

ROLE OF BEARINGS IN MECHANICAL ENGINEERING

У статті розглянуто роль підшипників у сучасному машинобудуванні, їх класифікацію, особливості, з яких матеріалів вони виготовляються та галузі їх застосування. Проаналізовано переваги та недоліки основних типів підшипників, а також сучасні тенденції їх розвитку.

Ключові слова: підшипник, підшипник кочення, підшипник ковзання, кульковий підшипник, роликовий підшипник, машинобудування, мастило, навантаження.

The article examines the role of bearings in modern mechanical engineering, their classification, and specific features, including the materials used in their manufacture and their fields of application. The advantages and disadvantages of the main bearing types are analysed, along with current trends in their development.

Keywords: bearing, rolling bearing, plain bearing, ball bearing, roller bearing, mechanical engineering, lubrication, load.

Bearings are very important parts of modern machines. They help them work reliably and well. The main job of a bearing is to stop parts from rubbing against each other. This makes movement smooth and helps the parts last much longer without breaking. You can find them everywhere in engines, pumps, cars, and big factory machines. Because of bearings, machines work better and stay in good shape for many years.

A bearing is a machine element that constrains relative motion to only the desired motion and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts.

A rolling bearing has several parts: the inner and outer rings, the rolling pieces (like small balls or rollers), a cage, and a seal. The rings have special tracks where the balls or rollers move to stop the parts from rubbing against each other. Usually, the rings are made of a strong steel called 100Cr6. This steel is specially treated with heat so it doesn't break easily and lasts a long time. Sometimes, you can find hybrid bearings that use steel rings but have ceramic balls inside. The cage is there to keep the balls apart and make sure they stay in the right places. It can be made of steel, brass, or even plastic. Some bearings are "closed," meaning they have seals and are already filled with grease at the factory. This makes them last longer and much easier to use because you don't need to fix or oil them yourself.

Bearings are divided into groups based on how they work, the parts they use, and how much weight they can carry. The two main types are rolling bearings and plain bearings. In plain bearings, a shaft rotates inside a hole in a metal case. Between them, there is a thin layer of oil or grease. These bearings work very quietly, they don't vibrate much, and they don't take up a lot of space. However, you always need to keep them lubricated so they work well for a long time. Rolling bearings use small balls or rollers inside. They turn sliding into rolling, which makes a big difference. This helps to reduce friction, makes the machine work better, and makes it much easier to take care of the equipment.

You can find bearings in almost every machine today. In construction, they are inside engines, gearboxes, and hydraulic systems. There are also special "swing bearings" that let an excavator's cabin spin around in a full circle. In cars, we use "closed" wheel bearings that are already lubricated, so you never need to add more oil or grease yourself. In the aerospace and energy industries, bearings have a very tough job. They must work perfectly even when it's very hot or under a lot of pressure. If the bearings are reliable, the whole machine will work well and last for a very long time.

We measure how long a bearing lasts using a special number called L10. This means that if you have 100 identical bearings, 90 of them will still work perfectly after a certain time, while only 10 might fail because the metal gets tired. Most bearings use grease to stay slippery. However, for very

high speeds, we use oil because it helps to cool the parts down. "Closed" bearings come with grease already inside from the factory, so you never need to touch them. "Open" bearings are different – you have to add new grease to them every once in a while. Some special bearings, like those with a PTFE (Teflon) coating, can work for decades without any help. There are also fluid bearings that almost never wear out. Because machines put a lot of pressure on them over and over again, the rings are made of very hard, heat-treated steel to make sure they last a long time.

Hybrid bearings use ceramic balls instead of steel, making them light, hard, and safe from electricity. They are great for electric motors and wind turbines. Today, "smart bearings" also have sensors to track heat or vibration, so they can tell you when they need fixing. Magnetic and air bearings are even cooler because their parts don't touch, so there is almost no friction. With new materials like PTFE, bearings can now last for a very long time, even in tough jobs.

Bearings are a must-have part of modern machines. They help reduce friction, make equipment work better, and help it last much longer. You can find them almost everywhere – from cars to power plants and airplanes. New types, like hybrid, magnetic, or even "smart" bearings, show that they will play an even bigger role in making our technology more reliable and efficient in the future.

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Тюрєнкова К.В.
Ганніченко Т.А.

ENVIRONMENTALLY ORIENTED INNOVATIVE SOLUTIONS AND ORGANIC PRODUCTION AS DRIVERS OF LONG-TERM BUSINESS SUSTAINABILITY

Було проаналізовано вплив екологічних стандартів та екоінновацій на діяльність підприємств. Висвітлено переваги впровадження органічних методів господарювання, роль екологічно орієнтованих інновацій у підвищенні ефективності бізнесу та залученні інвестицій. Визначено основні виклики, зокрема недостатню державну підтримку та брак уніфікованих стандартів, та запропоновано ключові напрями для розвитку сталого бізнесу.

Ключові слова: екологічні стандарти, екоінновації, органічне виробництво, сталий розвиток, бізнес-процеси, інвестиції.

The impact of environmental standards and eco-innovations on enterprise activities has been analyzed. The advantages of implementing organic farming methods and the role of environmentally oriented innovations in improving business efficiency and attracting investments are highlighted. The main challenges, including insufficient government support and the lack of unified standards, are identified, and key directions for the development of sustainable business are proposed.

Keywords: environmental standards, eco-innovations, organic production, sustainable development, business processes, investments

In the context of globalization and growing societal attention to environmental issues, compliance with environmental standards has become a crucial element of the long-term strategic development of enterprises. Today, such standards serve not only as tools for environmental protection but also as instruments for enhancing market appeal, strengthening financial stability, and building a positive corporate reputation. The implementation of environmentally oriented innovations helps businesses meet modern market requirements while promoting the principles of sustainable development. Therefore, analyzing the impact of environmental standards and innovations on