Koyo®

High-performance Product Series

For Steel Production/Rolling Equipment

JTEKT

JTEKT CORPORATION

JTEKT
Koyo TOYODA

CAT.NO.B1001-1E

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.

Only One Partner

Photo courtesy of Nippon Steel & Sumitomo Metal Corporation

History of JTEKT products for steel production equipment

(Bearings Drive shafts)

Year 1940

Social conditions /events: WWII; Post-WWII

Steel manufacturer trends: Catch-up with industry overseas

Domestic production of bearings for rolling mills

- Developed four-row tapered roller bearings for hot-strip mill work rolls (Japan 1st)
- Developed tapered roller bearings for hot-strip mill backup rolls (Japan 1st)

1950

Social conditions /events: High growth period

1960

Steel manufacturer trends: Mass production; increase productivity; high-load/ high-speed/continuous

Development of high-performance bearings (longer service life, high-speed compatibility)

Introduction of overseas Drive shafts technologies; domestic production

- Developed three-row cylindrical roller bearings with cage for Sendzimir mills
- First delivery of drive shafts for wire-rod mills (Japan 1st)

1970

- Entered agreement with Sendzimir Japan, Ltd. to manufacture backup roll assemblies
- Started production of Sendzimir mill backup roll assemblies (Unique to Japan)
- Adopted roller bearings for 1,680m/min cold-strip mill backup rolls (Japan 1st)
- First delivery of drive shafts for cold-strip mills (Japan 1st)
- First delivery of drive shafts for hot-strip mills (Japan 1st)

1975

Social conditions /events: Stable growth period

- Received award from the Japan Society of Mechanical Engineers for hot-strip mill drive shaft
- Developed sealed cylindrical roller bearings for Sendzimir mills

1980

Steel manufacturer trends: Large-variety, low-volume production; improve thickness accuracy; reduce maintenance cost

Development of bearings/drive shafts compatible with shape-controlled rolling mills

Longer-life bearings/drive shafts and extended maintenance interval

- Developed (sealed) roll neck bearings for 6HI work roll shift mills
- Improved bearings for backup rolls from oil-film bearings to roller bearings (Japan 1st)
- Developed split bearing units (spherical Roller bearings)

1985

Social conditions /events: Bubble economy

- Developed CR mill backup roll assemblies
- First delivery of drive shafts for hot-strip WR shift mills (Japan 1st)
- Developed fastening-ring split bearing units with fastening-ring
- Developed cylindrical roller bearings with self-aligning ring

1990

Social conditions /events: Burst of bubble / Economic stagnation

- Developed long-life Cross & Bearing with different diameter rollers
- First delivery of drive shafts for pair cross mills
- Developed carburized steel (CH213) for large bearings

1995

- Developed oil/air lubrication system
- Developed HSC split bearing units
- First delivery of drive shafts for Plate mills (World 1st)

2000

Steel manufacturer trends: Pursue higher functionality/better quality

- Developed new material for core hardening
- Developed sealed cylindrical roller bearings for new Sendzimir mill producing magnetic steel sheets
- Developed long-life Cross & Bearing with cross burnishing process

2005

Social conditions /events: Economic expansion

- First delivery of small/medium-diameter hydraulic expansion torque limiter
- Adopted newly developed material and carbonitriding process (premium) for JHS520 highly corrosion-resistant long-life bearings

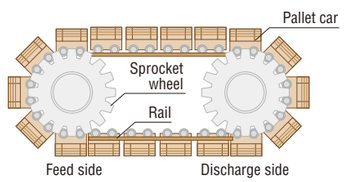
2010

Social conditions /events: Global economic downturn

- Developed JHS210 high-performance backup roll bearings for new Sendzimir mill producing magnetic steel sheets

Introduction to products for steel production equipment

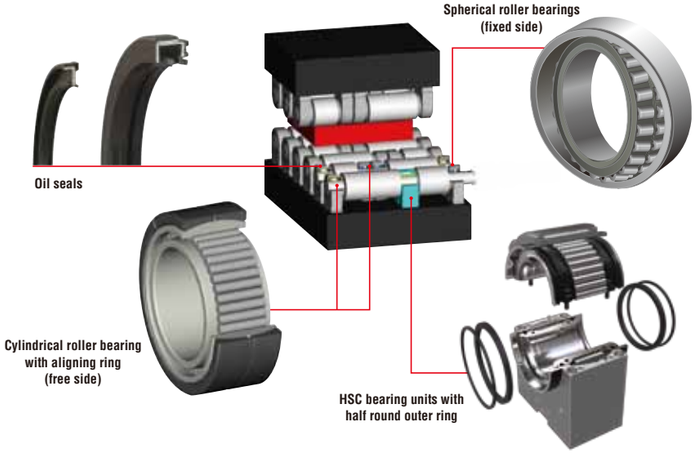
Bearings for sintering machine pallet car

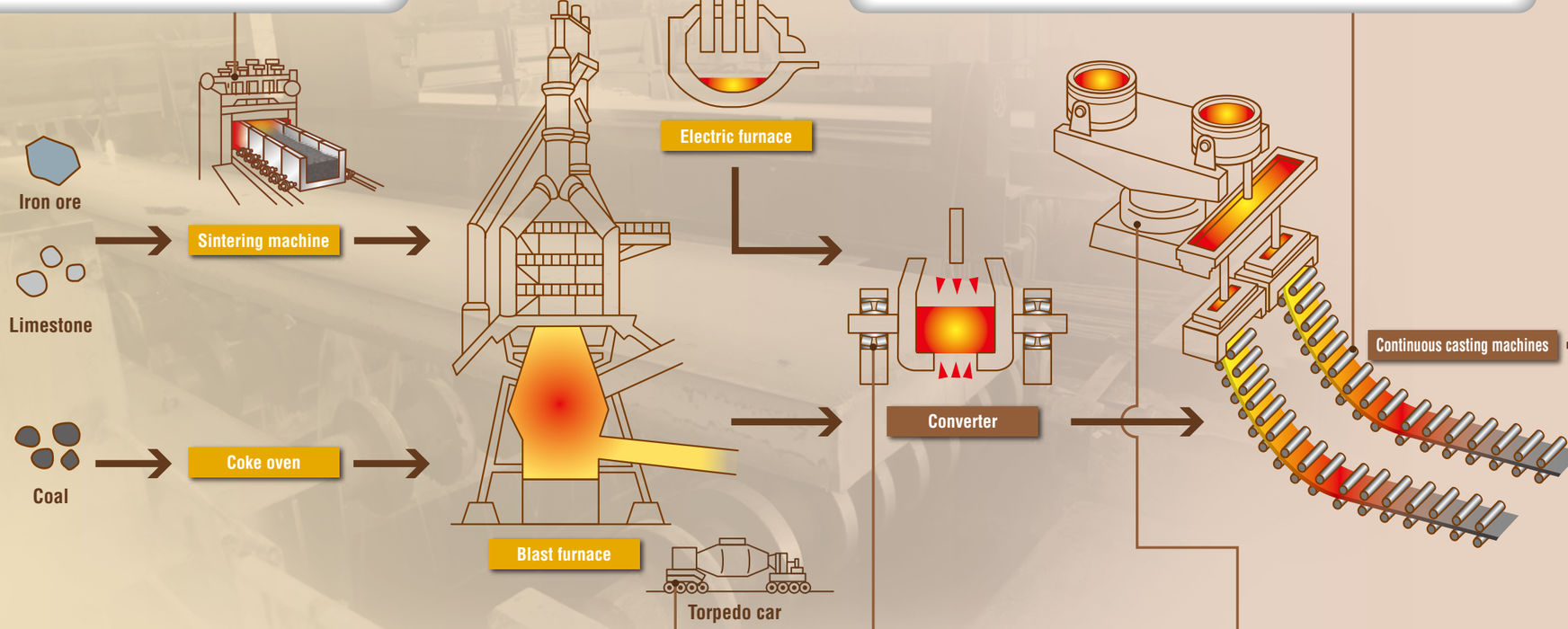


Pressure roller bearings (sealed type double row cylindrical roller bearings)

Wheel bearings (sealed type double row tapered roller bearings)

Products for continuous casting machines

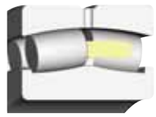




Axle bearings

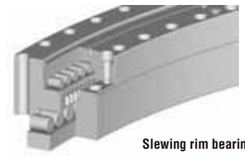
Sealed type double row tapered roller bearings

Bearings for converter



Large spherical roller bearings

Bearings for swing tower support

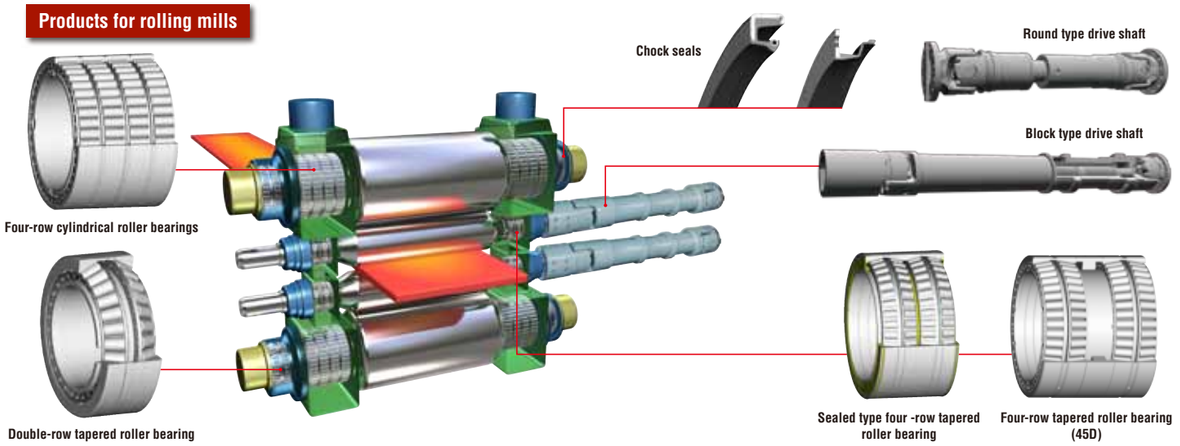


Slewing rim bearings

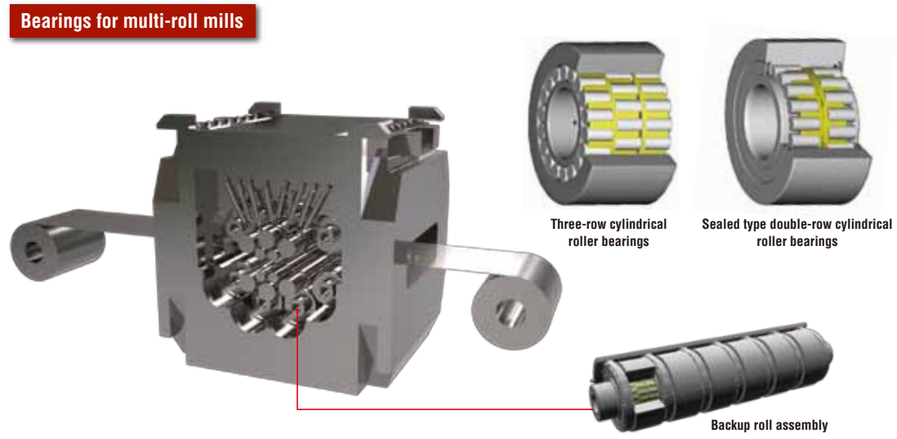
Ironmaking

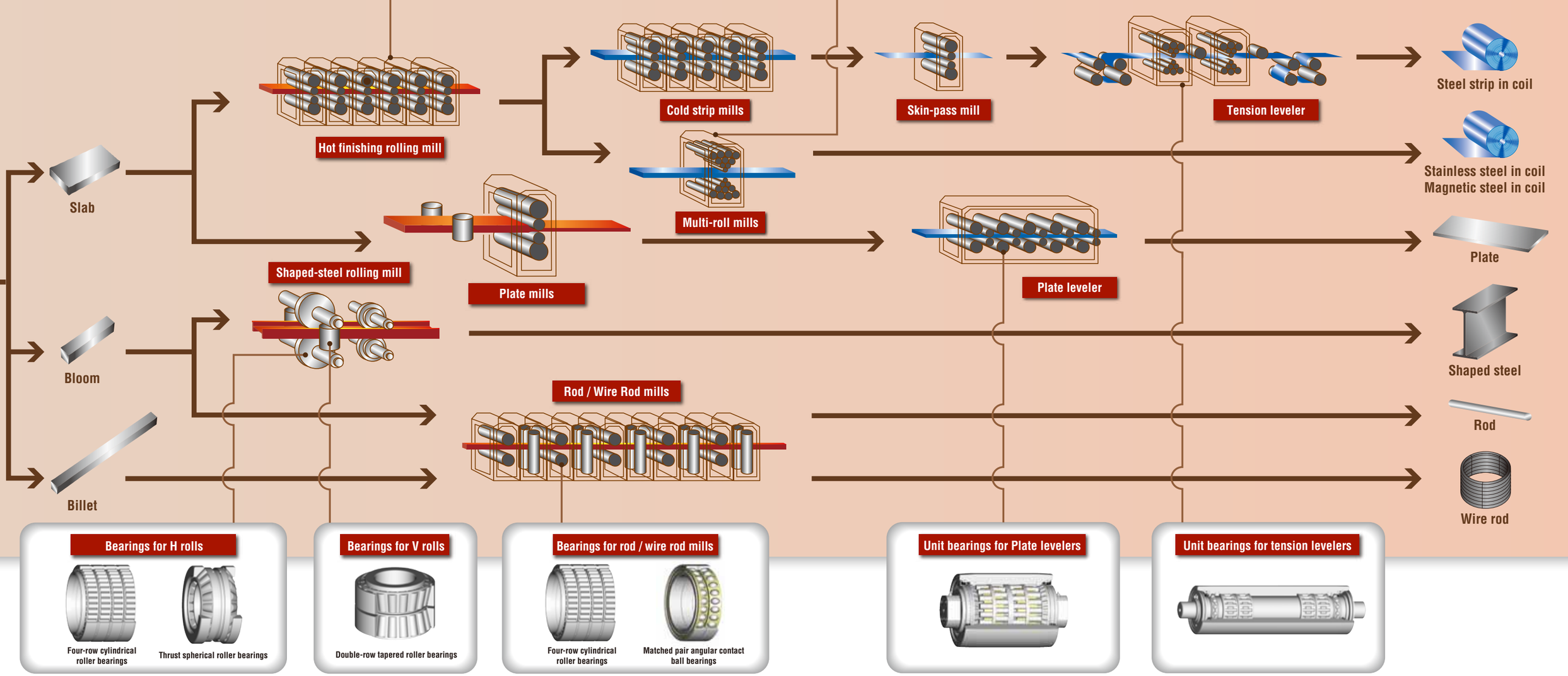
Steelmaking

Products for rolling mills



Bearings for multi-roll mills





Bearings for H rolls

Bearings for V rolls

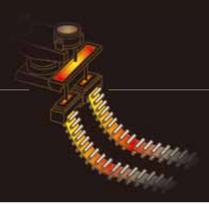
Bearings for rod / wire rod mills

Unit bearings for Plate levelers

Unit bearings for tension levelers

Rolling

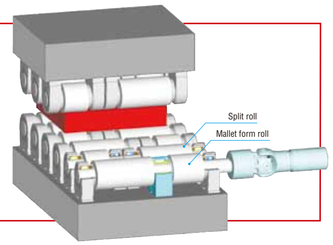
Products for continuous casting machines



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.

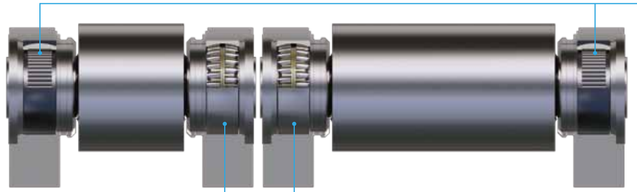
Required performance and issues

- Measures for ultralow-speed rotation, which is unfavorable for lubrication
- Measures for high contact stress / roll deflection under high 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



Roll configuration example 1 (single and split rolls)

- Optimal configuration for roll elongation absorption using single and split rolls



【 bearing for free side 】 【 bearing for fixed side 】 【 bearing for free side 】

Roll configuration example 2 (pestle-shaped roll)

- Optimal configuration for roll elongation absorption using pestle-shaped roll

【 bearing for free side 】 Split bearing for mallet form roll 【 bearing for fixed side 】

Measures for high loads

High-load type spherical roller bearings

Features • Designed for maximum load rating; internal design reduces contact stress

【Service life】

Conventional bearing

Approx. 1.3-fold — High-load bearing

Measures for high load / high temperature

Cylindrical roller bearings with self-aligning ring

Features • Smooth absorption of roll movement in the axial direction
• Absorption of roll deflection and misalignment

【Static load rating】

Spherical roller bearings

Max. 10% increase (approx) — Cylindrical roller bearings with self-aligning ring

HSC bearing units with half round outer ring

Features • High-load type using compact sealing structure
• Water-cooled structure with high cooling efficiency

【Service life】

Conventional unit

Approx. 2.4-fold — HSC bearing units with half round outer ring

【Rated static load】

Conventional unit

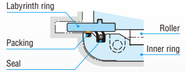
Max. 30% increase (approx) — HSC bearing units with half round outer ring

【Flow consumption】

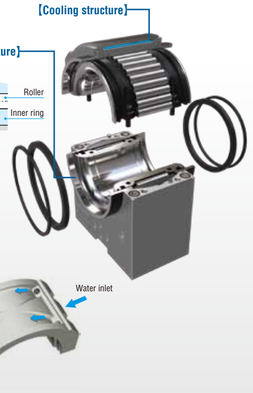
Conventional unit

Reduced 45% (approx) — HSC bearing units with half round outer ring

【Compact sealing structure】



【Cooling structure】



Measures for ultralow-speed rotation and water / mill-scale intrusion

Oil / Air lubrication system

Features • Positive pressure inside the housing prevents the intrusion of water / mill-scale, and the adoption of a high-viscosity oil improves lubrication
• Oil / Air distributor supports multipoint oil supply

【Comparison with grease lubrication】

Reduce unexpected incident ratio

【Segment replacement interval extended】

Grease: 1

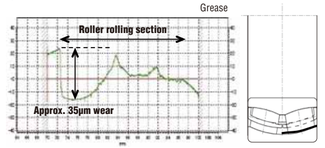
Approx. 1.5-fold or longer — Oil/Air

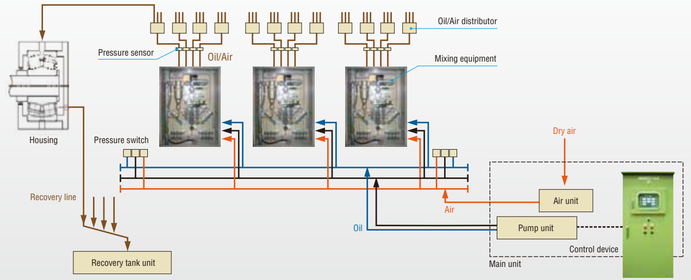
【Operating cost】

Grease: 1

Reduced 15% (approx) — Oil/Air

【Comparison of outer ring path surface shape】



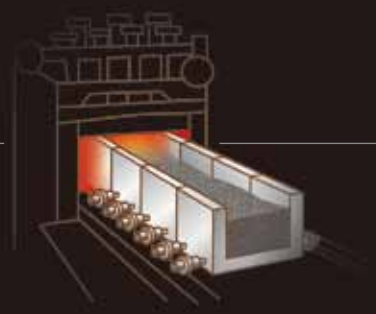


Measures for intrusion of water / mill scale

Oil seals

Features • Superior sealing performance
• Lip contact stress dispersed
• Compatible with H-NBR and Fluoro-Rubber

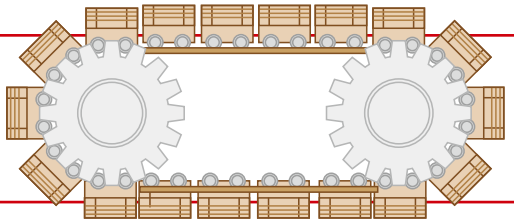
Bearings for sintering machine pallet car



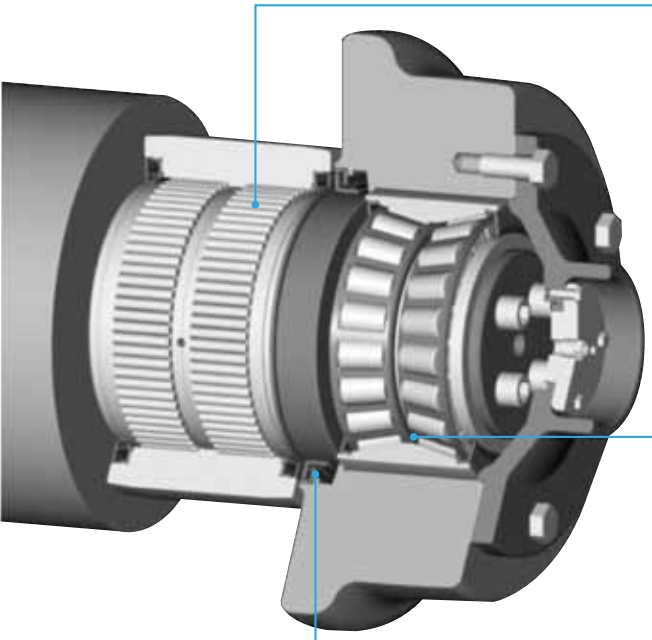
Sintering machines are used in harsh environments where high temperatures and large amounts of dust are generated. We provide sealed bearings and mill-scale seals capable of withstanding these kinds of environments.

Required performance and issues

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



Measures for heavy loads / shock loads　Preventing the intrusion of dust



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

Features

Optimized outer ring thickness and carburized steel adopted
→ **Capable of withstanding large load / shock load**

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)

Features

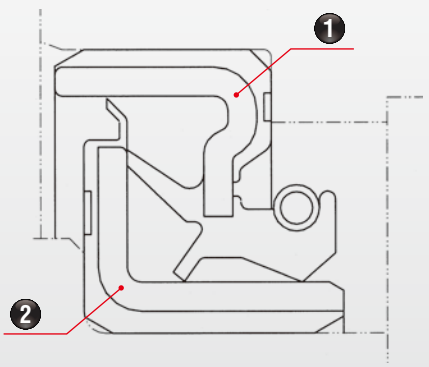
Integrated seal structure offers both high load capacity and excellent sealing performance
→ **Can withstand heavy loads and prevents the intrusion of dust**

Oil seal for wheel bearings

Features

Structure combining two parts (❶and❷)
→ **No damage to peripheral parts**

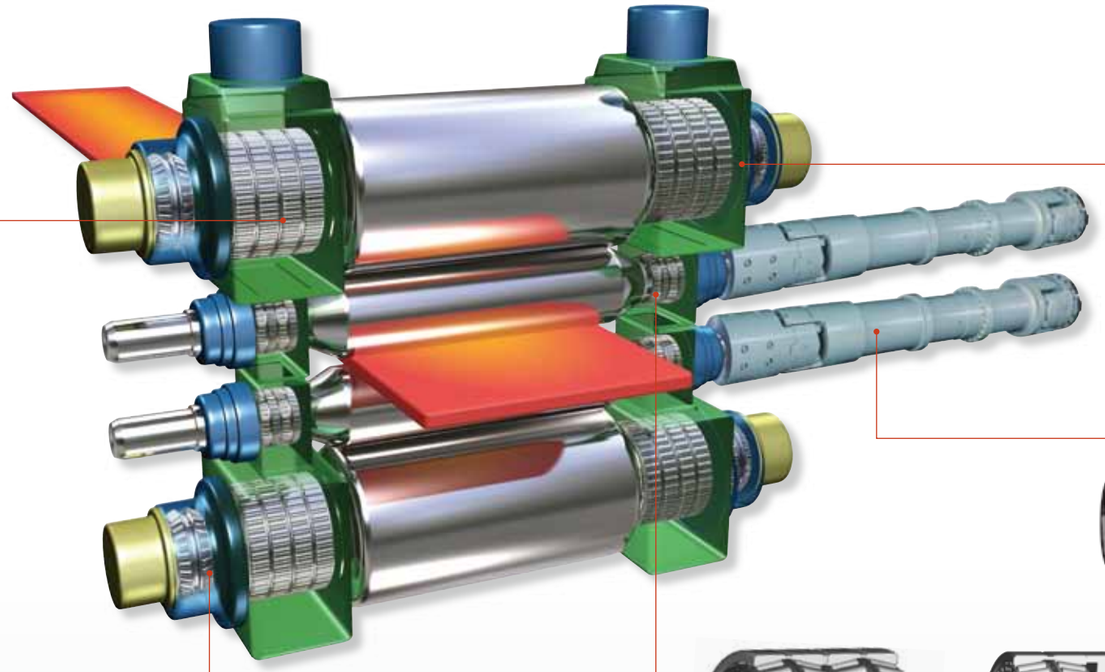
High sealing performance owing to multilayer lip structure
→ **Prevents the intrusion of dust**

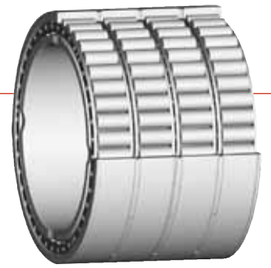


Rolling Mill Product Line-up

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 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 and durability in the ever-evolving field of steel equipment. Please keep your expectations high. We won't let you down.



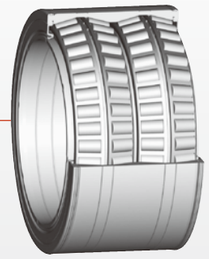


Four-row cylindrical roller bearings
Inside diameter: 180~1,349.04mm

Large-sized bearings mainly used for rolling mill backup rolls. Produced for high-load, high-speed applications, they are optimized for use in rolling mills. Compared to oil-film bearings, they provide stable rotational accuracy, which enhances product precision.

Double-row tapered roller bearings
Inside diameter: 200~717.55mm

Bearings developed to manage the axial load of roll necks in rolling mills. A large contact angle is used to create a structure that increases axial performance. Additionally, an oil seal is inserted to constrain grease flow and prevent intrusion of water and mill scale inside the bearing.



Sealed type four-row tapered roller bearings
Inside diameter: 220~800mm

Four-row tapered roller bearings (open)
Inside diameter: 170~939.8mm

Four-row tapered roller bearings (45D)
Inside diameter: 360~685.8mm

These bearings, mainly used for work rolls or intermediate rolls, carry both of radial load and axial load at a time. Adjustment of internal clearance is not required, facilitating handling. Open type is also available. Reliability is being pushed to higher levels through the adoption of special bearing materials that improve rolling fatigue service life and corrosion resistance.

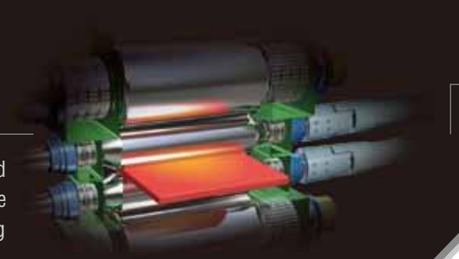
Chock seals

A lip shape with excellent sealing performance is used, and rubber materials matched to the environment are applied.

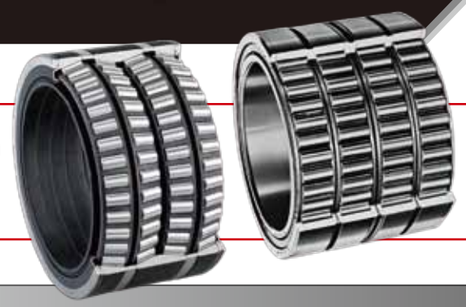
Drive shafts for rolling mills
Swing dia: 160~1,250mm

Drive shafts optimized for use in high-load applications such as in rolling-mill roll drives. High-strength and long-life technologies have been adopted, thereby enabling compatibility with ever higher torques.

Bearings for roll necks

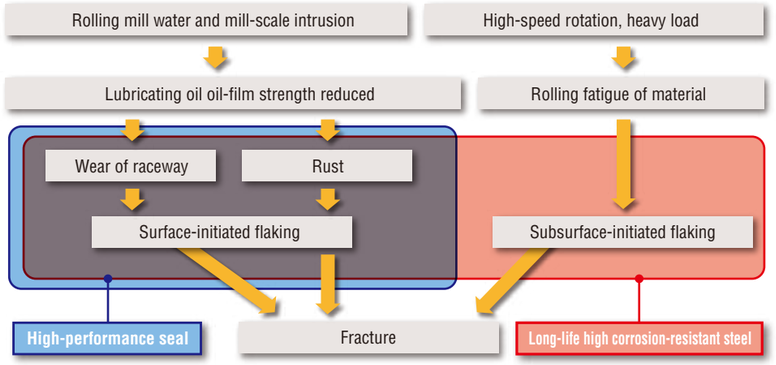


Bearings used to steel mill roll necks must cope with heavy loads and high-speed rotation in severe environments. In order to respond to these needs, JTEKT works daily to resolve related issues such as developing bearing materials and improving bearing seal performance.



Required performance and issues

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



Enhancing durability and service life under heavy load / high-speed rotation

Long-life high corrosion-resistant steel

JHS 520 JTEKT HYPER STRONG

Use of a newly developed case-hardened steel substantially improves service life, durability and corrosion resistance compared to conventional products. The lineup also includes products with "premium" specifications, which undergo special processing to provide increased rolling fatigue service life and corrosion resistance.

Features

1. **Long-life, corrosion-resistant steel realized by adding standardized amounts of chromium and Molybdenum**
2. **Enhanced corrosion and abrasion resistance realized using a carbonitriding heat process developed by JTEKT**

Bearing service life evaluation results under maintenance-related rust environment (water-contaminated grease injected)

	Comparison of rust-resistance ※1	Service life (in-house bench test ※2)
Conventional product		
Carburized developed steel ①		Approx.2.2-fold
Special heat-treatment processed developed steel ①+②		Approx.3.8-fold

Rust High ↓ Rust Low

※1 Conditions (humidity cabinet test conditions): Test Temperature: 49°C±1°C; Relative humidity : 95% or more Test period: 96 hours
※2 Conditions/Sample: Tapered roller bearing; Main dimensions, φ50×φ120×30; Lubrication, grease; Water content ratio, 30%

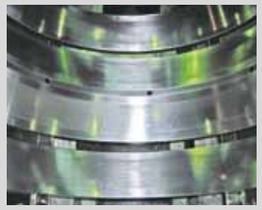
Examples of used result in the customer

Cold strip mill work roll (open) ①

Conventional type

Approx. usage 4,000,000t (under DS)

Approx.5-fold



No flaking

Cold strip mill work roll (sealed) ①+②

Conventional type

Used approx. 24months (under OP)

Approx.4.8-fold

Hardly any indication of rust

Preventing intrusion of water / mill scale

Sealed type four-row tapered roller bearings

Features

- **Substantial reduction in grease consumption**
- **Reduction in harmful effects on working environment**
- **Intrusion of rolling mill water and mill scale prevented**

Special oil seal

Higher rated load and easier maintenance

The oil seal width has been narrowed, freeing up space for the roller and enabling a higher load rating.
Design also took ease of maintenance into consideration.

Seal cover with seal and O-ring

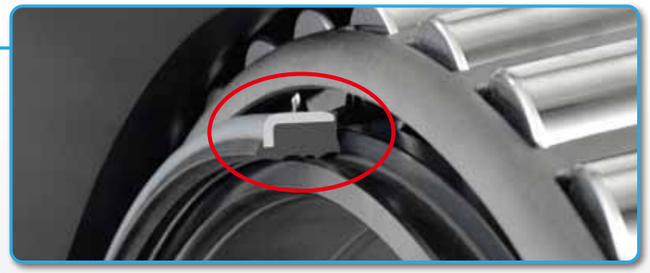
Conventional type

Sealed bearing load rating ratio
Approx.1.2-fold

Bearing service life ratio
Approx.1.8-fold

Seal between inner rings

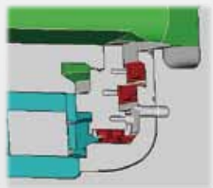
Integration of metal ring and packing
↓
Compact and easy to handle



Chock seals

Features

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



For more information, please refer to catalog No. B2013E and No.B2002E.

Bearings 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

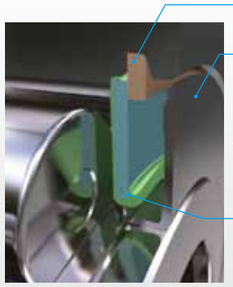
- Seal structure that maintains a favorable lubricated state
- Longer inner ring rolling fatigue service life
- Improving outer ring durability
- Improving outer ring rotational accuracy
- Improving ease of outer ring regrinding work

Seal structure that maintains a favorable lubricated state / Improving outer ring durability / Improving outer ring rotational accuracy

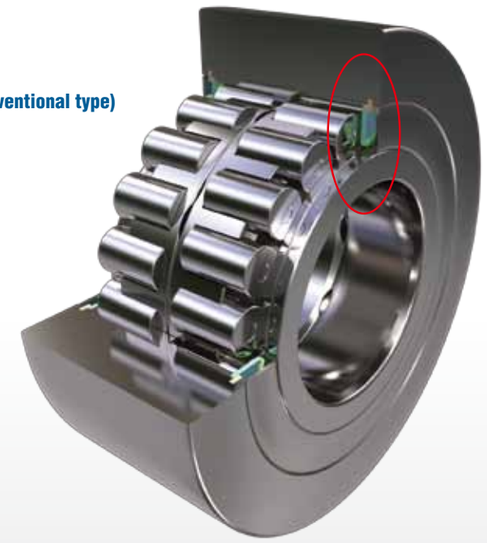
Bearings for oil mist lubrication

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

【Service life】



Centrifugal force of the seal lip section discharges rolling water that has infiltrated to the outside



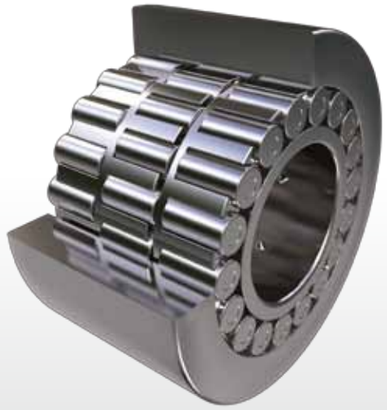
Premium specifications JHS 210 (JTEKT HYPER STRONG)

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.

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

Bearings for forced oil lubrication

Features
- 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



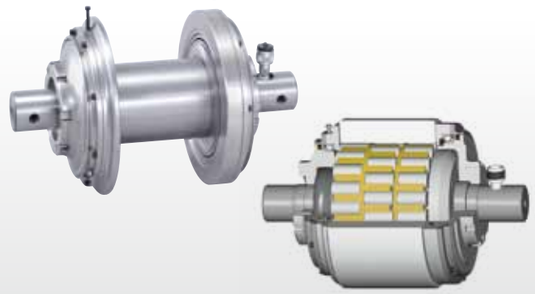
Premium specifications JHS 210 (JTEKT HYPER STRONG)

Case-hardened steel is used for the inner ring to suppress the loss of rolling service life under low-viscosity lubrication.
Bearing service life is approx. 1.5–3-fold that of conventional products.

Improving ease of outer ring regrinding work

Bearings-regrinding Jigs

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



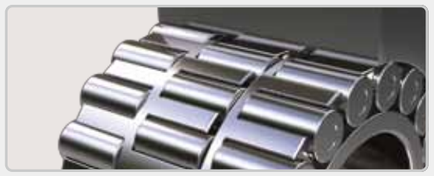
Improving ease of outer ring regrinding work

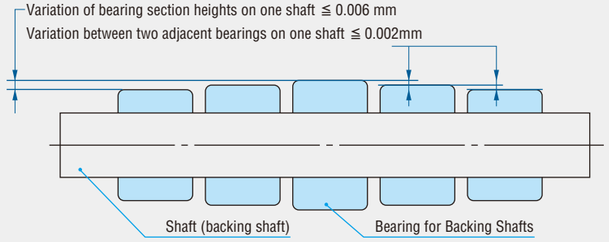
Measurement for Bearing Section Height

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

Optimized load distribution

Contributes to rolled coil quality / precision

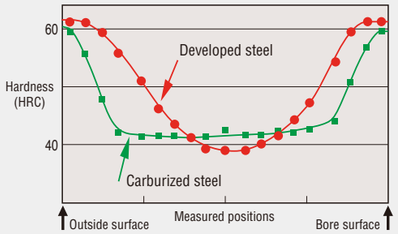




Core hardening

Surface-hardened layer improved approximately 3-fold

【Surface-hardened layer】

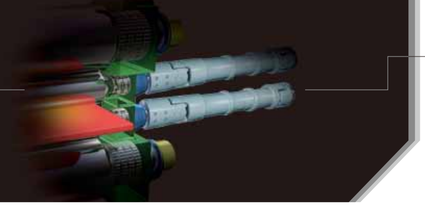


【 typical hardness distribution of cored hardening outer ring 】

For more information, please refer to catalog No. B2012E.

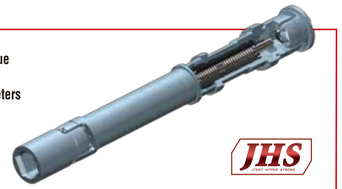
Drive shafts for rolling mills

We provide high-strength, long-life drive shafts that have good torque transfer efficiency under severe environments.

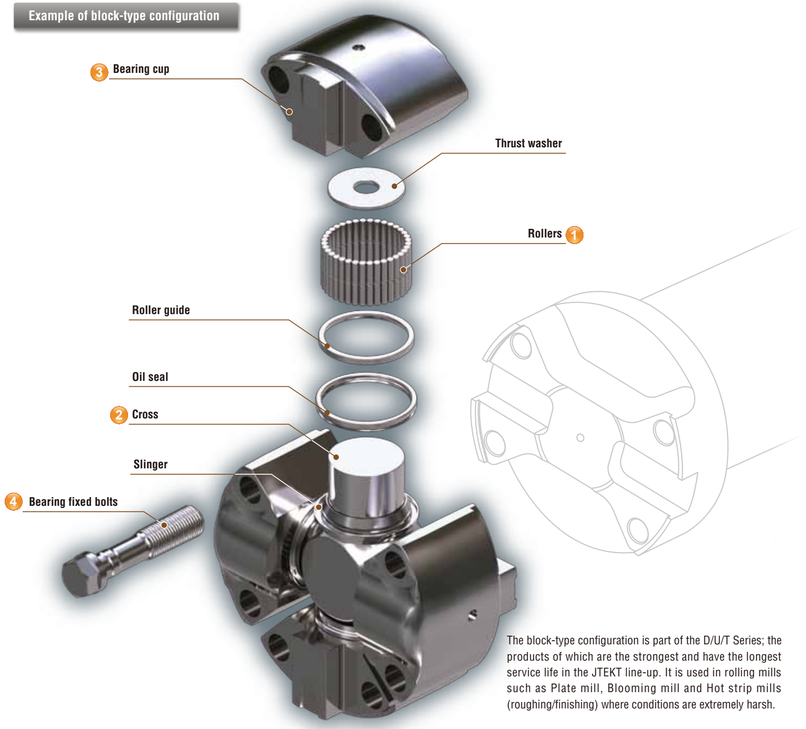


Required performance and issues

- 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



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.

Contributing to stronger, longer-life drive shafts

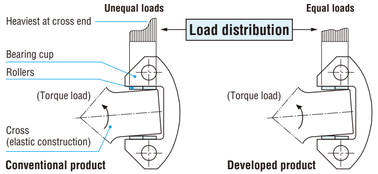
1 Application of different diameter rollers for cross & bearing

Features

Roller diameter at the end of the cross reduced slightly

- **Uniform multi-row roller load**

[Longer service life]

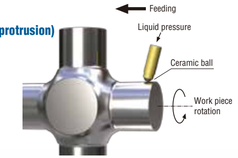


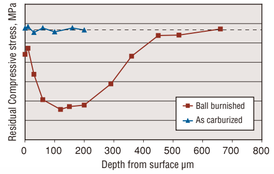
2 Ball burnishing on cross shaft

Features

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

[Longer service life]





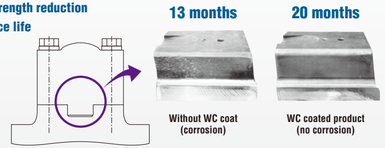
3 Thermal spraying coat of tungsten carbide (WC) on bearing cup key

Features

Restraining of clearance between key and key way due to corrosion wear

- **Alleviating bending stress of bolt ··· Restraint of Strength reduction**
- **Minimizing heavy load at cross end ··· Longer service life**

[Improved corrosion resistance]

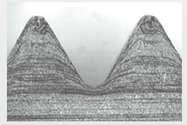


4 Application of form rolling to bearing set Bolt

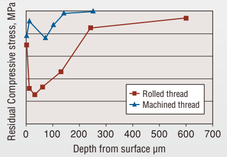
Features

- **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**

[Improved fatigue strength]



【 Fiber flow of rolled thread 】



【 Residual compressive stress distribution of rolled thread 】

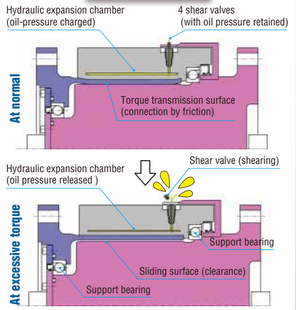
Optional mechanisms supporting drive shafts for rolling mill

Hyper coupling (torque limiter)

Features

- **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**

Operating principle



Recovery work process (required time: 30min)

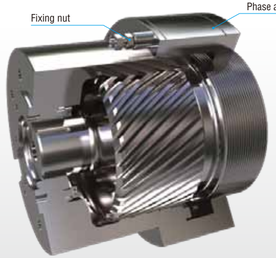
1. Phase alignment
2. Shear valve replacement (x4)
3. Re-pressurizing hydraulic expansion chamber

Optional mechanisms supporting drive shafts for rolling mill

Roll phase adjustment device (for bar & rod mill)

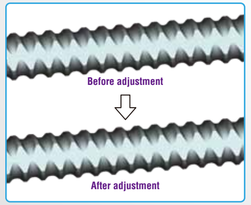
Features

- **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.**



Product example

Screw reinforcing bar



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

Bearing units for plate levelers

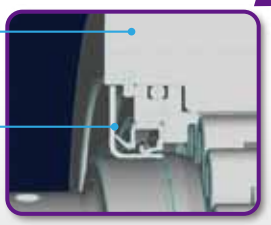
We provide plate leveler units to cope with severe usage environments such as heavy loads, rust and the intrusion of water / foreign matter.

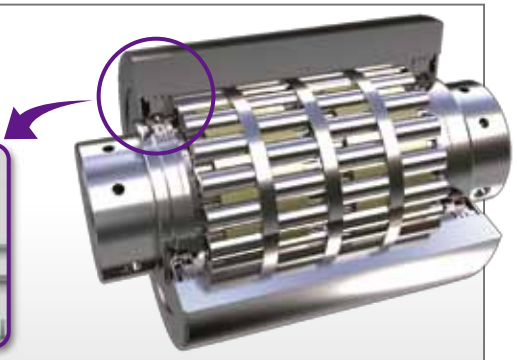
Required performance and issues

- Stable operation under heavy load
- High corrosion resistance
- Prevent 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





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

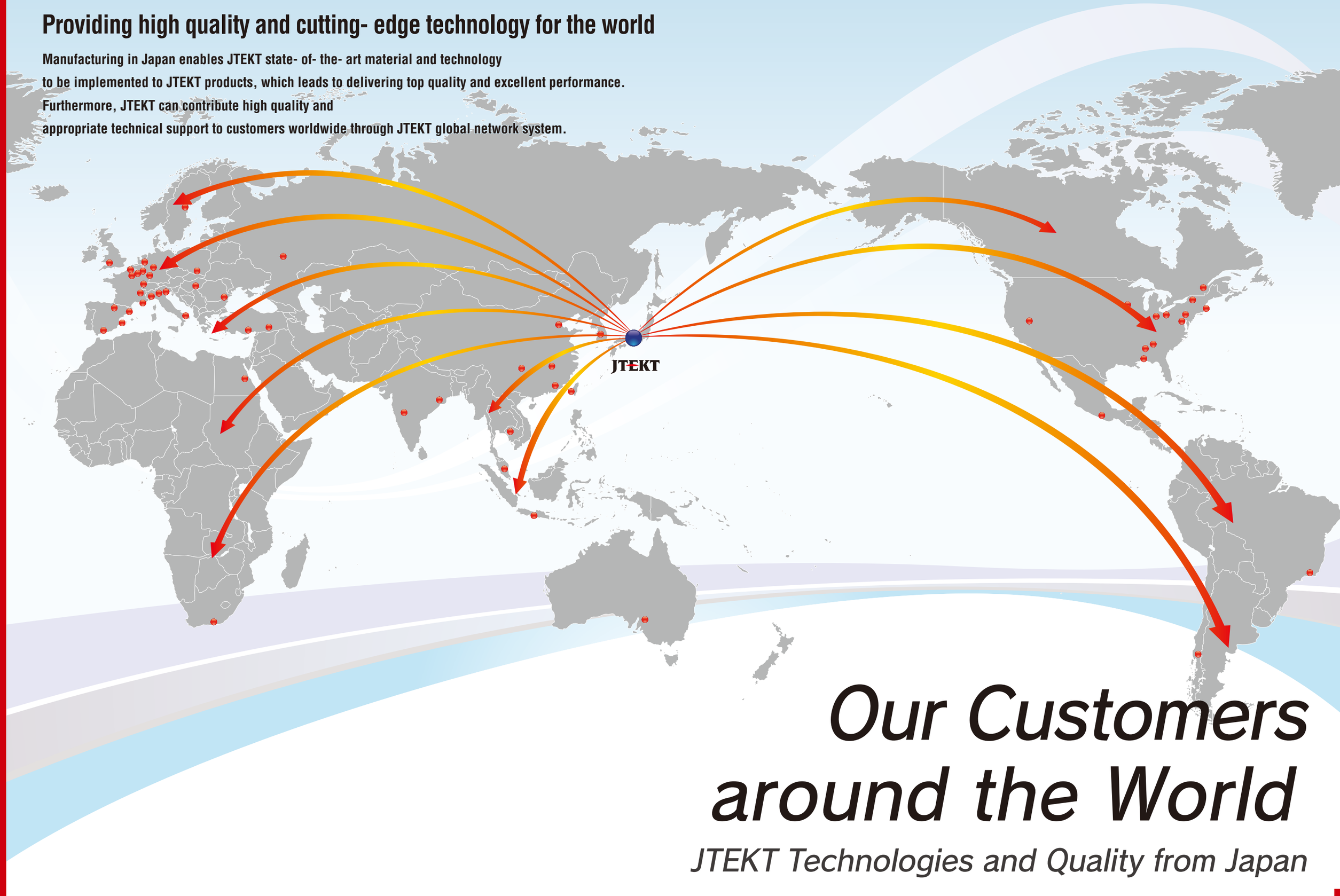
- Low torque
- Tightly sealed structure
- High section height accuracy

Bearing units for tension levelers

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

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.



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