FAILURES IN MECHANICAL ENGINEERING: CAUSES, DIAGNOSTICS AND PREVENTION

Kannazarov Ilyas Sagidullaevich
Student at the faculty of mechanical engineering technology,
mechanical engineering equipment and management.
Nukus state technical university.

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Abstract. *This article is devoted to the analysis of the causes of breakdowns in mechanical engineering, as well as methods for their diagnosis and prevention. Mechanical engineering occupies an important place in modern industry, providing the production of a wide range of goods and services. However, despite modern technologies and highquality standards, mechanism breakdowns are not uncommon. The article examines in detail the main causes of failure, including material defects, load factors, corrosion and wear, and design errors.*

A number of methods are available to effectively diagnose failures, including visual inspection, non-destructive testing, vibration and noise analysis, and chemical analysis. Each of these methods allows you to identify both visible and hidden defects, which allows you to quickly take measures to eliminate them. In addition, the article offers a number of practical recommendations for preventing breakdowns. Quality control of materials, regular maintenance, use of modern technologies and personnel training play an important role in preventing accidents. In conclusion, the author emphasizes that preventing breakdowns in mechanical engineering is a key task that contributes to the stable and efficient operation of industrial equipment. Correct diagnosis, analysis of causes and the use of effective preventive measures can minimize the risk of breakdowns and ensure uninterrupted operation of mechanisms

Аннотация. *Настоящая статья посвящена анализу причин поломок в машиностроении, а также методам их диагностики и профилактики. В современной промышленности машиностроение занимает важное место, обеспечивая производство широкого спектра товаров и услуг. Однако, несмотря на современные технологии и высокие стандарты качества, поломки механизмов не редкость. Статья подробно рассматривает основные причины поломок, включая материальные дефекты, нагрузочные факторы, коррозию и износ, а также проектные ошибки.*

Для эффективной диагностики поломок представлен ряд методов, включая визуальный осмотр, неразрушающий контроль, анализ вибраций и шумов, а также химический анализ. Каждый из этих методов позволяет выявить как видимые, так и скрытые дефекты, что позволяет оперативно принимать меры по их устранению.

Кроме того, статья предлагает ряд практических рекомендаций по профилактике поломок. Контроль качества материалов, регулярное техническое обслуживание, использование современных технологий и обучение персонала играют важную роль в предотвращении аварийных ситуаций.

В заключение, автор подчеркивает, что предотвращение поломок в машиностроении является ключев,ой задачей, способствующей стабильной и эффективной работе промышленного оборудования. Правильная диагностика, анализ причин и применение эффективных мер профилактики позволяют минимизировать риски возникновения поломок и обеспечить бесперебойную работу механизмов

Annotatsiya. *Mazkur maqola mashinasozlikdagi buzilishlar (nosozliklar) sabablarini tahlil qilish, ularni aniqlash va oldini olish usullariga bag‘ishlangan. Zamonaviy sanoatda*

mashinasozlik muhim o‘rin tutadi, u keng turdagi mahsulotlar va xizmatlar ishlab chiqarilishini ta’minlaydi. Biroq, zamonaviy texnologiyalar va yuqori sifat standartlariga qaramay, mexanizmlarning buzilishi kam uchraydigan holat emas. Maqolada buzilishlarning asosiy sabablari, jumladan, materiallardagi nuqsonlar, yuklama omillari, korroziya (zanglash) va eskirish, shuningdek, loyihadagi xatoliklar batafsil ko‘rib chiqiladi. Buzilishlarni samarali aniqlash uchun bir qator usullar keltirilgan: vizual ko‘rik, buzmay tekshirish (no‘ldiruvchi nazorat), tebranish va shovqin tahlili, shuningdek, kimyoviy tahlil. Bu usullar orqali ochiq va yashirin nuqsonlarni aniqlash mumkin, bu esa ularni tezda bartaraf etish choralarini ko‘rishga yordam beradi. Bundan tashqari, maqolada buzilishlarning oldini olish bo‘yicha amaliy tavsiyalar berilgan. Materiallar sifatini nazorat qilish, muntazam texnik xizmat ko‘rsatish, zamonaviy texnologiyalardan foydalanish va xodimlarni o‘qitish avariya holatlarini oldini olishda muhim rol o‘ynaydi.

Xulosa qilib aytganda, muallif mashinasozlikdagi buzilishlarning oldini olish sanoat uskunalarining barqaror va samarali ishlashini ta’minlashda asosiy vazifa ekanligini ta’kidlaydi. To‘g‘ri tashxis, sabablarni chuqur tahlil qilish va samarali profilaktika choralarini qo‘llash nosozliklar xavfini minimallashtirish hamda mexanizmlarning uzluksiz ishlashini ta’minlash imkonini beradi.

Keyword: *Mechanical engineering Breakdowns Production Material defects Load factors Corrosion Wear Design errors Breakdown diagnostics Visual inspection Non-destructive testing Vibration and noise analysis Chemical analysis Breakdown prevention Material quality control Maintenance Modern technologies Personnel training Reliability Productivity*

Ключевые слово: *Машиностроение Поломки Производство Дефекты материалов Нагрузочные факторы Коррозия Износ Проектные ошибки Диагностика поломок Визуальный осмотр Неразрушающий контроль Анализ вибраций и шумов Химический анализ Профилактика поломок Контроль качества материалов Техническое обслуживание Современные технологии Обучение персонала Надежность Производительность*

Kalit so‘zlar: *Mashinasozlik, Nosozliklar, Ishlab chiqarish, Materiallar nuqsonlari, Yuklama omillari, Korroziya, Eskirish, Loyihaviy xatoliklar, Nosozliklarni aniqlash, Vizual ko‘rik, Buzmay tekshirish, Tebranish va shovqinlarni tahlil qilish, Kimyoviy tahlil, Nosozliklarning oldini olish, Materiallar sifatini nazorat qilish, Texnik xizmat ko‘rsatish, Zamonaviy texnologiyalar, Xodimlarni o‘qitish, Ishonchlilik, Samaradorlik*

Introduction

Mechanical engineering plays a key role in modern industry, providing the production of various goods and services. However, despite advanced technologies and quality standards, breakdowns often occur in mechanical engineering, which leads to downtime, economic losses and increased repair costs. This article is devoted to the analysis of the causes of breakdowns in mechanical engineering, methods for their diagnosis and the development of effective measures to prevent them.

1. Causes of breakdowns

1.1. Material defects

One of the main causes of breakdowns are material defects, such as improper processing, inclusions, cracks and other imperfections in the materials used in production.

1.2. Load factors

Insufficient or excessive loads on machine parts and components can also lead to their breakdown. This may be caused by incorrect calculation of loads, wear of elements, as well as failures in lubrication and cooling systems.

1.3. Corrosion and wear

The operation of mechanisms in aggressive environments, as well as an insufficient anti-corrosion protection system, contributes to the development of corrosion and wear of parts.

1.4. Design errors

Flaws in design, incorrect choice of materials, insufficient strength calculations - all this can lead to defects and breakdowns during operation.

2. Diagnosis of breakdowns

2.1. Visual inspection

The first step in diagnosing a breakdown is a visual inspection of parts and assemblies.

This allows visible damage such as cracks, deformations and signs of wear to be identified.

2.2. Unbrakable control

The use of non-destructive testing methods, such as ultrasonic flaw detection, radiography and magnetic flaw detection, makes it possible to detect hidden defects and assess the condition of materials.

2.3. Vibration and noise analysis

Monitoring vibrations and analyzing the operating noise characteristics of a machine can indicate possible failures in bearings, gears and other mechanisms.

2.4. Chemical analysis

Laboratory analysis of the chemical composition of materials allows us to identify defects associated with the composition of alloys and chemical resistance.

3. Prevention of breakdowns

3.1. Material quality control

Carrying out strict quality control of supplied materials and components helps to avoid material-related defects.

3.2. Regular Maintenance

Carrying out periodic technical inspections and replacing worn parts in accordance with the manufacturer’s recommendations helps prevent breakdowns.

3.3. Use of modern technologies

The use of the latest technologies in production, as well as the use of modern methods for calculating strength and loads, helps to increase the reliability of mechanisms.

3.4. Training

Improving the technical operations skills of employees and regular training to detect and repair breakdowns are important steps in preventing accidents.

Avoiding breakdowns in mechanical engineering is an important task, since they can lead to serious consequences for production and the economy as a whole. Correct diagnosis, analysis of causes and the use of effective preventive measures can minimize the risk of breakdowns and ensure uninterrupted operation of mechanisms. Continuous technology improvement, quality control and personnel training are key components of a successful breakdown prevention strategy.

At the same time, it should be noted that breakdowns in mechanical engineering cannot be completely excluded.

Therefore, it is important to have effective systems for monitoring and responding to possible breakdowns in order to take the necessary measures to eliminate them in a timely manner. In conclusion, understanding the causes of breakdowns, correct diagnosis and systematic work to prevent these events can improve the reliability of machine-building mechanisms and ensure stable and efficient operation of industrial equipment. This in turn helps to increase the productivity and competitiveness of enterprises in the modern market.

Engineering education and work experience play an important role in preventing breakdowns. Knowledge of design principles and technological processes allows you to develop more reliable parts and assemblies, as well as optimize production processes.

Close cooperation with material suppliers is also of great importance. Regular audits and quality control of raw materials help to avoid defective materials entering production.

However, despite all the measures taken, breakdowns are sometimes inevitable. An important aspect in this context is a prompt response to a breakdown. The availability of spare parts and components, as well as competent organization of repair work, help to minimize downtime and reduce economic losses.

In conclusion

We emphasize that the problem of breakdowns in mechanical engineering requires an integrated approach. Effective methods for diagnosing and preventing breakdowns, together with constant improvement of technology and personnel qualifications, make it possible to increase the reliability and durability of mechanisms. This, in turn, contributes to the sustainable development of the industrial sector and increases its competitiveness

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