High-performance Product Series for Steel Production/Rolling Equipment

CAT.NO. BA010EN-OCH
JTEKT...
Utilizing comprehensive strengths to manufacture products that respond to steel production equipment needs and support stable operations.

Steel production equipment are operated in extremely harsh environments, where machinery is exposed to high temperatures, water and mill scale. The bearings used in this equipment must continually withstand heavy loads and high-speed rotation. These conditions test not only each bearing, but also the overall strengths of peripheral parts and the integration thereof. As a general manufacturer of bearings, drive shafts and oil seals, JTEKT is a full-service provider for a wide range of products.

JHS (JTEKT Hyper Strong) is a product series incorporating designs to meet the requirements of various industrial machinery. In order to achieve high-durability of ever-evolving steel production equipment, JHS is evolving daily together with JTEKT customers and provides total support for bearings, drive shafts and oil seals.

JHS Series

**Bearings**

- RZ-type Spherical Roller Bearings (CAT.NO.B2023E)
- Bearings for multi-roll mill backup rolls (CAT.NO.B2012E)
  - Case-hardened steel is used on the inner ring to improve rolling life in low-viscosity lubrication.
- Bearings for roll necks (CAT.NO.B2013E)
  - Standard
    - By using our newly developed case-hardening steel in the bearing rings, we have improved the rolling life, toughness, and corrosion resistance.
  - Premium
    - A special heat treatment is applied to the newly developed hardened steel to further improve rolling life and corrosion resistance.
- Bearings for sintering machine pallet car

**Drive shafts**

- Drive shaft for roll drives (CAT.NO.B2021E)
- Hyper coupling (CAT.NO.B1010E)

We will continue our efforts to enrich the JHS series.
History of JTEKT products for steel production equipment

**Introduction to products for steel production equipment**

- **Bearings for sintering machine pallet car**
  - Sprocket
  - Wheel bearings
  - Intermediate seal
  - Pressure roller bearings
  - Wheel bearings
  - Sealed type double row cylindrical roller bearings

**Products for continuous casting machines**
- Spherical roller bearings (fixed side)
- Cylindrical roller bearing with aligning ring (free side)
- Oil/air lubrication system CAT.NO.B1019E

**Large seal (MS)**
- CAT.NO.B2025E

**Sealed type double row tapered roller bearings**

**Bearings for converter**
- Large seal (MS)
- Large spherical roller bearings

**Bearings for swing tower support**
- Slewing rim bearings

**Continuous casting machines**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>First delivery of drive shafts for hot-strip mills</td>
</tr>
<tr>
<td>1963</td>
<td>Developed a new material for steel-making bearings</td>
</tr>
<tr>
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<td>Improved new material for steel-making bearings</td>
</tr>
<tr>
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<td>Developed new material for steel-making bearings</td>
</tr>
<tr>
<td>1967</td>
<td>Improved new material for steel-making bearings</td>
</tr>
<tr>
<td>1968</td>
<td>First delivery of drive shafts for cold-strip mills</td>
</tr>
<tr>
<td>1969</td>
<td>Developed new material for steel-making bearings</td>
</tr>
</tbody>
</table>

**Steel manufacturer trends**
- Mass production; increase productivity;
- Development of high-performance bearings (longer service life, high-speed compatibility)
- Development of bearings/drive shafts compatible with shape-controlled rolling mills

**World 1st**
- First delivery of drive shafts for cold-strip mills
- First delivery of drive shafts for hot-strip mills
- First delivery of drive shafts for wire-rod mills
- First delivery of drive shafts for 1,680m/min cold-strip mill backup rolls

**Unique to Japan**
- Developed a new material for steel-making bearings |
- Developed new material for steel-making bearings |
- Developed new material for steel-making bearings |
- Developed new material for steel-making bearings |
- Developed new material for steel-making bearings |

**Large Bearing Technical Development Center**
- for new Sendzimir mill producing magnetic steel sheets
- for new Sendzimir mill producing magnetic steel sheets

**Developed**
- Pressure roller bearings
- Wheel bearings
- Intermediate seal
- Pressure roller bearings (several types)
- Wheel bearings (several types)

**Products for continuous casting machines**
- Spherical roller bearings (fixed side)
- Cylindrical roller bearing with aligning ring (free side)
- Oil/air lubrication system CAT.NO.B1019E

**Large seal (MS)**
- CAT.NO.B2025E

**Sealed type double row tapered roller bearings**

**Bearings for converter**
- Large seal (MS)
- Large spherical roller bearings

**Bearings for swing tower support**
- Slewing rim bearings CAT.NO.B2025E

**Continuous casting machines**

**Ironmaking**
- Sealed type double row tapered roller bearings

**Steelmaking**
- Axle bearings
- Bearings for converter
- Bearings for swing tower support
Offering long-life bearings for systems, we manufacture bearings for continuous casting equipment, bearing housing units, oil/air lubrication devices, oil seals and other products.

### Required performance and issues
- Measures for high contact stress/roll deflection under heavy load
- Measures for roll elongation under high temperature
- Measures for corrosion / lubrication failure due to the infiltration of steam (water)
- Measures for surface roughness / indentations due to the intrusion of mill scale

### 1. RZ-type Spherical Roller Bearings
- Designed for maximum load rating; internal design reduces contact stress
- Designed to stabilize roll position
- Resistant to high temperature for use in various environments

### 2. Cylindrical roller bearings with self-aligning ring
- Smooth absorption of roll movement in the axial direction
- Absorption of roll deflection and misalignment
- Spherical roller bearings
- Cylindrical roller bearings with self-aligning ring

### 3. HSC bearing units with half round outer ring
- Heavy load type using a compact sealing structure
- Water-cooled structure with high cooling efficiency

### Oil seals
- Superior sealing performance
- Lip contact stress dispersed
- Materials: hydrogenated nitrile rubber (HNBR) and fluoro rubber (FKM)
Bearsings for roll necks

Bearsings used to steel mill roll necks must cope with heavy loads and high-speed rotation in severe environments. In order to respond to these needs, JTEKT works daily to resolve related issues such as developing bearing materials and improving bearing seal performance.

Required performance and issues

- Enhancing durability and service life under heavy load / high-speed rotation
- Preventing the intrusion of water / mill scale
- Improvement of durability and service life to withstand heavy loads and high-speed rotations

Long-life / high corrosion-resistant carburized steel

- Long-life and high corrosion-resistant steel with optimized content of chromium and molybdenum
- Original carburizing heat treatment improves corrosion-resistance and wear-resistance qualities

Results of evaluations of bearings in an environment prone to rust (filled with water-mixed grease) Results of evaluations of bearings in clean oil

<table>
<thead>
<tr>
<th>Bearing Type</th>
<th>Test Period</th>
<th>Relative Humidity</th>
<th>Test Temperature</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional product</td>
<td>96 hours</td>
<td>95%</td>
<td>49°C ± 1°C</td>
<td>Humidity cabinet</td>
</tr>
<tr>
<td>Developed, carburized product</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JHS520 (premium)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developed, special heat treated product</td>
<td></td>
<td></td>
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</tbody>
</table>

- Standard: By using our newly developed case-hardening steel in the bearing rings, we greatly improved the rolling life, toughness, and corrosion resistance compared to our conventional products.
- Premium: By using our newly developed case-hardening steel and by applying special heat treatments, we have produced the premium specification with further improved rolling fatigue life and corrosion resistance.

Technology for minimizing temperature increases

- On the basis of the EHL theory, improvement of the lubrication of the rolling part between the roller large end face and the face of cone back face rib
- Optimization of the shapes and suppression of temperature rising for the rolling part between the roller large end face and the face of cone back face rib

Chock seals

- Original design realizes an optimal lip structure that demonstrates excellent sealing performance

For more information, please refer to catalog No. B2011E and No.B2020E.
**Bearing for multi-roll mill backup rolls**

We provide high-precision bearings with excellent durability based on long years of experience and achievements.

**Required performance and issues**

- Seal structure that maintains a favorable lubricated state
- Longer inner ring rolling fatigue service life
- Improving outer ring durability
- Improving outer ring rotational accuracy
- Improving ease of outer ring regrinding work

**Seal structure that maintains a favorable lubricated state**

- Longer inner ring rolling fatigue service life
- Improving outer ring durability
- Improving outer ring rotational accuracy
- Improving ease of outer ring regrinding work

**Bearings for oil mist lubrication**

- Improved bearing service life (2-fold/4-fold compared to the conventional type)
- High sealing performance
- Space-saving size for simple installation / removal

**Features**

- Use of retaining ring simplifies oil-seal insertion / removal
- Improving ease of outer ring regrinding work
- Seal plate

**Bearings-regrinding Jigs**

- Measurement for Bearing Section Height

**Features**

- Premium specifications
- Case-hardened steel is used for the inner ring to suppress the loss of rolling service life under low-viscosity lubrication. For oil-seal materials, fluoro rubber is used, improving sealing performance and realizing an increase in bearing service life of approximately four-fold compared to the conventional type.

**Optimized load distribution**

- Contributes to rolled coil quality / precision

**Core hardening**

- Surface-hardened layer improved approximately 3-fold

**Surface-hardened layer**

*Hardened steel*:

- Hardened steel
- Carbureted steel
- Approx. 3-fold

**Measurement for Bearing Section Height**

**Features**

- High rigidity, possible to make extremely accurate measurements
- Possible to measure outer ring rotational accuracy
- Adoption of mandrel shape realizes easy bearing insertion / removal

**Bearings for forced oil lubrication**

- Outer ring with both high rigidity and durability realized
- High resistance to fatigue realized owing to superior materials composition
- Design optimized to match surrounding structure

**Features**

- Use of retaining ring simplifies oil-seal insertion / removal
- Improving ease of outer ring regrinding work

**Features**

- Case-hardened steel is used for the inner ring to suppress the loss of rolling service life under low-viscosity lubrication. For oil-seal materials, fluoro rubber is used, improving sealing performance and realizing an increase in bearing service life of approximately four-fold compared to the conventional type.

**Premium specifications**

- Bearing radial runout minimized
- Installation / removal work simplified
- Reproduction of radial runout accuracy equivalent to that when product is new

**Features**

- High rigidity, possible to make extremely accurate measurements
- Possible to measure outer ring rotational accuracy
- Adoption of mandrel shape realizes easy bearing insertion / removal

**Surrounding environment**

- Developing environment
- Carburized steel
- Carburized steel
- Developed steel

**Hardness (HRC)**

- Developed steel
- Carburized steel
- Case-hardened steel
- Approx. 3-fold

**Example of hardness distribution**

- Typical hardness distribution of core hardening outer ring

**For more information, please refer to catalog No. B2012E.**
We provide high-strength, long-life drive shafts that have good torque transfer efficiency under severe environments.

Required performance and issues

- Stronger, longer-life drive shafts capable of handling increased rolling torque
- Stronger, longer-life drive shafts for use with smaller rolling-mill roll diameters
- Protecting rolling-mill drive systems from excessive torque
- Ability to randomly adjustment the roll rotational phase

Example of block-type configuration

Drive shafts for rolling mills

1. Application of different diameter rollers for cross & bearing

   - Roller diameter at the end of the cross reduced slightly
   - Uniform multi-row roller load

2. Ball burnishing on cross shaft

   - Increasing of residual compressive stress at subsurface
   - Increasing of surface hardness
   - Fine surface roughness (Removal protrusion)

3. Thermal spraying coat of tungsten carbide (WC) on bearing cup key

   - Restraining of clearance between key and key way due to corrosion wear
   - Alleviating bending stress of bolt
   - Minimizing heavy load at cross end
   - Longer service life

4. Application of form rolling to bearing set Bolt

   - Thread section processing changed from machining to form after heat treatment
   - Fiber flow is formed along the shape of the thread
   - Residual compressive stress at subsurface beneath the bottom radius of the thread increases

The block-type configuration is part of the D/U/T Series; the products of which are the strongest and have the longest service life in the JTEKT line-up. It is used in rolling mills such as Plate mill, Blooming mill and Hot strip mills (roughing/finishing) where conditions are extremely harsh.

For more information, please refer to catalog No. B2021E.
### Improved service life of oil seals and cross bearings

#### Development of a high-sealing oil seal

**Features**
- Improved sealing performance through material change
  - Reduction of permanent elongation under rolling mill water and high temperature (90°C) environment by 50% compared to conventional.

- Improved sealing performance through shape change
  - By changing from side lip seal thrust contact to radial contact, sealing performance relative to axial oscillating motion has improved.
  - Reduced decline in lip tension by 80% compared to conventional.

These changes suppress sudden damage to the cross bearing caused by deterioration in lubricating ability, thus contributing to reduced maintenance costs and improved productivity for customers.

**Operating environment**
- Rolling mill water
- Scale

**Movement of oil seal during operation**
- Rotational oscillating motion
- Axial oscillating motion

**Material change**

**Shape changes**

**Features**
- Improved sealing performance through material change
- Improved sealing performance through shape change

**Shape changes**

- These changes suppress sudden damage to the cross bearing caused by deterioration in lubricating ability, thus contributing to reduced maintenance costs and improved productivity for customers.

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### Hyper coupling (torque limiter)

**Operating principle**
- Device for protecting rolling mill drive system from excessive torque
  - Significantly improved operating precision and durability
  - Easy to set operating torque
  - Significant reduced recovery time after finishing operation

**Features**
- Device enables the rotational phase of rolls to be randomly adjusted when producing screw reinforcing bar and deformed steel bar used for construction.
- Phase can be adjusted almost seamlessly in a short time, improving product accuracy.
- Operation being possible without dismounting the drive shafts.

**Product example**
- Screw reinforcing bar

**Roll phase adjustment device (for bar & rod mill)**

**Features**
- Device enables the rotational phase of rolls to be randomly adjusted when producing screw reinforcing bar and deformed steel bar used for construction.
- Phase can be adjusted almost seamlessly in a short time, improving product accuracy.
- Operation being possible without dismounting the drive shafts.

**Adjustment work process (online work)**
1. Measure misalignment of workpiece
2. Set adjustment angle
3. Loosen the fixing nut
4. Turn the adjusting nut the required amount
5. Tighten the fixing nut

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### Optional mechanisms supporting drive shafts for rolling mill

**Features**
- Hydraulic expansion chamber (oil-pressure charged)
- Hydraulic expansion chamber (oil pressure released)
- Shear valve (shearing)
  - 4 shear valves (with oil pressure retained)
- Phase adjusting nut
- Hyper coupling (torque limiter)
- Optional mechanisms supporting drive shafts for rolling mill
- Roll phase adjustment device (for bar & rod mill)
- Measure misalignment of workpiece
- Set adjustment angle
- Loosen the fixing nut
- Turn the adjusting nut the required amount
- Tighten the fixing nut

**Recovery work process (required time: 30min)**
- Phase alignment
- Shear valve replacement (oil)
- Re-pressurizing hydraulic expansion chamber
**Bearings for sintering machine pallet car**

Sintering machines are used in harsh environments where high temperatures and large amounts of dust are generated. We provide sealed bearings and mill-scale seals capable of withstanding these kinds of environments.

**Intermediate seal**

- Structure combining two parts (1 and 2)
- No damage to peripheral parts
- High sealing performance owing to multilayer lip structure
- Prevents the intrusion of dust

**Pressure roller bearings** (sealed type double row cylindrical roller bearings)

- Optimized outer ring thickness and carburized steel adopted
- Capable of withstanding heavy loads/impact loads
- Sealing structure using special seal
- Prevents the intrusion of dust
- Full roller shape adopted
- High load capacity realized

**Wheel bearings** (sealed type double row tapered roller bearings)

- Integrated seal structure offers both high load capacity and excellent sealing performance
- Can withstand heavy loads and prevents the intrusion of dust

**Required performance and issues**

- Measures for heavy load / shock load
- Preventing intrusion of dust

**Bearings for plate levelers**

We provide plate leveler units to cope with severe usage environments such as heavy loads, rust, and the intrusion of water / foreign matter.

**Bearing units for plate levelers**

- Roll strength and bearing load rating improved as the result of integrating the roll and outer ring structure
- Special stainless steel for rolls developed
- Seal and shield are combined to form a labyrinth structure that has excellent sealing performance

**Required performance and issues**

- Stable operation under heavy load
- High corrosion resistance
- Prevent the intrusion of water / foreign matter

**Bearing units for tension levelers**

We provide optimal tension leveler units that are compatible for high-speed rotation, wet / dry environments and low torque.

**Required performance and issues**

- Low torque
- Tightly sealed structure
- High section height accuracy

**Wet-specification unit**

- Wet-specification unit has an oil seal that forms a tightly sealed structure and also realizes lower torque

**Dry-specification unit**

- Dry-specification unit has a labyrinth seal structure that realizes the lowest possible torque
- Addition of a suitable, uniform corrective force by controlling bearing section height (H) dimensional accuracy

**We provide plate leveler units to cope with severe usage environments such as heavy loads, rust and the intrusion of water / foreign matter.**
JTEKT’s accumulated knowledge and experience helps our customers solve problems. We provide new, high-value-added products and processes for businesses with a global supply system developed to meet those demands.

Regarding large bearings used in the industrial machinery field, there have been many cases in the past where customers evaluate by using actual machines after conducting desk review and basic evaluation. As a result, development took too long due to unforeseen problems that arose. At the Large Size Bearing Technology Development Center which was established and launched operations, evaluation tests in environments close to actual machines are now possible within JTEKT. The accumulated data will be used to raise the accuracy of CAE analysis (simulation analysis) which will result in significant reduction of the product developmental period as well as the development of new, high-value-added products.

Bearing testing equipment for steel production equipment

Our testing equipment is able to evaluate the scattering rolling mill water in high-temperature environments to recreate close to actual conditions. In this way, we can deliver bearings and oil seal components with excellent performance.

Catalog Series for JTEKT Steel Production Equipment Products

Please contact JTEKT to request a catalog or for advice regarding other technical issues or concerns.

JHS Series RZ-type Spherical Roller Bearings
CAT.NO.B2023E

Roll neck bearings for rolling mill
CAT.NO.B2013E

Cylindrical Roller Bearings for Multi-roll Mill Backup Rolls
CAT.NO.B2012E

Oil Seal For Steel Production Equipment
CAT.NO.B1020E

Drive shafts for steel production/industrial equipment
CAT.NO.B2021E

JHS Series Hyper Coupling
CAT.NO.B1010E
Providing high quality and cutting-edge technology for the world

Manufacturing in Japan enables JTEKT state-of-the-art material and technology to be implemented to JTEKT products, which leads to delivering top quality and excellent performance. Furthermore, JTEKT can contribute high quality and appropriate technical support to customers worldwide through JTEKT global network system.

Our Customers around the World

JTEKT Technologies and Quality from Japan