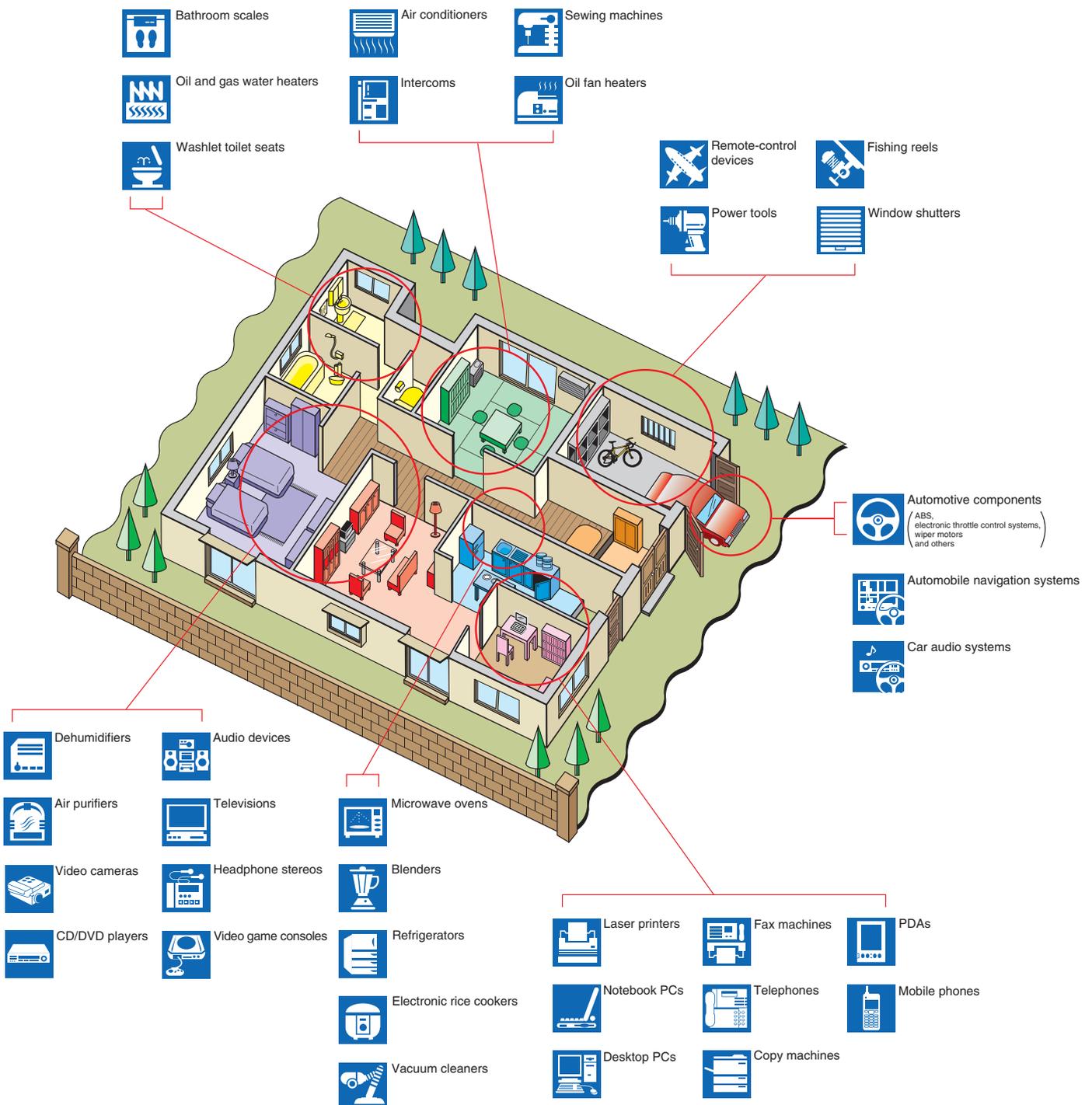


The Minebea Group manufactures ball bearings; machined components, notably aircraft and automotive components; and electronics components, including motors, liquid crystal display (LCD) backlights, strain gages and PC keyboards.

These products are used in a wide range of devices in everyday life.

It is estimated that, for example, between 100 and 200 small-sized ball bearings are used in the average home. Ball bearings contain rolling elements, that are, balls, which minimize friction, thus enabling devices to rotate smoothly. They are required for advanced home and office electronic equipment and are contributing to efforts to develop models that are smaller, use less energy and last longer.

■ Minebea Products: Essential to Modern Lifestyles



## ■ Development of Environment-Friendly Products

### ◎ World's smallest ball bearings with ultra-small outer diameter of 1.5 mm

Minebea has succeeded in the commercialization of ultra-small ball bearings that are 1.5 mm in outer diameter and 0.65 mm in thickness, making them the smallest in the world (according to our research). These ball bearings have the same pressed-steel ball bearing cage structure as normal miniature ball bearings.

With a 60% share of the global market, Minebea is the leading manufacturer of miniature ball bearings with outer diameters of 22 mm or less. The smallest ball bearings that Minebea has put to practical use up to this point have been the 2.2 mm outer diameter ball bearings.

While achieving further miniaturization, these ultra-small ball bearings of 1.5 mm in outer diameter have the same high precision, durability and rigidity of the products that were formerly the smallest. This new product will be proposed for active use in the moving parts of medical devices, micro-motors, micro-machines and other fields for which the conventional ball bearings were not suited.



World's smallest ball bearings with ultra-small outer diameter of 1.5 mm

### ◎ High corrosion resistant miniature bearings

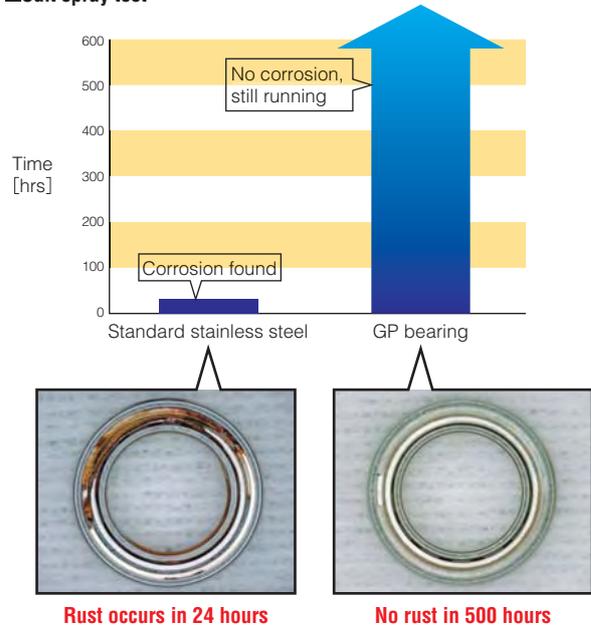
Minebea started marketing of high corrosion resistant miniature bearings called "Giga Protection®" (the "GP bearings") in July, 2009. Compared with stainless steel used in ordinary bearings, the GP bearings improve the resistance to rust and corrosion by 20 times or more (over 500 hours at salt spray testing, JIS-Z-2371).

Adopting materials with superior resistance to rust and corrosion, the GP bearings can be expected to be used in the applications requiring high resistance to rust and corrosion - such as fishing tackles, including fishing reels, and marine equipment exposed to seawater (salt water); wind meter exposed to wind and rain; and medical equipment easily eaten away by chemicals, etc. More attractive products can be developed by using GP bearings in easily rusting parts to offer users some benefits such as being able to largely reduce maintenance after the purchase of the product.

\* Lower in load bearing performance than conventional stainless steel bearings due to the characteristics of the materials. Ideally suited to comparatively low load bearing applications.

### < GP bearing salt spray testing result (in accordance with the JIS-Z-2371 standard) >

#### ■ Salt spray test



### © Weather-resistant, long-life, high-performance AC fan motors

Minebea has commercialized a series of weather-resistant (oil proof and dust proof), long-life AC fan motor for products used in harsh environments, such as machine tools and for products used outdoors, such as solar light generation systems and rechargers for electric vehicles.

Adopting a coil section formed in one piece of epoxy resin and a labyrinth structure<sup>(1)</sup> in the rotating section, this series dramatically enhances oil proof and dust proof capabilities (equivalent to "IP54"<sup>(2)</sup>). Additionally, when compared with our conventional models, it improves static pressure by up to 30%. It comes in two sizes (120 Square and  $\phi 170$ ), as well as in a total of four types, which allows for selection of the best models for specific application needs. "Metal Blades Type" excels in oil proof requirement, while "Plastic Blades Type (PBT)" offers high static pressure and long wear requirement. Users have to do troublesome maintenance work to use a fan motor in a harsh environment. Enhancing weather resistance in all kinds of environments, this series saves users' time and trouble required for the maintenance while at the same time contributing to lowering life cycle costs.

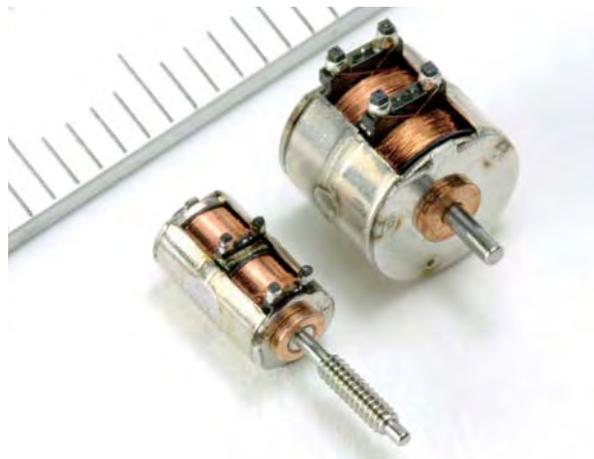


Weather-resistant, long-life, high-performance AC fan motors

### © Ultra-small permanent magnet (PM)-type stepping motor with high resolution

Minebea has commercialized two types of world's highest resolution ultra-small permanent magnet-type stepping motors (the "PM stepping motors")<sup>(3)</sup> having outside diameter of 3.3 mm and 6 mm as mass production models.

The outside diameter of 3.3 mm (hereinafter referred to as  $\phi 3$  mm), despite with an ultra-small diameter, allows fine positioning of 20 steps per rotation. It aims for adoption in compact, low-profile digital products - such as high-performance cameras for cellular phones and Blu-ray Disc drives for slim-type notebook computers - that was difficult for conventional products. The model with outside diameter of 6 mm (hereinafter referred to as  $\phi 6$  mm) achieves high resolution of 40 steps per rotation (conventional products are 20 steps) - the first time in the world as a mass-produced PM stepping motor of the same size. Both  $\phi 6$  mm and  $\phi 3$  mm motors allow ultra high fineness and high power torque. The  $\phi 6$  mm contributes to further heightening the functionality and added value of digital cameras, such as image stabilization through accurate positioning control, quick auto focuses and miniaturizing and silencing products by eliminating reduction gears.



High resolution, ultra-small PM stepping motor (Left:  $\phi 3$  mm, Right:  $\phi 6$  mm)

#### Glossary

- (1) **Labyrinth structure:** A special structure that eliminates the incorporation of dust into the rotation axis and the coil section, this structure is called "labyrinth structure" because it has a complicated shape in itself.
- (2) **IP54:** IP (Internal Protection) is "degrees of protection provided by enclosures (IP code)" referred to in JISC 0920(IEC 60529). The degrees of protection are expressed in two figures following the IP.  
1st code 5: Protection against the penetration of solid foreign objects. The apparatus is dust proof.  
2nd code 4: Protection against splashing water. This represents no splashed water effects from any direction.

#### Glossary

- (3) **Stepping motors:** Stepping motors convert electrical signals into mechanical actions. The number of electrical signals generated determines rotation number. Stepping motors support not only successive rotation but also intermittent driving, variable rotation, positive rotation and negative rotation. They are used in various OA equipment, such as printers and fax machines, PC peripherals, digital devices, precision equipment, etc.