

We pioneer motion

Metallurgical Production and Processing Playbook

Schaeffler's products and services for the metal industry

Interactive
e-booklet



Metallurgical Production and Processing Playbook

This Schaeffler Playbook supports sales activities in the metal industry. It provides valuable information about all aspects of the industry and shows what makes Schaeffler the leading technology partner for the sector: the products, systems, and solutions with which Schaeffler helps the industry to reach its goals. From the production process and the (user-specific) product and service portfolio to customized solutions, this Playbook answers every question, all for the purpose of meeting our goal of giving our customers the best advice possible.

















Metal Industry

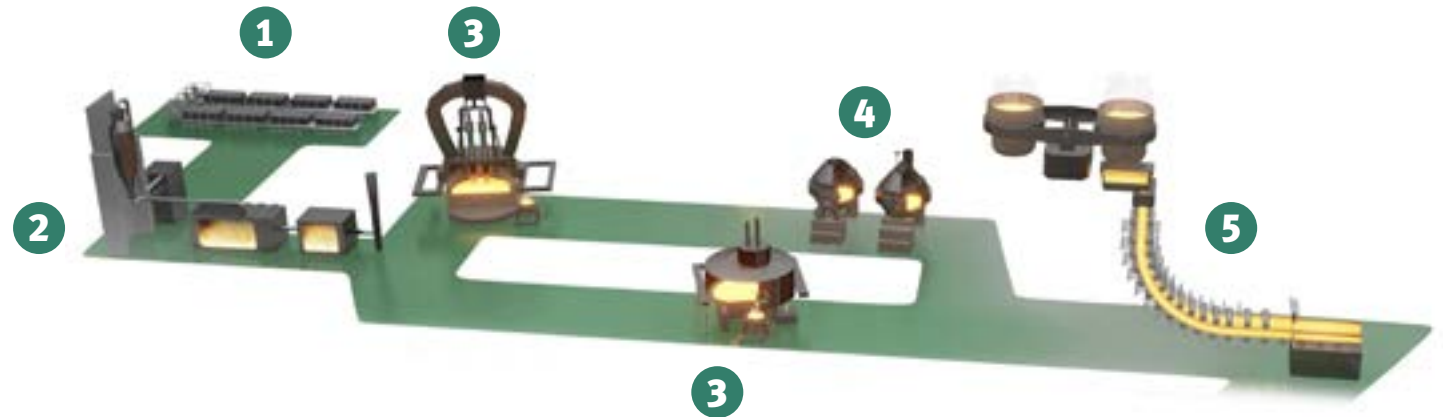


Conventional Steel Production and Processing



Green Steel: More Sustainable Steel Production Using Hydrogen

In addition to scrap metal recycling, the search for more sustainable processes for metallurgical production and processing is increasingly focusing on alternative energy sources. Whereas conventional methods use coking coal as an energy supplier, “green steel” is produced using hydrogen from renewable energy sources.



• Electrolyzers extract hydrogen from water molecules by splitting water into hydrogen (H₂) and oxygen (O).

1 Electrolyzer

2 Direct reduction

Direct reduction uses a reducing agent (natural gas/hydrogen) to convert iron ore to sponge iron. A reducing gas extracts the oxygen from the iron ore at about 1,050° C in overpressure conditions without smelting it.

• The arc furnace is used to smelt metals and sponge iron. The thermal radiation heats conductive materials to up to 3,500° C.

3 Arc furnace Open bath furnace

Sponge iron from the direct reduction is smelted into liquid pig iron in the open bath furnace. The conversion to crude steel takes place in the converter.

4 Converter

After the sponge iron is smelted in the open bath furnace, the pig iron is converted to crude steel in the converter.

• Conventional and alternative processes in metallurgical production and processing run from the ladle turret, which delivers the liquid steel to the continuous casting machine.

5 Ladle turret and continuous casting machine

Overview of the Most Important Applications

Converter



Continuous casting machine



Hot strip mill



Cold rolling mill



Multi-roll mill



Wire rod mill



Trends in the Metal Industry

Metal is an essential material in key industries like transportation, infrastructure, energy, mechanical engineering, and the automotive sector. That's why the metal industry plays a special role in one of the greatest trends of our time: the transformation of industry toward climate-neutrality.



Green steel: the path to sustainability

Solutions for energy-efficient, resource-saving, and carbon-neutral production are extremely challenging for the metal industry. On the one hand, steel is a 100% recyclable material and paves the way to the circular economy. On the other hand, it must be possible to cost-efficiently manufacture sustainably produced metal using renewable energy. Direct-reduction plants using green hydrogen is considered to be the clean technology of the future because it will enable a 95% reduction in CO₂ emissions. The resulting “green steel” is a key component in designing a more sustainable metal industry, and it also has a positive impact on the other industries where it is used.



Did you know?

An off take agreement signed in 2021 with H2 Green Steel to supply green steel is the first step toward making Schaeffler's supply chain climate neutral by 2040. In the future, we will source 100,000 tons of virtually CO₂-free steel on an annual basis.

The three biggest trends in the metal industry

Recycling and more sustainable alternative production processes aren't alone in determining the future direction of the metal industry. There are also other elements that will advance the entire industry:



Sustainability, carbon neutrality, and resource efficiency



Smart solutions for reducing plant downtime



Research and development of new materials and technologies

Facts and Figures

300 t is the maximum **capacity** of the world's largest **converters**
to **400 t**

Approximately **450 km/h**
is the wire exit speed of
a **laying head**

Approximately **30 MW** of drive power is
required by a **rolling mill** (hot strip mill)

Approximately **120 km/h** maximum
rolling speed is achieved by an
aluminum foil rolling mill

Approximately **6,000 t–11,000 t**
is the maximum **rolling force** of the
world's most powerful **plate mills**

Today the use of renewable energies is already making it possible to generate low-carbon steel on scrap-metal-based electrical steel routes.

Source: Wirtschaftsvereinigung Stahl – "Fakten zur Stahlindustrie 2021"



Did you know?

A total of four tons of new steel products can be generated from one ton of steel after it has been recycled six times.

Source: Wirtschaftsvereinigung Stahl – "Fakten zur Stahlindustrie 2021"

Steel Production Worldwide

Top crude steel-manufacturing countries in 2021

Rank	Country	Capacity (million t/year)
1	China	1,032.8
2	India	118.2
3	Japan	96.3
4	USA	85.8
5	Russia	75.6
6	South Korea	70.4
7	Turkey	40.4
8	Germany	40.1
9	Brazil	36.1
10	Iran*	28.5
11	Italy	24.4
12	Taiwan	23.2
13	Vietnam	23.0
14	Ukraine	21.4
15	Mexico	18.5
16	Indonesia	14.3
17	Spain	14.2
18	France	13.9
19	Canada	13.0
20	Egypt	10.3

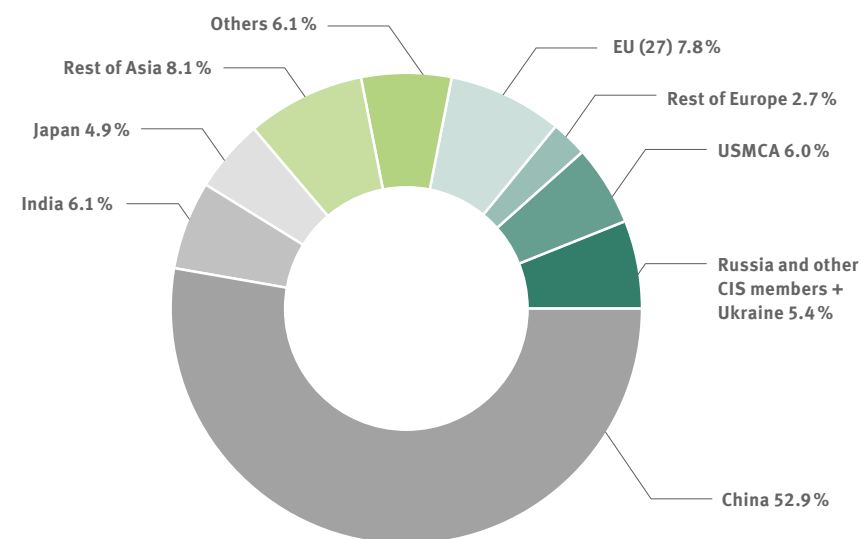
*Estimated value

Top steel manufacturers 2021

Rank	Company	Million t/year
1	China Baowu Group	119.95
2	ArcelorMittal	79.26
3	Ansteel Group	55.65
4	Nippon Steel Corporation	49.46
5	Shagang Group	44.23
6	POSCO	42.96
7	HBIS Group	41.64
8	Jianlong Group	36.71
9	Shougang Group	35.43
10	Tata Steel Group	30.59
11	Shandong Steel Group	28.25
12	Delong Steel Group	27.82
13	JFE Steel Corporation	26.85
14	Valin Group	26.21
15	Nucor Corporation	25.65
16	Fangda Steel	19.98
17	Hyundai Steel	19.64
18	Liuzhou Steel	18.83
19	JSW Steel Limited	18.59
20	Steel Authority of India Ltd. (SAIL)	17.33



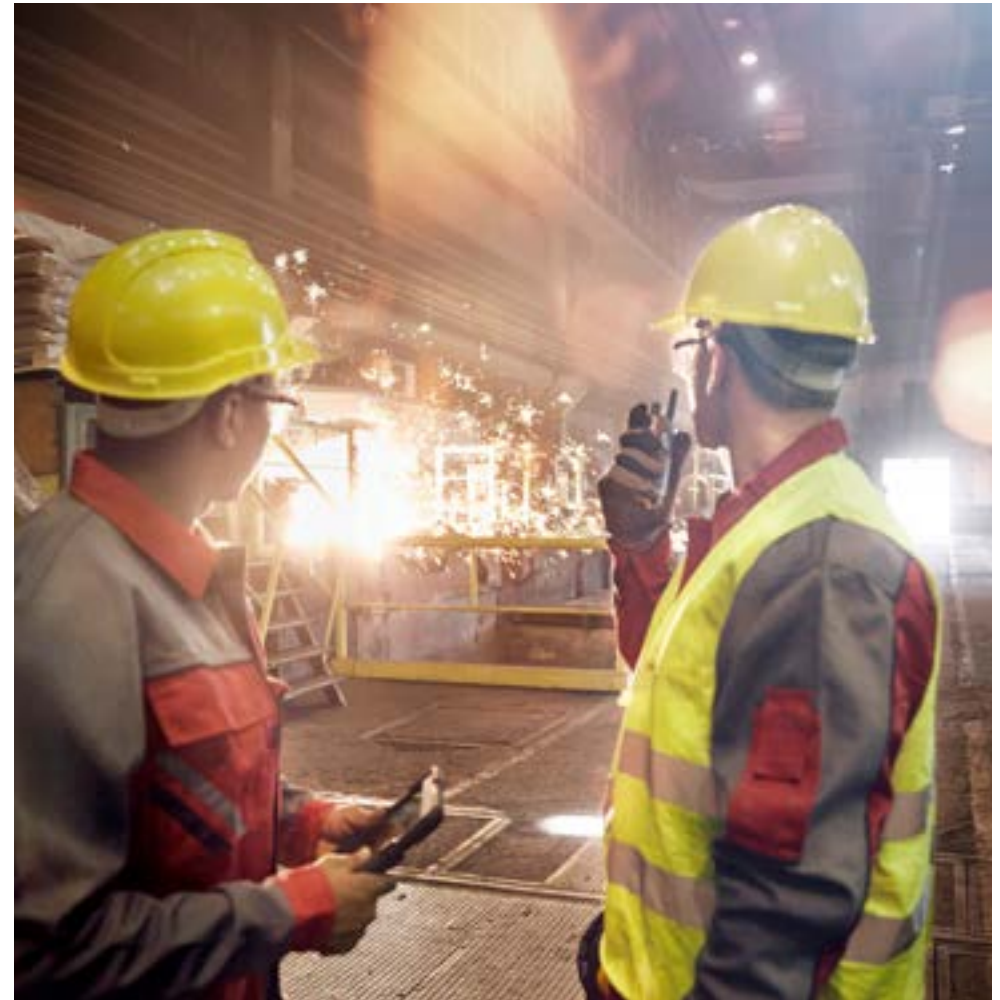
Global shares of crude steel production



Total: 1,951 million tons

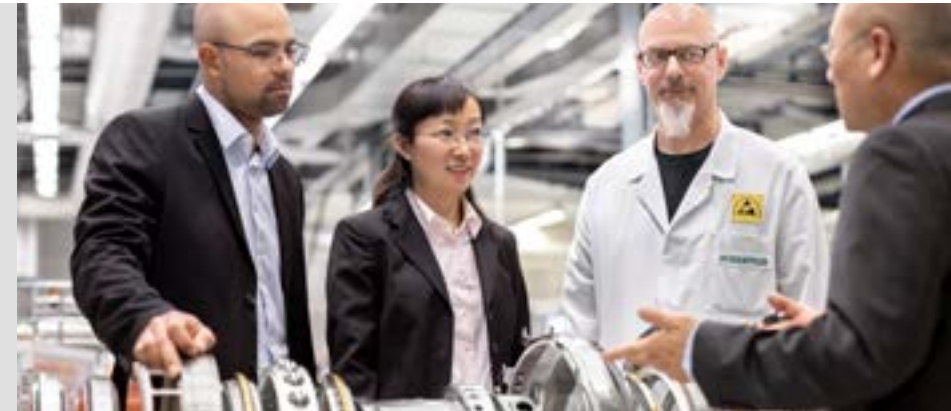
Source: worldsteel.org (<https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/>)

Schaeffler for the Metal Industry



Schaeffler: Your Partner for Metallurgical Production and Processing

Schaeffler is a partner of leading manufacturers and operators in the metallurgical production and processing industry. Our broad range of products and services enables us to help our customers worldwide optimize their plant processes.



Successful together

The harsh operating conditions in metallurgical production and processing impose tough demands on the performance and operational safety of all the components used. Thanks to years of close collaboration with our customers and extensive shared experience, we have a thorough understanding of the special challenges the metal industry presents. That means we are able to offer solutions that always utilize state of the art technologies while keeping the needs of the industry in mind.

With Schaeffler, companies can also rely on:

- A global network of experts
- Broad-based expertise with bearings
- User-friendly engineering tools in medias
- Sustainable product concepts
- Comprehensive digital solutions and an application-specific service portfolio

Benefits offered by Schaeffler in the metal industry at a glance

Top supplier to plant manufacturers and operators

End-to-end **expert knowledge**

Leader in **wireless machine diagnostics**

Forward-looking with **smart automatic lubrication**



We support customers ...

- **with expertise**
Application-specific support from our engineers.
- **with marketing**
Information, brochures, and social media content on our Partner Portal and in the Schaeffler Media Library.
- **with conversions**
A large database with customer part numbers and customized support when converting to Schaeffler parts.
- **during all project phases**
Planning, implementation, postprocessing, and maintenance.

Schaeffler Products and Services for Metallurgical Production and Processing



The extremely harsh operating conditions in metallurgical production and processing require equipment that meets the toughest demands. Thanks to our close collaboration with our customers, we're familiar with the specific requirements of the industry. Our high-quality bearings are specially designed for the specific challenges created by heat, dirt, scale, and cooling water as well as high operating and impact loads. As a leading roller bearing manufacturer, we work with manufacturers and operators to support metallurgical production and processing with comprehensive solutions. In addition to a large number of customized solutions, we also offer a broad portfolio of innovative products and services across a bearing's entire lifecycle.

Schaeffler roller bearings for the metal industry

Tapered roller bearings – four-row 	Cylindrical roller bearings – four-row 	Tapered roller bearings – double-row 	Spherical roller bearings 	Spherical roller bearings – split 
Angular contact bearings 	Cylindrical roller bearings – full-complement 	Spherical plain bearings 	Back-up rollers 	Housings 

Your advantages

- Decades of experience
- Proven quality
- High level of operational safety
- Long bearing life
- High load-carrying capacity and stability
- Reduced maintenance requirements
- Easy to install and remove
- Temperature resistance
- Suitable for heavy impact loads
- Comprehensive portfolio of digital solutions and application-specific services

Schaeffler services for the metal industry

Mounting tools and services 	Lubrication solutions 	Monitoring solutions and services 	Remanufacturing 	Expert services 
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Sustainability at Schaeffler

Sustainability is one of the Schaeffler Group's four company values. Our sustainability strategy is consistently aligned with the three ESG dimensions of environment, social, and governance.



Sustainable production for every industry

Schaeffler helps its customers reduce the CO₂ emissions of their plants, fully utilize their resources, and minimize their operating costs. This allows them to achieve their sustainability goals while at the same time optimizing their production processes.

Safety and high product quality

Schaeffler's solutions and products enable safe production with a consistently high product and process quality. They allow customers to improve the durability of their plants and also protect it from contaminants. This is also a form of sustainability.

Success thanks to innovative technologies

Climate-friendly production also means increasing plant availability. Automated system solutions and smart condition monitoring are examples of how sustainable production can become a factor for success when innovative technologies are used.

Benefits for our customers in terms of sustainability

Better market positioning
through sustainable
products

Lower production costs
through resource
efficiency

Sustainable production
through innovative
technologies

Long-term success
through high product
quality

Focus on sustainability

Schaeffler takes its social and ecological responsibilities seriously. Our roadmap for the fight against climate change includes ambitious goals:

- By 2025, we want to reduce emissions in our own production by 75% compared to 2019.
- By 2030, our production will be completely climate neutral. By 2030, emissions resulting from input and raw materials in our supply chain will be reduced by 25%.
- By 2040, our supply chain will also be completely climate neutral thanks to specific reduction measures. We will offset unavoidable emissions with compensation measures.

As described in our Sustainability Report, we have been recognized multiple times for our contribution to the fight against climate change.

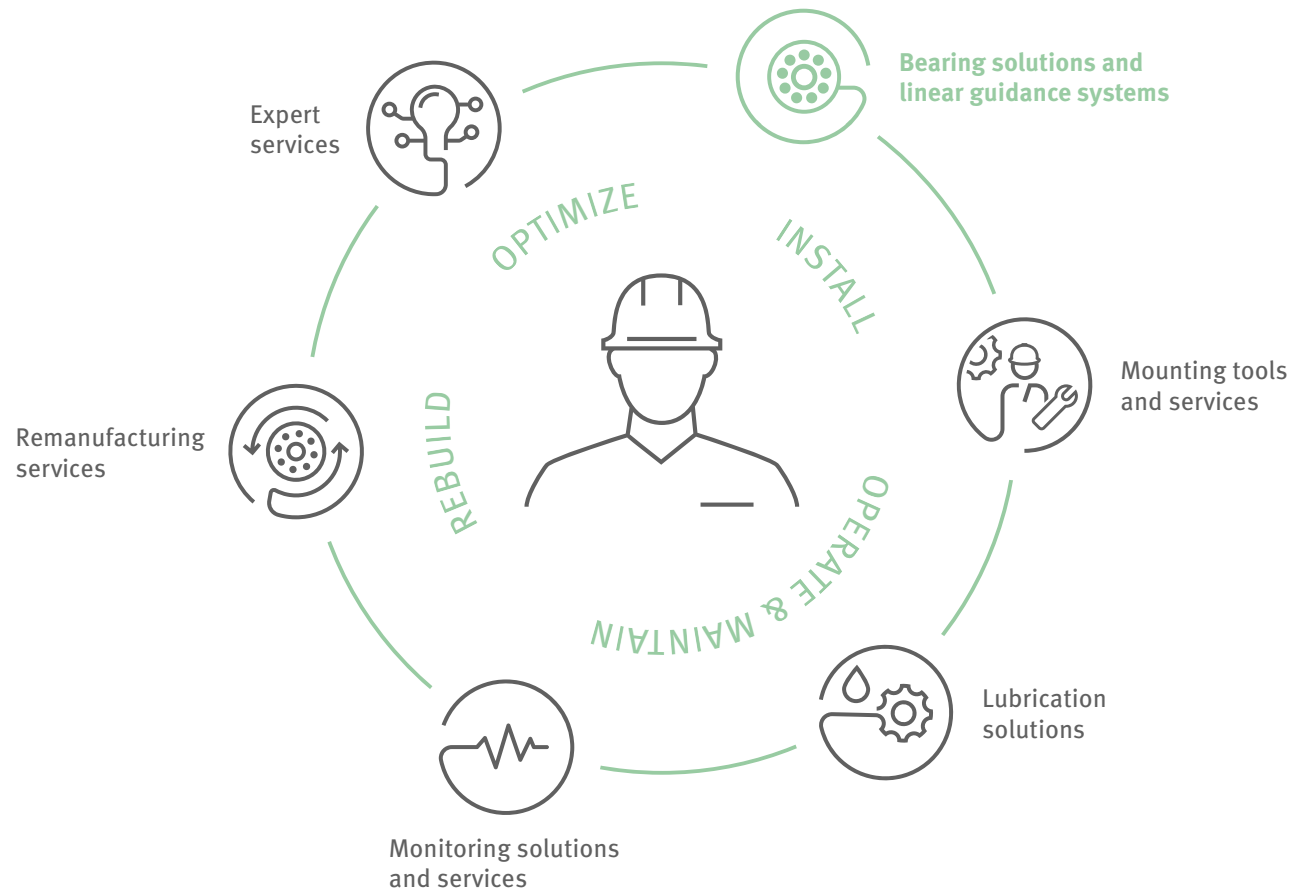
Added Value in Every Phase of the Life Cycle

Our customers are at the center of everything we do. No matter what industry they come from: we equip them with our innovations for pioneering motion. From bearing solutions to complete linear guidance systems, that's how we pioneer motion for the industry of the future.

What's more, we create innovations to extend the lifetime of these solutions. And with over 100 years of experience in the bearing business, we have earned the experience it takes to add value to every stage of the solution lifetime.

From the moment one of our solutions is installed to how it is operated and maintained: Schaeffler has a full portfolio of solutions and services to support maintenance teams and managers. Called Schaeffler Lifetime Solutions, the portfolio includes mounting tools and services as well as solutions and services for condition monitoring and lubrication.

But the lifetime does not end there. Schaeffler also offers re-manufacturing services to extend the lifecycle of bearings belonging to our customers and expert services to optimize their use. And that's how we add value over the lifetime for our customers.



Bearing Solutions for the Main Applications in the Metal Industry

As one of the world's largest roller bearing manufacturers, Schaeffler is an important partner for the metal industry. Based on our in-depth industry knowledge, we provide our customers with optimal bearing solutions for their applications – for maximum reliability even under the harshest ambient conditions.

Navigation instructions:
With the help of this overview, you can quickly and easily access the corresponding content in the Playbook by clicking the respective application or product in the table.

	Metallurgical production		Hot rolling			Cold rolling		
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Lifetime Solutions for the Main Applications in the Metal Industry

Schaeffler Lifetime Solutions offers an end-to-end portfolio specially tailored to the needs of maintenance teams and plant managers. From assembly to condition monitoring and smart lubrication, our products, solutions, and services are perfectly coordinated and help prevent up to 100% of all machine outages. Keep your machines rolling with Schaeffler.

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	Metallurgical production		Hot rolling				Cold rolling			
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14	●		●	●		●		●	●	●



Our comprehensive offering of bearing solutions and Lifetime Solutions is completed by a broad range of expert services and training courses.

Lifetime Solutions for Other Applications in the Metal Industry

Schaeffler Lifetime Solutions offers an end-to-end portfolio specially tailored to the needs of maintenance teams and plant managers. From assembly to condition monitoring and smart lubrication, our products, solutions, and services are perfectly coordinated and help prevent up to 100% of all machine outages. Keep your machines rolling with Schaeffler.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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14				●										●

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Our comprehensive offering of bearing solutions and Lifetime Solutions is completed by a broad range of expert services and training courses.

Application-Specific Solutions



Solutions for the Main Applications

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Converter

Where iron becomes steel

Tasks in the metal industry

- Convert pig iron to crude steel
- Reduce carbon and nitrogen content
- Add alloying elements

Challenges

- High loads and process-related misalignment of trunnion bearings
- Shock loads, heat, and dirt
- Lubrication under mixed-friction conditions

Schaeffler solutions

- Application-specific split and unsplit spherical roller bearings for trunnion bearings
- Application-specific housings
- Maintenance-free spherical plain bearings for vessel mounting and torque supports
- Condition monitoring (GreaseCheck, ProLink CMS), ARCANOL lubricants, and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Ladle Turret

Keeps steel production flowing

Tasks in the metal industry

- Constant operation of the continuous casting machine by loading it with liquid steel
- Turning and lifting the ladles between the casting position and tapping position

Challenges

- Heat
- Dirt
- Limited design envelope

Schaeffler solutions

- Low-maintenance and maintenance-free large spherical plain bearings
- ARCANOL lubricants
- OPTIME Ecosystem for auxiliary units



Continuous Casting Machine

A hot ride at low speeds

Tasks in the metal industry

- Cast the liquid steel
- Produce slabs, billets, and blooms

Challenges

- Heavy loads
- Low speeds
- Heat, dirt, and scale
- Cooling water

Schaeffler solutions

- Rolling bearings for strand guide rolls:
 - Needle roller bearings
 - Spherical roller bearings (optionally sealed)
 - Full-complement cylindrical roller bearings (optionally sealed)
 - Water-cooled housings combined with full-complement split cylindrical roller bearings
- Re-manufacturing (CO₂ reduction)
- ARCANOL lubricants
- OPTIME Ecosystem for auxiliary units



Roughing Stand, Finishing Train, and Coiler

Heat, dust, and shock load in reverse mode

Tasks in the metal industry

- Roll slabs
- Upcoiling of finished strip

Challenges

- Heavy loads
- Shock loads and working in reverse mode
- Contaminants like scale and dust
- Heat
- Cooling media

Schaeffler solutions

- Four-row tapered roller bearings (optionally sealed)
- Axial tapered roller bearings (optionally sealed)
- Axial spherical roller bearings
- Condition monitoring (ProLink CMS), ARCANOL lubricants, tools, and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Drive Spindle

Drive for the hot rolling process

Task in the metal industry

- Drive the work rolls via joint shafts or joint spindles

Challenge

- Forged joint flanges on the shafts require split bearing versions

Schaeffler solutions

- Single- and double-row split cylindrical roller bearings for easy bearing replacement
- Mounting tools



Section Mill

Shapes semi-finished products

Task in the metal industry

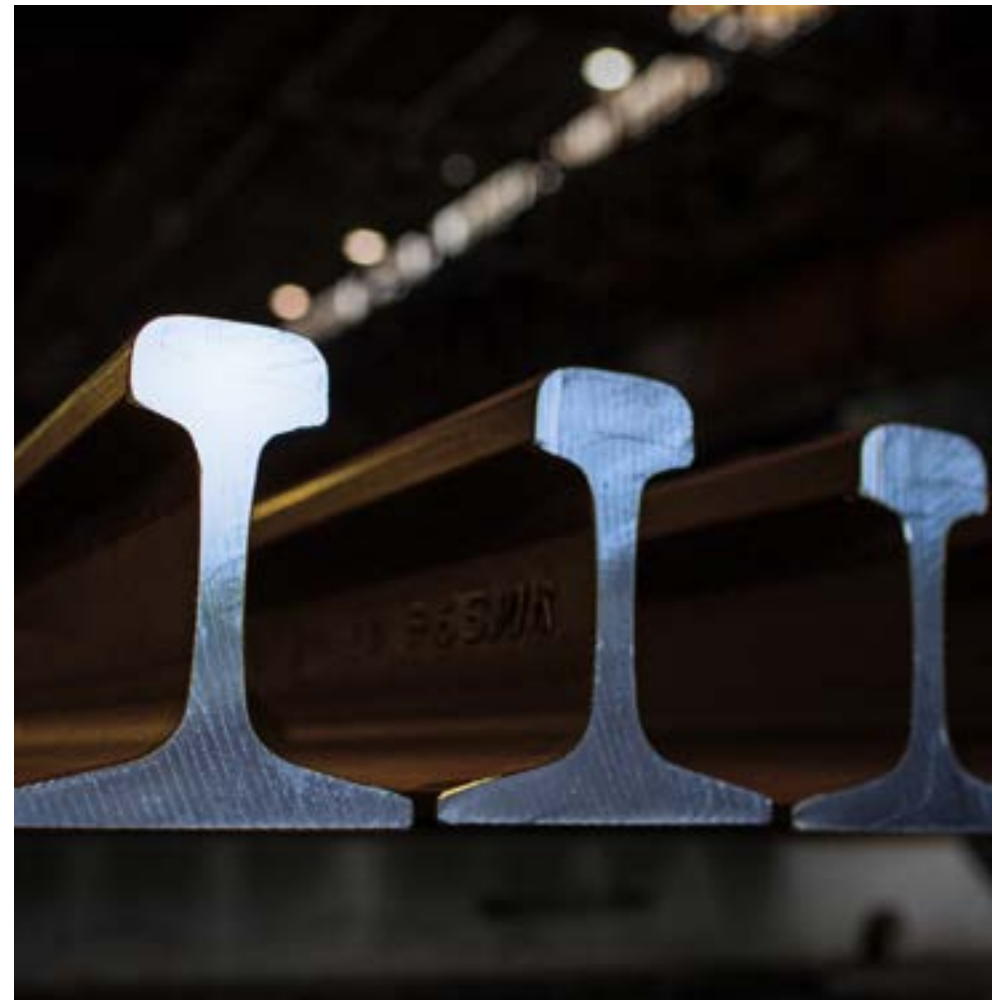
- Roll billets and blooms to make supports, section steel, and bar steel

Challenges

- Heavy loads and shock loads
- Dirt, heat, cooling media

Schaeffler solutions

- Four-row cylindrical roller bearings and four-row tapered roller bearings, optionally with wear-resistant heat treatment by carbonitriding
- Double-row angular contact bearings
- (Axial) spherical roller bearings
- Condition monitoring (ProLink CMS), ARCANOL greases, and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Tandem Rolling Mill

Higher surface quality thanks to higher dimensional accuracy

Tasks in the metal industry

- Produce application-specific material properties
- Improve surface quality

Challenges

- High rolling forces and speeds
- High dimensional accuracy

Schaeffler solutions

- Four-row cylindrical roller bearings with optional coating
- Double- and four-row tapered roller bearings, optionally sealed
- Angular contact bearings and deep groove ball bearings as axial guidance bearings
- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Cold Rolling Mill

Precision work on the surface structure under a changing load

Task in the metal industry

- Improve flatness and improve surface structure through cold rerolling

Challenges

- Varying strip speeds
- Changing loads
- Accuracy of product geometry

Schaeffler solutions

- Four-row cylindrical roller bearings
- Double- and four-row tapered roller bearings, optionally sealed
- Angular contact bearings and deep groove ball bearings as axial guidance bearings
- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for Auxiliary units



Multi-Roll Mill

Precision rolling method thanks to optimal bearing arrangement

Task in the metal industry

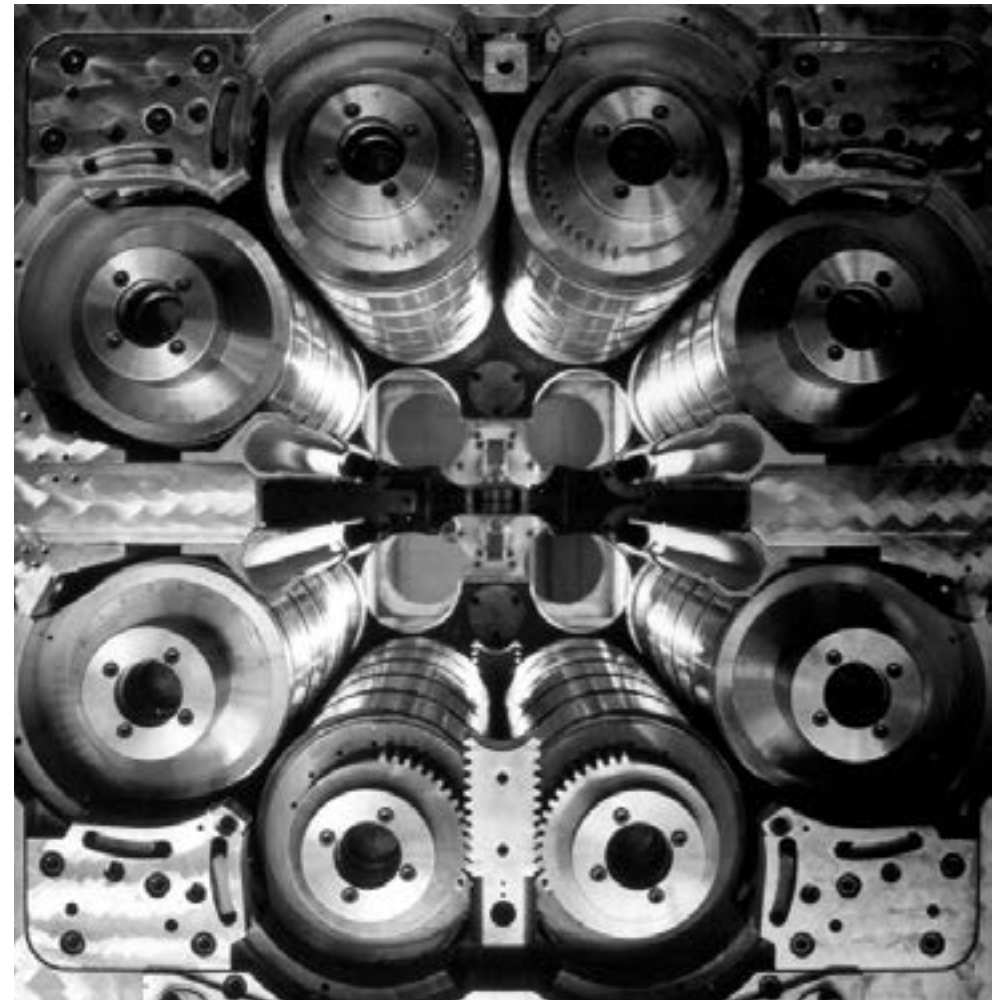
- Roll high-strength steel and stainless-steel strips

Challenges

- Very heavy loads
- High accuracy
- Critical lubrication conditions

Schaeffler solutions

- Back-up rollers (WGTR) with a high running precision in groups by section height, special heat treatment of the outer ring, and optional sealing (for pneumatic and recirculating oil lubrication)
- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Solutions for Other Applications

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Laying Head

Taking the corner at 450 km/h

Task in the metal industry

- Deposit the wire on the cooling and conveyor belt in overlapping windings

Challenges

- Very high speeds and high centrifugal forces on the bearing
- Vibration
- Elastic deformation

Schaeffler solutions

- Non-locating bearing side: single-row cylindrical roller bearing in a customized version (lubrication bore in the outer ring and special cages)
- Locating bearing side: paired spindle bearings or angular contact bearings
- Condition monitoring (ProLink CMS) and other Lifetime Solutions



Tubular Strander

Getting the hang of it

Task in the metal industry

- Produce steel strands and steel cables

Challenges

- Very high speeds with an application-related light bearing load
- High acceleration when starting up
- Vibration during operation

Schaeffler solutions

- Non-locating bearing (rotor bearing): single-row cylindrical roller bearing in a customized version (lubrication bore in the outer ring and special cages)
- Locating bearing: spherical roller bearings
- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Ring Rolling Mill

Perfection despite a high temperature and enormous load

Task in the metal industry

- Produce seamlessly rolled, ring-shaped, semi-finished products for further processing

Challenges

- Heavy loads and temperatures
- Deflection of main and mandrel rolls
- Contaminants due to scale and dust

Schaeffler solutions

- Spherical roller bearings with high load carrying capacity (optional coating)
- Axial spherical roller bearings
- Back-up rollers with optimized outer ring surface profile and special seals
- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Transfer Crane or Carriage

Reliable transportation in virtually all process steps

Tasks in the metal industry

- Usage as overhead or steel transfer cranes
- Tasks range from placing raw materials in the smelting furnace to lifting and loading finished steel coils onto a means of transportation

Challenges

- Heavy loads
- Heat
- Dirt

Schaeffler solutions

- Condition monitoring (ProLink CMS) and other Lifetime Solutions
- OPTIME Ecosystem for auxiliary units



Roller Tables

Carried on rolls: transportation of semi finished products in hot and dirty conditions

Task in the metal industry

- Transport slabs, billets, sheet metal, and profiles

Challenges

- Heavy loads
- Heat
- Contaminants like scale and dust

Schaeffler solutions

- Spherical roller bearings
- Sealed spherical roller bearings
- Housings
- ARCANOL lubricants and mounting tools



Gear Units

Reliable and economical operation

Tasks in the metal industry

- Power transmission
- Influence the direction of rotation
- Control of speed and torque

Challenges

- Heavy loads
- Speed
- Design envelope
- Shaft arrangement
- Narrow radial and axial shaft guidance
- Rigidity of connector parts

Schaeffler solutions

- Broad portfolio of bearings: cylindrical roller bearings, spherical roller bearings, double-row tapered roller bearings, deep groove ball bearings, angular contact bearings
- Different condition monitoring systems (OPTIME Condition Monitoring, SmartCheck, ProLink CMS), and other Lifetime Solutions



Electric Motors

Driving the industry

Task in the metal industry

- Responsible for the drive in almost all applications

Challenges

- Long-term machine availability with lowest possible maintenance overhead
- Risk of current discharge in bearing
- Lifetime lubrication
- High operating temperatures

Schaeffler solutions

- Friction-optimized deep groove ball and cylindrical roller bearings
- Other rolling bearings commonly used in electric motors, including angular contact bearings, spindle bearings, and axial spherical roller bearings
- Aluminum oxide coating (J20) or versions with ceramic balls for electrical insulation
- Various condition monitoring systems (OPTIME Condition Monitoring, SmartCheck, ProLink CMS)
- Optimal lubrication with automatic CONCEPT lubricators or the smart OPTIME C1 lubricator solution
- ARCANOL lubricants



Fans

For an optimal fresh air supply

Tasks in the metal industry

- Air-conditioning and cooling
- Discharge used air and exhaust gases
- Feed the process air

Challenges

- Imbalances and misalignments
- High speeds
- High temperatures
- Slippage in rolling bearings
- Subject to dust and dirt

Schaeffler solutions

- Generation C deep groove ball bearings with standard and low-friction lubricants
- Angular contact bearings, cylindrical and spherical roller bearings
- Flanged SNS and SES housings, including a variety of sealing options
- Various condition monitoring systems (OPTIME Condition Monitoring, SmartCheck, ProLink CMS)
- Optimal lubrication with automatic CONCEPT lubricators or the OPTIME C1 smart lubricator solution
- ARCANOL lubricants



Pumps

Working under high pressure

Tasks in the metal industry

- Pump and feed the cooling media in process technology
- Convey lubricants

Challenges

- High radial and axial loads
- Strong vibration
- Shaft arrangement and design envelope
- Long-term machine availability with lowest possible maintenance overhead
- Economical bearing solutions

Schaeffler solutions

- Generation C deep groove ball bearings (optionally sealed)
- Single-row and double-row angular contact bearings (optionally sealed)
- Spherical and tapered roller bearings
- Non-locating bearing: single-row cylindrical roller bearings in N or NU design
- Various condition monitoring systems (OPTIME Condition Monitoring, SmartCheck, ProLink CMS)
- Optimal lubrication with automatic CONCEPT lubricators or the OPTIME C1 smart lubricator solution
- ARCANOL lubricants



Roll Shop

Maintenance of bearings and rolls

Tasks in the metal industry

- Maintenance of rolls and chocks
- Inspection of rolling bearings
- Inspection of rolls
- Assemble / disassemble of rolling bearings
- Grinding the rolls

Challenges

- Expert maintenance of chocks and rolling bearings
- Plannable availability
- Cost-efficiency and sustainability

Schaeffler solutions

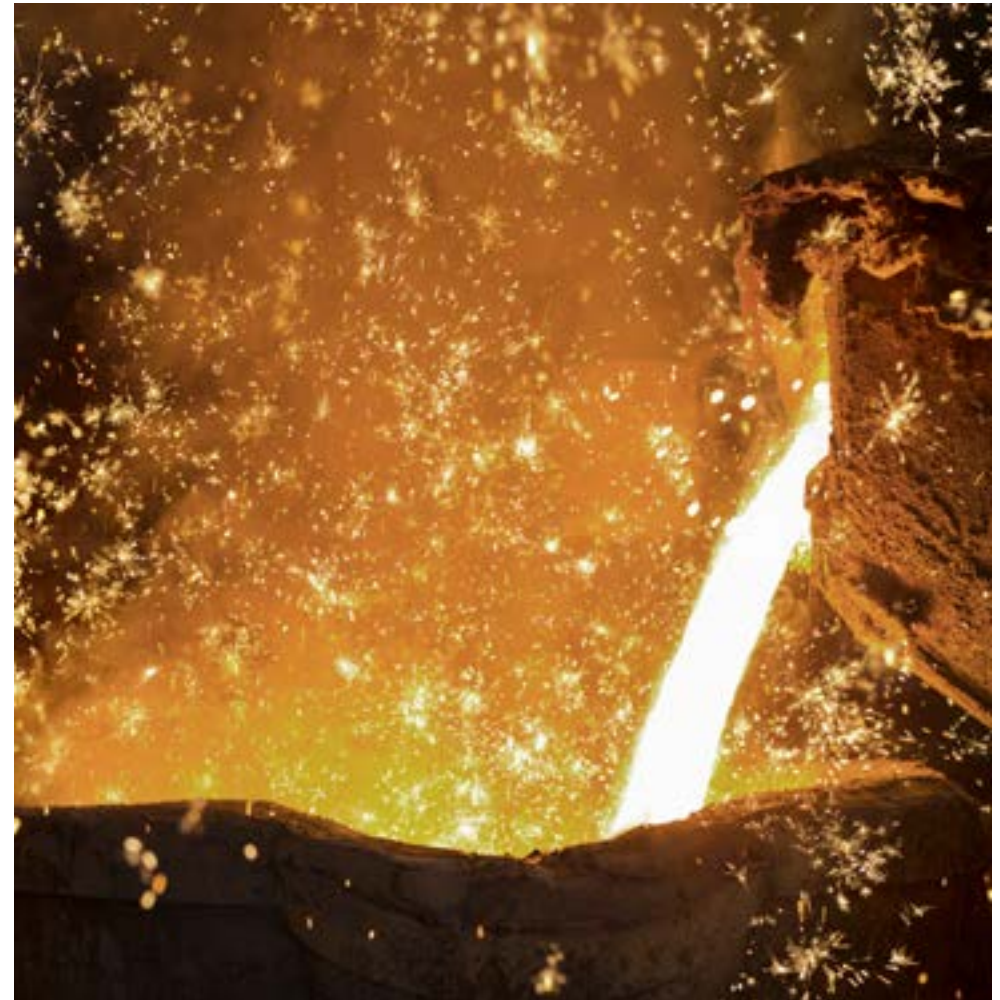
- Bearing remanufacturing and chock unit service
- Mounting service, mounting tools, medium frequency technology (MFT) heating devices
- ARCANOL lubricants



Products and Services



Bearing Solutions



Tapered Roller Bearings

Bearings with optimum load distribution

FAG



Heavy-duty, reliable, and energy efficient: Tapered roller bearings balance loads effectively due to their bearing spacing and ensure precise and rigid shaft guidance. They have a broad speed range and are easy to adjust, disassemble, and assemble.

Tapered roller bearings manage radial and axial loads with equal effectiveness. They are also characterized by a broad usable range of speeds. The tapered roller bearings reliably withstand loads even under adverse conditions and ensure precise and rigid shaft guidance. The adjustability and removability of the bearings ensure easy installation and maintenance. Schaeffler offers many standard series of tapered roller bearings at X-life quality. The effect: higher load capacity, less maintenance, longer service life, and optimized overall cost-effectiveness. We also offer a wide range of flexible and individual product solutions through our concept of partnership-based development.

At least double the operating life thanks to high-performance steel

Rolling bearing materials in rolling mills are subjected to heavy loads and severe ambient conditions due to coolants, scale, and dust. Plant operator PAO Severstal chose to use four-row tapered roller bearings made of Manganese high-performance carbonitrided steel in order to extend the operating life of its bearings in a six-stand strip mill in Cherepovets, Russia. This special material optimizes wear resistance and doubles the operating life. Good lubrication conditions also extend fatigue life, which in turn increases plant availability.

Axial tapered roller bearings for screw-down mechanisms

Axial tapered roller bearings for screw-down mechanisms are a special version of single-direction axial tapered roller bearings that are specifically designed for this site. They are mounted between the pressure spindle and the upper chock, can handle extremely heavy axial loads, and leave the chock the space necessary for angular motions. They are extremely low friction and reduce screw-down forces, which is especially advantageous when rolled stock thicknesses are frequently changed.



Double- and Four-Row Tapered Roller Bearings

Designed for combined loads



Multi-row tapered roller bearings consist of solid rings and multiple tapered roller assemblies arranged on an incline with a cage. Specifically designed to support combined loads, they are ideal for heavy radial and axial loads in both directions. Multi-row tapered roller bearings can also be disassembled.

All of our multi-row tapered roller bearing designs have high load carrying capacity and rigidity. Options from the modular design kit for tapered roller bearings – including heat treatment (carbonitriding), integrated sealing, and X-life quality – double the operating life and ensure greater wear resistance and better protection from external influences. Bearings at X-life quality are also distinguished by low bearing friction and reduced grease consumption, which in turn contributes to a reduction in CO₂ and protects the environment. Whereas double-row tapered roller bearings are deployed in many industries, including the automotive sector, four-row tapered roller bearings are used almost exclusively in rolling mills for metal processing. They can withstand maximum loads in harsh environments and usually make axial bearings superfluous. Mancrodur high-performance steel extends the bearing's operating life and has an added positive impact on its carbon footprint.

Mancrodur tapered roller bearings deployed for 10 years

The rolling bearings in the hot strip mill at thyssenkrupp Steel Europe's Bochum location have to withstand massive loads, including extreme forces, high temperatures, constant exposure to water, and external influences. That's why Germany's leading provider of high-grade steel products chose extremely wear- and heat-resistant tapered roller bearings made of carbonitrided Mancrodur. Schaeffler experts at the Remote Diagnostic Center have been monitoring the plant for ten years and immediately report imminent bearing damage to the thyssenkrupp maintenance team.

What are the effects of carbonitriding?

Carbonitriding is a special heat treatment technology where the surface layer of the bearing rings is enriched with nitrogen as well as with carbon. The result:

- Bearings have a higher surface hardness and improved wear resistance
- Longer operating life, even in the presence of particle overrolling and mixed friction
- Delayed material fatigue with optimal lubrication



1: Simple carbon: coarse-grained carbide distribution

2: Carbonitrided (carbon and nitrogen): finely distributed carbonitride

Cylindrical Roller Bearings

For heavy radial and axial loads



Able to withstand enormous forces: Cylindrical roller bearings can withstand extremely heavy radial loads, and can also handle axial forces if they are used as support or locating bearings. Radial loads are transferred via the race, while axial loads are transferred via the rolling-element end faces and ribs.

Cylindrical roller bearings basically comprise a single- or multi-row set of cylindrical rolling elements. They are available in a variety of designs, dimensional ranges, and sizes to meet specific requirements. Options include different combinations of ribs on the inner and outer rings, with or without a cage, in a single-row full-complement or double-row full-complement version, and with a variety of cage versions. What all the versions have in common is that they are all suitable for heavy radial loads, because, in contrast to a ball, a roller has a larger contact area perpendicular to the roller axis. This doesn't just enable a more efficient transmission of greater forces, it also makes the bearings more rigid and smaller in size for the same load. Cylindrical roller bearings are easy to dismantle and mount.

Rapid assistance from Schaeffler experts

Undetected damage to bearings resulted in a sudden shutdown of the wire mill owned by a globally active long steel producer. Because downtime is extremely expensive for the customer, Schaeffler sent an employee to diagnose the damage on the same day. The failure analysis revealed that the new bearings only recently installed were incorrectly mounted by the customer. Schaeffler guided the customer through the process of professionally mounting the new bearings, which made it possible to reduce plant downtime to a minimum. To ensure that the customer is better prepared for damage in the future, Schaeffler experts also conducted a special training course for personnel.

Full-complement cylindrical roller bearings for continuous casting machines

The bearings in continuous casting machines need to continuously withstand high loads and shocks. Full-complement cylindrical roller bearings are ideal for these operating conditions. Rolling bearings in continuous casting machines are also subject to extremely high temperatures and cooling water. Schaeffler specifically developed the CoCaB (**C**ontinuous **C**aster **B**eating) program with these requirements in mind. Full-complement cylindrical roller bearings as a non-locating bearing solution are also part of this program and feature:

- High radial load carrying capacity
- Unrestricted axial displacement facility
- Ability to compensate for misalignments
- Fast and easy mounting



Four-Row Cylindrical Roller Bearings

For maximum load carrying capacity and speed

FAG



Four-row cylindrical roller bearings can handle very heavy and exclusively radial loads, thanks to the cylindrical rolling elements' large contact area, the large number of rollers, and a rigid design. The bearings also have a high runout accuracy and are suitable for high speeds.

Larger four-row cylindrical roller bearings in particular are designed with a pin type cage so they can accommodate as many rolling elements per row as possible. They're an economical and operationally reliable bearing alternative for complex applications, especially in heavy industry. They can be dismantled in order to simplify the process of mounting, disassembly, and inspection of raceways on the bearing rings. Design options like Mancrodur high-performance steel, heat treatments (case hardening and carbonitriding), and X-life quality ensure a longer operating life, greater wear resistance, and lower friction. The inner rings are also available with preground raceways (suffix F12). In this case, after being mounted on the customer's premises, the inner rings on the roll neck are ground at the same time as the rollers. This increases runout accuracy and the dimensional accuracy of the rollers. Four-row cylindrical roller bearings with solid or pin cages are special rolling bearings that were specifically developed for the metal industry.

Upgrade to higher rolling forces

VDM Metals GmbH's location in Siegen, Germany, replaced its old mill with a state-of-the-art version capable of working with a maximum rolling force of 60 Meganewtons and incorporating hydraulic adjustment and work-roll bending. The customer requested that as many components as possible be reused. This was achieved in part by chromium-plating the existing bearings to the new diameter. A special four-row cylindrical roller bearing with a larger bore diameter and one-piece steel cage made it possible to upgrade to the higher rolling forces.



Benefits of X-life quality

- Dynamic load ratings increased by up to 20%
- Approximately 70% longer service life under the same operating conditions
- Up to 75% less friction
- Lower operating costs, thanks to reduced energy consumption
- Extended maintenance intervals, thanks to improved lubrication
- Less strain on lubrication, thanks to reduced heat generation

Spherical Roller Bearings

For special loads and long service life

FAG



Designed for the highest loads, Schaeffler's spherical roller bearings are made for plants in which high stresses occur and where shaft deflections or misalignments have to be compensated. In every area of application, they are distinctive for their high performance and reliability.

X-life increases performance, cost-effectiveness, operating life, and reliability. Decisive advantages from which customers benefit include optimum kinematics, low wear, and a 60% longer service life, with low maintenance requirements and minimal costs compared to the previous standard. The versatile bearings also save space as significantly smaller bearings can easily match the performance of larger variants.



Rapid converter mounting thanks to a custom-tailored design

In 2013, a leading European steel manufacturer planned to replace a converter in order to increase the capacity of its oxygen steel plant. To allow assembly and subsequent maintenance to be performed as quickly as possible, the customer chose Schaeffler split spherical roller bearings and custom-tailored spheroidal graphite cast iron housings, which are also designed for use with split spherical roller bearings. Both bearings significantly reduced mounting time, and as a result, maintenance and downtime costs were permanently reduced.

One bearing, many solutions

Schaeffler offers a wide range of spherical roller bearings, as well as the necessary expertise and infrastructure to solve a range of challenges.

Spherical Roller Bearings with End-Profiled Rollers

FAG

The solution for bearings exposed to particularly heavy stresses

Harsh operating and environmental conditions like those found in the metal, cement, and mining industries place bearings under extreme stress. Depending on the application, the bearings are also subject to high forces, tremendous weight, and shock loads. During operation, dust and other contaminants quickly penetrate the bearings. The bearing components are also subject to wear due to high loads and unavoidable mixed friction conditions. These dirt particles act like sandpaper and facilitate early material fatigue, which leads to edge loading and further accelerates wear. With end-profiled rollers, the defined removal of material helps reduce the edge loading and thus prevents wear. The result is a significant improvement in bearing service life.

15%

The modified line contact between the rollers and races prevents harmful edge stress. This improves service life by up to 15%.

The switch to spherical roller bearings with end-profiled rollers helps reduce edge stress caused by abrasive material wear by up to 20%.

20%

ADVANCED STANDARD FOR
SPHERICAL ROLLER BEARINGS
IN CONVERTERS
AND CONTINUOUS
CASTING MACHINES
IN THE METAL INDUSTRY.



Benefits at a glance

- Improved overload protection
- Improved service life
- Improved wear resistance
- Improved system availability
- Improved operational safety



Axial Spherical Roller Bearings



For very heavy axial loads and high speeds



Axial spherical roller bearings are single-row roller bearings with an angular adjustment capability. They consist of solid shaft and housing locating washers and asymmetrical barrel rollers with cages that hold the roller and cage assembly together with the shaft locating washer.

Axial spherical roller bearings absorb very high axial loads and enable relatively high operating speeds, even under the harshest environmental conditions. The bearings can be disassembled, which means the bearing components can be fitted separately. A range of sizes are available in the X-life version. This quality seal guarantees features such as maximum lifespan and service life, and the best load capacity even at maximum speeds. The higher dynamic load ratings compared to conventional versions open up new design opportunities for axial spherical roller bearings in X-life quality. That means they are ideally suited for downsizing, for example.

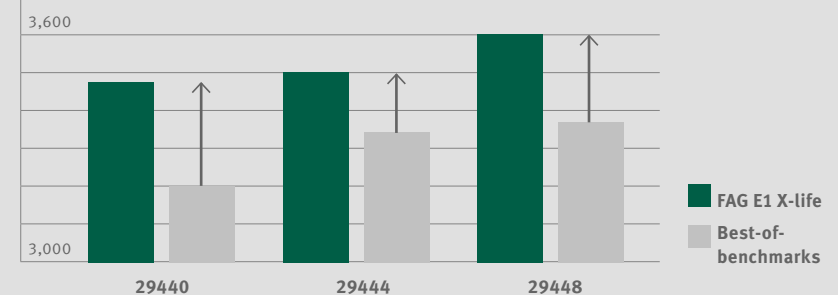
Spherical roller bearings provide shade in Wimbledon at the push of a button

At Wimbledon's Centre Court, more than 300 spherical roller and axial spherical roller bearings ensure that the roof with a span of 77 meters opens or closes in just a few minutes. Like an accordion, the 5,200 square meters of fabric can be folded to save space. Several arched trusses in the roof halves bridge the playing field and stands, and give the roof stability. FAG axial spherical roller bearings support the loads of up to 60 metric tons that emanate from the tension cables used to keep the truss arches and roof fabric taut.

The highest-performing bearings on the market

- 45% longer service life
- 12% higher dynamic load rating
- 4% higher static load rating
- Up to 20% less friction
- 14% higher fatigue limit load
- 7% higher speeds

Dynamic load rating C_d



Sealed Spherical Roller Bearings **FAG**

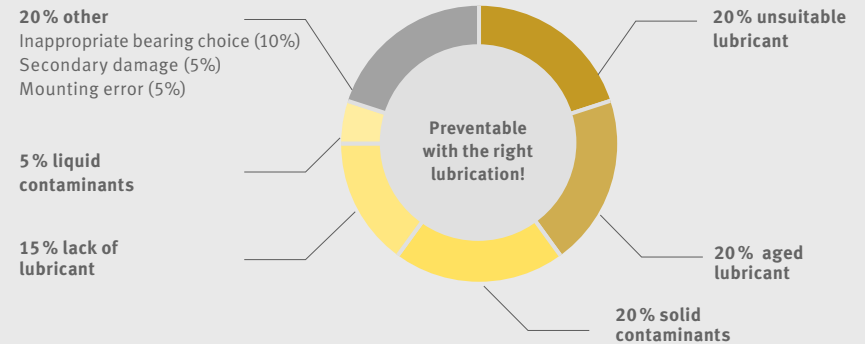
For a longer operating life and smaller carbon footprint



The sealed versions of spherical roller bearings are extremely sustainable and virtually maintenance free. They cut grease consumption by up to 80 %, which in turn significantly reduces CO₂ emissions. Four different sealing concepts are employed, depending on the series and application.

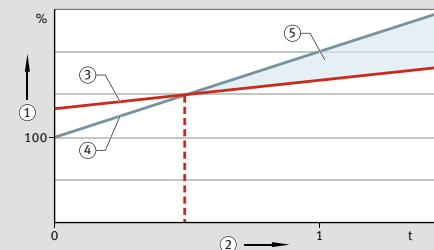
Sealed spherical roller bearings are typically recommended when bearings are subject not just to heavy loads but also to severe contamination or high temperatures. To guard against penetration by particles, exposure to wastewater, and loss of grease, these rugged bearings have sealing washers on the outside edge on both sides. A variety of elastomers are used as sealing materials. Temperatures from -30° C to +200° C are possible. All designs are characterized by extremely high static and dynamic load ratings, which makes them suitable for downsizing. The sealed versions usually have the same external dimensions as the non-sealed versions, are available at X-life quality, and can also be used in a split plummer block housing because they have the same main dimensions as open bearings. Sealed spherical roller bearings are lubricated with high-performance grease in the ARCANOL lubricant range. Lifetime lubrication is also optionally available, allowing operators to reduce their grease consumption by 100%.

Causes of rolling bearing failure



Sealed spherical roller bearings quickly pay for themselves

This version is distinguished by a lower maintenance outlay and a longer life. They need less grease, which also reduces the cost of grease disposal.



- 1 Accumulated costs as a %
- 2 Amortization time in years
- 3 Sealed spherical roller bearings
- 4 Open spherical roller bearings
- 5 Savings

Sample cost comparison of sealed and open spherical roller bearings in a continuous casting machine.

Split Spherical and Cylindrical Roller Bearings

For short downtime and easy maintenance



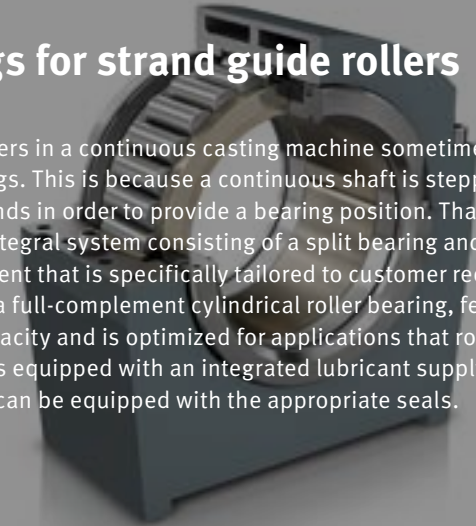
Split bearings shorten downtimes in the event of bearing replacement and massively reduce the associated costs. They are mainly used where the replacement of unsplit bearings would require time-consuming additional work, such as the dismantlement of drive systems or removal of gears.

Both the inner and outer rings of split bearings are split in half. For each row of rolling elements, there are two roller and cage assemblies that are held in place by cage segments. This makes split bearings the ideal solution when the goal is to avoid removing drive components or dismantling and aligning the shaft.

Along with the adapter sleeves, unsplit bearings can generally be replaced by split bearings with the same dimensions. Assembly and disassembly are easy. When purchased, split bearings require a higher investment than unsplit bearings, but they very quickly pay for themselves thanks to reduced maintenance and mounting costs as well as less plant or machine downtime.

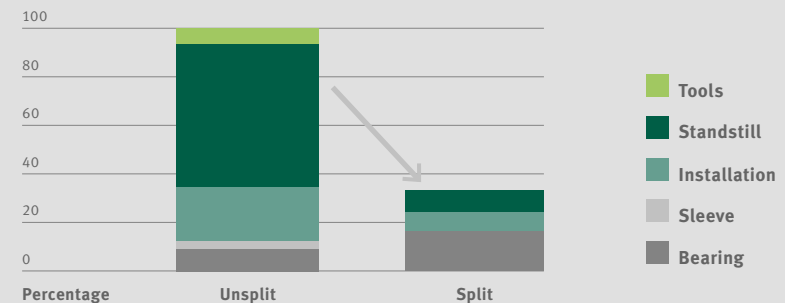
Split bearings for strand guide rollers

Designs for driven rollers in a continuous casting machine sometimes require the use of split bearings. This is because a continuous shaft is stepped at defined points at both ends in order to provide a bearing position. That's why Schaeffler offers an integral system consisting of a split bearing and housing for this bearing arrangement that is specifically tailored to customer requirements. The bearing, which is a full-complement cylindrical roller bearing, features a high load carrying capacity and is optimized for applications that rotate at low speeds. The housing is equipped with an integrated lubricant supply and water cooling channels and can be equipped with the appropriate seals.



Technical and financial advantages

Savings: The installation of split spherical roller bearings reduces machine and system downtimes and significantly lowers installation costs.



Deep Groove Ball Bearings

For low-friction, reliable operation

FAG



Deep groove ball bearings are versatile, self-retaining bearings. These bearings, with a simple design, high resistance, durability, and low maintenance, are available in different variants: single-row or double-row, open or sealed design, and unidirectional and bidirectional.

Single-row deep groove ball bearings are designed for high speeds and can accommodate both radial and axial forces. If a large radial load-carrying capacity is required for which single-row deep groove ball bearings are not sufficient, the double-row variants are the best choice. They can be subjected to higher loads because of the larger number of rolling elements. Since the bearings also support loads caused by tilting, they are suitable for particularly short shafts that are only to be supported by one bearing. Deep groove ball bearings are especially used in electric motors for driving industrial pumps and fans, but these versatile bearings are also primarily deployed wherever components rotate.

Optimal bearing arrangement of work rollers in a cold rolling mill

Novelis, the aluminum sheet expert in the United States, commissioned Maschinenfabrik Sack GmbH, Düsseldorf (now Sack & Kiesselbach GmbH) to develop a four-high cold rolling mill for its factory in the Swiss canton of Wallis. The factory's four rollers process bars into strips in single-way mode for industry. For the rollers' bearing arrangement, the OEM relied on Schaeffler technology. At the drive end of the 600 millimeter diameter work rollers, angular contact bearings absorb the axial forces, and deep groove ball bearings locate the relevant chock.



Generation C deep groove ball bearings

More durable, quieter, lower friction:

- Suitable for high speeds
- Refined manufacturing processes
- Reduced amount of noise generated
- Optimized bearing kinematics
- Improvement of cage roundness, waviness, and roughness
- High sealing effect without friction losses

Angular Contact Bearings

For combined radial and axial loads

FAG



Low-noise and durable even when prevailing forces differ, angular contact bearings in the X-life version optimally support different loads acting simultaneously and transmit them from one raceway to another.

Schaeffler offers angular contact bearings in single-row and double-row versions. Whereas single-row bearings are ideal for radial loads and for medium to heavy axial loads in one direction, double-row bearings can support heavy radial and axial loads as well as tilting moments in both directions. In terms of design, they correspond to two single-row angular contact bearings in a universal design arranged in a pair, but they're slightly narrower. This makes them the first choice for smaller design envelopes. Angular contact bearings from Schaeffler are available with plastic, brass, and sheet-steel cages.

Optimal bearing arrangement of work rollers in a cold rolling mill

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Technological and financial benefits

- Favorable load distribution
- Suitable for high speeds
- Smoother operation
- Lower-friction and more energy-efficient operation
- Reduced heat development
- Measurably longer operating life

Spherical Plain Bearings

Maintenance-free and environmentally friendly with long service life



Spherical plain bearings feature extremely low coefficients of friction and low wear of the sliding surfaces. At the same time, they have excellent sealing. The result is lengthy service lives, easier maintenance, and a substantial reduction in maintenance overheads.

Users benefit from significant savings in maintenance costs and lubricant usage, as plain bearings are either maintenance-free or, thanks to their superior optimized sealing, significantly reduce the amount of maintenance required. Maintenance-free spherical plain bearings are self-lubricating by means of polytetrafluoroethylene (PTFE) and do not require any maintenance or lubrication. Innovative sliding materials such as ELGOGLIDE, PTFE-GFRP ELGOTEX, or the metal-polymer composite E40 significantly reduce friction in spherical plain bearings, heads, bushings, washers, and strips. Compared in terms of performance and combined with the optimized sealing, spherical plain bearings requiring maintenance offer protection against dirt, which extends the service life.

Maintenance-free spherical plain bearings for “Puente de la Mujer”

A true architectural and technical masterpiece, the “Puente de la Mujer” is a pedestrian bridge in the old port of Buenos Aires and an imposing structure with a weight of 1,093 metric tons and a length of 170 meters. Its distinctive feature is its 35 meter high pylon and a rotating function to allow water traffic to pass through. The mobile section can rotate 90°. The maintenance-free axial and radial spherical plain bearings from Schaeffler ensure that the asymmetrical design functions reliably.

Spherical plain bearings with glass fiber reinforced plastic plates

Spherical plain bearings are also available with glass fiber reinforced plastic plates. This special sliding layer is thicker than standard sliding materials, making it much easier to measure wear and plan a bearing replacement. Thanks to the grooves in the sliding layer, foreign particles can be removed from direct sliding contact, which results in the bearings being less susceptible to contaminants. The special sliding layer is appropriate for large bearings and is preferred in applications with loads in only one direction, such as ladle turrets.



Needle Roller Bearings

High load capacity in a small size



Needle roller bearings are rolling bearings with a low radial section height and very high load-carrying capacity that are used as non-locating bearings. These bearings comprise machined outer rings, needle roller and cage assemblies, and removable inner rings. This means that they are available with or without an inner ring, depending on the application.

Needle roller bearings are rolling bearings with an especially low section height. Their rolling elements look like needles, and while they resemble cylindrical rollers, they are much thinner and longer, giving them a high load capacity relative to their smaller size. The Schaeffler portfolio includes needle roller bearings with or without ribs and with or without an inner ring. Needle axial ball bearings comprising radial needle roller bearings with a rolling bearing component capable of supporting axial loads are also available from Schaeffler at X-life quality. X-life machined needle roller bearings have a load rating that is 13% higher than that of conventional machined needle roller bearings, thanks to the improved surface quality. This results in a longer operating life, reduced demand on the lubricant, and less friction for lower bearing temperatures.

Perfectly aligned with the demands of continuous casting machines

Machined needle roller bearings are part of the “Continuous Caster Bearing (CocaB)” line from Schaeffler. This bearing line is perfectly aligned with the extreme requirements of continuous casting machines, where the strand is reliably transported and supported by slowly rotating rollers during the cooling phase. The bearing arrangements for the rollers need to withstand heavy loads, high temperatures, and spray water. Needle roller bearings are mainly used in the upper segments of continuous casting machines, because the liquid steel has to be guided through many tight-fitting rollers – which is facilitated by the low section height of this bearing version. Machined needle roller bearings at X-life quality from Schaeffler are distinguished by a high load carrying capacity and a long service life.



Benefits at a glance

- Low section height
- Extremely high load carrying capacity
- Suitable for high speeds
- Create an extremely space-saving, economical, and cost-efficient bearing arrangement
- Different sizes are available in a high-quality X-life version
- Available with or without inner ring

Back-Up Rollers

Ready-to-mount bearings for shafts



Back-up rollers are special double- or multi-row needle or cylindrical roller bearings with a thick-walled, profiled outer ring made of steel. Mounted on shafts or studs and supported on an even mating track, they are ideal for transmitting heavy radial loads that act on the outside surface.

Back-up rollers are used in industry in cam gears, conveying equipment, support shafts, and linear guidance systems. In addition to heavy radial loads, they also need to be able to support light axial loads caused by skewed running, misalignment, and contact running impacts. To prevent edge stresses, they usually have a crowned outside surface (a cylindrical outside surface is also available on request). The series at X-life quality offer an up to 30% longer service life. They have an optimized raceway geometry, an optimized lateral surface profile with an improved surface structure, and a higher static and dynamic load carrying capacity. Back-up rollers with Corrotect corrosion protection are available as an option. In the metal industry, special WGTR back-up rollers are used for multi-roll mills. Depending on the design – which differs in terms of the number of rows and roller spacing, among other things – these back-up rollers support heavy radial and axial forces and transmit them to the stand via the adjacent construction.

Back-up rollers in a Sendzimir mill

Modern cold rolling mills process steel strips into end products at thicknesses of less than one millimeter. To consistently achieve this quality even on high-speed aluminum lines, the back-up roller system needs to be high precision and manufactured in compliance with close tolerances. At ArcelorMittal (previously Ugine&ALZ), five three-row back-up rollers per support shaft were installed in the 20-roller Sendzimir mill.

Back-up rollers (WGTR) for multi-roll mills

Special back-up roller designs are used in multi-roll mills to create rolled products with the best surface quality and flatness and to manufacture them cost-efficiently. Back-up rollers (WGTR) for multi-roll mills

- are manufactured with restricted tolerances.
- have a running accuracy greater than P4.
- are classified in three to seven section height groups, each from 3 μm to 5 μm .
- are suitable for high loads.
- withstand heavy strip speeds (up to 100 m/min, depending on operating conditions).
- are manufactured in three designs with optional sealing.

Plummer Block Housings

For a balanced distribution of loads

FAG



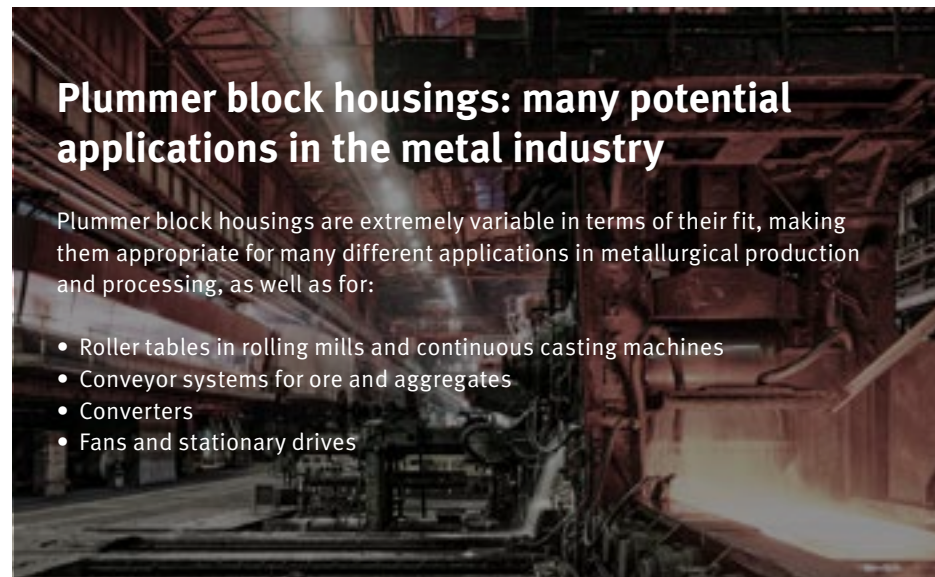
The Schaeffler portfolio offers a wide selection of standard housings for a large number of different applications. They can also be specially configured – for example, with regard to the desired bearing type, lubrication, or sealing of the housing.

The standard housing portfolio includes split and unsplit plummer block housings. Since the upper part of the housing is removable in the split design, installation and maintenance are much easier. If harsh environmental conditions and enormous stress on the bearing arrangement are to be expected, unsplit plummer block housings should be selected for easy access to the installed bearings and seals. Schaeffler also offers special housings when standard housings can no longer satisfy all requirements in particularly complex applications.

Plummer block housings: many potential applications in the metal industry

Plummer block housings are extremely variable in terms of their fit, making them appropriate for many different applications in metallurgical production and processing, as well as for:

- Roller tables in rolling mills and continuous casting machines
- Conveyor systems for ore and aggregates
- Converters
- Fans and stationary drives



Housing types for the steel and NF industry

- Split housings
 - SES for shaft sizes up to 140 mm
 - SNS for shaft sizes from 140 mm
 - RLE for 241 series spherical roller bearings
 - LOE, especially for oil lubrication
 - SAF500 (U.S. market) for shaft sizes from 1 3/8 in
- Unsplit housings
 - BND for especially heavy loads



SES housing with split spherical roller bearing

Lifetime Solutions



ProLink CMS

Multi-channel condition monitoring system for vibration measurement



ProLink CMS monitors the condition of machinery and equipment by measuring vibrations. The system is ideally suited for monitoring complex aggregates and, thanks to remote sensor technology, is ideal for use in harsh ambient conditions.

ProLink is a vibration monitoring system for ongoing frequency-selective plant monitoring. It consists of a processor module and up to four vibration modules as well as four further I/O modules for the detection of additional signals, such as temperature, loads or similar. This covers a wide range of applications. Integrated Schaeffler SmartWeb software is used for simple configuration. The connected modules along with their inputs and outputs are configured in it and adapted to the system on site. After the analysis, the system can transmit characteristic values or alarms (up to a maximum 32 analog signals) to a control system. With the help of interfaces such as OPC/UA or Profinet, all information from the ProLink can be transmitted to the higher-level control system.

Preventing millions in damage with reliable remote diagnosis

If a converter in a steel mill fails, the costs can amount to several million euros. Preventing unplanned downtime requires a comprehensive solution. The ProLink CMS vibration monitoring system provides the foundation, and it can be extended with sensors for acoustic emission, deflection, load, as well as grease monitoring with GreaseCheck. The data acquired is evaluated by Schaeffler experts at the German Online Monitoring Center (OMC) via remote diagnosis.



Advantages at a glance



- Simple commissioning, immediately ready for use
- Wide range of integration options
- Visualization of all information about the system status
- Early fault detection
- Connectivity with digital infrastructure

SmartCheck

Online measuring system for decentralized machine monitoring



SmartCheck is a compact, innovative, modular online measuring system for continuous, decentralized monitoring of machinery and process parameters. The system is particularly attractive for assemblies where monitoring was previously too cost-intensive.

Companies often forgo continuous monitoring of the process variables of standard units such as pumps, motors, and gearboxes for cost reasons. SmartCheck changes this. The system offers the same performance features as expensive monitoring systems, but is compact, easy to install, and easy to operate. After installation and setup, for example, vibration as well as motor speed and temperature can be displayed in a Web browser. Alarms go off if a limit is exceeded. In addition, a connection to the control system or the control station is possible using analog and digital interfaces. In the case of complex and specific requirements, monitoring can also be implemented using multiple SmartChecks.

Continuous roller monitoring at the continuous furnace

At the ArcelorMittal plant in Mouzon, France, an innovative service concept with 14 SmartCheck systems ensures that seven deflection rolls reliably convey the steel strips through a continuous furnace at the optimal tension. The solution, which also includes a SmartController, continuously monitors roll oscillation, which makes it possible to immediately detect damage to bearings or mechanical components and correct it before it results in a costly production standstill.



Function

The device can be connected to the control system or the control station using analog and digital interfaces, for example.



OPTIME Condition Monitoring

Plug. Play. Predict.



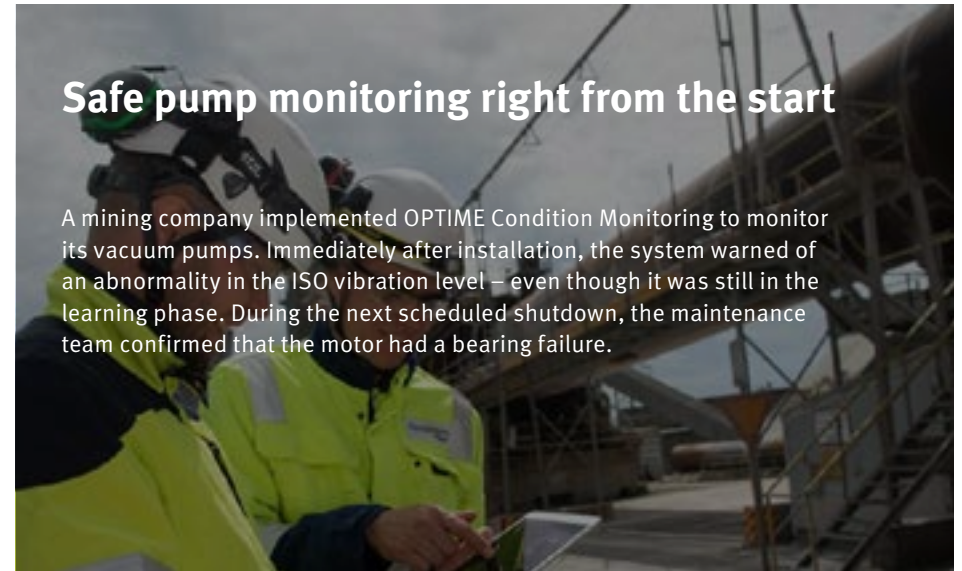
Condition monitoring can be expensive. Which is why up to 95% of all machines inside factories are only sporadically monitored – or not at all. This can lead to breakdowns and unplanned downtime.

Schaeffler's OPTIME Condition Monitoring solution helps eliminate such downtime thanks to wireless vibration sensors that can detect potential damage, imbalances, and misalignments weeks in advance. Its simple plug-and-play functionality means installing it takes mere minutes – no prior experience required. This allows entire plants to be monitored in just a single day.

The wireless condition monitoring solution also works with almost all machines – and is more affordable than most other condition monitoring solutions. And scaling up is always possible as additional vibration sensors can be easily added at any time.

Safe pump monitoring right from the start

A mining company implemented OPTIME Condition Monitoring to monitor its vacuum pumps. Immediately after installation, the system warned of an abnormality in the ISO vibration level – even though it was still in the learning phase. During the next scheduled shutdown, the maintenance team confirmed that the motor had a bearing failure.



OPTIME Ecosystem

Easy in every way



Consisting of award-winning solutions for both condition monitoring and smart lubrication, the OPTIME Ecosystem reduces expensive downtime by making predictive maintenance easy for the process industry.

OPTIME C1

Turn complexity into simplicity



The world is complex. And so is the job of a maintenance manager. And part of that complexity comes from the truly insignificant things. The tasks they wish they could cut out of their daily routines – but can't. Because there's been simply no better way of doing it. Not till now at least.

Combining all the benefits of automatic lubrication with award-winning smart technology: the OPTIME C1 is the world's first truly smart lubricator and eliminates tasks such as lubricating by hand. Such as having to manually check many lubrication points.

Instead: all the maintenance manager needs to do to check on the status of their lubrication points is to check the app – from wherever they are. With an extremely intuitive interface, the OPTIME C1 will tell the user which lubrication points are insufficiently supplied and which cartridges need to be refilled or replaced. Thus eliminating premature bearing failure caused by insufficient and/or incorrect lubrication – and eliminating downtime.

Simplification in action

Founded in 1916, Westerwälder Elektro OSMOSE is a manufacturer of ceramic products for the building, water, and wastewater industries. By using the OPTIME C1 in their plants, the company was able to avoid downtime that would have generated costs of €47,000. With its smart functionality, the OPTIME C1 helps OSMOSE's maintenance managers keep an eye on the fill level of their lubricators and warns them of any impending lubrication shortage – thus saving time and money.

OPTIME Ecosystem

Easy in every way



Did you know that the OPTIME C1 is part of a larger ecosystem that helps reduce expensive downtime? Find out more.

OPTIME Ecosystem

Easy in every way

Consisting of award-winning solutions for both Condition monitoring and smart lubrication, the OPTIME Ecosystem reduces unplanned downtime by making predictive maintenance easy for the process industry. Here is an overview of the ecosystem's elements and how they work together.

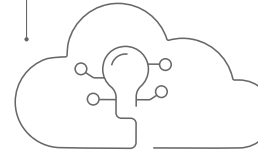
OPTIME User Interface

Including an intuitive mobile app, dashboard, and expert viewer: these user interfaces give users easy access to the right information at the right time, no matter where they are or what their role is.



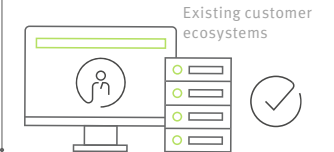
OPTIME Cloud & Analytics

With unlimited processing power and capacity, OPTIME Cloud & Analytics takes huge amounts of data and makes it easy to understand and work with.



OPTIME REST-API

The OPTIME REST-API makes it easy to connect the OPTIME Ecosystem to other existing systems – and get the most out of the data collected.



OPTIME Gateway

A standalone device that lets users connect to the OPTIME Cloud via a mobile network or Ethernet. Makes secure cloud connectivity and IT integration easy.



OPTIME Mesh Network

Connecting all OPTIME Ecosystem devices via the gateways: The automatic and self-healing OPTIME Mesh Network is easy to set up, needs low energy, and makes large-scale installations possible.



OPTIME Condition Monitoring

Wireless vibration sensors that let users monitor their machines from wherever they are.

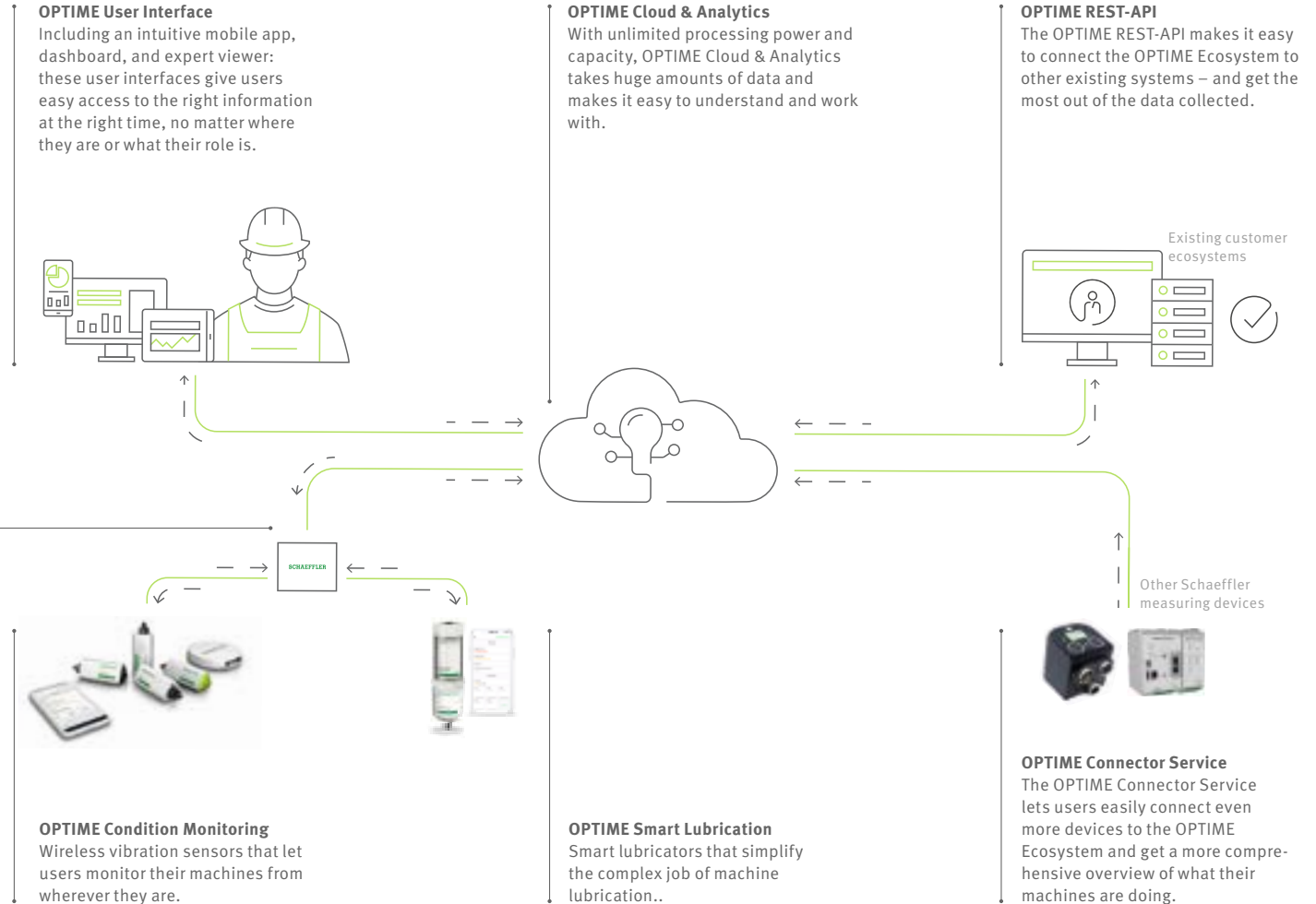
OPTIME Smart Lubrication

Smart lubricators that simplify the complex job of machine lubrication..



OPTIME Connector Service

The OPTIME Connector Service lets users easily connect even more devices to the OPTIME Ecosystem and get a more comprehensive overview of what their machines are doing.



CONCEPT1–8

Precise, automatic grease and/or oil lubrication



Almost all bearings can be supplied with precise amounts of oil or grease using the automatic lubricators in the CONCEPT series. The range covers single-point devices for entry-level automatic lubrication and complex solutions that can even be integrated into control systems.

The CONCEPT1–8 electrochemical lubricators offer a low-cost and versatile solution for supplying equipment with grease or oil. The lubricant is dispensed by gas pressure built up by means of an electrochemical drive unit. CONCEPT2, CONCEPT4, and CONCEPT8 are electromechanical lubricators and are used for more complex requirements, such as when there are a large number of different lubrication points. They differ in the number of outlets (2, 4, and 8), in whether grease or oil is used, and in whether the dispensing process is to be triggered by internal pulses, for example.

Providing constant lubrication

To keep its kilometer-long belt conveyors constantly moving in extremely harsh conditions, Schaeffler customer Mátraí Erőmű in Visonta, Hungary, relies on the CONCEPT2 lubrication system. It's filled with ARCANOL MULTITOP and lubricates the drive motor bearings during ongoing operation, which ensures that both the drum belts and the bucket wheel excavators operate optimally. In the past, the company had experienced problems with electrochemically driven lubricant cartridges, because grease delivery was unreliable when outdoor temperatures fluctuated.



Advantages at a glance

- Lubrication for almost all systems
- Premium lubricants
- Future-oriented expertise
- Flexible programmability



ARCANOL

Lubricants for every application



Perfectly matched lubrication increases the performance and service life of a rolling bearing immensely. With ARCANOL, Schaeffler developed a lubricant range that is divided into four different application groups, covering almost all areas of application.

The ARCANOL grease range includes multi-purpose, heavy-duty, high temperature, and specialty greases and currently features different lubricant grades in up to eight different container sizes. ARCANOL greases generally have better characteristics than regular greases. The respective composition was analyzed and tested for each individual application area using modern processes and systems under different operating conditions and with rolling bearings of all designs. They are subjected to a new quality inspection before delivery. This means that there is clear evidence of the quality of each batch. Assembly paste and corrosion protection oil complete the lubricant portfolio.

10% longer service life with the right grease

A major Peruvian copper producer switched to the high-quality ARCANOL LOAD1000 grease for its high-pressure grinding rollers in open-pit mining. It is more resilient and higher-yielding than the lubricants previously used. By switching to ARCANOL, the company now saves several tons of grease annually. In addition, a sustainable contribution is made to the preservation of the environment.



Advantages at a glance



- Lubricant matched to the application
- Consistent, high quality standard
- Extended rolling bearing life
- Great savings in grease consumption

Accessories and Services for Lubrication

Manual lubrication tools and more



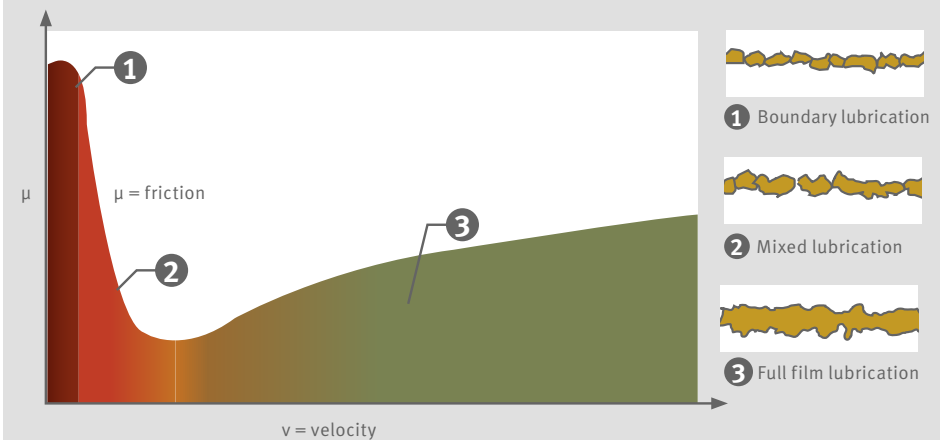
The optimized lubrication portfolio is complemented by accessories for automatic lubricators, manual lubrication tools, customized lubricant cartridges, and assembly pastes, as well as oil for corrosion protection.

If automatic lubrication is not possible or not desired, the optimal amount of grease can be applied with grease dispensing guns or grease pumps and other tools from Schaeffler during manual lubrication. The mounting paste facilitates the sliding of bearing rings and prevents stick/slip effects, scoring, wear, and fretting corrosion. It also provides protection against corrosion. The paste can be used at temperatures between -30 °C and $+150\text{ °C}$. It is resistant to water, steam, and many alkaline and acid agents. Anti-corrosive oil protects all bare metal surfaces, for example on equipment and machinery, and especially unpacked bearings when stored indoors.

Services for lubrication

Lubrication prevents or reduces contact between the rolling and sliding surfaces, protects against corrosion, and seals at the same time. Our services start with recommendations for suitable lubricants and systems, continue with the development of recommendations for action, and end with comprehensive analyses of the lubricants in use.

Comparison: wear with and without lubrication



GreaseCheck

An optical system for grease condition monitoring



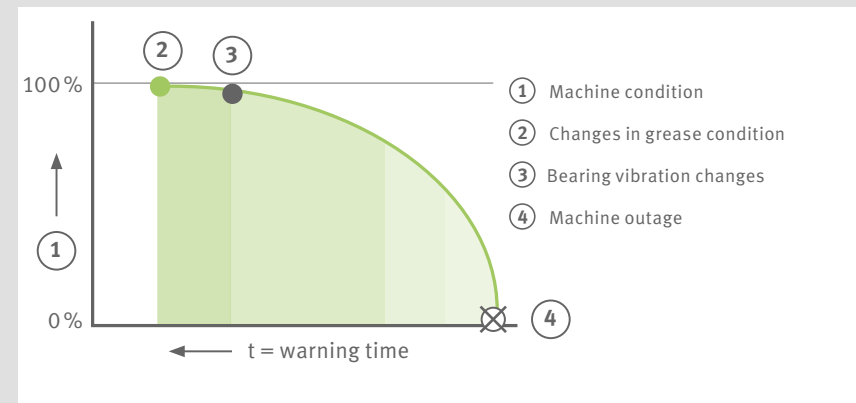
GreaseCheck detects changes in the grease's condition. It allows operators to identify the most common sources of rolling bearing failure before vibration changes occur later on prior to vibration changes. It also enables precise planning of demand-based relubrication.

GreaseCheck is a self-sufficient, maintenance-free, optical measuring system. It consists of a grease sensor and an evaluation unit that provides different analog and digital interfaces. GreaseCheck can be used to monitor grease contamination, consistency, and water content during operation. Thus, information on the condition of the grease is provided rapidly and easily. This enables maintenance teams to perform grease relubrication based on actual demand, eliminating the need for time-consuming calculations of the lubrication quantity or unnecessary relubrication. GreaseCheck is suitable for ARCANOL LOAD 400, LOAD 460, and Mobil SHC 460 WT. Further greases can be qualified on request. Upon request, additional greases can be specified.

Integrated bearing and service solution for converters

A leading steel manufacturer planned to increase the capacity of its two converters and now relies on an integrated Schaeffler solution. The converter status is monitored using a combination of different methods, which means acoustic emissions, vibrations, and the lubricating greases are analyzed. GreaseCheck is used to prevent unplanned downtime due to bearing damage.

Extended warning time with GreaseCheck



LASER-EQUILIGN2

For precise and cost-effective shaft alignment

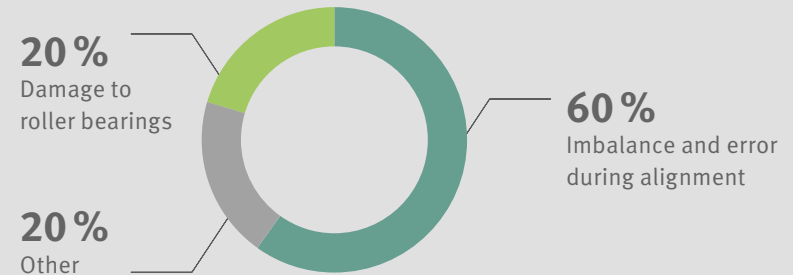


Designed for aligning rotating shafts to avoid downtime: With its single-laser technology, the LASER-EQUILIGN2 alignment system offers maximum user-friendliness, precision, energy, and cost efficiency.

Interrupted processes increase the cost of any operation. If rotating shafts are not correctly aligned, they can result in unintentionally high vibrations, temperature increases, energy consumption, and therefore downtime. LASER-EQUILIGN2 helps to avoid unplanned downtime. This is because it improves the alignment of the shafts of pumps, compressors, and gearboxes with each other. This innovative laser system lets machine performance and plant availability be increased while reducing operating costs because rotating shafts are perfectly aligned with LASER-EQUILIGN2.

One laser to combat downtime

Approximately 60% of all unplanned downtime in production plants is attributable to unbalance and misalignment. Such incidents can be avoided with the LASER-EQUILIGN2 shaft alignment device.



Sample calculation: lowering electricity costs

Precise alignment with LASER-EQUILIGN2 significantly reduces operating costs. This example shows the savings resulting from 1% lower power consumption by six machines running at 75 to 200 kW (running time 8h/day).

Motor power	75 kW	100 kW	200 kW
Annual energy cost	€37,440	€49,920	€99,840
Expected energy reduction	1%	1%	1%
Saving per machine	€374	€499	€998
Saving with six machines	€2,244	€2,994	€5,988

MF-GENERATOR

Induction systems with medium-frequency technology for large components



Induction systems with medium-frequency technology (MFT) are used to heat rolling bearings so that they can be easily installed or removed. The plant consists of a generator and – depending on the requirements – a fixed or flexible inductor, which is placed on the workpiece.

Medium frequency technology systems can also be used for thermal assembly and disassembly, and can significantly reduce energy costs. With efficiency of over 90%, they are significantly more energy-efficient than conventional heating devices. The compact systems can even be used in areas that are difficult to access. In all devices for heating, the temperature can be adjusted up and down continuously.

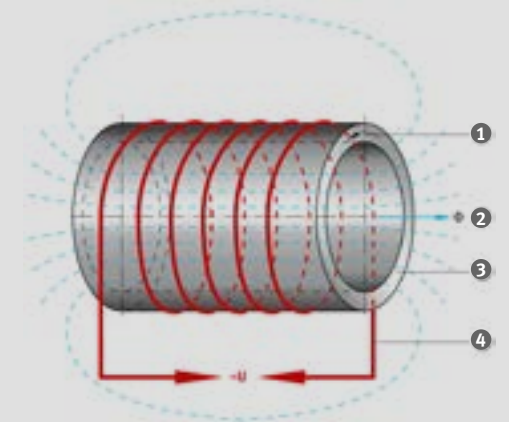
More than €300,000 saved thanks to a high-performance heating device

With an installed production capacity of five million metric tons of cement per year, Asia Cement Public Company Limited is one of the largest cement producers in Thailand. Previously, this customer usually needed about 30 days to overhaul a large raw material mill gearbox. The highly efficient Schaeffler heating device with medium-frequency technology and flexible inductors was used to accomplish this overhaul faster and more economically. It achieved its goal despite the very large components that had to be warmed up for removal and installation.



MFT functionality principle

1. Short-circuit current IR in the bearing ring
2. Alternating magnetic field
3. Bearing ring
4. Exciter coil



HEATER

Inductive heat for precise and sustainable assembly



Sealed and greased spherical plain bearings can also be heated with the HEATER induction heating devices for spherical plain bearings with a mass of up to 1,200 kg. In addition to the regular HEATER tabletop and floor-standing units for larger warehouses, HEATER devices can also be upgraded to a mobile version.

The HEATER product line is available in two series. The BASIC series has all the necessary basic functions for induction heating and is suitable for harsh ambient conditions. The HEATER BASIC units are available in either table-top or floor standing configurations for a maximum rolling bearing mass of up to 1,600 kg. The SMART models have a delta-T control system, which is recommended for rolling bearings with low radial clearance. They can precisely document the heating process, which can be important for particularly safety-relevant applications, for example.

Larger volume for more pig iron

Inductive heating technology has taken the Tata Steel Group a major step forward in its plan to quickly double production at its biggest undertaking in Jamshedpur, India. In a very short time, Schaeffler service specialists were able to overhaul a converter on-site and increase its volume. The bearings to be installed were heated using a HEATER 1200 device, which allowed them to achieve the necessary mounting temperature three times faster than with a conventional oil bath. After a mounting period of just seven days, the converter was once again ready to use.

Available heating methods

HEATER BASIC

- The temperature mode (controlled heating)
- The time mode (serial heating without temperature sensor)

HEATER SMART

- The temperature mode (controlled heating)
- The time mode (serial heating without temperature sensor)
- The time and temperature mode (select target temperature or heating time)
- The temperature and velocity mode (with maximum temperature gradient per time unit)

Hydraulic Pumps

For simple installation and removal of rolling bearings in conjunction with hydraulic nuts



Comfortable work with little force required for assembly and disassembly. Hydraulic hand and foot pumps are used for the installation or removal of rolling bearings in conjunction with hydraulic nuts to pressurize them.

The pumps are also used for the installation and removal of roller bearings with a tight fit, as well as other rotary machine elements where oil is pressed between the fitting surfaces for widening. The risk of bearing damage is significantly reduced because the components and rolling bearings can be precisely positioned by defining a starting pressure. The hydraulic pumps are available in different versions, which can be manual or air-operated. There is a perfectly fitting variant for almost every application.

Hydraulic pump design variants

Schaeffler supplies its hydraulic pumps as complete hydraulic pump sets. They consist of the pump body (hand or foot pump), an analog pressure gauge, a hydraulic hose (with plug-in coupling sleeve), and plug-in coupling nipple with G 1/4 thread for the consumer. The range includes the following designs:

- PUMP700-2L – manual pump, two-stage
- PUMP1000-2.2L – manual pump, two-stage
- PUMP1000-5L-AIR – foot pump, air-powered, continuously variable stages
- PUMP4000-1.6L – hand pump, single-stage



Advantages at a glance

- Work can be done comfortably with minimal force being required
- Risk of damage to rolling bearings is reduced
- Allows precise positioning of rolling bearings
- Oil can easily be refilled
- A digital measuring gauge can be used to monitor the drive-up distance
- Options for surface pressures of up to 200 N/mm²
- Wide range of accessories available

Hydraulic Nuts HYDNUT

For strong contact forces



If a lot of force is needed when assembling and disassembling bearings, hydraulic tools such as hydraulic nuts can be valuable tools. When fitting and removing large-size bearings and machine components with a conical bore, they are the first choice.

The application of hydraulic nuts such as HYDNUT..-E and HYDNUT..-E-INCH involves pressing rolling bearings or other ring-shaped components with a conical bore onto a conical seat. They are used mainly when significant force is required and cannot be achieved with pressure screws. In addition, it is easier to set the radial internal clearance for bearings. The hydraulic nut can also be used for disassembly if fastening withdrawal sleeves or adapter sleeves. The HYDNUT..-HEAVY hydraulic nut is ideal for assembling press-fit assemblies where very high drive-up forces are required for gears, shaft couplings, crushers, and roller presses, for example. The HYDNUT..-HEAVY variant is also suitable for special applications, such as those without threads on the shaft or sleeve.

Advantages of measuring displacement during mounting

Simplified installation: To be able to measure the internal clearance using a feeler gauge, there must be sufficient space for the feeler gauge and the technician's hand. When using a dial gauge, even confined spaces are no longer a problem.

Safety and accuracy: Correct measurement of the internal clearance using a feeler gauge requires a great deal of experience. The risk of incorrect measurements is almost eliminated when measuring the displacement using a dial gauge.

Correct installation of sealed bearings: The radial clearance measurement using a feeler gauge is also possible for the sealed rolling bearing designs, the seals of which can be removed. However, there is a risk of contaminating the grease and damaging the seal. Both of these factors significantly reduce bearing life.

Abbreviation name	Format	Application
HYDNUT50-E to HYDNUT200-E	With DIN 13 metric fine thread	Standard adapter and withdrawal sleeves with metric dimensions, shaft journals with metric thread
HYDNUT205-E to HYDNUT1180-E	With DIN 103 trapezoidal thread	Standard adapter and withdrawal sleeves with metric dimensions, shaft journals with metric thread
HYDNUT50-E-INCH to HYDNUT950-E-INCH	Standard adapter and withdrawal sleeves with metric dimensions, shaft journals with metric thread	Mine journals or sleeves with inch-based thread
HYDNUT100-HEAVY to HYDNUT900-HEAVY	Reinforced finish without thread	For heavy mounting forces, e.g., shipbuilding

Mechanical Tools

For professional assembly, disassembly, and maintenance



Mechanical tools are indispensable for mounting, dismounting, and maintaining bearings. The Schaeffler portfolio includes tools that cover all life cycle phases of the rolling bearing while taking into account the total costs for the customer.

For all assembly and maintenance work, it is important to keep the necessary downtimes of the production operation as short as possible. The work must be fast, without quality and safety taking a back seat. Schaeffler's high-quality conveyor and assembly tools, extraction solutions, and installation tool sets, as well as socket wrenches and hook wrenches provide the prerequisites for completing all activities efficiently and maximizing system availability for customers.



Mounting tool sets

for mounting small rolling bearings gently



Transport and mounting tool

for lifting and transporting large bearings by crane safely



Socket and hook wrenches

for tightening and loosening locknuts efficiently



Three-section extraction plates

for extraction without damage – by gripping the bearing directly on the inner ring and transmitting the extraction force via the rolling elements



Mechanical extractors

for dismantling bearings, bearing inner rings, and other components cost-effectively



Hydraulic extractors

for dismantling bearings and bearing inner rings even if high extraction forces are required, and for disassembling other components

Remanufacturing

Sustainable option to extend service life

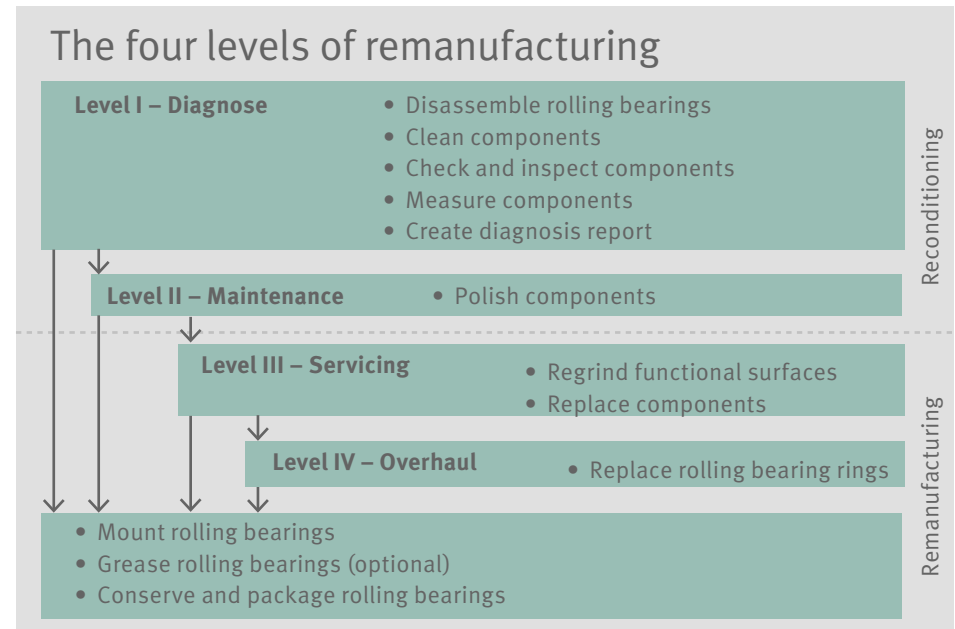


Bearings are often replaced even though they can be restored to as-new condition through proper remanufacturing. In general, the costs for such remanufacturing are significantly lower than the costs of a new bearing – with shorter delivery times in most cases.

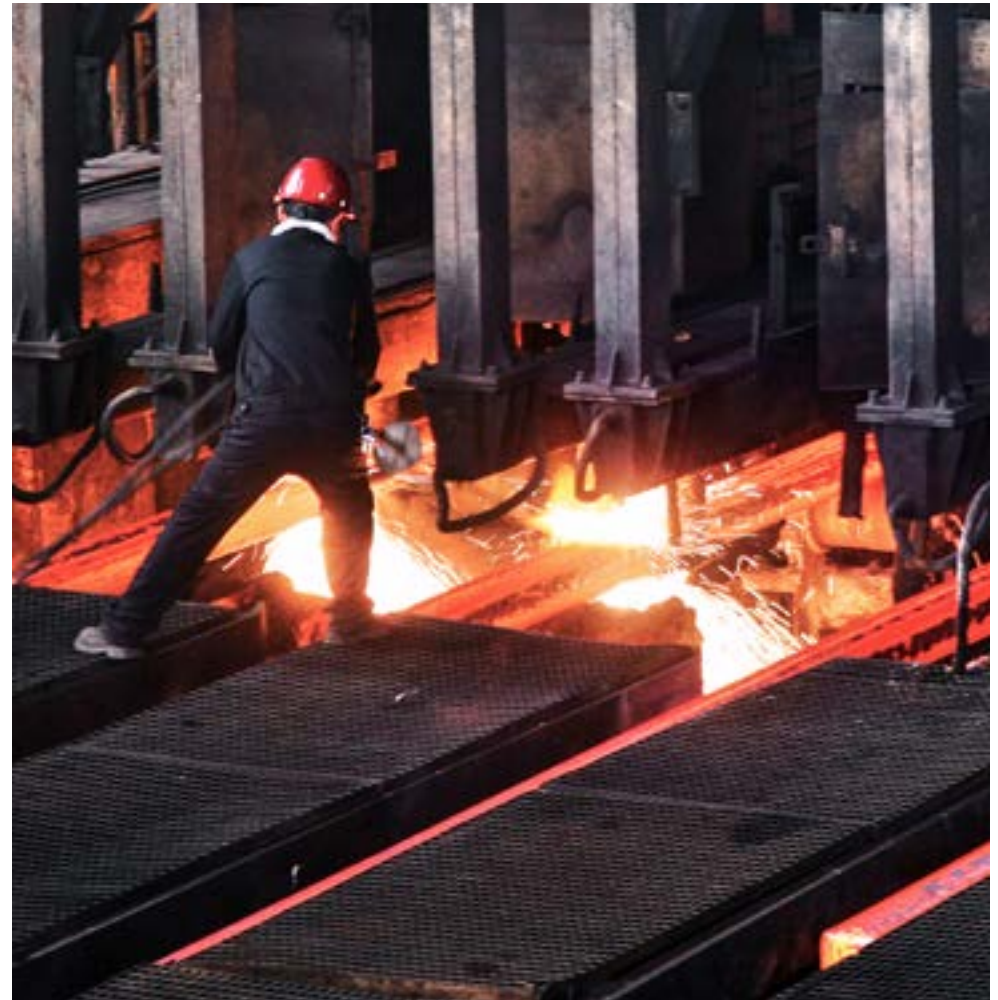
Schaeffler carries out the remanufacturing in compliance with and control of all norms and standards worldwide. Before remanufacturing, the bearing is professionally dismantled, cleaned, and examined. Once the analysis is complete, the necessary work steps for restoration are determined and a quotation is prepared. Like new bearings, the remanufactured bearings pass through the accredited Schaeffler test laboratories. This service is currently used primarily by the rail and aviation industries, but is also being considered for manufacturing, which uses bearings with larger diameters. Here, too, service can significantly reduce life cycle costs.

Steel mill with annual savings in the five-figure range

Schaeffler's remanufacturing service saved a Belgian stainless-steel plant an average of 50% on its rolling bearing costs compared to a new acquisition. That adds up to annual savings in the low five-figure range. Maintenance is performed on slightly damaged bearings, and bearings showing a significant amount of wear are remanufactured. This is how the steel manufacturer is extending the service life of its bearings and reducing the life-cycle costs of its plants.



Customer Success Stories



thyssenkrupp Steel Europe

thyssenkrupp Steel Europe is a leading provider of high-grade steel products in Germany. At its Bochum plant, the company primarily rolls highly stable, high-grade stainless steel which is extremely heat-resistant.



Challenges

At thyssenkrupp's Bochum plant, the company operates a hot strip mill that can deliver a maximum rolling force of 45 Meganewton. In this mill, the rolling bearings don't just need to be able to withstand these extreme forces, they also come into constant contact with water, high temperatures, and foreign bodies. If dirt penetrates the bearing position, it can damage the bearing raceway. This would result in bearing damage, and rolling mill stoppages would be unavoidable. The customer wanted to prevent this situation in the future – and has successfully done so for many years, thanks to Schaeffler.

Solution

Tapered roller bearings made of carbonitrided Mancrodur have been deployed in the hot strip mill since 2015. This heat-treated, high-performance steel from Schaeffler is ideal for the extreme conditions in rolling mills. The bearings are more wear-resistant and the surfaces are harder. A condition monitoring system from Schaeffler not only helps detect rolling bearing damage, it also monitors the condition of all work and back-up rolls. The measured data is automatically recorded and sent to the thyssenkrupp maintenance team and to Schaeffler's Remote Diagnostic Center. If bearing damage or other irregularities are found, the customer is immediately notified and can remove the work rollers from production as a precaution according to plan.



Many years with no work roller failures

The advantages of four-row tapered roller bearings made of carbonitrided Mancrodur and roller monitoring from a single source:

- Greater wear resistance
- Higher fatigue strength when well-lubricated
- Doubling of operating life
- Monitoring of work roll bearings
- Preventive, plannable maintenance before failures occur

Bearing and Service Solution for Converters

The customer is a leading steel manufacturer with several production sites in Europe. In its oxygen steel plants, the company produces five million metric tons of crude steel per year.



Challenges

The steel manufacturer planned to replace one of its converters to increase the capacity of its oxygen steel plant to 400 metric tons. In the giant crucible suspended in a supporting ring, pig iron becomes steel when its carbon content is reduced by blowing in oxygen. If a converter fails, of the entire production process comes to a halt. Converter bearings in particular need to meet high demands. With this in mind, the customer was looking for a bearing solution with an extremely long service life that would also be fast to mount and could be serviced.

Solution

To enable fast mounting and subsequent maintenance, the customer opted for split spherical roller bearings and customized spheroidal graphite cast-iron housings with prepared installation points. Both products considerably reduced mounting time. At the same time, an online condition monitoring system was installed that measures acoustic emissions and monitors the condition of lubricants, the transmission of forces into the non-locating bearing housing, axial displacement of the non-locating bearing, and a potential vertical misalignment of the trunnions. The gear units themselves are also monitored by means of oil particle analysis. The result is a permanent reduction in maintenance and downtime costs.



Converter with a customized bearing and service solution

Thanks to the close collaboration with the converter manufacturer, the customer now has an application solution that is perfectly aligned with its requirements.

- Customer-specific housing design for precisely tailored deployment
- Split spherical roller bearings for fast mounting
- Cylindrical roller bearings for converter gear units
- Comprehensive online condition monitoring
- Includes bearing mounting and remote monitoring

Karabük Demir Çelik Fabrikaları (KARDEMİR)

KARDEMİR is a Turkish steel producer with a history dating back to 1937. It was founded as a state-owned company in Karabük and was later privatized in 1995. The company has a capacity of producing three million tons of steel per year.

Challenges

The steel mill plant in Karabük operates around the clock, subjecting all machines to high temperatures, loads and vibrations. The concern about potential unplanned failure in one of the converters due to bearing damage is as prevalent at KARDEMİR, as it is at other steel producers worldwide. In the event of a failure, the risk of high costs, would result in a shutdown of the entire production. To minimize the risk and react promptly in case of any damage, the company plans to monitor one of its converters in the future.

Solution

The choice fell on a comprehensive monitoring concept from Schaeffler. In this process, vibration, sound, distance, strain, and the condition of the grease are measured with GreaseCheck via sensors. The multi-channel condition monitoring system ProLink CMS records the collected data and transmits it for visualization in the control center on-site. Schaeffler experts can remotely access and evaluate the measurement data from the German Online Monitoring Center. Thanks to remote diagnostics, unplanned failures can be prevented in advance, while the on-site maintenance team always has an overview of the converter's condition.



Monitoring saves nine million euros per breakdown

Predictive maintenance keeps maintenance personnel informed about the condition of machine components.

- Easy-to-understand reports and diagrams with visualized characteristic values
- Plannable maintenance work
- Optimized lubricant use
- Less bearing damage
- Reduced risk of unplanned downtime

Aleris Aluminium Koblenz GmbH

Aleris Aluminium Koblenz GmbH, which is now a subsidiary of the American company Novelis, is one of the world's leading manufacturers of high-quality rolled aluminum products. The company has been producing aluminum and aluminum products since 1964.



Challenges

Koblenz is one of the world's most important production locations for aluminum sheet used in aerospace applications. In order to fulfill the long-term contracts concluded with the industry, the cold rolling mill has to reliably generate the necessary volume. However, if rollers overheat during the production process, there's a risk of fire and substantial downtime. In addition, rolling bearing defects result in lower-quality end products, especially when the bridle rollers that are responsible for tractive force operate incorrectly. To enable a quick response to potential anomalies, the customer was looking for a continuous and preventive monitoring solution for its processes.

Solution

Schaeffler technology makes it possible to seamlessly monitor rolling processes. Two FAG DTECT X1 systems – precursor solutions to the ProLink CMS system currently in Schaeffler's portfolio – and a total of 16 sensors were installed on the bridle rollers, the Sexto rolling stand, the mill pinion gears, and the deflector and flatness-monitoring rollers. Vibration data from the bearings and machine components are measured via the sensors and sent for analysis to the Schaeffler Online Monitoring Center in Herzogenrath, Germany. If irregularities are detected, the Schaeffler diagnostic experts immediately communicate the results to the customer so they can respond. Schaeffler's diagnosis guarantee ensures that the customer is warned at least four weeks before a failure.



Cold rolling mill: Vibration diagnosis prevents downtime

Thanks to expert diagnoses, Schaeffler has prevented damage to machines at least four times since installation. The cost savings are in the six-figure range.

- Short repair time and less material used: €30,000 per year
- Reduced chatter marks: €120,000 per year
- No stand fires: €50,000 per year

Tata Steel Group

Tata Steel is one of the world's largest steel manufacturers with an annual capacity of about 31 million metric tons and around 65,000 employees on five continents. At its steel mill in Port Talbot, Great Britain, the company produces hot-rolled, cold-rolled, and hot dip-coated steel.



Challenges

Tata Steel operates two BOS (basic oxygen steelmaking) vessels at its Port Talbot location. Basic oxygen steelmaking is the key process in manufacturing steel. If one BOS vessel fails and disrupts the conversion of high-carbon pig iron into low-carbon steel, there can be a significant loss of output. A fast solution had to be found when a BOS vessel's main trunnion bearing needed replacement. The bearing was damaged and about to fail.

Solution

Instead of spending a lot of time dismantling the BOS vessel's main drive unit, Schaeffler recommended that the customer replace the locating bearing on the drive side with a split spherical roller bearing. Split bearings can be installed much more quickly than standard bearings. The customer followed the recommendation, despite the higher procurement costs. The Schaeffler team then developed a detailed mounting schedule. In addition to the actions that needed to be taken, the step-by-step instructions also contained a list of tools and technical documentation for the replacement. This made it possible to complete the entire process of bearing removal and installation in just ten days, even though the team discovered other components that were damaged while removing the old bearing.



Potential savings for the customer

The customer's tremendous time savings were essential to the success of the project. A longer downtime for the BOS vessel would have resulted in significant financial losses for Tata Steel:

Bearing type	Downtime	Cost
Unsplit bearing	7 days	€4.5 million
Split spherical roller bearing	3 days	€1.7 million
Savings*	4 days	€2.3 million

*Savings depend on throughput and the steel product.

Remanufacturing Chocks for Rolling Mills

Chocks are an important component in a rolling mill. They support and guide the work and back-up rollers. Bearings that perform this task are subject to extreme requirements and quickly wear out as a result.



Challenges

The process stability of a rolling mill largely depends on the condition of the chock. The bearings in the chocks, on the other hand, reduce roller friction to a minimum and absorb the rolling forces, which means they are susceptible to extreme wear. The response is often to install new rolling bearings, even though the existing bearings could be professionally remanufactured and returned to a like-new state. This is precisely the service that Schaeffler offers its customers. Not only are the bearings themselves professionally remanufactured in a high-quality process, entire chocks in rolling mills are also remanufactured.

Solution

Remanufacturing is performed by trained specialists at Schaeffler's Remanufacturing Center in Wuppertal, Germany. After receiving the complete chock, they mount and clean all the components and bearings. They then examine all the individual parts in detail. Even the chock bore is inspected, and if necessary the team reworks the original bore dimensions. Once the bearings have been thoroughly tested, the team decides whether they can be remanufactured or require immediate replacement. In the final step, the remanufactured or replaced bearings are remounted in the chock and sent back to the steel mill. All essential knowledge is recorded in a final report that is made available to the customer.



100% return service for chocks

For every chock that is sent to Schaeffler for remanufacturing, the customer is guaranteed the return of a fully functional unit.

- Simpler and faster chock maintenance
- Extended bearing life and less unplanned downtime
- Reduced lifecycle costs and CO₂ emissions
- Remanufactured bearings of the same high quality as new Schaeffler bearings

Digital Tools and Support



medias

Knowledge database and digital product catalog

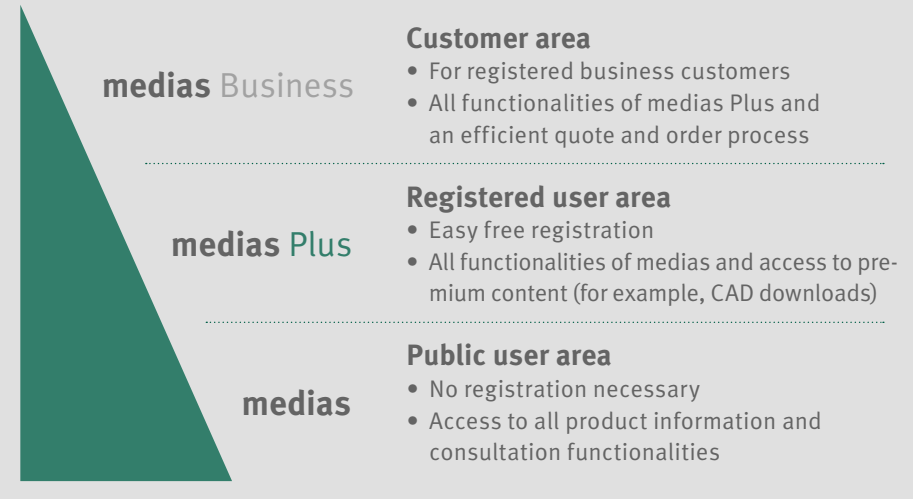


In addition to the Schaeffler product catalog, medias provides detailed information on all products and solutions, including a knowledge database with useful materials, such as white papers and online training courses. Calculation and configuration tools provide support in product selection.

More than just an online store

With the medias platform, Schaeffler fully supports its customers in selecting, configuring, and ordering products. It not only gives you detailed information on products and services in the form of a comprehensive knowledge database, but also advanced e-commerce functions and the necessary tools to help you calculate and configure the products you need in line with your requirements. You can get access to additional exclusive content with a free medias Plus membership. Registered business customers can expect an expanded product catalog and an even more efficient quote and order process with medias Business.

The three medias user levels



What medias has to offer

Customers can find these features on our advanced medias e-commerce platform:

- Detailed information about products and solutions
- Specific solutions for specific industries
- Helpful engineering tools for selecting, calculating, and configuring products
- Comprehensive knowledge database as well as white papers, online courses, customer success stories, and more
- Free newsletter with industrial news from Schaeffler

medias Engineering Tools

Select, analyze, and configure bearings and accessories



How big is the design envelope? What speeds and loads does the bearing have to withstand? How important is it that it's low noise? With the medias expert tools for selecting, analyzing, and configuring bearings and all types of accessories, Schaeffler supports its customers during the development phase and guides engineers to the right product and its accessories one step at a time.

An optimal arrangement of bearings gives OEMs a significant competitive edge. To help them along, Schaeffler provides its customers with the best possible service and engineering support by making several tools and selection assistants available to its customers' development and design departments in the medias knowledge platform. Once the most important parameters and key design data have been entered, the results are output with specific product recommendations that can be accessed with the click of a mouse. This shortens the development process and creates transparency.

Bearing Selection Assistant

One of over 24,000: The assistant helps designers find exactly the right bearing for their application.

medias-interchange

Help when converting to Schaeffler bearings: medias-interchange converts the rolling bearing designations of other manufacturers to INA/FAG nomenclature.

Grease Selection Guide

Never again use the wrong lubricant: This tool helps users find exactly the right grease so that their bearings run smoothly and have a long service life.

Bearing Frequency Calculator

Allocate clear frequency models: The calculator makes it possible to determine basic bearing frequencies so that anomalies can be allocated to specific components.

Housing Selection Assistant

Comprehensive support for selecting housings and housing units: This tool takes environmental conditions into account as well as the demands on the bearing arrangement.

Linear Configurator

Simple configuration and calculation of linear systems with multiple tracks and carriages.

BEARINX-online Easy

For calculating rolling bearings in shaft and linear guidance systems

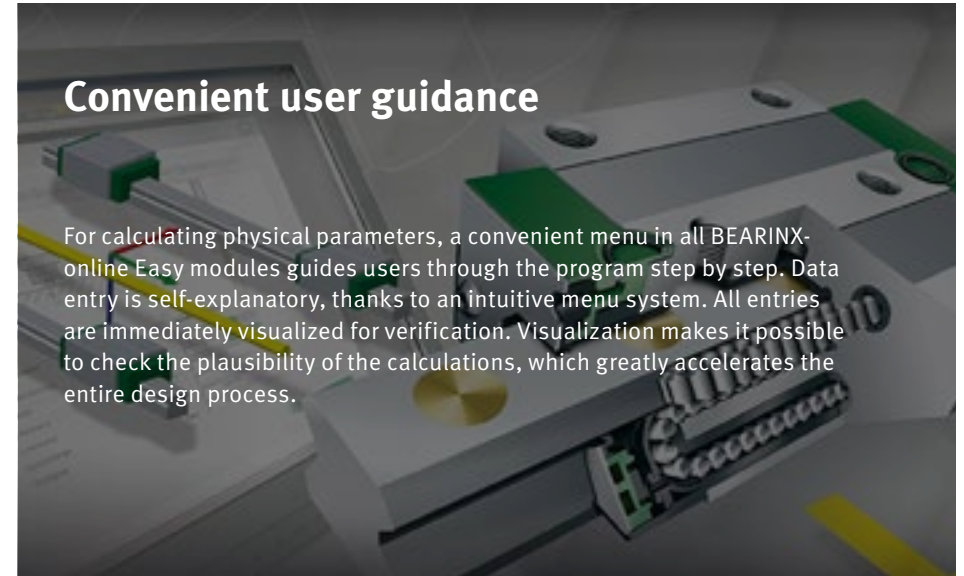


Conventional tools generally use highly simplified calculation and approximation methods that examine bearings in isolation instead of looking at the complex interactions on-site in the systems. As a result, they fail to take into account the actual load and displacement situation. BEARINX-online Easy allows operators to model and calculate the actual demands and bearing behavior.

Whether it's frictional forces, mounting setting values, nominal service life, or static load safety factor: Depending on the application, four different BEARINX-online modules are freely accessible at no cost after one-time registration. They're based on the logic of BEARINX, Schaeffler's leading calculation program that incorporates several decades worth of experience in design consulting. When calculating frictional forces, BEARINX takes rolling and sliding friction into account. For linear calculations, it can consider 1-, 2-, and 3-axis positioning systems and a flexible arrangement of drives. This makes it possible to perform a detailed analysis of the behavior of bearings in actual use. All the results can be downloaded as a PDF for documentation purposes, including in the free online version.

Convenient user guidance

For calculating physical parameters, a convenient menu in all BEARINX-online Easy modules guides users through the program step by step. Data entry is self-explanatory, thanks to an intuitive menu system. All entries are immediately visualized for verification. Visualization makes it possible to check the plausibility of the calculations, which greatly accelerates the entire design process.



BEARINX-online Easy calculation modules

From deformations in linear systems to mounting setting values in screw drive bearing arrangements and complete bearing arrangements in liquid pumps – the broad range of BEARINX-online Easy calculation modules delivers precise data on diverse use cases:



Partner Portal

The platform for certified Schaeffler partners

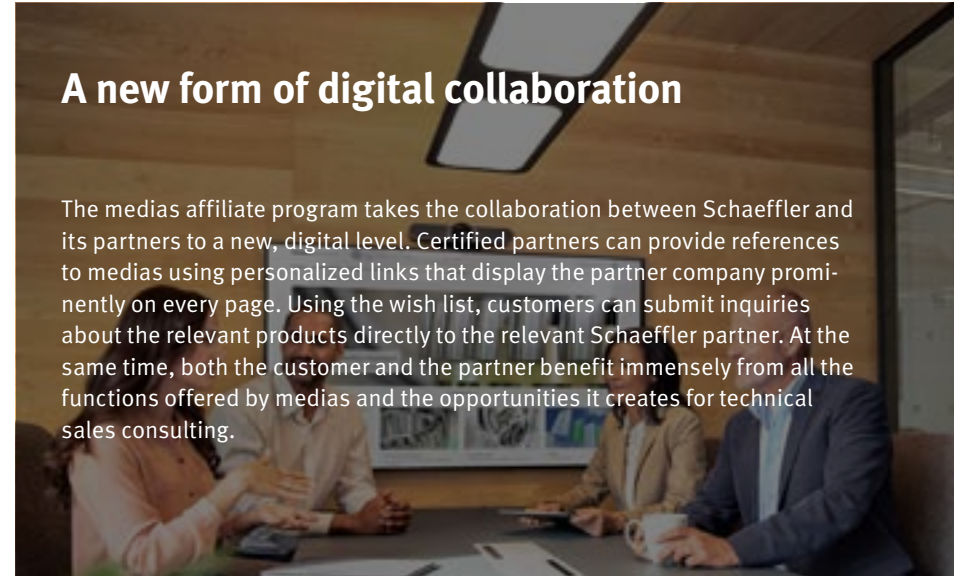


With the Partner Portal, Schaeffler has created a unique platform that provides certified partners with comprehensive information about its broad product and service portfolio and presents innovations. In addition, partners are provided with useful material to support the sale of and consultations regarding products.

Schaeffler has a long tradition of cooperating closely with manufacturers and customers in the development of products and solutions. This philosophy is also reflected in the Partner Portal. Certified Schaeffler partners can find all the information they need about our products and services here, including product data and images for use in product catalogs, news, and training for their sales staff. In addition, our partners receive access to exclusive marketing material which can help gain customers.

A new form of digital collaboration

The medias affiliate program takes the collaboration between Schaeffler and its partners to a new, digital level. Certified partners can provide references to medias using personalized links that display the partner company prominently on every page. Using the wish list, customers can submit inquiries about the relevant products directly to the relevant Schaeffler partner. At the same time, both the customer and the partner benefit immensely from all the functions offered by medias and the opportunities it creates for technical sales consulting.



What you will find on the Partner Portal:



- News and updates
- Trainings
- Campaign material on products and industries
- Product information
- Marketing materials with individual personalization options

Expert Services

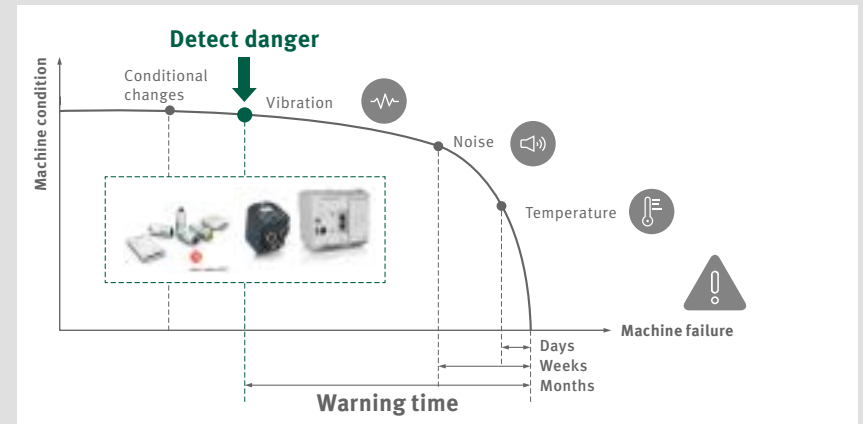
Services related to condition monitoring



Schaeffler expert services provide support for the use of suitable monitoring systems. This includes not only hardware selection, but also system configuration and, where necessary, its integration into existing systems. Condition monitoring during operation is also provided on request.

Our service specialists support customers throughout the entire service life of their equipment and bearings. They advise about suitable monitoring solutions prior to purchase, and subsequently provide on-site or remote installation assistance and support for configuration and commissioning. On request, they can also provide continuous condition monitoring during operation via online connection or carry out regular on-site measurements for vibration analyses. If malfunctions occur on a machine, they trace faults through comprehensive diagnostics, such as endoscopy. They rectify faults such as unbalances or incorrect lubrication quickly and accurately.

Why condition monitoring is important



Services at a glance

- Condition monitoring consulting
- System history
- On-site support for installation and commissioning
- Remote support during installation
- Vibration analyses
- Remote monitoring

Trainings

Certified expertise from maintenance specialists



Customized training modules familiarize customers with all important Schaeffler products for bearing maintenance. Customers learn details about proper lubrication and detailed know-how about condition-based machine monitoring.

The training courses offered for condition-based machine monitoring start with basic knowledge and an overview of the products that can be used in condition monitoring. Additional training courses expand the theoretical expertise gained and are complemented by practical exercises. They prepare for certification courses according to ISO 18436-2. Customers can have their knowledge tested and certified at various levels. Training programs tailored to specific needs are available. In these cases, the modular training program is also customized for balancing bearings or on the subject of lubrication.

Schaeffler Technology Center

The modular course program at the Schaeffler Technology Center follows a comprehensive principle of capabilities. It covers the entire product and service portfolio and offers all participants the greatest possible individual selection and in-depth options. This is how each individual acquires the exact knowledge that they need for their daily work in areas such as design, assembly, maintenance, or purchasing.



Products

- Product training sessions from the rotary, linear, and service areas
- Sector-based product training sessions



Assembly

- Assembly and disassembly of rotary and linear products
- Large bearing assembly



Basic principles

- Basic training sessions, including sector relevance
- Kinematics, speed, lubrication, and fault analysis



Lifetime Solutions

- Vibration analysis
- Balancing and aligning
- Condition monitoring

Aftersales and Customer Service



Literature and Publications



- Brochures

- Metallurgical production and processing publications
- Catalog HR1
- Partner Portal campaign page
- Condition Monitoring Handbook (print edition)



Contact

How can we assist you?
Do you have questions about our products or solutions?
Feel free to contact us at any time!

We are there for you at all times and in any location.
You can find a Schaeffler worldwide contact here.



We pioneer motion