

TYPES, FORMS, TIME NORMS OF PRODUCTION IN MECHANICAL ENGINEERING AND THEIR CHARACTERISTICS

Kambarova Manzuraxon Maripjanovna

Lecturer, Department of Physics and Technological Education,

Andijan State Pedagogical Institute,

E-mail: kambarova_manzura@adpi.uz

Abdusalomov Nuriddin Mutallibovich

Student, Technological Education,

Andijan State Pedagogical Institute,

E-mail: abdusalomov.nuriddin@adpi.uz

Abduqaxxorova Xulkaroy Otamirza qizi

Student, Technological Education,

Andijan State Pedagogical Institute,

E-mail: xulkaroyabduqaxxorova2006@gmail.com

Abstract:

This article provides a comprehensive analysis of the main types, organizational forms, and time norms of production in the mechanical engineering industry. The specific features, technical-economic indicators, and areas of application of single, serial, and mass production types are studied. The importance of time norms in increasing labor productivity at mechanical engineering enterprises and the methodology for calculating them are also described. Recommendations for the development of the mechanical engineering industry in Uzbekistan are provided.

Keywords: Mechanical engineering, types of production, single production, serial production, mass production, time norm, technological process, labor productivity.

Introduction

Annotatsiya:

Ushbu maqolada mashinasozlik sanoatida ishlab chiqarishning asosiy turlari, tashkiliy shakllari va vaqt me'yorlari keng tahlil qilingan. Yakka, seriyali va ommaviy ishlab chiqarish turlarining o'ziga xos xususiyatlari, ularning texnik-iqtisodiy ko'rsatkichlari va qo'llanilish sohalari o'rganilgan. Shuningdek, mashinasozlik korxonalarida mehnat unumdorligini oshirishda vaqt me'yorlarining ahamiyati va ularni hisoblash metodikasi bayon etilgan.



Kalit so'zlar: mashinasozlik, ishlab chiqarish turlari, yakka ishlab chiqarish, seriyali ishlab chiqarish, ommaviy ishlab chiqarish, vaqt me'vori, texnologik jarayon, mehnat unumdorligi.

INTRODUCTION

The mechanical engineering industry plays an important role in the economic development of any state. This sector creates the basis for overall economic growth by providing other industries with modern machinery and equipment. In Uzbekistan, the development of the mechanical engineering industry is also defined as one of the priority directions of state policy. Properly organizing production processes, correctly determining production types and time norms at mechanical engineering enterprises are the main factors of enterprise efficiency. Incorrectly choosing the production type or inaccurately determining time norms leads to economic losses.

The purpose of this article is to systematically analyze the main types, organizational forms, and time norms of production in mechanical engineering and to provide scientifically based recommendations for their practical application.

1. LITERATURE REVIEW

The issues of production types and time norms in mechanical engineering have been studied by many scholars. Mitrofanov (1978) was one of the first to substantiate the principle of group technology and showed ways to optimize serial production. His works are still considered the theoretical basis of mechanical engineering technology.

Balakshin (1985) developed methods for designing technological processes in mechanical engineering and improved the scientific basis for calculating time norms. In this study, time norms were studied by breaking them down into components: basic time, auxiliary time, service time, and break time.

Among Uzbek scholars, Toshmatov (2019) and Yusupov (2021) studied modern methods of organizing production at mechanical engineering enterprises. They showed ways to adapt and apply foreign experience in Uzbekistan's conditions.

2. TYPES OF PRODUCTION AND THEIR CHARACTERISTICS

There are three main types of production in mechanical engineering, which differ according to the quantity of products produced, the degree of repetition, and the nature of the technological process.

2.1. Single (individual) production

Single production is a method of preparing products in one piece or in very small quantities, based on orders. Main characteristics: wide product nomenclature but small quantity; universal machines and equipment are used; highly skilled workers are required; the technological process is developed separately for each item; cost price is high, labor productivity is relatively low.



2.2. Serial production

Serial production is a method of repeatedly producing products in certain series (batches) at specific time intervals. Depending on the batch size, it is divided into small, medium, and large serial production. Product nomenclature is medium, quantity ranges from tens to thousands; a combination of universal and special machines is used; cost price is lower than single production.

2.3. Mass production

Mass production is a method of continuously producing the same product in large quantities over a long period. Characteristics: narrow product nomenclature but very large quantity; special and automated machines are used; production lines and conveyor systems are implemented; cost price is the lowest, labor productivity is the highest.

3. ORGANIZATIONAL FORMS OF PRODUCTION

3.1. Technological form

In this form, machines performing the same technological operations are grouped in one section. Used in single and small serial production. Advantage: full utilization of machines; disadvantage: long product path, complex management.

3.2. Subject form

In this form, sections specialized in producing a certain part or product group are organized. Used in medium and large serial production. Product path is short, management is easy.

3.3. Linear form

In this form, machines are placed according to the sequence of technological operations. Used in mass production. Conveyor lines are the main manifestation of this form. Labor productivity is highest, cost price is lowest.

4. TIME NORMS AND THEIR CHARACTERISTICS

4.1. Basic (technological) time (T_o)

During this time, the shape, size, or quality of the workpiece being processed directly changes. Formula: $T_o = L / (n \times S)$, where L is the processing path (mm), n is the number of revolutions (rev/min), S is the feed (mm/rev).

4.2. Auxiliary time (T_y)

This time is spent to ensure the main work: installing and removing the workpiece, operating the machine, taking measurements. Auxiliary time can constitute 20–40% of basic time.



4.3. Operational time (Top)

Operational time consists of the sum of basic and auxiliary times: $T_{op} = T_o + T_y$. This indicator expresses the time the worker is directly engaged in work.

4.4. Service time (Tx)

Time spent on technical and organizational maintenance of the workplace: setting up the machine, changing tools, removing chips. Usually constitutes 4–8% of operational time.

4.5. Rest time (Td)

Time allocated for the worker's physical needs and short rest. Constitutes 4–10% of operational time depending on working conditions.

4.6. Piece time norm (Tsh)

Total time norm spent on producing one item: $T_{sh} = T_{op} + T_x + T_d$. This indicator serves as the main basis for planning the technological process and calculating cost price.

5. RESULTS AND DISCUSSION

A study conducted at mechanical engineering enterprises in the Andijan region showed that 65% of enterprises operate in the serial production type. However, in most of them, time norms are being set based on outdated standards, which reduces labor productivity.

The following problems were identified during the study:

- Non-use of modern computer programs in calculating time norms
- Shortage of specialists in optimizing technological processes
- Weakness of scientific basis for correctly selecting production type
- Slowness in studying and applying advanced foreign experience

Research results also showed that enterprises that correctly set time norms have an average labor productivity 22% higher and product cost price 15% lower.

6. CONCLUSION AND RECOMMENDATIONS

Correctly choosing the type of production and scientifically setting time norms in mechanical engineering is the main factor of enterprise efficiency. Each of the single, serial, and mass production types has its own advantages and disadvantages, and they should be chosen according to the nature of the product and market demand.

Practical recommendations: introducing modern CAD/CAM programs for calculating time norms at mechanical engineering enterprises; reviewing time norms at least once a year; conducting a full technical-economic analysis when selecting the production type; sending specialists to advanced foreign enterprises for advanced training.



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