



# **KEY TOPICS OF MACHINE RENEWAL**

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**Abstract:** This article presents basic information related from renewal machine. Aim a contribution is delimits and clarifies the problem of renewal frame: within the frame maintenance machine. Carrying idea of contributions is mentioning meaning and relations of renewal by eliminate of physically and morally obsolescence. There are further advert on possibilities and effects of machine renewal how the assumption for determination of suitable alternative necessary technical- economic source planning.

Keywords: Maintenance machine, renewal machines, innovation machine, machine life.

## Introduction

Prosperity business today depends primarily on the efficiency of machinery and equipment company, i.e. the optimal management and maintenance in working condition. Nowadays you can hardly imagine its security without significant use of new methods to tackle the technical and economic problems of enterprises. Exact approaches in decision-making and development of computer technology have become a crucial impetus and basis for the development of quantitative approaches in the rehabilitation of machinery and equipment.

## **Definition of the problem**

The term maintenance is the concept of Standard (EN 13306, ISO 13372). On the other hand, the concept of recovery is not yet standardized. Both concepts are in practice by serving relevant and require thorough analysis.

Maintenance is carried out to ensure the required reliability of the object while maintaining the lowest total cost of operations for the period of operation.

Machines are subject to renewal problems replacement objects, which are due to traffic wear out or fail. Recovery is performed for two basic reasons. First renewal provides repair and / or commissioning of machinery and production systems for the resulting failure. In this regard, it is part of the recovery of maintenance, which is known as corrective maintenance. The second reason is the moral renewal of technical obsolescence of equipment and their subsequent replacement with advanced. In this regard, recovery is no longer quite part of the maintenance and development is an important area in business strategy and operations.

## Approaches and ways to renewal machines

Problems replacement objects (machines, respectively. Their building blocks, modules, etc.), which is due to traffic wear out or fail are subject to renewal machinery [1, 2, 3]. Recovery according to how we understand it has two basic lines of development issues, from whose solution depends on its real effectiveness and to:

• Theory-speak for an operational research method, which with the help of mathematical models to examine the problems of economy, the exchange of technical and operational facilities,

• Practical, talking about practical steps of regeneration of machine system in order to eliminate technical obsolescence of the machine. Is associated with an intensification of progressiveness and repair (removal not only physical but also moral wear and tear).





The importance of the first group of problems is critical because access to their solution ultimately formed the technical approaches to the second group. The basic theoretical approaches include:

• Discrete models allow us to determine the probable number of renewals in time "t" and the age structure of objects in different periods of the system. Examine the recovery process technically homogeneous (inhomogeneous) premises which takes into account wear and tear through the probability of default for a certain period;

• Optimal recovery strategy, enabling us to determine the optimal expected time of life (the life) of the selected type of cost function (e.g. minimum maintenance costs);

• Theory of optimal recovery more parametric-modelling, you determine the optimal interval for recovery of objects using other parameters (number of units produced, the quantity of material processed, overrun distance) to create a more faithful model [2, 3].

The basic recovery approaches focused on technical experience includes:

• Modernization, the modernization will generally be also improved machine, which does not alter its original character (e.g., higher performance, easier operation, greater accuracy, longer life, greater safety, etc.);

• Reconstruction, the reconstruction is, however, consider such a performance that changes (and permanently) the original character of the reconstructed object (e.g. a change of scope of technological operations, respectively. Professions);

• Replacement of machinery, is an easy way to recovery, which applies to cases where none of the type of activity fails the machine in operating condition, maintenance costs are inadequate, respectively. If an economic, technical and logistical restructuring of production organization;

• Upgrades, this is the way to recovery based on the exchange of modules when the module production of scale is cheaper than repairing a fault, respectively. When downtime due to repairs and loss of this downtime and repair costs are comparable with the value of the new module.

## The optimum machine life

With the increasing level of innovation of production problems arise related to the optimal use of production machines, updating them and gradual recovery. It is necessary to optimize the contradictions between an exaggerated preventive renovation and restoration, which guarantees one hundred percent uptime, low operating costs, high productivity and between late solution to the problem associated with loss, increasing costs of operation and maintenance of obsolete production machines and systems, the course is dependent on the physical and Planned obsolescence. Therefore, requests for production machines analyze physical and moral wear and tear, with regard to the existence of efficient, low cost and cheaper machines and its direct impact on the change in the economic value of the machine. Which are distinguished by two kinds of moral deterioration, the first resulting from the reduction of acquisition and operating costs of new machinery and constant performance data, the second of their increase in the productivity and economic characteristics at the same cost.

As an example, view the principle of optimal correction of the exchange time machine given the moral deterioration of the second kind ( $\Delta$  t<sub>2</sub>) shown in Fig. 1. If the first machine will also work in the period from its moral obsolescence (t<sub>1</sub>-  $\Delta$  t<sub>2</sub>) to its theoretical recovery (t<sub>1</sub>), losses (S), resulting from the fact that they produced to more productive machine 2, will be equal to:





$$S = \left(N_{plt} - N_{p2t}\right)\Delta t_2 \tag{1}$$

where:

 $N_{p1t}$  - total cost of the machine relative unit labour during 1.na efficient use of time  $t_1$ ,  $N_{p2t}$  - total cost of the machine relative unit labour during 2.na efficient use of time  $t_2$ ,  $\Delta t_2$  - optimal correction of the exchange time machine first for machine 2.



Fig. 1 Correction of machine exchange time considering the existence of more efficient machines

This loss in Fig. 1 below shows the area "with". When the machine first exchanged at the time  $(t_1 - \Delta t_2)$ , the benefits of productive work-area "b" second machine shall be equal to:

$$P = (N_{p1x} - N_{p1t})(t_1 - \Delta t_2)$$
(2)

where:

 $N_{p1x}$  - total relative cost of one machine at establishing a second time  $t_x$ .  $t_1$ - efficient use of time machine I.,

Correcting time exchange machine with respect to moral obsolescence of the second kind is therefore:

$$\Delta t_2 = \frac{N_{p1x} - N_{p1t}}{N_{p1x} - N_{p2t}} t_1 \tag{3}$$

Different types of wear are independent of each other and give rise to a combination of technical and moral, respectively. Planned obsolescence of the first and second kind, which allows taking into account specific differences (operation and Development) member.

#### **Examples and effects of machine renewal**

#### Examples of machine renewal

Incentive to settle regenerative recovery machines are the current trends in machinery and equipment (modularity, compatibility, compact solutions) and their corresponding application of technology and innovation policy in recent years. The focus of recovery strategies is the





use of sophisticated equipment mechanics, electronics and cybernetics to enhance the efficiency and performance of works in all phases of the innovation cycle. In the case of production machines is aimed at restoration:

1. Architecture and motor function machine includes a number of possible structural modifications of machines that increase their production and technological capability. Achieve the desired final state of the restored machine can perform the following steps and methods:

• Increasing the technological capabilities of the machine, for example increase machine performance and extending equipment,

• Extending the geometry of the machine, for example increasing the working length and stroke, increasing the clamping area,

• Extending the number of axes, the implementation of the turret as the axis NC, where the connection of controlled axes,

• Replacement of building components and modules with higher parameters and reliability, for example. direct drives to generate and transform energy, tough and lightweight frames for the stabilization and proper conduct of physical modules, intelligent mechanics for the purpose of branch movement, mechanisms with variable structure (Fig. 2), shift types and modes of movement, stiff and slack-free self-locking mechanisms ensuring a static condition.



Fig. 2 Mechanism with hybrid joints

In the case of fig. 3 there is view of a four-member planar mechanism consisting of fixed length rods and kinematics pairs of two or, respectively, multiple levels of freedom. If we replace the cranks 2 and 4 at one or both ends with the hybrid joints - 2D / R, R, then we can substitute a series of mechanisms by the general movements, whose features can be further developed on the basis of the variable rods and the expansion of the kinematics chain by other members.

2. Management and sensors, recovery options are based on the application of NC control units using electromechanical and electronic controls and unit. Application of partial units of this kind can be of the order of increasing level of automation of existing resources and affect the parameters attained accuracy, reliability, etc. Basis for recovery is to be considered:

• Electrical and electronic completion, are now available and new management systems for use in the older machine (with a significantly lower price than the new system, compactness





providing easy replacement, universal features, simplicity in control and using some new computing possibilities),

• Completion of the sensory machinery of modern elements, such as metering coordinates with run on the default grid. Upgrading is also recommended in monitoring, signalling and control system / control buttons, signals, signs and so on.

3. Infrastructural facilities, rehabilitation are based on the complexity of the solution with regard to means of production system environment. It is assumed stack integration, mobile, transport and other units within the structure of the production machine (workstation), respectively cells. It is mainly about:

- Innovation and work piece clamping tool,
- Manipulation of the work piece on the machine,
- Increasing multifunctional, increasing the degree of concentration functions, for example retrofitting machinery ancillary units,
- Active control,
- Raising the level of ergonomic and safety.

#### Effects of machine renewal

With respect to the specifics turbulent environment and the state in which is currently in industrial practice, the prospect of recovery can be seen especially in the case:

• There is currently a large number of machines to which it would be possible to make an appropriate degree of innovation, increase its value,

• The current situation indicates the beginning of a gradual economic recovery and the recovery of the market of machine tools,

• Session price of new machines will however continue to capital-poor entrepreneurs start too high and will need to restore mechanical machinery park through innovation through the modernization and reconstruction.

In the event that they apply the principles of modernization and reconstruction, there is clearly to increase readiness and life is prolonged restored machine. This is accompanied by the following groups of effects:

1. Technical, including:

- An overall increase in stiffness, improve the quality of machined surface and increase the achievable dimensional accuracy of work piece,
- Technological design and thus easy to manufacture all components of the machine, its easy installation and simple operation,
- Reduce weight and dimensions, respectively large capacity per unit weight of the machine and the drive-up area.
- 2. Businesses, including:
- Increase the productivity required to ensure the accuracy of the desired shape and surface quality of components,
- Economic efficiency of the machine, thus acquiring and low operating costs.

3. Social, including:

• Improving working conditions (simplifying and facilitating the elimination of operating machines, physically and mentally work above the threshold),





- Improve the working environment of work-Merit,
- Technological change (social) thinking.
- 4. Organic, including:
  - Reduction of material and technological waste,
  - Reduce the environmental burden (reducing production emissions, air pollution).

### Conclusion

The program highlights the need for extending the knowledge base of the recovery machine. The theme of renewal of machinery is now busy and contributes significantly to ensuring the prosperity of any enterprise. It is seen mainly for its significant interests in the removal of physical and moral obsolescence of capital goods. The main benefit and the spirit of the program is to highlight the content, effects and possible recovery of machinery as a prerequisite for determining the appropriate restoration alternatives and planning resources needed to ensure it.

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