is apart, not clear including overhaul and minor repair times and the number of different types.

4. Conclusions

In this paper, from the aspects of electrical automation of whole life cycle cost minimum, plans for electrical automation testing on the problem of the optimal arrangement of maintenance carried out comparatively systematic research, according to the theory such as bad, in order to deduce the detection of the maintenance model of the relationship between the failure rate, it is concluded that two groups of different equipment inspection maintenance mode, in determining the overhaul reasonable plan or the number of minor repairs. Mentioned in this article the test inspection and maintenance of the different pattern in the root in further focus on different testing maintenance plan, according to the different devices in the process of operation for reliability, reliability and economy as a whole problems are solid.

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