



# BREAKTHROUGHS

**HDD Spindle Motors and Other Precision Small Motors**

**We are maximizing important breakthroughs aimed at lowering costs, enhancing quality and ensuring market leadership to raise the profitability of our HDD spindle motors and other precision small motors businesses.**



# LOWERING COSTS

## ROF-Type HDD Spindle Motors

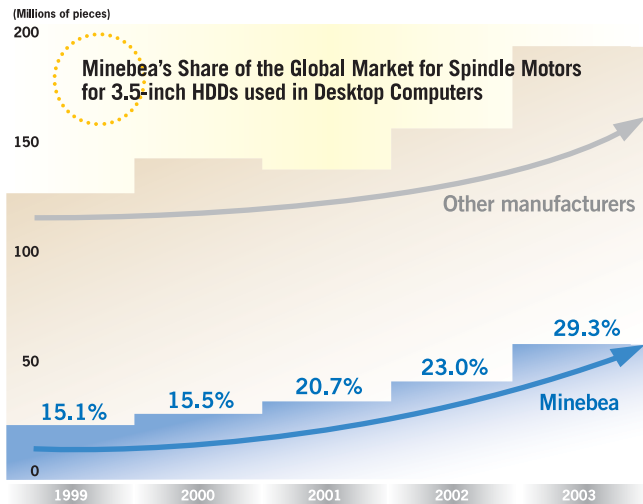
Annual sales of our spindle motors for 3.5-inch HDDs are currently approximately ¥40.0 billion.  
Our newly developed ROF-type FDB unit will enable us  
to significantly lower costs for these motors.

# HDD Spindle Motors

Improving the profitability of our Electronic Devices and Components business segment hinges on our ability to raise the profitability of our HDD spindle motors business. This, in turn, depends on lowering costs for FDB spindle motors for 3.5-inch HDDs and entering the rapidly expanding market for FDB spindle motors for 2.5-inch or smaller HDDs. Our new ROF-type FDB spindle motor was developed primarily for use in 2.5-inch or larger HDDs, while our HMF-type FDB spindle motor was developed for use in 2.5-inch or smaller HDDs.

## Market for Spindle Motors for 3.5-inch HDDs

Despite intense pressure on the profitability of this business, owing to the steady erosion of motor prices, we continue to command a global market share of approximately 30%. Accordingly, we are well positioned to strengthen our profit performance if we can achieve necessary, significant cost reductions.



Source: Techno Systems Research Co., Ltd.

With the aim of significantly lowering costs for FDB spindle motors, we developed the ROF-type FDB unit:

### ROF-Type FDB Unit (Patents Pending)

#### Basic Development Concept

Unmatched suitability to mass production

Unrivaled cost competitiveness

Outstanding performance

The basic development concept for our ROF-type FDB unit was to create an FDB that was unmatched in terms of suitability to mass production and offered unrivaled cost competitiveness and outstanding performance.

#### Features

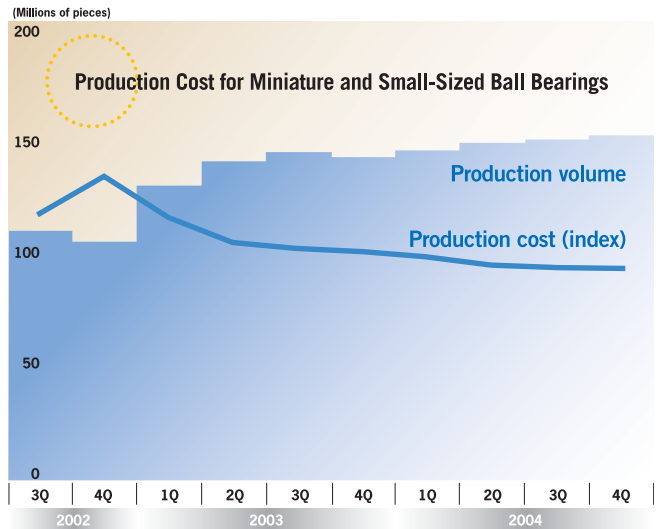
ROF-type FDB units are manufactured using the same manufacturing technologies, production lines and production methods as our ball bearings, monthly global output of which is currently over 170 million pieces. As with ball bearings, steel is put through quenching and grinding processes to form the bearing, the heart of the FDB unit.

Same manufacturing technologies

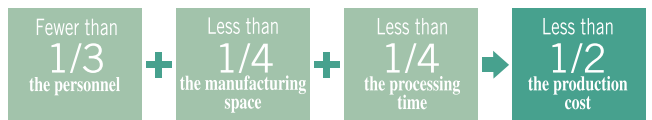
Same production lines

Same production methods

We began sample shipments of spindle motors with ROF-type FDB units, primarily for 3.5-inch HDDs, in June 2004, and intend to commence mass production in late 2004.



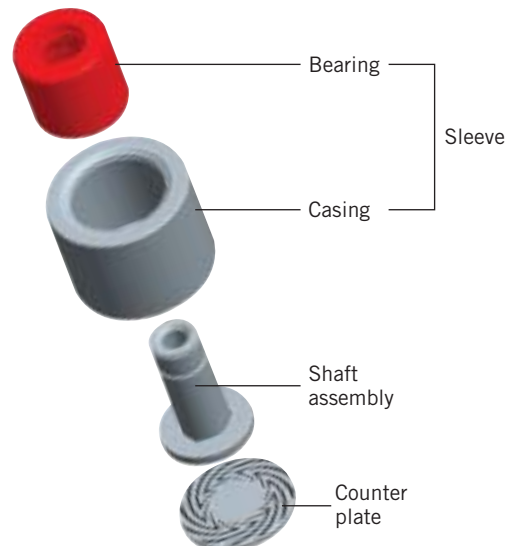
### Comparison of ROF-Type and Conventional FDB Units



Because ROF-type FDB units are produced on the same lines as ball bearings, requirements in terms of personnel, manufacturing space and processing time are significantly reduced. As a consequence, production cost is approximately one-half of that of conventional FDB units, giving Minebea a considerable advantage in terms of cost competitiveness.

### Structure of ROF-Type FDB Unit

The ROF-type FDB unit comprises four parts. In conventional FDB units, the bearing and the casing are integrated in a single component, called the sleeve. In the ROF-type FDB unit, however, the bearing and the casing are independent. This enables us to manufacture the bearing—the costliest part of the FDB unit—using the same manufacturing technologies, production lines and production methods as we use for ball bearings. The two remaining parts of the ROF-type FDB unit—the shaft assembly and the counter plate—are the same as those used for our conventional FDB units.





# ENHANCING QUALITY

## HMF-Type HDD Spindle Motors

The development of the HMF-type FDB unit has positioned us to capitalize on growth in the emerging market for spindle motors for 2.5-inch or smaller HDDs by ensuring an unmatched competitive edge in terms of performance as well as cost.



## Market for Spindle Motors for 2.5-Inch or Smaller HDDs

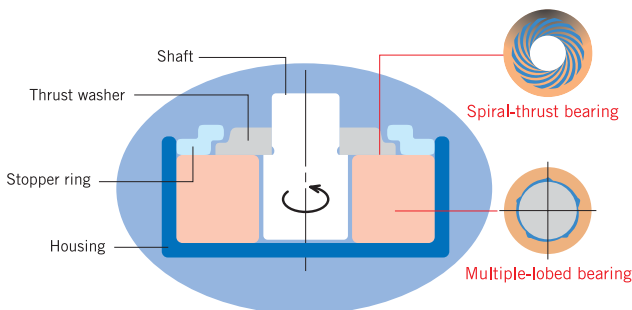
We will strategically cultivate demand for spindle motors for 2.5-inch or smaller HDDs by entering markets that offer high potential in terms of profitability and growth. We will also take advantage of rising demand for 2.5-inch or smaller HDDs for use in notebook PCs and cellular phones and other handheld information terminals.



### HMF-Type FDB Unit (Patents Pending)

While 2.5-inch or smaller HDDs currently account for only approximately 20% of the global HDD market, demand for use in such applications as notebook PCs, digital music players, digital cameras, cellular phones and car navigation systems is rising rapidly. The HMF-type FDB unit, developed in collaboration with Hitachi Powdered Metals, has positioned us to enter the market for FDB spindle motors for 2.5-inch or smaller HDDs. Delivering outstanding performance and cost-competitiveness, this unit uses sintered metal for the bearing and a multiple-lobed shape for the inner surface of the bearing to generate hydrodynamic force in the radial direction, which makes it highly appropriate for use in compact and thin motors. Proprietary precision sizing technologies facilitate the simultaneous forming of radial and thrust bearings, significantly reducing production costs.

### Structure of HMF-Type FDB Unit

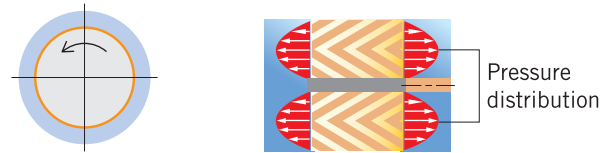


## Types of FDBs

### ● Herringbone-Groove FDB (Conventional FDB)

FDBs with herringbone grooves on the inner surface of the sleeve are commonly used in spindle motors for HDDs. A thin layer of oil is injected between the shaft and sleeve. The rotating shaft causes the oil to collect in the herringbone grooves, triggering a pumping action that generates hydrodynamic force that ensures the rotational accuracy of the shaft is maintained.

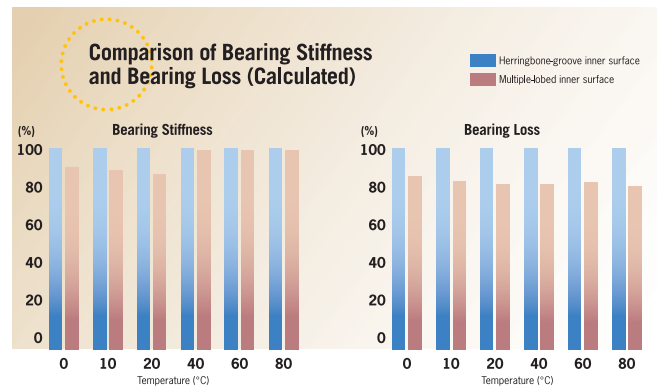
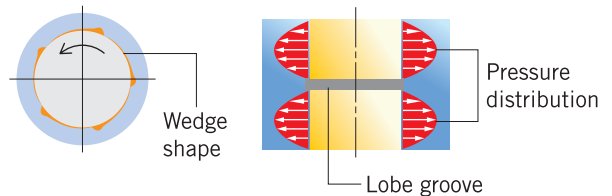
Herringbone-groove inner surface



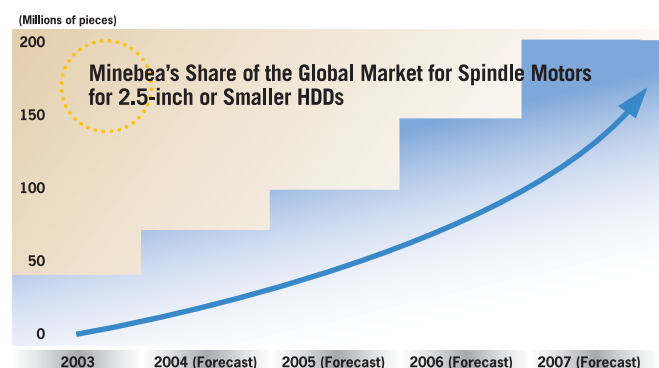
### ● Multiple-Lobed FDB (HMF-Type FDB)

FDBs featuring an inner surface with three lobes have been used to date in such applications as motors for laser scanners and spindle motors for CD-ROM drives. The HMF-type FDB was developed specially for use in spindle motors for HDDs by introducing a number of key technical improvements. Key among these is the use of five lobes instead of three. The wedge action of the oil in the bearing clearance generates hydrodynamic force that ensures the rotational accuracy of the shaft is maintained.

Multiple-lobed inner surface



Bearing stiffness and bearing loss are shown as percentages. As these graphs indicate, while bearing stiffness varies little between FDBs with multiple-lobed inner surfaces and those with herringbone-groove inner surfaces at all temperatures, bearing loss is close to 20% less for FDBs with multiple-lobed inner surfaces.



Source: Techno Systems Research Co., Ltd.



# ENSURING MARKET LEADERSHIP

Newly established joint venture Minebea–Matsushita Motor Corporation brings together the superior manufacturing and development capabilities and highly competitive product lineups of Minebea and MEI in the area of motors for information equipment.

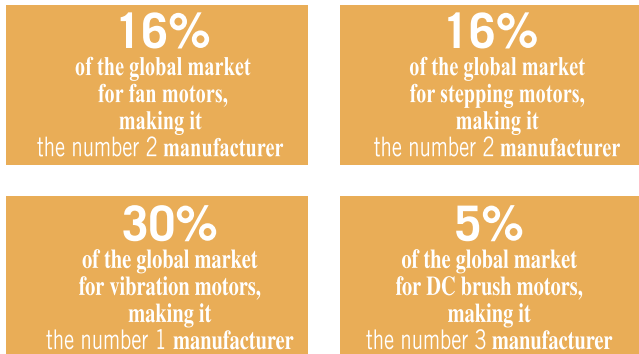
## Other Precision Small Motors

In April 2004, we established Minebea–Matsushita Motor Corporation, a precision small motor manufacturing joint venture with MEI that is the world’s second-ranked manufacturer of fan, stepping, DC brush and vibration motors in revenue terms. The objectives of the joint venture are to expand and enhance the product range of both parent companies—e.g., it has enabled us to add vibration motors to our lineup—as well as reinforce product development capabilities, quality and cost competitiveness. To these ends, the company will work to maximize the considerable synergies generated by MEI’s development prowess and extensive product range and our ultraprecision machining and mass production technologies to generate increased corporate value.

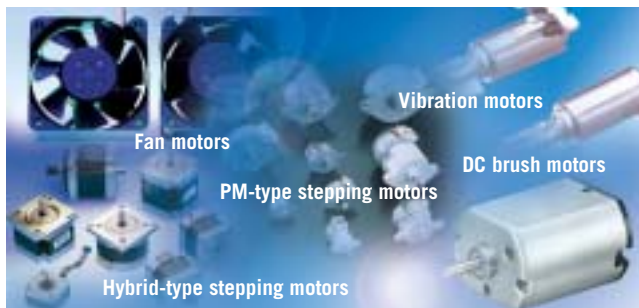
### Key Global Markets

Competition in the market for motors for information equipment has intensified in recent years, reflecting the oligopoly of Japanese manufacturers and the entry of an increasing number of manufacturers from China. In contrast, growth markets, including those for motors for plasma and LCD televisions and other digital household electrical appliances, PCs, cellular phones, handheld information terminals and game machines, are expected to see a sharp increase in demand.

Minebea–Matsushita Motor commands leading shares of key global markets.



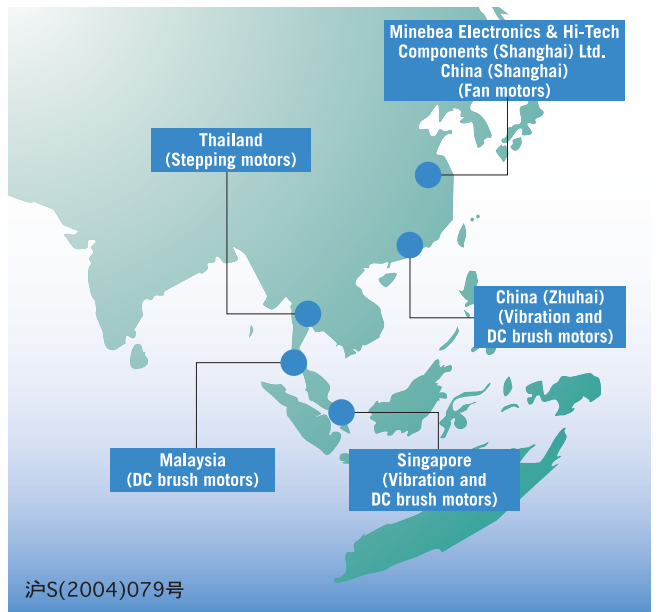
(Market shares are Minebea estimates and are in terms of units shipped.)



### Minebea–Matsushita Motor Corporation

|                                   |   |
|-----------------------------------|---|
| Start of operations:              | April 1, 2004   |
| Head office:                      | Meguro-ku, Tokyo, Japan   |
| Capital:                          | ¥10.0 billion   |
| Principal shareholders:           | Minebea Co., Ltd. (60%)<br>Matsushita Electric Industrial Co., Ltd. (40%) |
| Number of employees:              | 9,803<br>(including 275 in Japan)   |
| Net sales target for fiscal 2005: | ¥72.5 billion   |

### Optimized Production Sites



### Minebea–Matsushita Motor Product Lineup

| Product Category        | Markets  | Product Examples   |  |
|-------------------------|--|--|--|
| <b>Fan motors</b>       | PCs, household electrical appliances, AV equipment and others                | <b>DC axial fan motors</b><br>Newly designed fan blades and optimized motor engineering deliver improved airflow and air pressure<br>Lineup includes products compatible with ball bearings and high-performance sleeve bearings |  |
| <b>Stepping motors</b>  | Optical media equipment, OA equipment, digital cameras and others            | <b>Stepping motors with lead screws</b><br>Option of mold screws or metal screws to suit application<br>Lineup includes a new product that delivers outstanding torque and high stopping precision                               |  |
| <b>DC brush motors</b>  | AV media equipment, OA equipment, automotive electrical equipment and others | <b>DC brush motors</b><br>Lineup includes compact and thin motors for a variety of applications<br>Lineup includes an expanded range of motors for automotive applications   |  |
| <b>Vibration motors</b> | Cellular phones and others   | <b>Vibration motors</b><br>Product development is focused on maximizing features and minimizing costs<br>Small diameter, high-density wired motors deliver higher output   |  |