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• Scope
• Capacity
• Lead Time
• Prices
Scope
Study Scope

- This study assesses the supply market for large bore bearings.
- The antifriction large bore bearing family includes multi-row tapered and cylindrical roller bearings, which are critical in steel and aluminum rolling mills.

Bearing Families

- Antifriction
- Friction
  - Ball
  - Roller
    - Spherical
    - Tapered
    - Cylindrical
    - Needle

Multi-Row Roller Bearings
- Tapered
- Cylindrical
What are the parts of an Antifriction Bearing?

- Outer race, ring or cup
- Inner race, ring or cone
- Rolling elements
- Cage (Retainer) (Optional)
What is Large Bore? How to Measure Antifriction Bearings

- **Bore**: the inside diameter of the bearings
- **Large bore**: more than 10 centimeters (about 4 inches)

Source: efunda
Types of Large-Bore Antifriction Bearings

- Large-Bore Ball Bearing
- Large-Bore Tapered Roller Bearing
- Large-Bore Cylindrical Roller Bearing
- Large-Bore Spherical Roller Bearing
- Large-Bore Needle Roller Bearing
Large-bore ball bearings

- **Distinguishing characteristics**
  - Point contact
    - Highest speed bearings
    - Poor static load ability
  - Not adjustable
- **Applications**
  - Electric motors
  - Conveyor rollers
  - Light duty gear boxes
  - Small vehicles
Tapered Roller Bearings

- **Distinguishing characteristics**
  - Line contact – high load carrying
  - Radial + axial loads
  - Wide range of speeds

- **Applications**
  - Vehicles
  - Power systems
  - Extra precision applications
Cylindrical Roller Bearings

- **Distinguishing characteristics**
  - Line contact enables high radial loads
  - Low axial load

- **Applications**
  - Rolling mills
  - Electric motors: medium to heavy duty
Spherical Roller Bearings

- **Distinguishing characteristics**
  - Good for heavy radial loads
  - Poor for thrust load
  - Skew under axial load

- **Applications**
  - Fabricated housings
  - Windmills
  - Rolling mills
  - Paper mills
  - Pillow blocks
  - Large gear boxes
Needle Roller Bearings

- **Distinguishing characteristics**
  - Thin cross section
  - Accept large shaft
  - Good stiffness/rigidity
  - Light duty bearings
  - Limited axial loads
  - Cage guides rollers

- **Applications**
  - Gear boxes
  - Reduction units
Supply Market Highlights
Lead time and prices will increase; capacity utilization will get worse before easing

- Order lead time will increase by nearly 25% for next two years, but the rate of increase will slow down after 2010.
  - Most leading manufacture’s production is fully booked until 2009-2010.
- Prices will continue to grow briskly (by 20% by 2012).
  - Premium grade metal, major material and labor costs increase.
  - Strong global demand vs. limited supply
  - Oligopoly market: the top five suppliers occupy 86% of total market share
- Capacity utilization will slightly increase in the next two years, but will decrease from 2010 to 2012 as suppliers’ backlog starts to clear.
  - Current capacity is exhausting to an over 100% level.
  - The backlog will start getting cleared from 2010.
  - Overall capacity utilization will remain at a very high level through 2014.

<table>
<thead>
<tr>
<th>Key Indicators</th>
<th>2008-2010</th>
<th>2010-2012</th>
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<tbody>
<tr>
<td>Order Lead Time</td>
<td>▲ 24.1%</td>
<td>▲ 7.2%</td>
</tr>
<tr>
<td>Prices</td>
<td>▲ 25.6%</td>
<td>▲ 20.4%</td>
</tr>
<tr>
<td>Capacity Utilization</td>
<td>▲ 2.6%</td>
<td>▼ -4.3%</td>
</tr>
</tbody>
</table>

Source: Boston Logistics analysis
Capacity
Bearing suppliers are adding capacity, but it can’t come fast enough

• Major manufacturers have increased their capital expenditure in large bore bearing manufacture, but the total investment has been modest.
  • They are uncertain of the long term market growth.
    • Current strong demand appeared 3-4 years ago.
    • They are uncertain how long today’s strong market demand can last. Large bore bearings can last up to 30 years, depending on maintenance and applications, and a slow-down of capital expenditure in heavy industry can greatly reduce the demand for large bore bearings in future years.
  • They have had difficulty obtaining machinery and equipment.
• Most facilities will begin production in 2008 and 2009, but most product line’s whole year production has been fully booked.
• Capacity expansion is not enough to cater for the strong demand.
Bearing suppliers are adding capacity, but it can’t come fast enough (cont’d)

Demand vs. Capacity for Large Bore Bearing (All Types)

Source: Boston Logistics analysis
Schaeffler, SKF, Timken, and NSK are adding capacity

Capacity Additions of Leading Manufacturers for General Large Bore Bearings

- Schaeffler established Bearings Manufacturing Plant in Yinchuan. Construction of this plant started in April, 2008, with an $115 million in investment. The plant will mainly manufacture medium- and large-sized bearings, which is widely used in wind power, iron and steel, cement, paper making and mining equipment.

- SKF also made significant capacity investment in existing manufacturing. Its capacity growth rate for large size bearing manufacture was around 20% in the recent few years.
  - SKF announced that it decided to invest $66M in building a new manufacturing plant in India. The new plant, scheduled to begin production in 2008, will manufacture large roller bearings for the mining, steel, heavy vehicle and wind power industries.
  - SKF decided to invest in a new large size bearing factory in Gujarat, India. First production is expected by the first quarter 2009.

- Timken open its $25 million industrial bearing manufacturing plant in Chennai, India, in April 2008. The plant will make 8-12 inch taper roller bearings. Its initial capacity will be 310,000 units, and will be increased to 420,000 units per year by April 2009. But it’s whole year production has already been sold out.

- NSK opened its new industrial machinery bearing plant in Fujisawa, Japan in Feb. 2008. The manufacturing volume is expected to increase to $775 million. The bearings will be applied in steel equipment, machine tools, construction equipment, aircraft, robots, and wind power generators.
NTN, Timken, and JTEKT and adding specialized wind turbine bearing capacity

Specialized Capacity Additions of Leading Manufacturers for Wind Turbine Bearings

- NTN Corp. will start producing ultra-large bearings for wind turbines, having earmarked about $75 million to bring a factory in Ishikawa online in fiscal 2009 that will specialize in making bearings over 3 meters in diameter. The firm targets about $68 million in sales in fiscal year 2012, mainly to domestic wind turbine manufacturers.
- Timken will set up a joint venture plant in Hunan, China, with an outlay of $39 million to make ultra-large-bore bearings for windmills.
- JTEKT Corporation begun mass-production of large-size non-conductive ceramic bearings for use in windmill power at the end of 2007. JTEKT aimed to achieve sales of $24 millions for these bearings in 2010.
Capacity utilization is at a dramatically high level, and will slightly decrease later as new capacity comes on-stream

- China and India’s economic growth will substantially increase demand.
  - Capacity utilization over 100%.
  - Most of 2008-2010 production has been fully booked. Major manufacturers’, new orders from strong demand can increase capacity utilization in 2009 and 2010.
  - The leading suppliers have already demonstrated a willingness to take the risk to add capacity. This trend is likely to continue, which will ease capacity utilization between 2010 and 2014.

- Capacity is very limited
  - Limited numbers of suppliers, since the technical design and proprietary engineering of production processes cannot easily be replicated
  - Difficulties in acquiring raw materials and manufacturing machinery
Capacity utilization is at a dramatically high level… (cont’d)

Source: Boston Logistics analysis
Tapered roller bearings have the highest capacity utilization

- Tapered roller bearings have the highest capacity utilization rate
  - Strong demand due to its wide application in the industrial sector
- Limited strong supplier base. Timken invented Tapered Roller Bearings and it is the company’s special strength.
- Bearing manufacturers and distributors who responded to Boston Logistics’ capacity survey said they expect capacity utilization to ease after 2010.

**Capacity Utilization**

![Graph showing capacity utilization over years for different types of bearings](attachment:image)

Source: Boston Logistics analysis
Overall, available capacity will be unable to catch up with growing demand, leaving a shortage indefinitely

- 2009 for ball bearings
- 2012 for spherical roller bearings

Source: Boston Logistics analysis
Lead Time
Lead time increases as the bore size increases in the general large bore bearing market

- Lead time increases as the bore size increases, according to buyers, distributors, and industry experts.
  - Small size market (10cm-40cm)
  - Medium size market (40cm-60cm)
  - Large size market (>60cm)

**Order Lead Time by Size**

- Source: Boston Logistics analysis
Order lead times will remain uncomfortably high for at least the next three years

- Most leading manufacturers’ are adding capacity to meet the strong market demand. However, most of the facilities, even those that are still under construction, are fully booked through 2009-2010.

**Order Lead Time by Region**

![Order Lead Time by Region](image)

Source: Boston Logistics analysis

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Asia’s lead time is the shortest, but will increase rapidly as demand increases

- Asian manufacturers’ lead time is the shortest.
  - Japanese manufacturers generally have a shorter lead time than US and European manufacturers.
  - China has about 2,000 bearing manufacturers, some of which can also produce large bore bearings to certain size. Their lead times are from 6-9 months for large bore bearings.

- This is due to a large amount of local consumption.
  - China’s policy of encouraging the usage of national brands. According to interview, some large state owned steel plants are using national brand bearings now.
  - Highly fragmented user market in China, most users are not large and profitable enough to afford US and European brand
  - Leading manufacturers’ lead time is worst in Asia, due to high demand and insufficient Asian facilities

- In the future, Asia will buy more from global manufacturers.
  - User industry restructure (reducing number of firms, increasing size of each firm) will increase the mix of expensive and high quality leading brands.
  - Leading manufacturers’ Asian lead times will decrease due to the increase investment in Asian plants; however, total lead time will increase with the higher market weight on leading brands.
Competition will reduce European lead time, America will have the worst lead time problem

- America has the longest lead time now
  - Over-reliance on Timken. Within the top five suppliers, Timken is the only US-based company.
  - Timken has a unique strength in producing tapered roller bearings.
  - Current strong demand over occupies Timken’s product line.
- Europe’s lead time is better than America
  - Competition between SKF and Schaeffler encourages production process innovation and reduction of lead time
In small size market, Asia’s lead time is the shortest, but it will increase very fast

- The smaller the size of bearings in large bore bearing market, the more capacity that Asian local manufacturers have.
- Asian clients are willing to and have confidence in consuming local brand bearing for small size

![Order Lead Time - 10-40cm](image)

Source: Boston Logistics analysis
In the medium size market, Asia’s lead time is slightly longer than the other regions

- In medium size bearings, Asia has the most severe lead time problem.
  - Asia manufacturers’ production capacity for larger bore bearings is minimal.
  - Users are more inclined to source from leading manufacturers.

Order Lead Time - 40-60cm

Source: Boston Logistics analysis
Asia’s lead time is much worse than other regions in the large size market

- The lead time difference between Asia and America or EMEA is the largest.
  - Few facilities for manufacturing large bore bearings in Asia now.
  - Leading manufactures are increasing their Asian facilities, but key components are still mainly manufactured in their home regions.

Order Lead Time – >600mm

Source: Boston Logistics analysis
Overall lead time will slightly increase in next 2 years, and will slightly decrease after 2010

- Lead time will increase in the next two years.
  - Most leading manufacturers’ productions are fully booked through 2009-2010.
  - Adding capacity can not satisfy the future demand.
- Asian lead time will increase rapidly, driven by growing demand.

![Relative Regional Lead Time](image)

Source: Boston Logistics analysis
Prices
Labor cost represents the largest proportion of total cost

- Labor and metal account for the largest portions of total cost.
  - High professional labor cost due to non-standard bearing designs and special manufacturing techniques
  - High production labor cost since the majority of plants are in the US and Europe
  - Use of premium grade metals to meet the heat and chemical requirements

![Large Bore Bearing Cost Structure](image)

Source: Boston Logistics analysis
Premium grade metal prices will increase due to strong demand from bearing manufacturers, and a limited number of suppliers

- The major metals used in mill roll bearings are case carburized nickel and chrome steel.
  - Bearing races have stringent clean-ness requirements; only a few manufacturers are able to achieve these extremely tight specifications.
  - Rolling elements: particularly high requirements since they endure great stress, wear, and force.
- Regular chrome steel (one of the major metals used to manufacture bearings) prices are forecast to decrease:
  - By 20% in 2009
  - By roughly 10% per year thereafter (through 2012)
- However, large bore bearing prices will continue to rise:
  - Bearing manufacturers use premium grade chrome steel rather than the regular one. There are only a few steel suppliers being able to meet their requirements.
  - The general price forecast for chrome steel does not include the likelihood that the bearing manufacturers will use the high chrome steel price to take additional profits.
Large bore bearing consumers will bear both the rising material costs and the profit margin passed on by manufacturers

- Manufacturers will pass on rising material costs to bearing customers due to growing demand, and since the large bore bearing market is oligopolistic.
- This means 20%-30% profit margin for large bore bearings at leading manufacturers.
  - Timken, the market leader, has had extraordinary success recently. For example, financial results at its Bearings and Power Transmission group – (industrial group process industries segment, which includes bearings and lubricants), reported these earnings on April 30th:
    - Q1 sales increased by 25% and EBIT increased by 121%.
    - Profit margin is 19%
    - Timken’s Asian distributor mentioned that it increased its price by approximately 20% last year in China.
  - SKF’s annual conference call also revealed that their prices increased about 4%-8% in Q1
  - Strong volume, increased capacity for large-bore products and pricing are the major drivers of the strong performance.
Overall large bore bearing prices will continue to rise, but the rate of price increase will decrease over time

- Imbalanced demand and supply
- Soaring cost for premium grade metals
  - Dramatic decrease of overall metal price index forecasted\(^1\)
  - Scarcity and high demand will drive up the price increase of premium grade metals
- Increasing labor cost and other material cost

**Overall Price Projection Chart**

Source: Boston Logistics analysis
Prices will rise even more for high quality and customized large bore bearings

- Higher price growth rate for high-tech and customized bearings
- Gaps among different types of bearings
  - Tapered, cylindrical and spherical roller bearings have critical applications in industrial machinery.
  - A high percentage of these are customized and have special load, heat, and chemical requirements.

High Quality and Customized Bearing Price Projection Chart

Source: Boston Logistics analysis
The price of low quality and standard large bore bearings will increase but at a comparatively low rate

- Basic metals prices will fall
- Cost-efficient substitution of capital for labor on production lines
- Low proportion of professional and engineering labor
- Fewer differences between bearing types

Low Quality and Standard Bearing Price Projection Chart

Source: Boston Logistics analysis
Global Supply Chain Economists

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