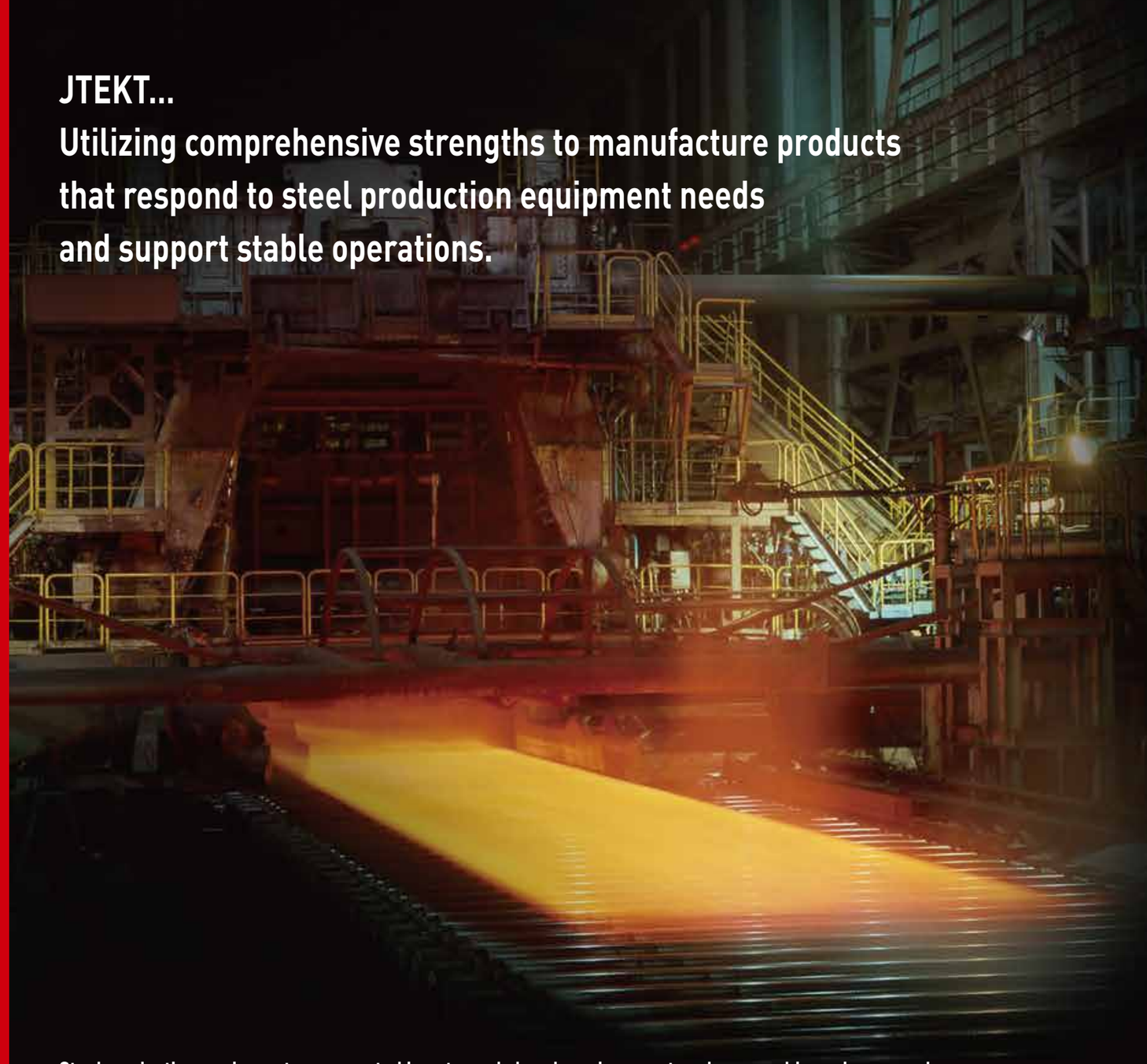
Koyo®

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.

Only One Partner

Photo courtesy of Nippon Steel & Sumitomo Metal Corporation

JHS (JTEKT HYPER STRONG)

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)

JHS 210

Case-hardened steel is used on the inner ring to improve rolling life in low-viscosity lubrication.

- **Bearings for roll necks** (CAT.NO.B2013E)

JHS 520

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

Year | Social conditions /events | Steel manufacturer trends | (■ Bearings ■ Drive shafts)

1940

WWII / Post-WWII

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

1960

High growth period

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

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

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

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

Burst of bubble / Economic stagnation

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

2000

Economic expansion

- 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

Pursue higher functionality/better quality

- Fiest delivery of hyper coupling
- Adopted newly developed material and carbonitriding process (premium) for JHS520 highly corrosion-resistant long-life bearings

2010

Period of economic change

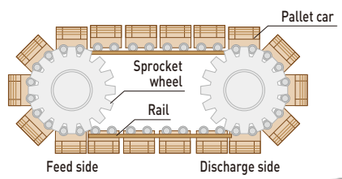
- Developed JHS210 high-performance backup roll bearings for new Sendzimir mill producing magnetic steel sheets
- Developed a long-life, high-speed JHS Series spherical roller bearings
- Commenced full-scale operation of the Large Bearing Technical Development Center

2015

- Developed an oil seal for sealed-type, four-row tapered roller bearings, for roll neck
- Developed an oil seal for drive shaft cross bearings

Introduction to products for steel production equipment

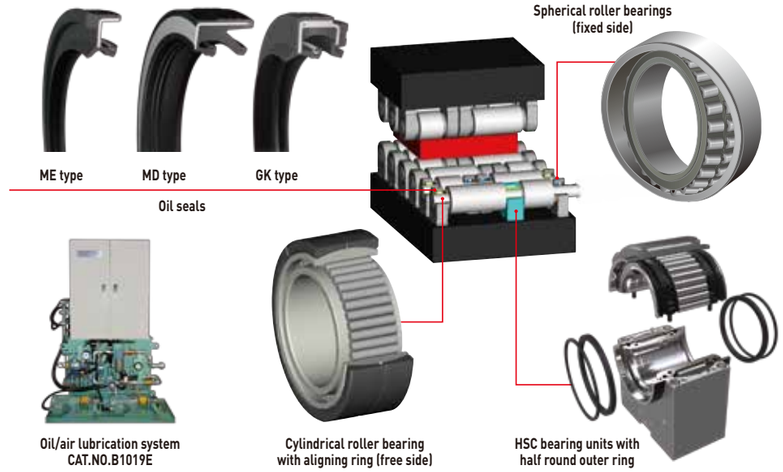
Bearings for sintering machine pallet car



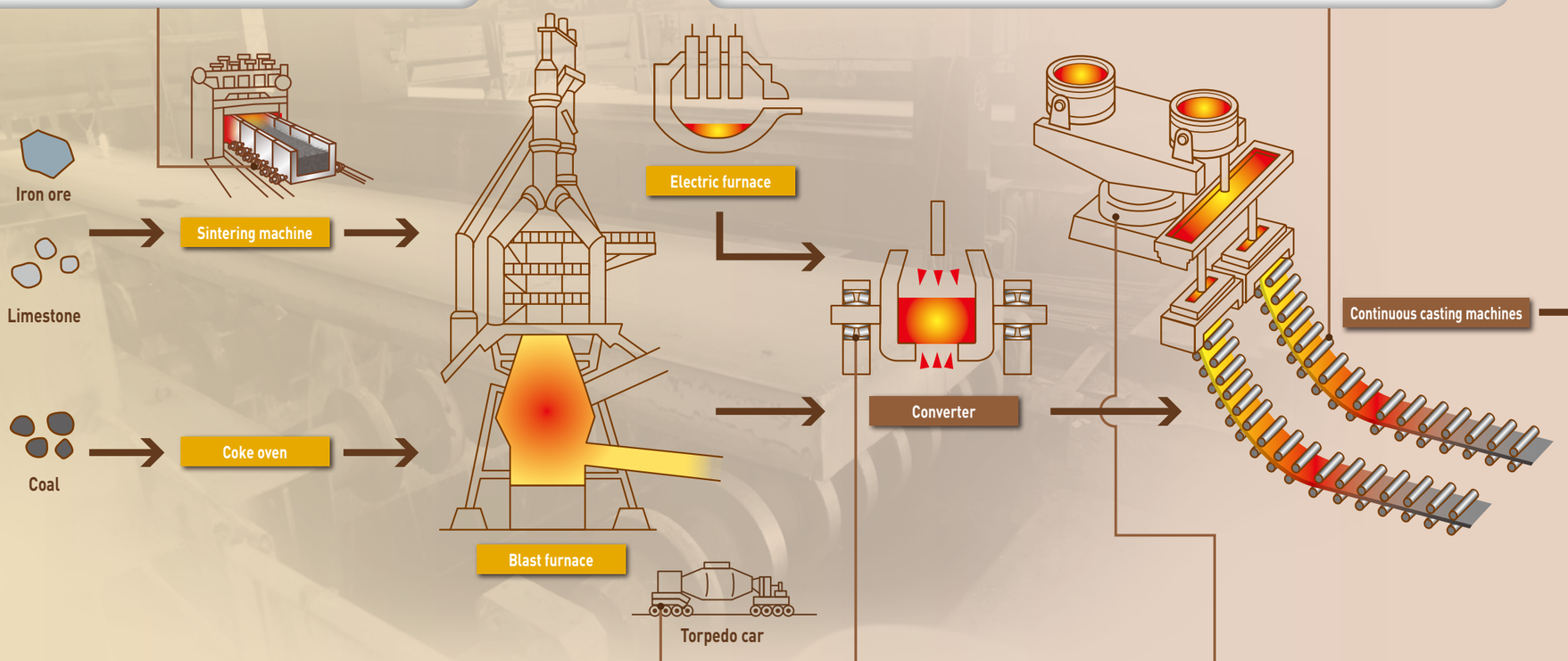
Pressure roller bearings (sealed type double row cylindrical roller bearings) | Wheel bearings (sealed type double row tapered roller bearings) | Intermediate seal

Products for continuous casting machines

CAT.NO.B2011E



Oil/air lubrication system CAT.NO.B1019E | Cylindrical roller bearing with aligning ring (free side) | HSC bearing units with half round outer ring



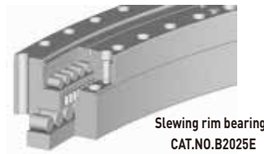
Axle bearings

Sealed type double row tapered roller bearings

Bearings for converter

Large seal (MS) | Large spherical roller bearings

Bearings for swing tower support

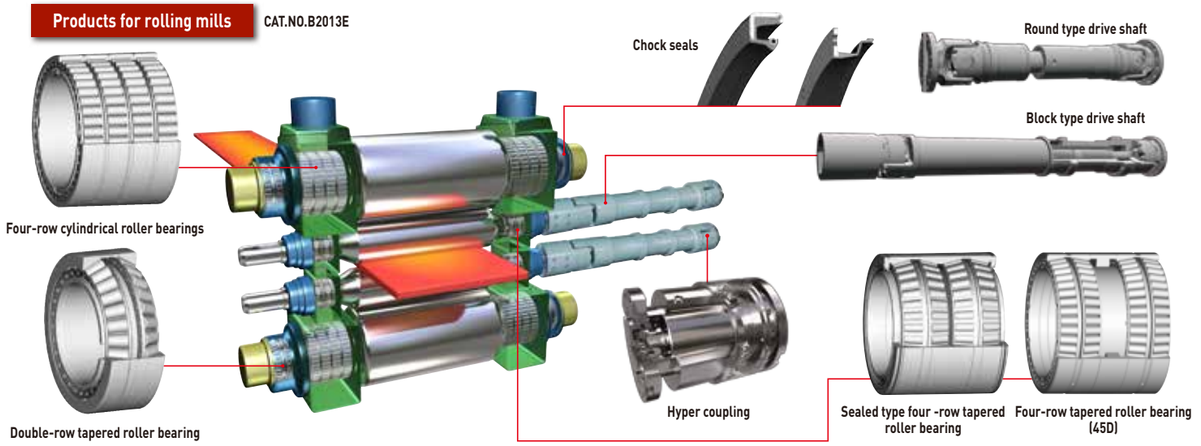


Slewing rim bearings CAT.NO.B2025E

Ironmaking — **Steelmaking**

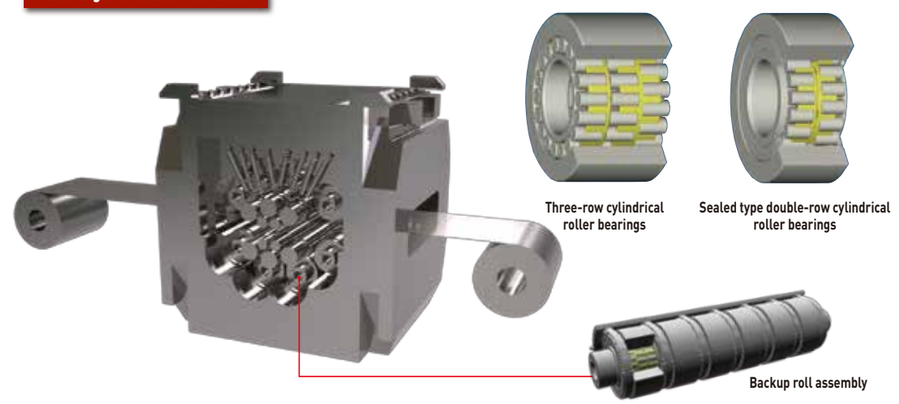
Products for rolling mills

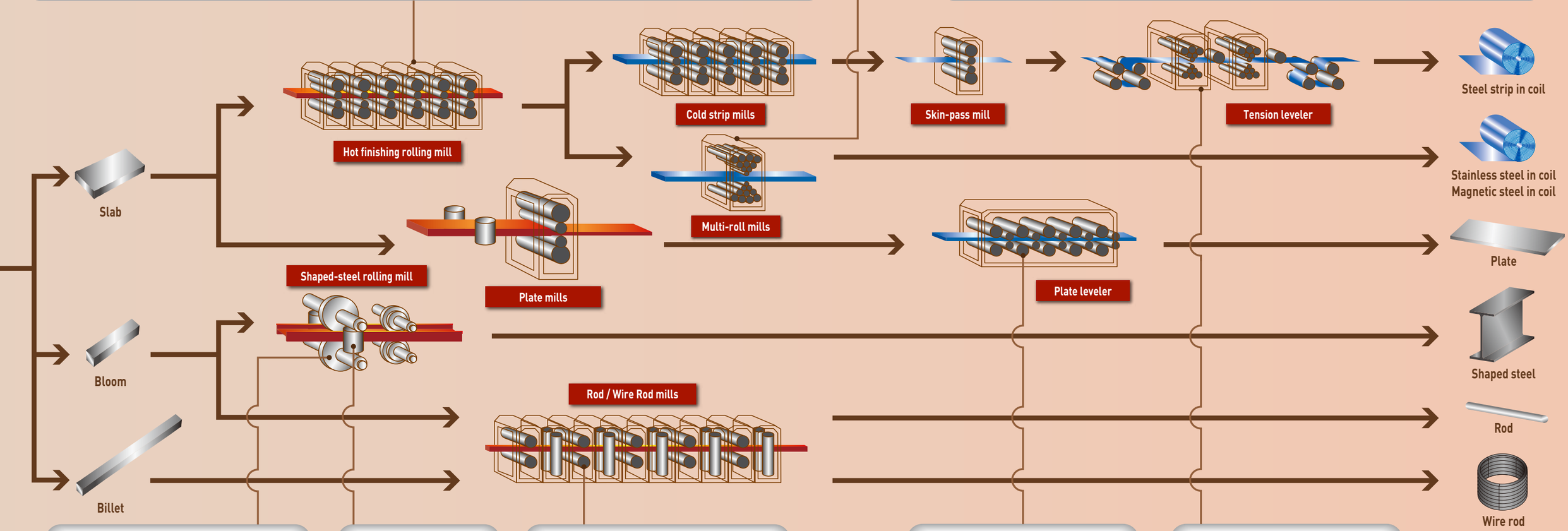
CAT.NO.B2013E



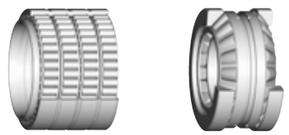
Bearings for multi-roll mills

CAT.NO.B2012E





Bearings for H rolls



Four-row cylindrical roller bearings

Thrust spherical roller bearings

Bearings for V rolls

Double-row tapered roller bearings

Bearings for rod / wire rod mills

Four-row cylindrical roller bearings

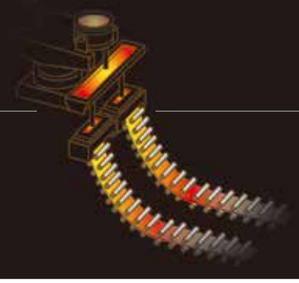
Matched pair angular contact ball bearings

Unit bearings for Plate levelers

Unit bearings for tension levelers

Rolling

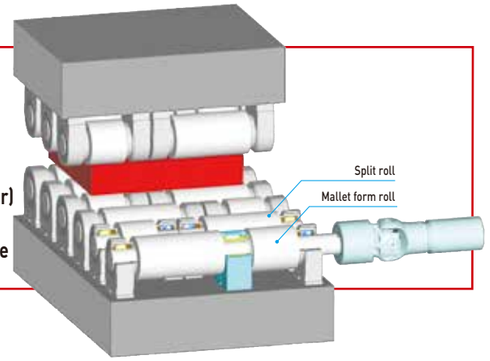
Products for continuous casting machines



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 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

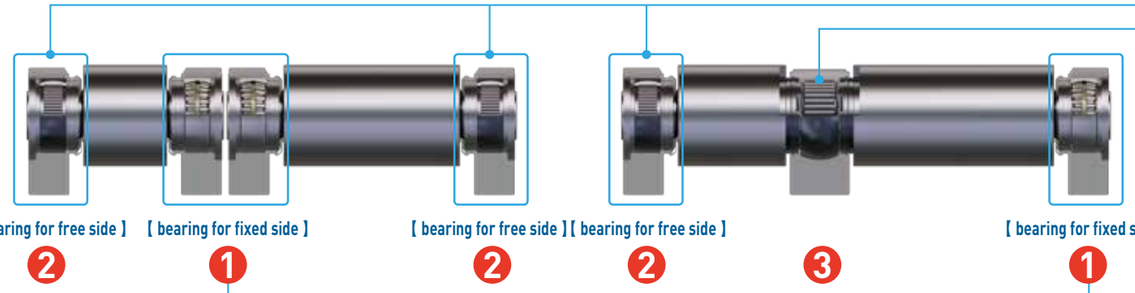


Roll configuration example 1 (single and split rolls)

Optimal configuration for roll elongation absorption using single and split rolls

Roll configuration example 2 (pestle-shaped roll)

Optimal configuration for roll elongation absorption using pestle-shaped roll



Measures for heavy load / high temperature

1 RZ-type Spherical Roller Bearings

Features
- Designed for maximum load rating; internal design reduces contact stress
- Designed to stabilize roll position
- Resistant to high temperature for use in various environments

[Service life]

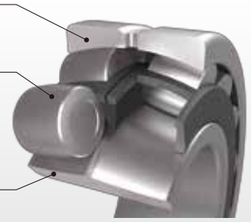
Conventional bearing

Approx. 1.3-fold — JHS series

Outer ring
- JTEKT specification steel

Roll
- Roller maximized
- Number of rollers increased
- Roller position stabilized

Inner ring
- JTEKT specification steel



Bearing composition diagram

Measures for heavy load / high temperature

2 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

3 HSC bearing units with half round outer ring

Features
- Heavy load type using a 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

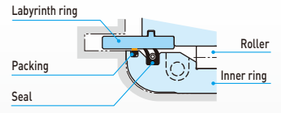
Max. 30% increase (approx) — HSC bearing units with half round outer ring

[Flow consumption]

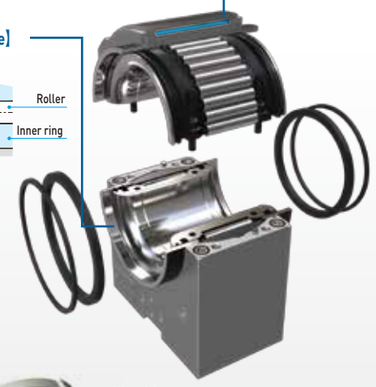
Conventional unit

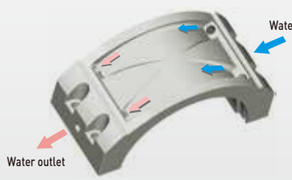
Reduced 45% (approx) — HSC bearing units with half round outer ring

[Compact sealing structure]



[Cooling structure]



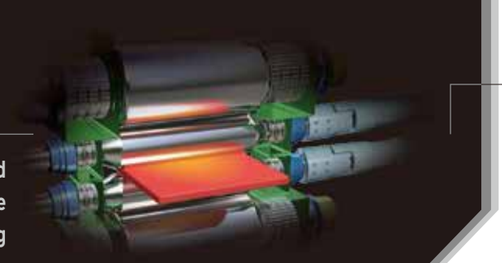


Measures for intrusion of water / mill scale

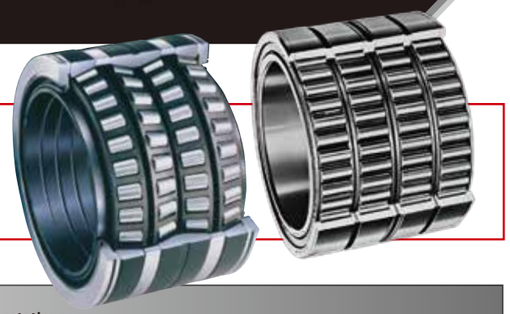
Oil seals

Features
- Superior sealing performance
- Lip contact stress dispersed
- Materials used are hydrogenated nitrile rubber (HNBR) and fluoro rubber (FKM)

Bearings for roll necks

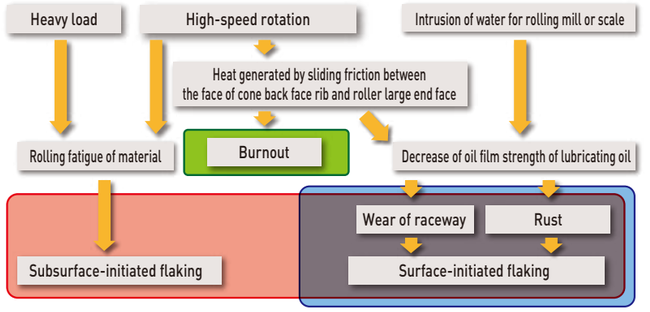


Bearings used to steel mill roll necks must cope with heavy loads and high-speed rotation in severe environments. In order to respond to these needs, JTEKT works daily to resolve related issues such as developing bearing materials and improving bearing seal performance.



Required performance and issues

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



Improvement of durability and service life to withstand heavy loads and high-speed rotations

Long-life / high corrosion-resistant carburized steel

JHS 520 JTEKT HYPER STRONG

◆ **Standard**
By using our newly developed case-hardening steel in the bearing rings, we have 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 treatment, we have provided the premium specification with further improved rolling fatigue life and corrosion resistance.

Features
1. Long-life and high corrosion-resistant steel with optimized content of chromium and molybdenum
2. Original carbonitriding 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
	Rust resistance comparison	Rust resistance comparison Life (JTEKT bench test)	
Conventional product			
Developed steel, carburized product ① (JHS520 standard)		Approx. 2.2-fold	Approx. 4-fold
Developed steel, special heat treated product ①+② (JHS520 premium)		Approx. 3.8-fold	Approx. 7-fold
Test conditions	Humidity cabinet test conditions Test temperature: 49°C ± 1°C Relative humidity: 95% or more Test period: 96 hours	Sample: Tapered roller bearing Main dimensions: ø50 × ø120 ×30 Lubrication: Grease (water content ratio, 30%)	Test piece form: 20 mm dia., 32 mm length Maximum contact stress: 5 800 MPa Loading cycle frequency: 285 Hz Lubricating oil: Turbine oil (ISO #VG68) Oil supply: 2 L/min (room temperature) * Test was stopped after 50 × 107 times.

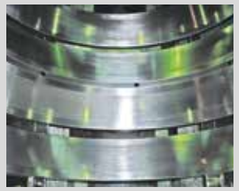
Examples of actual use

Cold strip mill work roll (open type) ① [JHS520 standard]

Conventional type

Used approximately 4 million tons (under DS)

Approx. 5-fold



No flaking

Cold strip mill work roll (sealed type) ①+② [JHS520 premium]

Conventional type

Used for approximately 24 mont (under OP)

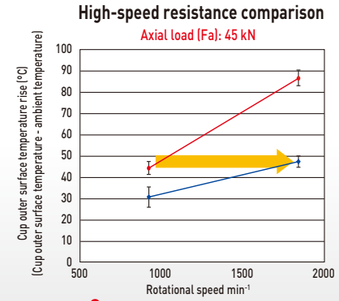
Approx. 4.8-fold

Hardly any indication of rust

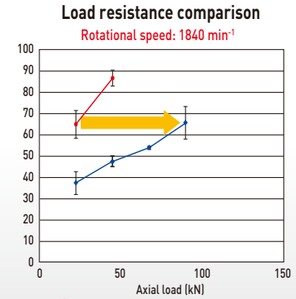
Improvement of durability and service life to withstand heavy loads and high-speed rotations

Technology for minimizing temperature increases

Features
- 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



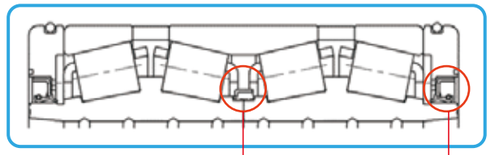
2 times the speed performance (at the same temperature rise)



4 times the load performance (at the same temperature rise)

Preventing intrusion of water / mill scale

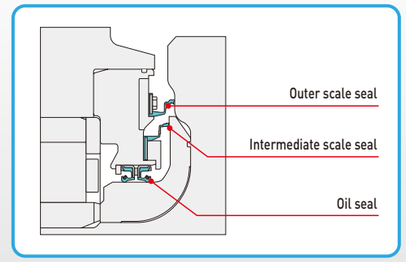
High sealing property oil seal for sealed-type, four-row tapered roller bearings



Features
1. **Greater robustness due to improved sealing property**
   - Optimization of seal lip shape
   - Maximized pump volume and reduced the amount of water infiltration into the interior of the bearing by 70% or more compared to conventional
2. **Expanded application range of the conventional material (NBR: nitrile rubber)**
   - Reduced seal lip temperature by 30% compared to conventional
   - Expanded the application range of common and low-cost NBR to improve convenience
3. **Reduced maintenance costs**
   - Contributed to reduction of customers' maintenance costs through extended service life of seals

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

Bearings for oil mist lubrication

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

[Service life]

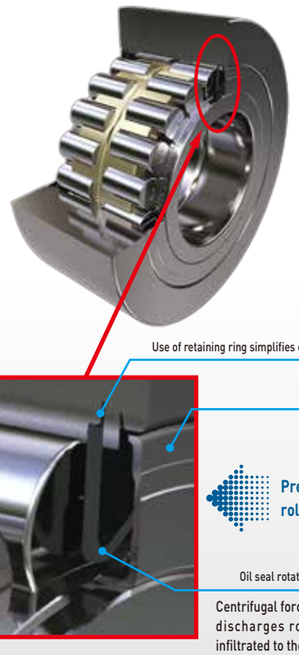
Conventional type

Approx. 2-fold (JHS210 Standard)

Approx. 4-fold (JHS210 Premium)

Premium specifications **JHS210** (JFEKT 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.



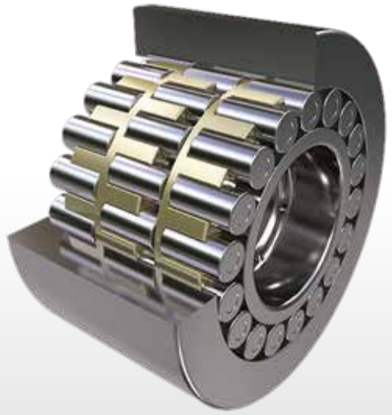
Longer inner ring rolling fatigue service life / Improving outer ring durability / Improving outer ring rotational accuracy

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 **JHS210** (JFEKT HYPER STRONG)

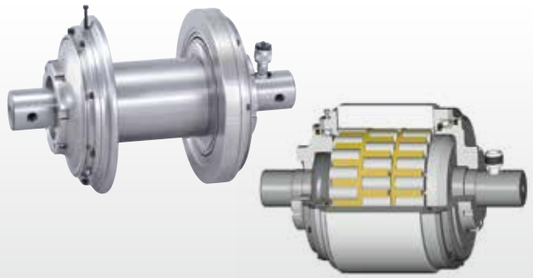
Case-hardened steel is used for the inner ring to suppress the loss of rolling service life under low-viscosity lubrication.
Bearing service life is approx. 1.5–3-fold that of conventional products.



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



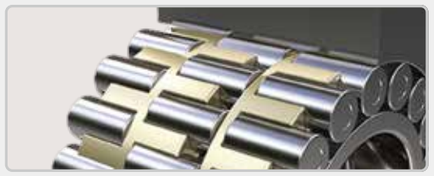
Improving ease of outer ring regrinding work

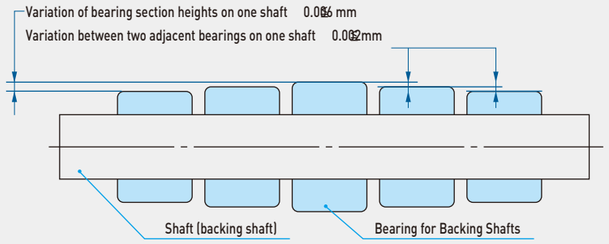
Measurement for Bearing Section Height

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





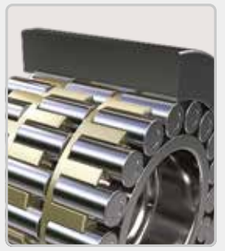
Core hardening

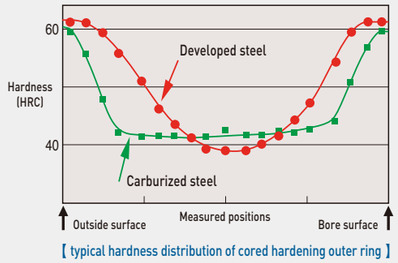
Surface-hardened layer improved approximately 3-fold

[Surface-hardened layer]

Carburized steel

Approx. 3-fold



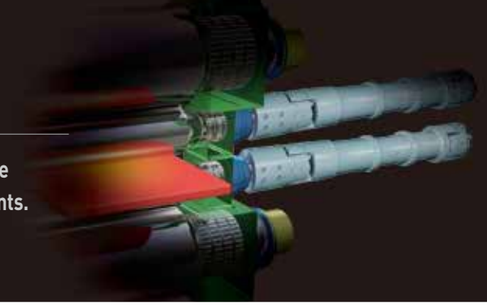


[typical hardness distribution of cored hardening outer ring]

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

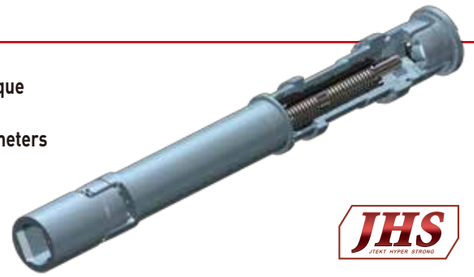
Drive shafts for rolling mills

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

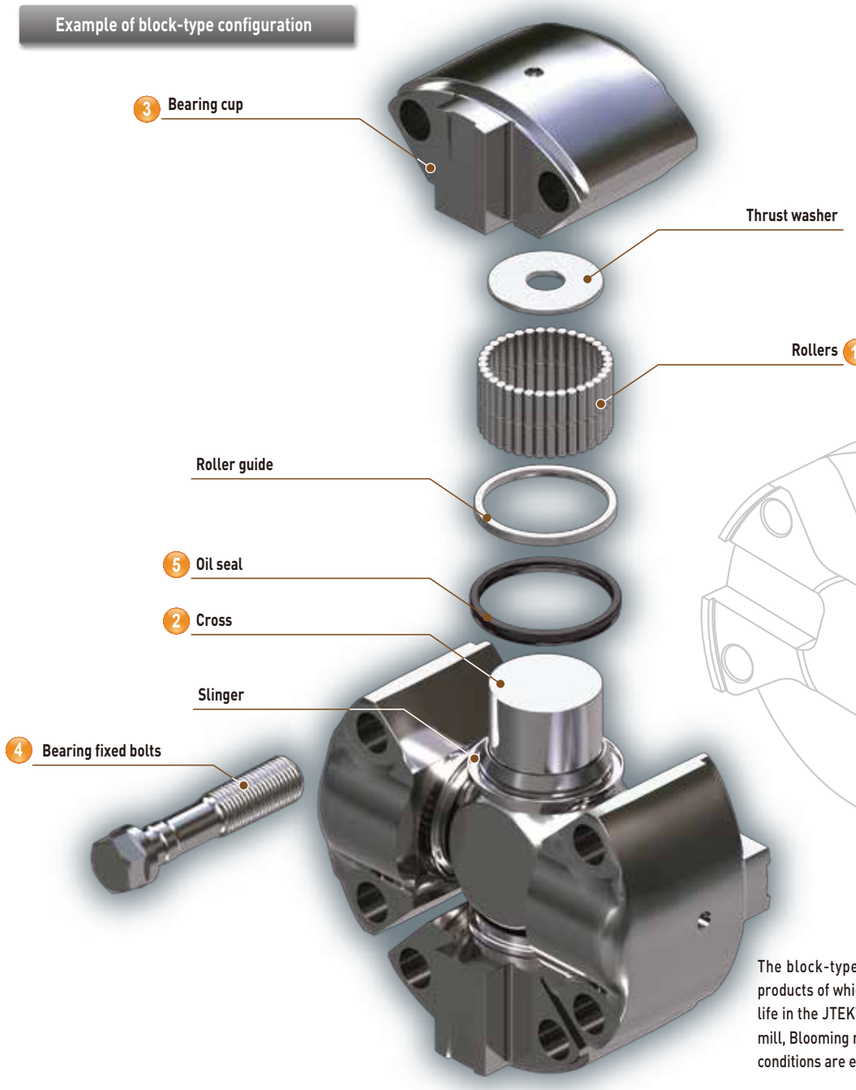


Required performance and issues

- 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



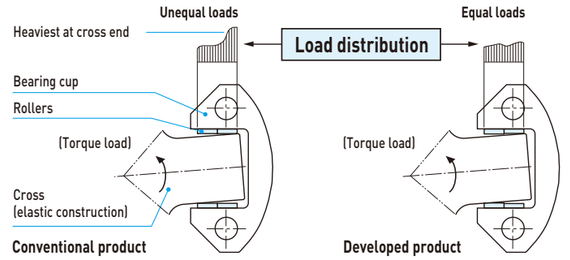
The block-type configuration is part of the D/U/T Series; the products of which are the strongest and have the longest service life in the JTEKT line-up. It is used in rolling mills such as Plate mill, Blooming mill and Hot strip mills (roughing/finishing) where conditions are extremely harsh.

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

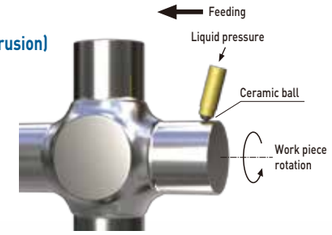
[Longer service life]

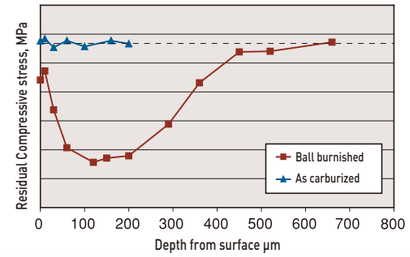


2 Ball burnishing on cross shaft

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

[Longer service life]

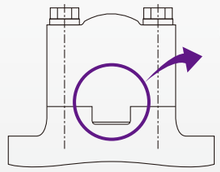


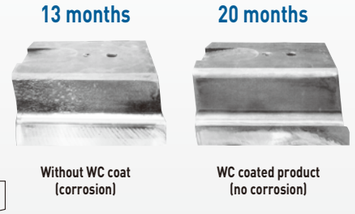


3 Thermal spraying coat of tungsten carbide (WC) on bearing cup key

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]

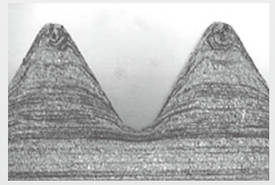




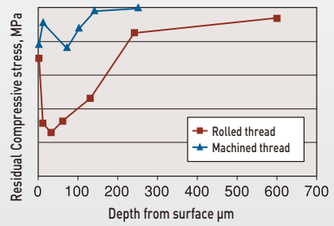
4 Application of form rolling to bearing set Bolt

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 】

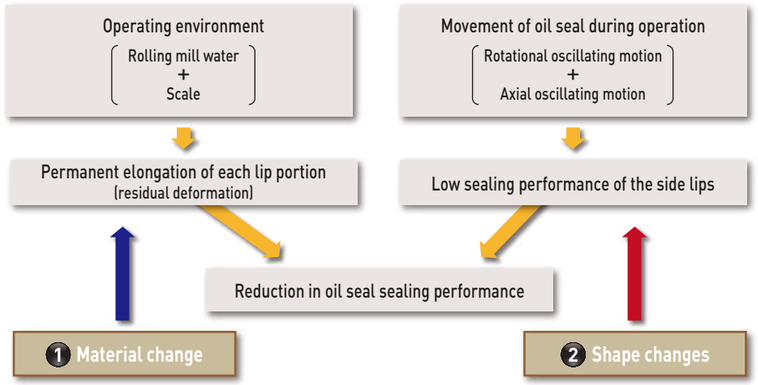


【 Residual compressive stress distribution of rolled thread 】

For more information, please refer to catalog No. B2021E.

Improved service life of oil seals and cross bearings

5 Development of a high-sealing oil seal



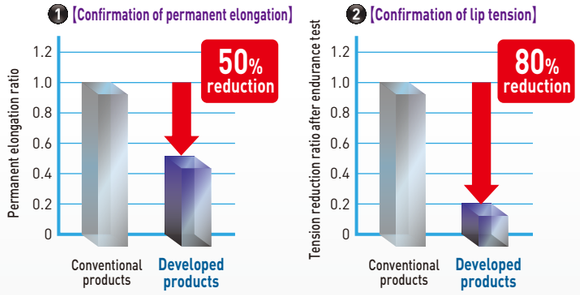
Features

1 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

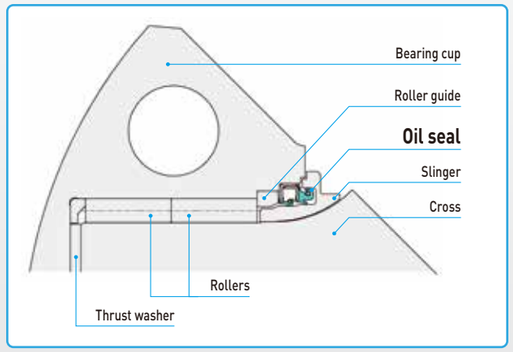
2 Improved sealing performance through shape change

- 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



Conventional product: NBR (nitrile rubber)
Developed product: NBR (high nitrile rubber)

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.



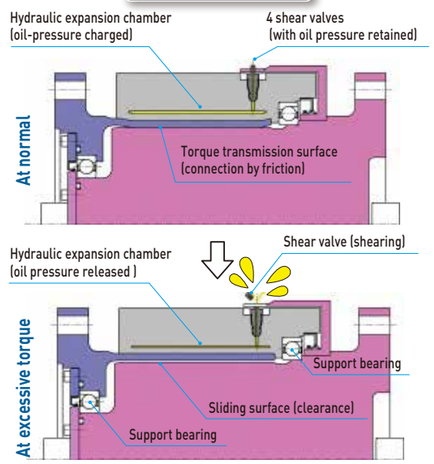
Optional mechanisms supporting drive shafts for rolling mill

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)

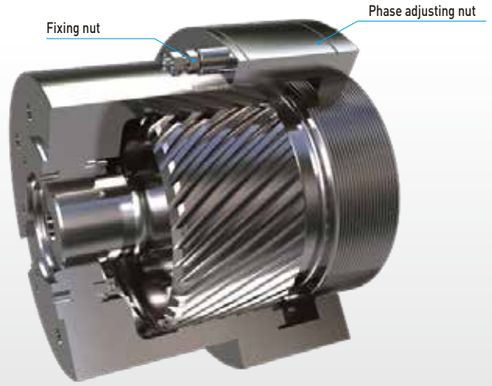
1. Phase alignment
2. Shear valve replacement (x4)
3. Re-pressurizing hydraulic expansion chamber

Optional mechanisms supporting drive shafts for rolling mill

Roll phase adjustment device (for bar & rod mill)

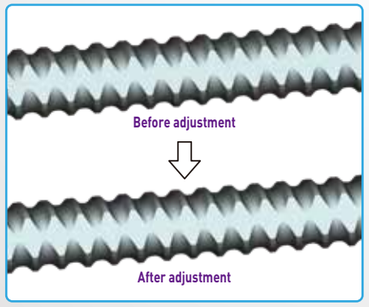
Features

- 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

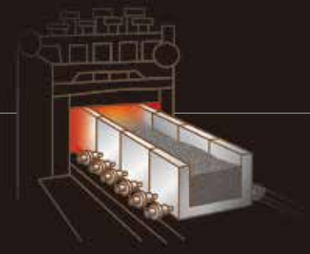


Adjustment work process (online work)

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

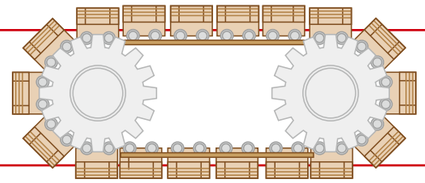
Bearings for sintering machine pallet car

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.

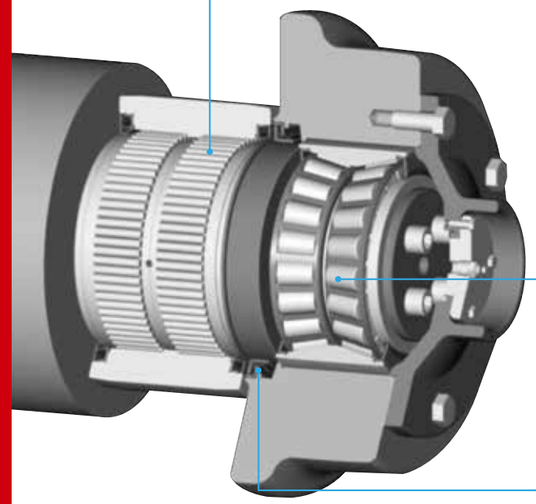


Required performance and issues

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



JHS JTEKT HYPER STRONG



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

Features

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)

Features

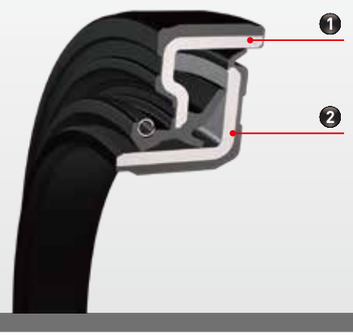
Integrated seal structure offers both high load capacity and excellent sealing performance
→ Can withstand heavy loads and prevents the intrusion of dust

Intermediate seal

Features

Structure combining two parts (❶ and ❷)
→ No damage to peripheral parts

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



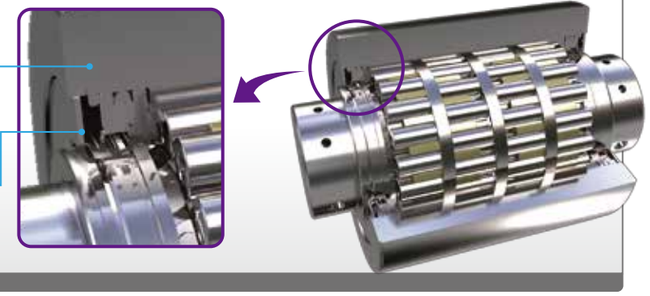
Bearing units for plate levelers

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

- 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

- 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

Large Size Bearing Technology Development Center

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

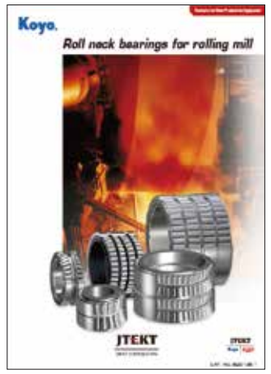
Please contact JTEKT to request a catalog or for advice regarding other technical issues or concerns.

JHS Series RZ-type Spherical Roller Bearings

CAT.NO.B2023E

Roll neck bearings for rolling mill

CAT.NO.B2013E

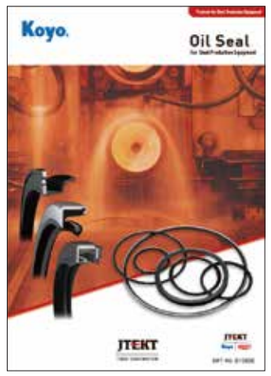


Cylindrical Roller Bearings for Multi-roll Mill Backup Rolls

CAT.NO.B2012E

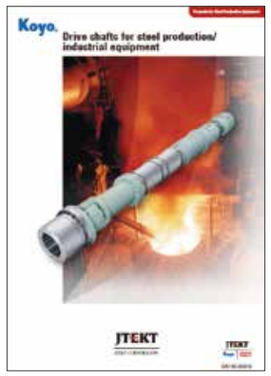
Oil Seal For Steel Production Equipment

CAT.NO.B1020E



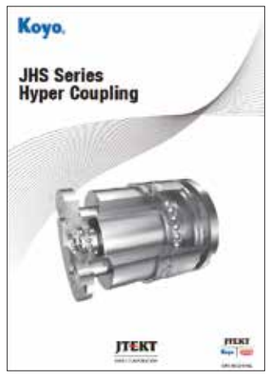
Drive shafts for steel production /industrial equipment

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.

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