Minebea's Core Competencies

Ultraprecision Machining Technologies

Miniature and Small-Sized Ball Bearings: The Origin of Minebea's Ultraprecision Machining Technologies

The raceway roundness of the inner and outer rings for ultraprecision ball bearings manufactured by Minebea for use in applications requiring high precision, such as VCR cylinders and pivot assemblies for HDDs, is less than 0.05 micron. One micron is

1/1,000th of one millimeter—a particle of cigarette smoke is between 0.01 mm and 1.0 micron. Minebea's ability to mass produce ultraprecision machined products is the root of its competitive advantage.

An approach to production that ensures consistently superiorquality products from Minebea's 10 mass production bases worldwide

Snap Rings

Snap rings are C-shaped steel wires used to affix metal shields to outer rings.

Shields

Shields are fitted onto outer rings to prevent foreign matter and dirt from penetrating and lubricants from escap-ing. Materials commonly used to manufacture shields include metal.

Retainers

Retainers are used to separate the balls housed between the inner and outer rings and keep them in place within the raceway. Retainers are usually made of metal or resin

Inner Rings

The inner ring has a raceway on the outside in which the balls roll. Inner rings are made from chrome or stain-

Balls

Balls—usually between five and 13, although the tive and 13, although the number varies depend-ing on the type and size of bearing—are housed between the inner and outer rings. The most prevalent materials are chrome and stainless steel, with ceramics also popular.



The outer ring of a ball bearing has a raceway on the inside, in which the balls roll, and grooves on the top and bottom which hold protective shields. Outer rings are made from the same materials

Outer Rings

The outer ring of a ball





Cold forging

Ultraprecision machining technologies and mass production of superiorquality products

The level of precision in each ball bearing production process is an essential factor in determining the quality of the finished product. Minebea conducts all processes in-house, as well as manufactures the dies, jigs, tools and production and assembly equipment used therein. This ensures consistently superior-quality products from Minebea's 10 mass production bases worldwide.



Vertically Integrated Manufacturing System

Minebea's vertically integrated manufacturing system maximizes its ultraprecision machining technologies

The level of precision in each production process is an essential factor in determining the quality of the finished product. Minebea's vertically integrated manufacturing system enables it to conduct all

processes in-house—design and development; manufacture and maintenance of dies; production of pressed, plastic-injection molded, diecast and machined parts and ferrites; and final assembly. This system facilitates mass production of Minebea's ultraprecision components.

Vertically Integrated Manufacturing System





Production of dies, jigs and tools

• Die:

Minebea designs and manufactures its own dies, facilitating in-house production of pressed, plastic-injection molded and diecast parts. Minebea also produces its own jigs and tools, enabling it to ensure dies are serviced and maintained to its highly exacting standards.



Development of materials

Development of mass production technologies

Development of dies, jigs and tools

Development of maintenance technologies



Development, design, analysis and quality control

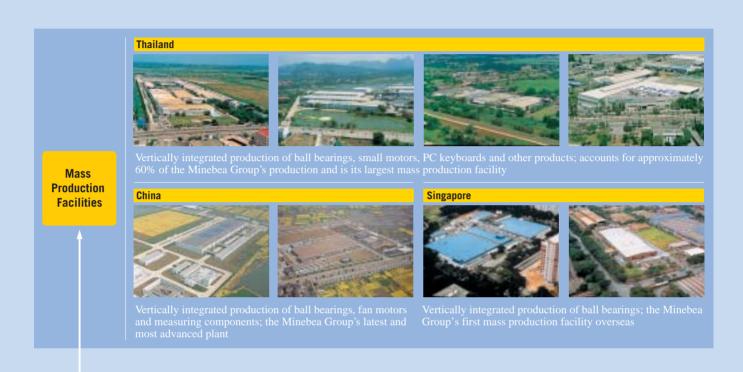
Development

PMDM in Germany are in charge of product design and development. As well, R&D centers located within Minebea's mass production bases in Thailand and Singapore conduct chemical analysis, cleanliness evaluation and environmental testing of products.

Mass Production Technologies

Minebea's vertically integrated manufacturing system facilitates the use of its mass production technologies

Responding swiftly and effectively to the increasingly diverse needs of customers requires unparalleled superiority in terms of supply capabilities and manufacturing costs. All of Minebea's mass production facilities worldwide operate under the same vertically integrated manufacturing system. Productive, organic links between facilities—especially those in Thailand, China and Singapore, which account for approximately 80% of the Minebea Group's production—the parent plants in Japan and global R&D bases ensure the effective integration of Minebea's vertically integrated manufacturing system and mass production technologies.







Analysis of HDD-related and other products

Motor Development Technology Center (Germany)



Design and development or small motors

Technical Center (U.S.A)



Quality evaluation and testing of ball bearings and other components for automotive applications

Electronics Engineering Center Europe (Germany)



Development of electronics technologies and related products





