Cylindrical Roller Bearings for Multi-roll Mill Backup Rolls
JTEKT started producing cylindrical roller bearings for backup rolls for Sendzimir mills in the 1950s and has continued to provide superior products for customers around the world.

As regards to the backup rolls assembling products, which is the Key component of the Sendzimir mill, we concluded a production agreement for licensing with SENDZIMIR JAPAN, LTD. in 1970 and now supply over 100 products for Sendzimir mills around the world.

We support our customer’s operations stability not only with cylindrical roller bearings for backup rolls, but with cylindrical roller thrust bearings for work rolls, bearing-regrinding jigs, measurement of the bearing’s section height with equipment developed at JTEKT and our technical know-how and experience.

JTEKT has a long history of providing high quality products and the experience to offer products with high durability and reliability.
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JTEKT has a long history of providing high quality products and the experience to offer products with high durability and reliability.

Multi-roll mills enable our customers to utilize extremely small diameter work rolls with a choice of 12 or 20 rolls. Thereby, we are now capable of rolling hard materials such as stainless steel sheets and electrical steel sheets as well as rolling ultrathin copper. Cylindrical roller bearings for backup rolls play a significant role in obtaining this high level of efficiency.
Cylindrical roller bearings for multi-roll mill backup rolls

JTEKT has provided Cylindrical roller bearings for backup rolls with high durability and precision, contributing to the utmost performance in multi-roll mills.

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 (P15-16)

Bearing configuration and features

The bearings which are used for multi-roll mill backup rolls are attached to the rolls on 1 shaft and the bearings outer diameter are fit closely to the intermediate roll which rotates while loading the rolling component force. Therefore, the outer ring must be fabricated having sufficient rigidity and fatigue strength as well as high precision. At JTEKT, we assemble the bearings in a specially controlled clean working environment.

- The outer surface of the bearing is manufactured through crowning, which accounts for the contact stress distribution to prevent damage to the intermediate roll due to edge load.
- By ensuring that high precision in both the variation of the bearing’s section heights and high rotation accuracy is achieved for optimum distribution of the bearing loads and supporting the development in rolling precision and the quality of the coils.
- Cored hardening
  - Surface-hardened layer improved approximately 3-fold
    - Outer ring is fabricated by JTEKT original developed steel and cored hardening.
      - [Macroscopic structure]
        - Carburized Steel
        - Developed steel
    - Cored hardening is applied to bearings of over 130mm inner diameter.
      - [Surface-hardened layer]
        - Carburized Steel
        - Developed steel
  - [Macroscopic structure]
    - Uncrowned outside surface
    - Crowned outside surface
    - Typical contact stress distribution of the outer-ring’s outside surface
      (Refer to P16 for the dimensions of the outer ring crowning)
  - Variation of bearing section heights on one shaft ≤ 0.003mm
  - Variation between two adjacent bearings on one shaft ≤ 0.002mm
  - Shaft (backing shaft)
  - Bearing for backup rolls

Advantages

- Service life
- Longer inner ring rolling fatigue service life
- Improving outer ring durability
- Improving outer ring rotational accuracy

Premium specifications

- Long life, highly corrosion-resistant JHS is driving innovations in steel production equipment.
- Long life, highly corrosion-resistant JHS is driving innovations in steel production equipment.
- By adopting newly developed materials and processes for bearing steel, seal materials and other components, we have realized a 2-to-4-fold increase in bearing service life compared to previously used bearings. Continuing from JHS520 for rolling mill roll necks and JHS210 for Sendzimir rolling mill backup rolls, we are steadily expanding the bearing series according to each application. The JHS bearing series offers total support for achieving maximum performance on from JHS520 for rolling mill roll necks and JHS210 for Sendzimir rolling mill backup rolls, we are steadily expanding the bearing series according to each application. The JHS bearing series offers total support for achieving maximum performance

Iron manufacturing and rolling mill lines must operate continuously while maintaining high reliability in severe production environments. Answering these needs through the realization of epoch-making long-life and high corrosion resistance is

* Cored hardening is applied to bearings of over 130mm inner diameter.
Long life, highly corrosion-resistant JHS is driving innovations in steel production equipment. Iron manufacturing and rolling mill lines must operate continuously while maintaining high reliability in severe production environments. Answering these needs through the realization of epoch-making long-life and high corrosion resistance is JTEKT Hyper Strong (JHS). By adopting newly developed materials and processes for bearing steel, seal materials and other components, we have realized a 2-to-4-fold increase in bearing service life compared to previously used bearings. Continuing on from JHS220 for rolling mill roll necks and JHS210 for Sendzimir rolling mill backup rolls, we are steadily expanding the bearing series according to each application. The JHS bearing series offers total support for achieving maximum performance and durability in the ever-evolving field of steel equipment. Please keep your expectations high. We won’t let you down.
Bearing instruction

Here is an illustration of how we disassemble, assemble and inspect the bearings. Please follow this for bearing maintenance.

Bearing for oil mist lubrication

Inner ring disassembling points

Inner ring inspection points

(1) Remove inner rings (both rings)
Shield will be removed with inner rings due to the press-fitting of the inner ring.

[!] Caution
Be careful when handling the shield. Any damage to shield may affect the performance of the bearing’s sealing.

Confirms for no axial scratches on raceway
Confirm no rust
Confirm no discoloration due to temperature raise
Confirm no abrasion on rib face
Confirm that race way has no unbalanced, asymmetrical roller contact marks on both rows.
**Confirm for no axial scratches on raceway**

**Confirm no rust**

**Confirm no discoloration due to temperature rise**

**Confirm no cracking or chipping**

**Confirm no rust**

**Confirm no discoloration due to temperature rise**

**Confirm no cracking or chipping**

**Confirm no slipping scratches or brinelling**

---

(2) Remove snap ring (both pieces)

(3) Remove oil seals (both pieces)

**Caution**

Be careful to not scratch the oil seal when removing the snap ring and oil seal.

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(4) Hold the cage and remove it with the roller (both rows)

**Caution**

Be sure to keep all rollers and other parts separate from other bearing parts and manage each bearing independently.

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**Oil seal disassembling points**

**Oil seal inspection points**

**Roller · Cage disassembling points**

**Roller inspection points**

**Outer ring inspection points**

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**Bearing for oil mist lubrication**

Here is an illustration of how we disassemble, assemble and inspect the bearings. Please follow this for bearing maintenance.

---

**Snap ring (2 pieces)**

**Shield (2 pieces)**

**Oil seal (2 pieces)**

---

**(1) Remove inner rings (both rings)**

**Shield will be removed with inner ring.**

**Caution**

Be careful when handling the shield. Any damage to shield may affect the performance of the bearing’s sealing.

---

**(2) Remove snap ring (both pieces)**

**Caution**

Be careful to not scratch the oil seal when removing the snap ring and oil seal.

---

**(3) Remove oil seals (both pieces)**

**Caution**

Be sure to keep all rollers and other parts separate from other bearing parts and manage each bearing independently.

---

**In case of cleaning the oil seal with cleaning oil, please wipe off the cleaning oil immediately.**

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**Cage (2 pieces)**

**Roller (2 rows)**

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**Outer ring (1 piece)**

**Inner ring (2 pieces)**

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**※ Please use 10-40kPa for oil mist manifold pressure.**

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**Bearing instruction**
Here is an illustration of how we disassemble, assemble and inspect the bearings. Please follow this for bearing maintenance.

Assembling cylindrical roller bearings for backup rolls

(1) Complete cleaning of each part before re-assembling.
(2) Assemble the bearings in the reverse order of disassembling.
(3) Before inserting the inner ring (with shield), supply the initial lubricate oil (mist oil) into the bearing.

【】Caution
・Be careful to insert only appropriate bearing parts. There are no compatible parts with other products.
・During re-assembly, be careful not to contaminate the bearing with any foreign matter. Please handle with care so as not to scratch any surfaces of the bearing.

Bearings for forced oil lubrication

Roller (3 rows)
Outer ring (1 piece)
Cage (2 pieces)
Guide ring (2 pieces)
(Cage’s bore surface side)
Inner ring (1 piece)

【】Caution
・Be careful to insert only appropriate bearing parts. There are no compatible parts with other products.
・During re-assembly, be careful not to contaminate the bearing with any foreign matter. Please handle with care so as not to scratch any surfaces of the bearing.

Inner ring disassembling points
(1) Remove inner ring (1 piece)

Inner ring inspection points
Confirm there are no axial scratches on the raceway
Confirm no discoloration due to temperature rise
Confirm no rust
Confirm that race way has no unbalanced, asymmetrical roller contact mark on 3 rows
(2) Hold the cage and remove it with roller (2 rows and 1 row)

Caution
Be sure to keep all rollers and other parts separate from other bearing parts and manage each bearing independently.

Confirm no cracking or chipping
Confirm no discoloration due to temperature rise
Confirm no rust
Confirm no abrasion

Outer ring inspection points

Confirm no cracking or chipping
Confirm no discoloration due to temperature rise
Confirm that race way has no unbalanced, asymmetrical roller contact mark on 3 rows
Confirm no rust
Confirm no scratching or brinelling

Assembling cylindrical roller bearings for backup rolls

(1) Complete cleaning of each part before re-assembling
(2) Assemble the bearings in the reverse order of disassembling

Caution
- Be careful to insert only appropriate bearing parts. There are no compatible parts with other products.
- During re-assembly, be careful not to contaminate the bearing with any foreign matter. Please handle with care so as not to scratch any surfaces of the bearing.

Confirm there are no axial scratches on the raceway
Confirm no discoloration due to temperature rise
Confirm no rust
Confirm no cracking or chipping
Confirm no discoloration due to temperature rise
Examples of bearing failures and countermeasures

JTEKT’s countermeasures for various failures. Please follow this bearing maintenance program for optimum performance.

Outside surface of outer ring’s slipping scratches and grinding burn

Probable causes:
- Slip with the intermediate roll (Sheet jam, involution and so on)
- Improper regrinding of outer ring (Heavy grinding, lack of grinding fluid, clogged grinding stone, etc.)
- Optimizing the grinding conditions, improving grinding stone
- Review operating conditions
- Review viscosity of oil lubrication
- Confirm the seals condition

Countermeasures:
- After removing the slipping scratches on outer surface of the outer ring, a minimum of 0.5mm re-grinding on outer ring diameter needs to be done.
- Reusable by grinding intermediate roll
- Reusable by lapping using sandpaper
- Reusable by regrinding outside surface
- Proper management of thrust washers
- Decrease the side force of the bearings in one shaft
- Review lubricant condition

Outside of outer ring’s grinding burn

Probable causes:
- Improper regrinding of outer ring (Clogged grinding stone) → rough outside surface (include scratches and foreign matter)
- Occurrence of transcription mark on intermediate roll
- Improper regrinding of outer ring

Countermeasures:
- Optimizing grinding conditions, improving grinding stone and cleaning outside surface and shaft
- Reusable by grinding outside surface
- Reusable by grinding intermediate roll

Brinelling on raceway

Probable causes:
- Foreign matter jam (rolling material’s fragmentation, etc.)
- Rolling oil cleaning
- Rolling fatigue service life, excessive loading, improper lubrication
- Excessive axial load due to misaligned roll or irregular section height of bearings in one shaft

Countermeasures:
- Improving grinding stone and oil grinding stone or sandpaper
- Sandpaper
- Oil grinding stone or sandpaper
- Improper regrinding of outer ring O.D.
- Scratches during bearing’s disassembling
- In case of severe condition, dispose (when picture’s state, dispose)
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal
- Improper regrinding of outer ring O.D.
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal

Raceway ring’s cracking

Probable causes:
- Outer surface damage progresses from slipping scratches.
- Side surface damage progresses from heat cracks (due to slipping with thrust washer)
- Excessive axial load due to misaligned roll or irregular section height of bearings in one shaft
- Excessive axial load due to misaligned roll in one shaft

Countermeasures:
- Remove the slipping scratch by regrinding the outer ring O.D.
- Proper management of thrust washers
- Reusable by lapping using sandpaper
- Reusable by grinding intermediate roll
- Reusable by lapping using sandpaper
- Improper regrinding of outer ring O.D.
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal
- Improper regrinding of outer ring O.D.
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal

Inner ring cracking

Probable causes:
- Excessive re-grinding of inner ring (Rolling oil cleaning, etc.)
- Excessive axial load due to misaligned roll or irregular section height of bearings in one shaft
- Excessive axial load due to misaligned roll in one shaft

Countermeasures:
- Improving grinding stone and oil grinding stone or sandpaper
- Sandpaper
- Oil grinding stone or sandpaper
- Improper regrinding of outer ring O.D.
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal
- Improper regrinding of outer ring O.D.
- Scratches
- Raceway wear
- Bearing misalignment
- Restraining misaligned roll
- Confirm the seals condition
- Review lubricant condition
- Proper loading
- Imposing misaligned roll
- Control of section height of bearings in one shaft
- Disposal

Transcription mark on intermediate roll

Probable causes:
- Improper regrinding of outer ring (Clogged grinding stone) → rough outside surface (include scratches and foreign matter)
- Occurrence of transcription mark on intermediate roll
- Improper regrinding of outer ring

Countermeasures:
- Optimizing grinding conditions, improving grinding stone and cleaning outside surface and shaft
- Reusable by grinding outside surface
- Reusable by grinding intermediate roll
Examples of bearing failures and countermeasures

### Raceway roller flaking

**Roller flaking**

- **Probable causes**
  - Rolling fatigue service life, excessive loading, improper lubrication
- **Countermeasures**
  - Review operating conditions
  - Review viscosity of oil lubrication
  - Dispose

However, in the case of minimal flaking of the inner ring, it’s reusable by removing the flaking and setting in an unloading position.

**Raceway flaking**

- **Probable causes**
  - After use, equipment has been left for a long period without disassembling
  - Improper storage condition
  - Intrusion of mill water
- **Countermeasures**
  - Proper management of thrust washers
  - Review lubricant condition

### Smearing or abrasions

**Roller Smearing**

- **Probable causes**
  - Minimal loading
  - Improper lubrication
- **Countermeasures**
  - Proper loading
  - Review lubricant condition
  - Reusable by lapping using In case of severe condition, dispose (when picture’s state, dispose)

**Roller abrasion**

- **Probable causes**
  - Bearing misalignment
  - Improper lubrication
  - Foreign matter jam
- **Countermeasures**
  - Maintaining alignment of the bearing
  - Review lubricant condition
  - Usually disposal

### Rust scratches

**Rust**

- **Probable causes**
  - After use, equipment has been left for a long period without disassembling
  - Improper storage condition
  - Intrusion of mill water
- **Countermeasures**
  - Reusable by lapping using oil grinding stone or sandpaper
  - In case of severe condition, dispose

**Scratches**

- **Probable causes**
  - Scratches during bearing’s disassembling or re-assembling
- **Countermeasures**
  - Reusable by lapping using oil grinding stone or sandpaper
  - In case of severe condition, dispose

### Raceway wear

**Raceway wear**

- **Probable causes**
  - Excessive loading
  - Improper lubrication
- **Countermeasures**
  - Proper loading
  - Review lubricant condition
  - Usually disposal

**Fretting on bore surface of inner ring**

- **Probable causes**
  - (It is not possible to change the shaft and inner ring fit independently)
  - Apply lubricant into the fitting surface of the shaft and inner ring
  - Appropriate operating period
- **Countermeasures**
  - Reusable by lapping using oil grinding stone or sandpaper

**Loose fitting between shaft and inner ring**

- **Probable causes**
  - Usually disposal

JTEKT’s countermeasures for various failures. Please follow this bearing maintenance program for optimum performance.
### Bearing dimensions table

A list of available bearings can be found in the following dimensions table. For any dimensions which are not on the table, please consult JTEKT.

#### Design 1

Design section height when manufactured (mm) Applicable multi-roll mill type

<table>
<thead>
<tr>
<th>Bearing No.</th>
<th>Basic load ratings (kN)</th>
<th>Fatigue limit load (kN)</th>
<th>Bearing section height when manufactured (mm)</th>
<th>Amount of bearings required per mill</th>
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Note 1) The numbers in parentheses show necessary bearing quantities per mill. Differences in numbers in parentheses mean it is necessary to use other bearings as well.
A list of available bearings can be found in the following dimensions table. For any dimensions which are not on the table, please consult JTEKT.

### Bearing dimensions table

<table>
<thead>
<tr>
<th>Boundary dimensions (mm)</th>
<th>Basic load ratings (kN)</th>
<th>Fatigue limit load (kN)</th>
<th>Bearing No.</th>
<th>Design</th>
<th>Bearing section height when manufactured (mm)</th>
<th>Mass (kg)</th>
<th>Amount of bearings required per mill</th>
<th>Applicable multi-roll mill type</th>
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<td>26DC30130DS</td>
</tr>
<tr>
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</tr>
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<td>300.02</td>
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<td>1430</td>
<td>1830</td>
<td>231</td>
<td>26DC30132ADS</td>
</tr>
</tbody>
</table>

Note: 1) The numbers in parentheses, show necessary bearing quantities per mill. Differences in numbers in parenthesis mean it is necessary to use other bearings as well.
The outer surfaces of the bearings used on the backing shafts of multi-roll mills should be ground periodically to retain precise bearing performance, thus ensuring the quality of rolled products. JTEKT supplies the jigs that grind bearing’s outside diameter surface with high precision.

Once the bearing is installed into the jig, the jig completely nullifies any clearance on the fitting surface between the jig and bearing and the internal clearance of the bearing, eliminating play in the radial direction. The jig grinds the outside diameter surface while turning the outer ring and maintaining the inner ring as stationary, enabling grinding under the same conditions as when in operation. Grinding of the bearings radial run-out can be performed with a high level of accuracy.

The jigs come in two types, which should be selected according to the dimensions and types of backing-shaft bearings. Please specify the type suitable to your needs.

- **Type 1**
  - This type of jig is suitable for bearings over 70mm bore with an outer ring rib.
  - This jig requires a hole for the work carrier on the side face of outer ring.

- **Type 2**
  - This type of jig is suitable for both bearings with and without outer ring rib.
  - It is used on the Sendzimir Rolling Mills ZR21 and ZR22.

JTEKT provides the GE series which is capable of processing both roll grinding and outer ring-regrinding with high accuracy using cylindrical grinders. (TOYODA brand)

Advantages
- The jigs minimize the radial run out of the bearings after regrinding.
- The jigs improve efficient installation and removal

Overview
The outer surfaces of the bearings used on the backing shafts of multi-roll mills should be ground periodically to retain precise bearing performance, thus ensuring the quality of rolled products. JTEKT supplies the jigs that grind bearing’s outside diameter surface with high precision.

Required performance and issues
- Improving ease of outer ring regrinding work

Cylindrical grinder for outer ring-regrinding
JTEKT provides the GE series which is capable of processing both roll grinding and outer ring-regrinding with high accuracy using cylindrical grinders. (TOYODA brand)

Mounting the regrinding jig and bearing assembly to the cylindrical grinder

cylindrical grinder (GEBi-PRO)
The outer surfaces of the bearings used on the backing shafts of multi-roll mills should be ground periodically to retain precise bearing performance, thus ensuring the quality of rolled products.

JTEKT supplies the jigs that grind bearing’s outside diameter surface with high precision.

When the outer surface of a bearing is ground, it is critical to accurately control the variation of bearing’s section heights of all the bearings installed on the backing shaft. JTEKT supplies Measurement for bearing section height that suit the individual bearings listed on the dimensional table.

The jigs come in two types, which should be selected according to the dimensions and types of backing-shaft bearings. Please specify the type suitable to your needs.

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This type of jig is suitable for bearings over 70mm bore with an outer ring rib. This jig requires a hole for the work carrier on the side face of outer ring.

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**Measurement for bearing section height**

- possible to measure to 1/1000mm
- possible to measure bearings radial run-out
- easy bearing installation / removal

When the outer surface of a bearing is ground, it is critical to accurately control the variation of bearing’s section heights of all the bearings installed on the backing shaft. JTEKT supplies Measurement for bearing section height that suit the individual bearings listed on the dimensional table.
JTEKT’s accumulated knowledge and experience helps our customers solve problems. We provide new high value-added products and processes for businesses by having developed a global supply system to meet those demands.

**Large size bearing technology development center**

JTEKT established a large size bearing technology development center to evaluate and analyze large size bearing uses in the industrial machinery field.

Until now, with regards to large size bearings used in the industrial machinery field, investment was made in the actual machines before accurate modeling was done resulting in customer dissatisfaction. As a result, development time took too long due to the problems that arose.

Now, we are able to simulate and evaluate production conditions close to the real machines in our large size bearing technology developing center.

The accumulated data for bearing testing equipment for steel production equipment introduced has allowed us to improve the accuracy of CAE analysis (simulation analysis) which gives us a significant reduction for the products developmental period and in the development of new high value-added products for the future.

### Bearing testing equipment for steel production equipment

Our testing equipment is able to evaluate the scattering rolling mill water under a high temperature environment to recreate close to actual conditions.

In this way, we can deliver bearings and oil seal components with excellent performance.
JTEKT’s accumulated knowledge and experience helps our customers solve problems. We provide new high value-added products for the future.

In this way, we can deliver bearings and oil seal components with excellent performance.

Our testing equipment is able to evaluate high temperature environment to recreate the scattering rolling mill water under a significant reduction for the products development period and in the development of new technology.

Now, we are able to simulate and evaluate the accuracy of CAE analysis (simulation analysis) which gives us a responsibility for all correction contents with the exceptions of error in writing, reproduction in any form is forbidden without express written consent of JTEKT CORPORATION.