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MAINTENANCE STRATEGIES IN THE CORRELATION MAN-MACHINE-ENVIRONMENT

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Abstract: *This paper presents the types of maintenances, their applicability, their advantages and disadvantages, and how the rotating machinery can be diagnostics. The fundamental concept of maintenance is getting a high degree of security in the formulation of complex man – machine – environment.*

Key words: *maintenance strategies, man – machine – environment.*

1. INTRODUCTION

Development of the society of consumption are required development has resulted in the development of productions as large, high-quality and low cost as possible. In the price of any product, regardless of industry or type of industrial production, maintenance costs are a significant proportion of the price of the products worked.

Therefore, a major concern for the management of companies and experts in machinery and equipment is the development of organizational measures and technologies, to reduce as far as the stops accidental of machinery, and the duration of repairs, with the consequence of reducing the cost of maintenance.

Also, there are facilities in industrial drives high complexity, technology that works with AIDS to pick up parameters (temperatures, pressures) and dangerous fluids (toxic, corrosive, flammable, explosive lethal, etc). These parameters can diminish the capacity of load-bearing elements and structures of their resistance and can damage the joints and test pieces etc.

In this way, providing a total of operation no fuses is possible and, a priori destined, was accepted the notion of risk. To get to the determination of an acceptable risk limits, it was, first, identification of risk and the follow-up of this risk assessment is to identify and develop the organizational and technical measures necessary to eliminate potential risk is unacceptable.

Using such data and of the need to reduce production costs, in time, they carry out studies to determine the technical measures of reliability to ensure safe operation of the plants, leading to the evolution of the different systems and maintenance concepts [Bay 99].

The literature categorizes programs by running the following:

1.1. Corrective Maintenance
1.2. Preventive Maintenance
1.3. Predictive Maintenance
1.4. Proactive Maintenance

The concept of maintenance includes all technical and organizational actions on testing, measurement and verification, in the sense of the prophylactic and remedial modules of parts of an installation; in order to maintain or reduce its running status and the operation are at levels of safety and security as performing.

Fundamental purpose of comprehensive is to achieve high levels of reliability and mentenability, so by default, an improvement of their cumulative-availability, and getting a high degree of security system in the formulation of complex man-machine-environment.

2. CORRECTIVE MAINTENANCE

Corrective maintenance - CORMENT-is the concept that equipment works by stopping the accidentally abrasion of recently established or because of defections. Repair means, as a rule, the replacement of damaged or even the Sub-Assembly of the whole machine. This situation is most unfortunate and implies, obviously, high maintenance costs.

Thus, corrective maintenance includes all work on the equipment in order to remove inappropriate conditions of operation, in terms of operational safety and/or protection of aggregate (to avoid the appearance of defects) or winding faults already incurred.

Using this method, machines are left up to the appearance of a major flaw, or until a decline in inadmissible efficiency.

Compared to other types of maintenance, corrective maintenance is holding a series of major disadvantages such as:

- the possibility of damage that can lead to loss of human lives and material goods;
- the impossibility of planning activity, spare parts, tools and appliances needed repairing machinery;
- growths the cost of repair, due to the impossibility of assessing the optimal stopping time equipment, etc.

3. PREVENTIVE MAINTENANCE

Preventive maintenance - PREMENT – represents the concept in which the machinery is stopped programmatically, based on the number of hours of operation for revisions raised, the current were technical and/or capital repairs. In this system, what matters is the number of accumulated hours of operation and the extent of wear is not installed.

Preventive maintenance involves performing cyclic-interventions made at the time intervals, specified-including works of maintenance and repairs undertaken, mainly in order to eliminate the effects of wear and tear. The actions taken in respect of prevention, as well as prevent the occurrence of fault conditions, by reducing the risk to occur also States. Thus, while corrective maintenance operations have a preventive character randomly, those are deterministic.

A first important issue that arises when preventive maintenance method adopted is to establish the optimal interval between two revisions planned. If the range you chose is too high, the percentage of fall incidental will increase considerably. On the other hand, shortening the interval between the revisions require extra charges from becoming larger.

When you restart to complete an installation, after overhaul, the probability of dropping each individual machine in hand is multiplied by the total number of machines. It is obvious that, in these circumstances, any restart is performed in conditions of considerable risk [Ste 99].

This concept has a number of disadvantages that cannot be ignored, namely:

- high costs of maintenance and repair activity, thanks to the intervention machinery which does not require such workmanship;
- the duration of a planned technical revisions due to high volume controlled machines;
- there is a possibility, as confirmed by practice, the reboot, the plant, which have worked well in advance of the shutdown, to have a malfunctioning as a result of the not good interventions during the revision.

4. PREDICTIVE MAINTENANCE

Predictive maintenance is the concept that is non-prophylactic and preventive means that the equipment operates safely until a certain level of wear or a defect. In this system, through its regular monitoring activities and, where appropriate, remedial effects of the various factors are highlighted destructive, which could affect to a large extent technical operational capability of the system and would lead to the initiation of corrective or preventive corrective interventions much more costly.

Predictive maintenance highlights the frequency of occurrence of faults and their location on the type of equipment, being a fundamental element to determine whether to carry out complex works of modernization and rehabilitation of industrial installations [Lee 04].

The main parameters in the report of the technical condition evaluation are carried out by the operation of technological equipment, as levels of vibrations and noise [Lal 90].

At the time at which it is found that the level of shock resistance came close to the upper limit of the admissibility team should be alert for intervention by the maintenance at any time, on the equipment [Don 02]. In a situation where it is found that the level of vibration has exceeded the maximum allowable value is necessary to terminate the technological equipment in order to determine the causes of vibrations and then repair malfunctions (Fig. 1).

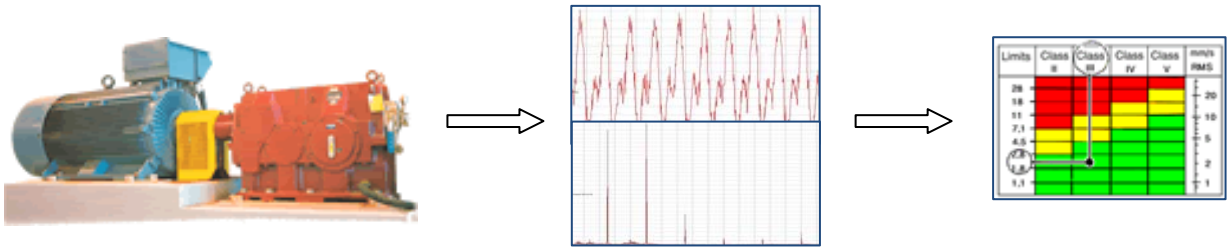

Fig. 1. **Diagnosis of rotating machinery dynamic**

Thus, the frequency of the vibration analysis (FFT analysis) is that which makes it possible to obtain information necessary for the time of the industrial equipment malfunctions.

Predictive maintenance has numerous advantages, the most important being:

- reduce costs associated with the stop time of technological equipment and increase profits by increasing the term of production;
- reduction or elimination of costs of technical incidents or serious damage to the machinery;
- reduce the costs of maintenance and spare parts stock, many tracks may be ordered even while carrying-out repairs;
- reduction and/or disposal costs caused by unplanned maintenance, repairs may be carried out with minimum losses;
- Optimizing the performance of the machines, which often operate without technical specifications;
- reducing the excessive consumption of electricity;
- reducing equipment needs and costs related to the phase of "stand-by";
- increase in production capacity and reducing capital investment, tools can be used a long time;
- reducing the risk of unsuccessful repairs, as well as the number of customers dissatisfied with delays in fulfilling orders or customers dissatisfied with the quality of products supplied;
- optimization of activity through the use of staff in other activities linked to production;
- the reduction and/or elimination of scrap or waste resulting from non performances of machinery;
- remove the additional time and cost of restoration of appearance and the conditions necessary for restarting and optimal functioning;
- reducing the possibility of sale of defective equipment;
- increasing safety in operation of the machinery;
- reducing the risk of penalties for the use of insecure machines;
- improving the performance of the technological and operational machinery.

Predictive maintenance applies perfectly to 85-90% of existing machinery in the plant, machinery may be stopped, without this actually lead to shut down the plant.

Statistical analysis of the causes of defects reveals that machinery dynamic 85% of the defects are predictive, 8% is due to the mistakes of operation and 7% is due to random causes (material defects, external causes, etc.).

As a result of the research has shown that, as shown in Figure 2, the life curve of a machine is a real rather than theoretical

transposition of certain facts relating to the equipment in question.

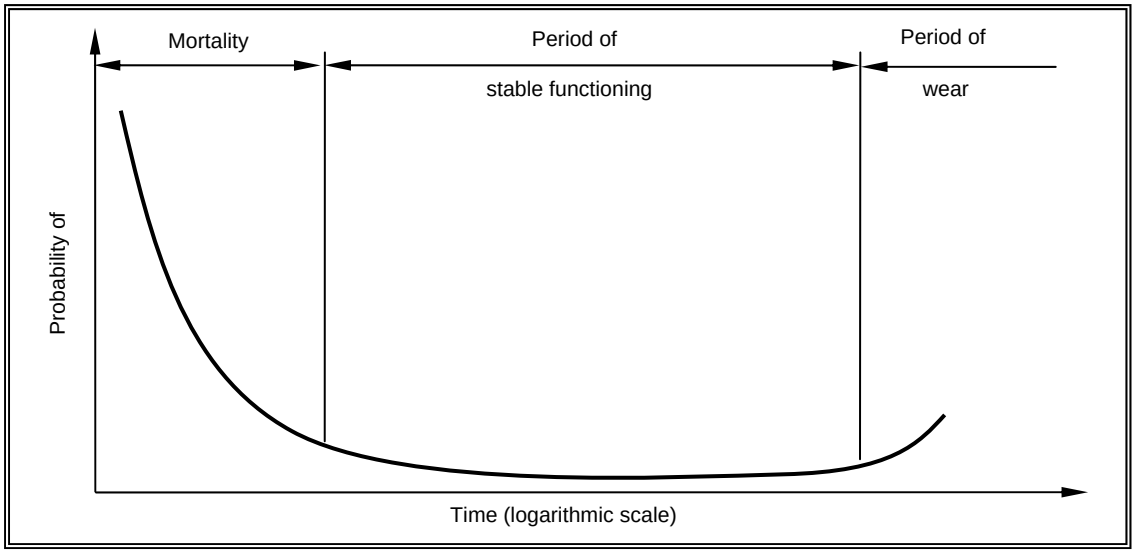

Fig. 2. The life cycle of a machine

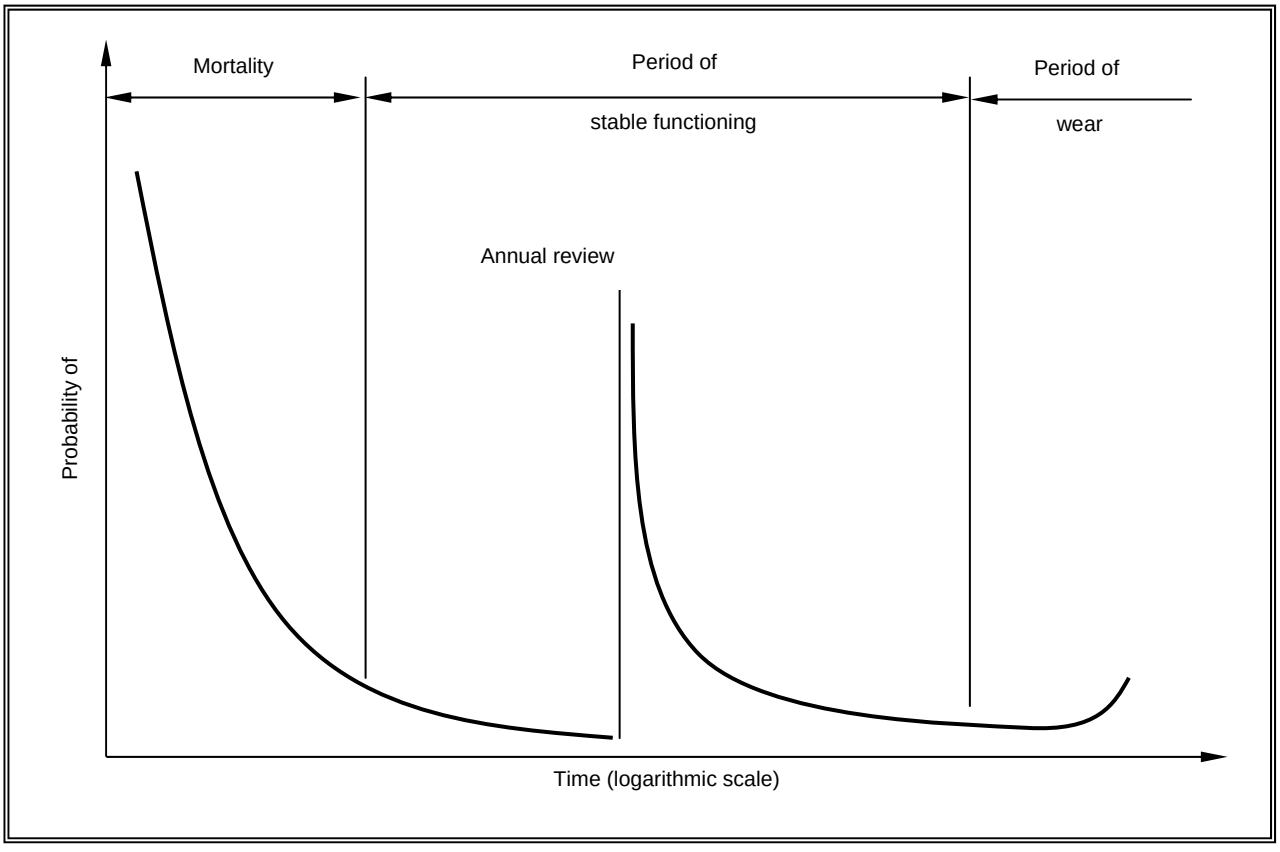

Fig. 3. The life cycle of a reconditioned machine

The life cycle of a machine shown in Figure 3 it is noted that immediately after rebooting the machine, there is a high probability that it would be damaged, in particular, because small imperfections in the business of repairing itself, but also due to the components or sub-assemblies.

Many factories respecting theorems reliability can make savings. Thus:

- If a machine works well, does not intervene on him! or

- look but don't touch!

We therefore need a predictive maintenance program, which, in addition to the fact that merges the two theorems, detect power failures inherent and substitution of damaged components. In addition, such a programmer reduces the magnitude of many shortcomings by reducing or preventing secondary damage. For example, an engine with a revolving defect can be stopped before damage to the impeller or the shaft.

From the economic point of view, it was found that companies that have implemented these predictive maintenance programs have registered an increase of profits by reducing the cost of repair.

Predictive maintenance depends on the status of the momentary state of equipment, permanently monitored. In the literature, this monitoring is known as "condition monitoring".

In relation to the above indicated, we appreciate that predictive maintenance is a qualitative leap, regardless of the industrial sector in which it is implemented, provides all the information necessary for the detection of early failures, locating and diagnosing them and not least in order to calculate the duration of the safe functioning of equipment.

To illustrate the process of monitoring and prediction in his character to detect malfunctions we present processes of oil and vibration monitoring equipment.

5. PROACTIVE MAINTENANCE

The concept of proactive maintenance adopted recently by the companies advanced in terms of maintaining dynamic machinery consists of carefully monitoring machinery that works well (the majority), the manager having to deal with them and the tools with problems with specialized staff.

Obviously, that proactive maintenance can be applied only in terms of predictive maintenance, maintenance of proactive as a continuation of it.

6. CONCLUSION

Followed the theory of this paper, the conclusions are:

1. All maintenance concepts contribute to optimizing the activity recognized companies, regardless of the field of industrial production, but at the moment, predictive and proactive maintenance provides the best conditions of operation, with the lowest cost while at the same time, increased safety in the operation of technological equipment, environmental protection and deserving staff.
2. All this is possible thanks to the comprehensive research in all areas, recognition internationally of the importance of comprehensive industry, so that both the production and all the processes and systems of enterprises, are heavily dependent on trade.
3. In order to streamline maintenance, for which the costs will be reflected in the cost price of the final product, it is necessary to use all the strategies and methods of management, and the first step in this optimization is to use a Computerized Maintenance Management Software followed by the use of Condition Based Maintenance – and it only the tools that may be warranted.
4. Another step towards optimization of the industrial activity is thus placing predictive maintenance methods with which you can evaluate appropriate time repairing the (economically or production) and set a time to the possibility of a breakdown that will stop the machine.
5. On the market there are various equipment and software that can be used to streamline maintenance.

6. In view of the current state, I consider necessary to conduct additional research (to decrease cost price and increasing the efficiency of comprehensive) in the field of condition monitoring equipment and the methods of prediction based on the status of equipment.

7. REFERENCES

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STRATEGII DE MENTENANȚA ÎN CORELAȚIA OM – MEDIU - MAŞINĂ

Rezumat: *Lucarea prezintă tipurile de mentență, aplicabilitatea acestora avantajele şi dezavantajele lor, precum şi modul de diagnosticare a maşinilor rotative*. Conceptul fundamental al mentenanței este de a găsi corelația între om – mediu – maşină.

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