


# Bearings and the Environment



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Rolling bearings are vital in our modern world. Without them, many of the devices, machines and services that we now take for granted would not function. Rolling bearings are inherently efficient products, and their use and development can contribute to solutions that save energy and reduce green house gas emissions. The bearing industry has taken action to reduce the negative environmental impacts that occur during the manufacture of bearings, and accepts the challenge and responsibility to reduce these further.

The World Bearing Association (WBA) was founded in 2006, and brings together the world's leading producers of bearings. This brochure has been produced by the WBA in order to explain and illustrate the contribution that the global bearing industry has and will make towards the protecting the natural environment.



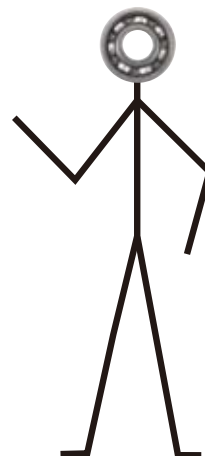
Ball bearing



Roller bearing

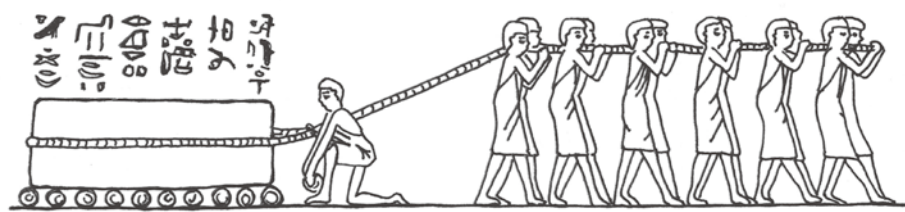


Needle roller bearing



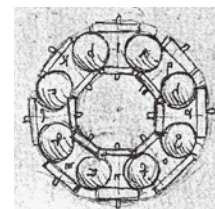
# Introduction to the bearing industry

## The history of bearings



We know that in 2400 BC the Egyptians used water as a lubricant in an attempt to reduce the number of men needed to pull the heavy stone blocks needed for their constructions. Later, around 1100 BC, the Assyrians used simple wooden rollers to transport similar blocks, but with significantly less effort (and fewer men). They had discovered that achieving movement through rolling is inherently more efficient than sliding. It is this basic principle that has driven the subsequent development and extensive utilization of rolling bearings.

Around 1500 AD, Leonardo da Vinci envisioned various different types of rolling bearings, including many of the basic features found in bearings today. The global bearing industry did not start to develop significantly until the Industrial Revolution.



Leonardo da Vinci's ball bearing design from the 15th century

During the last 120 years, the bearing industry has innovated and improved the designs, materials and production processes used so that bearings have become a universally accepted solution deployed in the products of our world. Bearings have played a vital part in the development of everything from the bicycle to the space shuttle, from personal computers to windmills.

## Bearing function and design

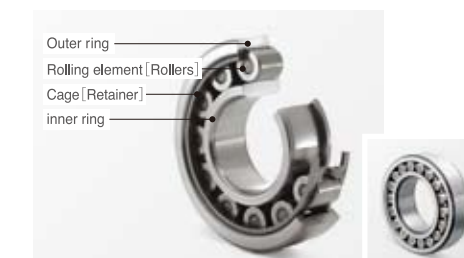
### Purpose and basic design

A bearing is a machine element whose function is to allow rotary motion of, or about, a shaft. In fulfilling this purpose, bearings should be durable under the loads and speeds applied as well as being light, cost effective and generating minimal friction. Many distinct bearing types have been developed by the industry, each with particular performance characteristics that are suited to specific applications. However, it is possible to broadly split these types into two groups; ball bearings where the rolling function is provided by a ball, and roller bearings where this function is provided by a roller of some kind.

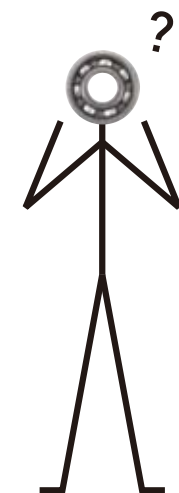
In both cases, the bearing assembly is comprised of four main components. These are the inner and outer rings (that are mounted to the shaft or housing and include the raceways on which the balls or rollers roll), the rolling elements (either balls or rollers) and the cage (which separates to avoid contact among the rolling elements).



Ball bearing



Roller bearing



## Highly engineered, precision products

In order to operate at or above the required levels of reliability and accuracy, bearings are produced with very high levels of precision. For example, balls and raceways are polished to achieve the mirror-like surfaces needed to ensure good performance. At the same time the dimensions of these components are controlled to within a few microns ( 1/1000 of a mm ).

## From 2 mm to 6 m

There is a huge variety in both the types and sizes of bearing available today. Miniature bearings are used in applications such as personal computers and have an outside diameter as small as 2mm. Large size slewing bearings, with external diameters above 6 meters and weighing up to 15 tons, are applied in applications such as tunnel boring machines. The photograph shows the machine that was used to construct the Euro tunnel, connecting England and France.



Ball bearing of 2 mm in outside diameter



Commemorative photograph of Euro tunnel opening to traffic  
(Photo courtesy of Mitsubishi Heavy Industries Tunneling Machinery & Geotechnology Co., Ltd.)



## The global bearing industry

The bearing industry has grown in parallel to, and in support of, the economic and technological development of modern society. In order to meet the requirements from new and ever more demanding applications, bearing manufacturing and design has evolved into a highly specialized technology requiring a deep knowledge of the materials and processes involved as well as the conditions in which bearings must operate.

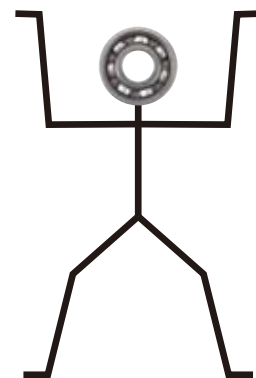
The global bearing industry is mainly focused in Asia, the Americas and Europe, and has developed sales and engineering networks that can support customers anywhere in the world by rapidly providing the products and engineering knowledge that they require. The graph on the right shows the total sales value and regional split of the global bearings industry.



Bearings are vital components  
of the modern world

Not visible outside - but essential inside !

Because bearings are typically installed inside machines, we seldom see them. However, bearings are used in a huge range of devices requiring rotary motion. They are essential components in everything from washing machines to wind turbines. The image illustrates just some of the many diverse applications in which bearings are vital components.



## Bearing focus on energy efficiency

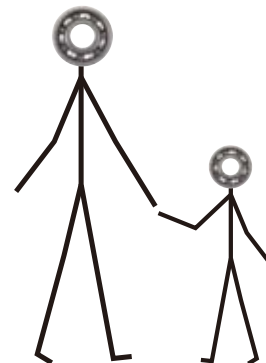
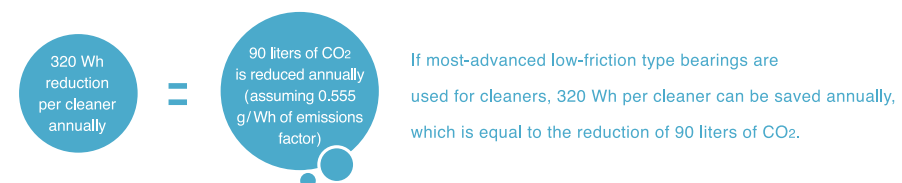
The WBA recognizes that global societies and economic entities must significantly change how energy is produced and used in order to avoid irreversible damage to the global climate. The industry as a whole is working to find meaningful ways in which our products can contribute to this transformation.

## Energy saving bearing solutions in daily life

It is possible to realize efficiency gains by careful adaptation of the design and materials used in bearings and the systems in which they are applied. Such efficiency gains will translate to reduced energy requirements for the given device and therefore contribute to overall efforts to reduce energy consumption.

## Energy efficient bearings for vacuum cleaners

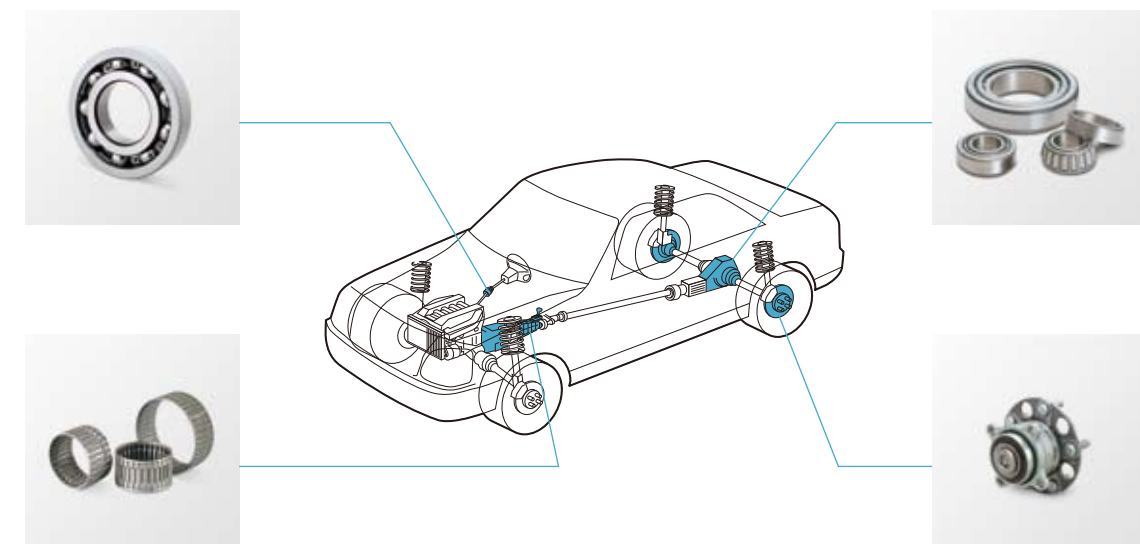
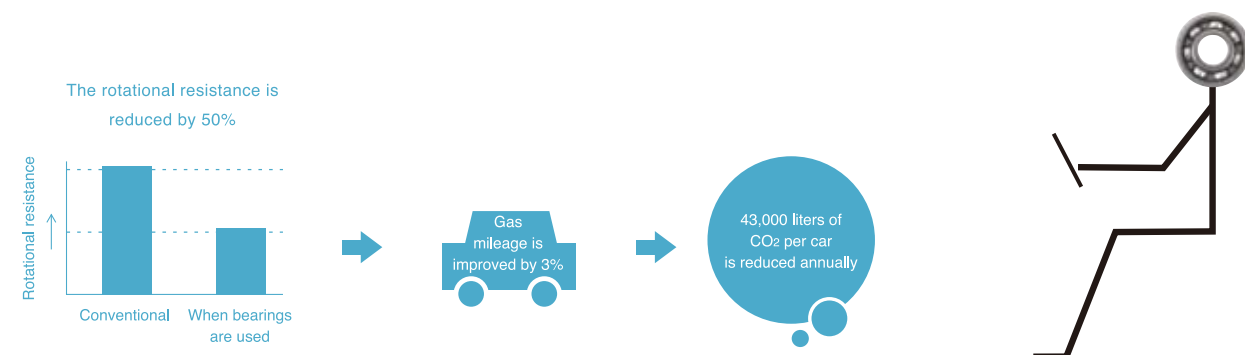
The energy efficiency of a vacuum cleaner motor can be improved by optimizing the frictional performance of the bearings. In addition to saving energy, this results in a quieter machine.



## Fuel and CO<sub>2</sub> reductions from automobiles

More than one hundred bearings can be found in a typical modern passenger vehicle. They are applied throughout the vehicle in applications such as the wheels, engine, alternator, suspension and gearbox. By working to optimize the frictional performance and durability of the bearings and the systems in which they operate, it is possible to improve the environmental performance of the vehicle.

The example below illustrates the potential efficiency improvement that could be achieved when the plain bearings (that are conventionally used to support the crank and cam shaft in an automobile engine) are replaced with needle roller bearings.

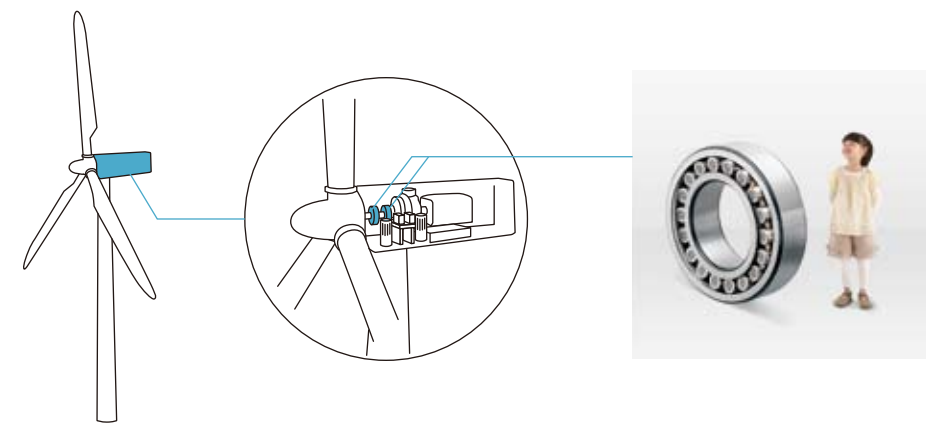
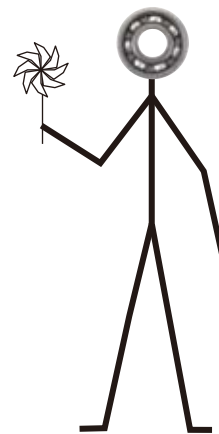


## Importance of bearings in renewable energy systems

Renewable energy is generated by capturing natural energy sources such as the sun, wind, wave and tide. It can be produced with almost no green-house gas emissions and is a vital element of any climate change abatement strategy.

A typical wind turbine requires around 30 bearings, all of which must operate with utmost reliability under extreme operating conditions. Working with the wind energy industry, the bearing industry has developed the knowledge and bearing solutions needed to help make commercial wind power generation a reality.

Looking to the future, new bearing designs may be required in emerging renewable power sources such as tidal or wave power, the bearing industry will actively support and drive the developments needed to make these systems viable.





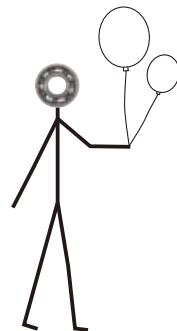
## Environmentally conscious manufacturing



### Acting to reduce CO<sub>2</sub> emissions

In addition to developing new, more efficient solutions that will help our customers save energy and reduce CO<sub>2</sub> emission, the bearing industry also strives to reduce the green-house gas emissions generated as a result of our own manufacturing activities.

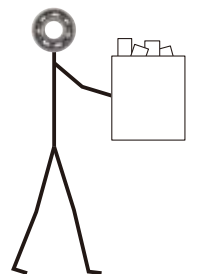
We actively pursue energy savings, by deploying energy management approaches and avoiding wasted energy in our manufacturing process as well as in heating, lighting and ventilation etc.



### Effective use of limited natural resources

The bearing industry acts to minimize the use of steel and other materials, and at the same time supports the recycling of materials wherever possible. Steel forms the majority of the material used in bearings and the majority of steel used by the industry in the manufacture of bearings is recycled.

We reduce the amount of material needed in our products and those of our customers by constantly developing smaller and lighter bearings with equal or improved performance. The industry is also continuously developing manufacturing processes that produce higher quality products using less material and natural resources such as water.





## We strive to reduce the use of hazardous substances

Environmentally conscious manufacturing is only part of the solution! The industry is proactively developing approaches to reduce or remove hazardous substances from our products and the processes applied to produce them.



For more information, please visit  
[www.bearingsandtheenvironment.com](http://www.bearingsandtheenvironment.com)

## Postscript

Bearings are indispensable for our modern life, though we seldom see them. We will continue to improve bearings that allow our customers to do more with less. Through this development and by constantly working to reduce the environmental impact of our operations, the bearing industry will continue to contribute to sustainable global development, meeting the economic and environmental needs of the future.

The data in this brochure contain information provided by companies participating in the WBA, based on their individual products.

The World Bearing Association (WBA) was founded by American Bearing Manufacturers Association (ABMA), Federation of European Bearing Manufacturers' Associations (FEBMA), and The Japan Bearing Industrial Association (JBIA) in September, 2006. The WBA contributes to the development of the global bearing industry and focuses on specific issues of common interest such as environmental protection.