



Bearings

New Frontiers in Core Businesses

Automotive Components

Spindle Motors

Reinforcing Competitiveness

SMALL BEARINGS

Minebea is the leading manufacturer of small ball bearings up to 22mm in external diameter, and has a global market share in excess of 60%. With the launch of production of fluid dynamic bearings, the Company has added a final key dimension to its lineup of small bearings, which includes conventional ball bearings, integrated-shaft ball bearings and RO bearings, positioning us well to take advantage of new markets for these products and respond to rising demand.

The unmatched competitiveness of Minebea's small bearings stems from its vertically integrated manufacturing system, which encompasses all processes, from engineering and development to the manufacture of components, assembly and final testing. This system ensures the same level of quality for small bearings produced at any of Minebea's 10 manufacturing bases worldwide.

Minebea uses its own high-precision small bearings in a broad range of other products, including spindle motors for HDDs, stepping motors, fan motors and pivot assemblies, which has given the Company an outstanding competitive edge in these product categories in terms of quality, supply capabilities, lead time and manufacturing costs.



Minebea's Small Ball Bearings

Minebea manufactures small ball bearings of more than 8,500 different specifications with external diameters ranging from less than 3mm to 28mm. Each ball bearing comprises an outer ring, inner ring, balls, retainer, shield and snap ring. The average motor contains two ball bearings. Ball bearings are thus essential components in information and telecommunications equipment, household electrical appliances and automobiles. The average household is said to use between 60 to 200 small ball bearings at any given time.



Integrated-Shaft Ball Bearings

The integrated-shaft ball bearing has two raceways on the shaft, allowing the integration of the inner ring and shaft of two ball bearings. This facilitates more precise rotation than is possible with two independent ball bearings, making integrated-shaft ball bearings particularly suited to use in, for example, the cylinder units of video cameras.

RO Bearings

The RO bearing features two raceways on the inside of the outer ring and one each on the shaft and inner ring fitted on the shaft, essentially combining the functions of two ball bearings in one while eliminating the misalignment that can occur with two bearings. Because it contains fewer components, the RO bearing also minimizes accumulated tolerance, improving rotating accuracy. Moreover, the stable thermal resonance of RO bearings makes the designing of motors easy. Minebea currently uses most of the RO bearings it produces in its spindle motors for HDDs, but demand is expected to grow for use in pivot assemblies, fan motors and other high-precision components.



Shipments of Small Ball Bearings

Demand for Minebea's ball bearings in the 1950s and 1960s came primarily from the aerospace industry for use in aircraft instruments. In the 1980s, the growing popularity of home-use video cassette recorders caused demand to soar, while in the 1990s, the expanding markets for office automation equipment, household electrical appliances, and PCs have further stimulated demand for ball bearings. The global market has been growing at an unprecedented rate since the second half of the period under review, in response to which Minebea plans to expand its global monthly production capacity by 30 million units, to 150 million units, by the end of 2000.

Cross-License and Other Agreements with Seagate Technology

“Seagate Technology is the world’s largest supplier of HDDs and related components, and pioneered the technological development and volume production of fluid dynamic bearing motors. In March 2000, Seagate and Minebea entered into cross-license, know-how license and supply agreements, enabling Minebea to become a major supplier to Seagate of fluid dynamic bearings and various types of motors, including fluid dynamic bearing spindle motors for HDDs based on Seagate’s pioneering designs. Seagate’s Motor Group holds a high number of motor patents for design as well as manufacturing. The company’s fluid dynamic bearings are the result of its leadership in advanced technology, design, quality, productivity and cost-effectiveness. Disk drives will continue to require higher areal and track densities and increasingly quiet operation. Motor technology is a critical, enabling factor in current and future disk drive design, and Seagate believes this agreement with Minebea will be of benefit to both companies. Seagate and Minebea see these agreements as an intelligent way to bring the most advanced disk drive motors to market in a timely and cost-effective manner. The combination of Seagate’s advanced motor designs and Minebea’s mass-production capabilities will be very powerful. Seagate looks forward to leveraging Minebea’s capabilities and its proven, high-volume, low-cost manufacturing expertise, and believes Minebea will be able to ramp quickly into a significant supplier of motors for our best-in-class disk drives.”

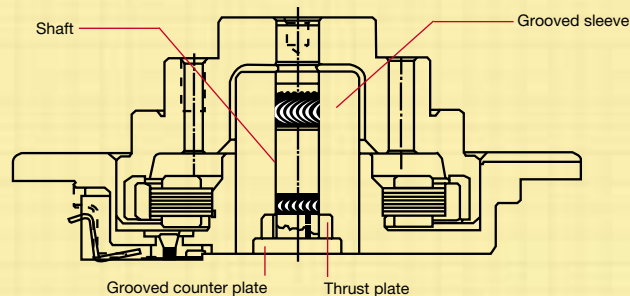


Gunter Heine,
Vice President,
Seagate Technology, Inc.

Fluid Dynamic Bearing Motor Operation

The principle of the fluid dynamic bearing involves replacing the ball bearing function with a layer of lubricant thinner than one-tenth the thickness of a strand of hair. The rotor supported by the bearing essentially “swims around” the shaft. Special grooves in the metal bearing parts generate a hydrodynamic force that stabilizes the motor rotation and provides the vibration damping required for future disk drive applications. Benefits to drive companies include improved quietness and robustness. Fluid bearings also make it easier to increase data storage density and data transfer rate. The reliability of the Seagate fluid dynamic technology has been proven through two and a half years of successful volume manufacturing experience.

Single-Plate Fluid Dynamic Bearing Spindle Motor for HDD



Expanding High-Value-Added Products

SPINDLE MOTORS FOR HDDs

Minebea uses its own high-precision ball bearings in its spindle motors for HDDs, one of the Company's mainstay products. In fact, almost all of the parts in these motors are produced in-house, which gives Minebea an outstanding competitive edge in terms of quality, supply capabilities, lead time and manufacturing costs.

Over the past two years, Minebea has strategically shifted its focus from spindle motors for 3.5-inch low-end HDDs to high-value-added spindle motors for 2.5-inch and 3.5-inch high-end HDDs. Although the Company saw a temporary decline in orders for these motors as a consequence, this strategy has begun to pay off as orders have risen steadily since the latter half of 1999.

Minebea expects to see significant growth in orders for spindle motors for HDDs in the years ahead and plans to expand its monthly production capacity, from approximately 2.0 million units in the first quarter of 2000 to an estimated 3.5 million units by the third quarter of 2000, 5.0 million by the third quarter of 2001 and 10.0 million in 2003.

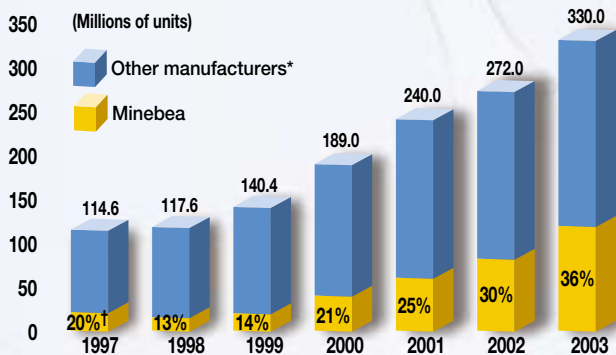
Prospects for Growth

At present, spindle motors for 3.5-inch low-end HDDs for desktop PCs account for more than half of Minebea's total monthly output of spindle motors for HDDs, with 3.5-inch high-end HDDs for desktop PCs and PC servers and those for 2.5-inch mobile information and telecommunications equipment accounting for approximately 20% and 25%, respectively. By the third quarter of 2001, the Company expects its monthly output to more than double, to 5.0 million units, of which approximately 70% will be for high-end markets—1.4 million units for 3.5-inch high-end HDDs for desktop PCs and PC servers, 1.5 million units for 2.5-inch HDDs for information and telecommunications equipment, and 500,000 units for 3.5-inch high-end HDDs for enterprise and host computers—and 30% for 3.5-inch low-end HDDs for desktop PCs.



Spindle Motors

Shipments of Spindle Motors for HDDs and Minebea's Global Market Share



*Percent figures in bars refer to Minebea's share or estimated share of the global market.

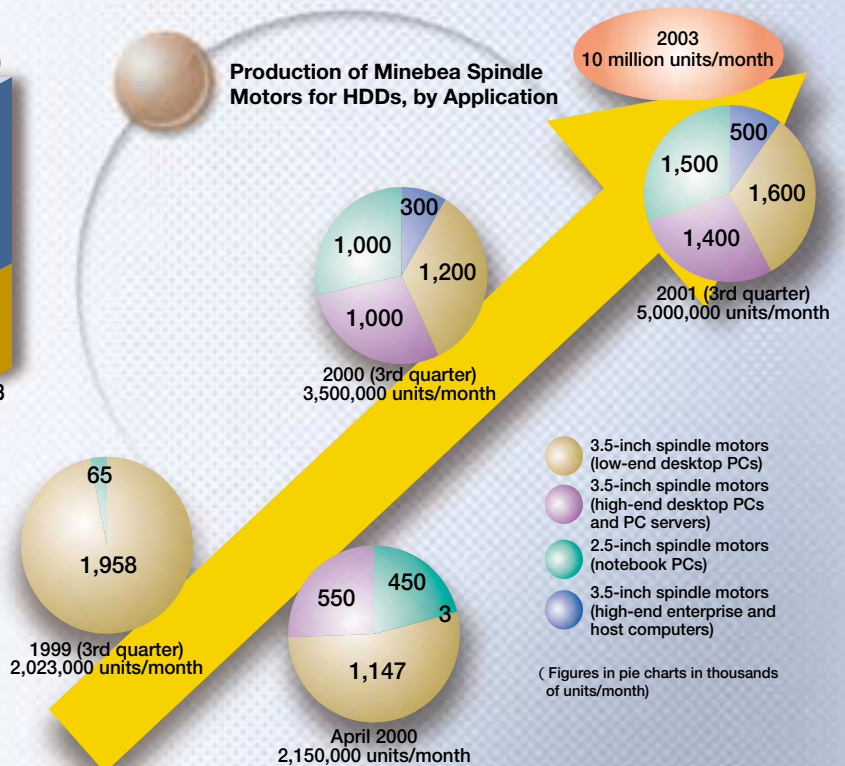
*Refers to manufacturers other than Minebea.

(Source: Pixie Pinnacle Corporation)

Global Market Prospects

In 2000, total shipments of spindle motors for HDDs are expected to amount to 189.0 million units, an increase of approximately 65% since 1997. Minebea's leading share of this market in 2000 is estimated at 21%, compared to 20% in 1997. In the next few years, however, the market is expected to explode, with shipments projected to reach 330.0 million units in 2003. By enhancing its lineup of spindle motors for HDDs and targeting high-end users, Minebea expects its share of the global market to climb to 36% in the same period.

Production of Minebea Spindle Motors for HDDs, by Application



- 3.5-inch spindle motors (low-end desktop PCs)
- 3.5-inch spindle motors (high-end desktop PCs and PC servers)
- 2.5-inch spindle motors (notebook PCs)
- 3.5-inch spindle motors (high-end enterprise and host computers)

(Figures in pie charts in thousands of units/month)

New Developments in Spindle Motors for HDDs

“Under Minebea’s vertically integrated manufacturing system, the Company develops and engineers spindle motors for HDDs in Japan and Germany and conducts all production processes, from the manufacture of parts through to final assembly, at its mass-production facilities in Thailand. Moreover, Minebea has established R&D centers at its product development bases (Japan and Germany), its mass-production base (Thailand), and one of its most important markets (Singapore) to conduct cleanliness evaluation and precision analysis, thus facilitating swift and accurate responses to customer needs in terms of product quality and earning the Company a solid reputation for reliability.

Like hard disks and magnetic heads, spindle motors are high-precision components that are critical to the performance of HDDs. With the rapid expansion of HDD memory capacity and shorter seek times, demand for increasingly precise spindle motors has escalated. In response to changing customer needs, Minebea has launched production of spindle motors for HDDs containing fluid dynamic bearings and spindle motors for HDDs containing RO bearings, and has started using ceramic balls in RO bearings.”



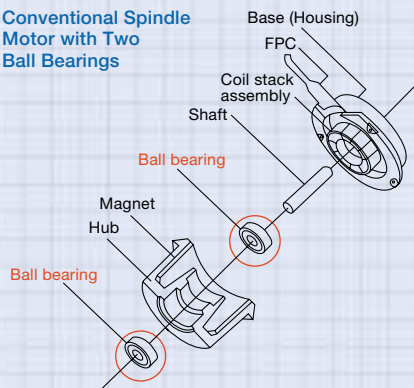
Rikuro Obara,
Senior Managing Director,
General Manager of the
1st Manufacturing Head-
quarters and Karuizawa
Manufacturing Unit, and
General Manager of Bear-
ings Manufacturing Div.,
Karuizawa Manufacturing
Unit, Minebea Co., Ltd.

RO Bearings

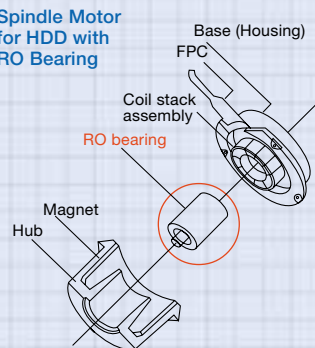


When used in a spindle motor, the RO bearing eliminates the misalignment that often occurs with two conventional ball bearings. RO bearings are also superior in terms of responsiveness to thermal shifts, rotating speed and non-repetitive run-out (NRRO). Because RO bearings also enable more compact designs, they are particularly suited to use in spindle motors for higher-precision 3.5-inch and 2.5-inch high-end HDDs. Moreover, the use of Minebea’s own ceramic balls, which are highly durable and resistant to thermal shift, facilitates even higher levels of precision. Minebea intends to expand the proportion of its total output of RO bearings used in its own spindle motors for HDDs to 60% by the end of 2001, from 45% at the close of fiscal 2000.

Conventional Spindle Motor with Two Ball Bearings



Spindle Motor for HDD with RO Bearing



Cultivating New Markets

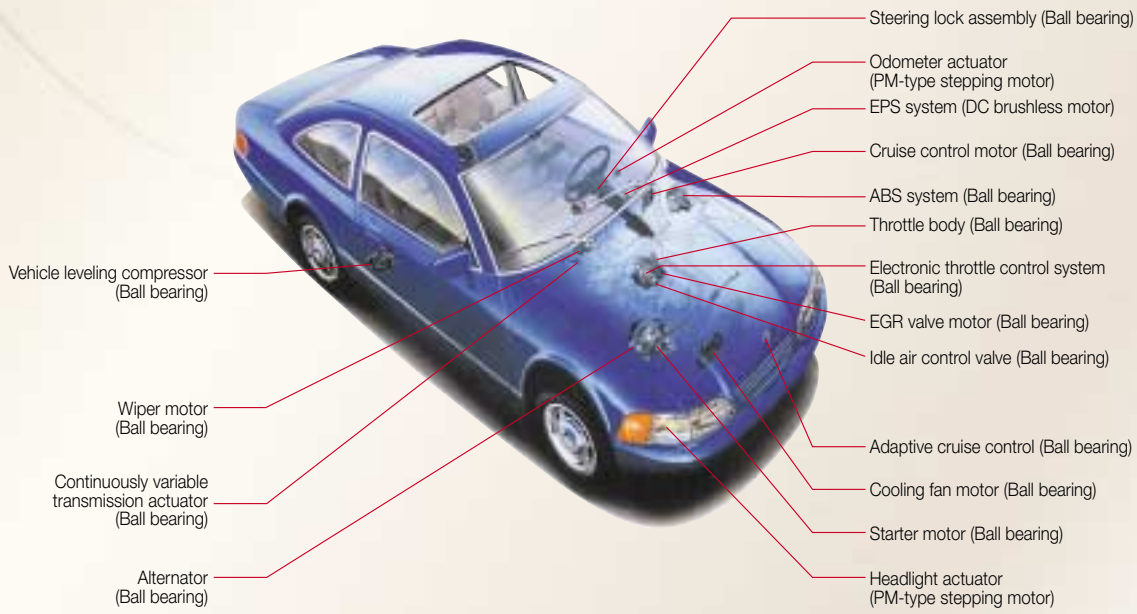
AUTOMOTIVE COMPONENTS

Concern for the environment and better vehicle performance has greatly increased the use of electronically controlled steering and engines. As a consequence, Minebea is seeing demand from automotive manufacturers soar not only for the products it has traditionally supplied to the industry, namely fasteners, speakers and rod-end bearings, but also for mainstay small ball bearings, small motors and a broad range of other products.

With the aim of cultivating new markets, in 1997 Minebea set up a sales group within its marketing headquarters in Japan that specializes in automotive components. The Company also augmented its engineering and development capabilities, which are centered at subsidiary PMDM, by establishing a technical center on the outskirts of Detroit to conduct quality evaluation and product testing. Further, Minebea's ball bearing production facilities in Thailand and Singapore have obtained QS-9000, the U.S. Automobile Manufacturers' Association certification of quality systems for suppliers. These efforts have positioned Minebea well to capitalize on the expanding market for automotive components.



Automotive Applications for Minebea Products



Production of DC Brushless Motor for Delphi

"In line with a contract signed with Delphi Automotive Systems, in April 1999 Minebea began production of a proprietary DC brushless motor for a new electric power steering system developed by Delphi. Delphi chose Minebea after comparing test motors produced by leading global motor manufacturers according to the same specifications, citing the superior motor technologies of PMDM, Minebea's principal small motor development subsidiary, in Germany. Minebea is manufacturing DC brushless motors for Delphi exclusively in Thailand, and with output expected to increase in the future, is planning to build a new plant in that country for this and other small motors for automobiles."



Dr. Helmut Hans,
Vice President,
Precision Motors
Deutsche Minebea
GmbH (PMDM)



Delphi Automotive Systems, a world leader in automotive components and systems technology headquartered in Troy, Michigan, designs, engineers and manufactures a wide variety of components, integrated systems and modules on a worldwide basis. Delphi employs approximately 214,200 people and operates 178 wholly owned manufacturing sites, 41 joint ventures, 53 customer centers and sales offices, and 27 technical centers in 39 countries.

Minebea has been chosen by Delphi to supply a proprietary DC brushless motor used in Delphi's E-STEER™ electric power steering system. E-STEER™ is an all-electric engine-independent power steering system developed by Delphi to replace conventional automotive hydraulics. Increased fuel economy and power are some of the numerous benefits that this system provides. Delphi was the winner of a 1999 Premier Automotive Suppliers' Contributions to Excellence (PACE) award, given by Ernst & Young LLP and Automotive News, for this innovative technology.

Minebea's commitment to the global automotive market is evident in the steps that it has taken to accommodate and support this new program. The development of this DC brushless motor, which was designed by Delphi, was performed both in Minebea's German facility and its Automotive Technical Center in Wixom, Michigan. Motors are manufactured at one of Minebea Thai Ltd.'s facilities and shipped to a Delphi facility in Europe, where they are integrated into steering systems for the European automotive market.



E-STEER™ electric power steering system