



We pioneer motion

Plain Bearings

For Everything That Moves



Plain bearings can also be found in cranes, forklift trucks, and straddle carriers.

*The World of
Schaeffler Plain Bearings
from A to Z*

Automobiles
Construction machinery
Bridges
Printing machines
Fluid technology
Industrial trucks
Conveying technology
Forestry machinery
Gardening tools
Buildings
High speed trains
Industrial gearboxes
Storage technology
Agricultural machinery
Motorcycles
Commercial vehicles
Power tools
Pumps
Solar energy systems
Sports equipment
Stadiums
Steel industry
Dams
Trams
Textile machines
Transport equipment
Packaging machines
Machine tools
Wind turbines
Cement mills

Schaeffler plain bearings – a success story

The right solution for every application

Schaeffler is one of the world's largest providers of rolling bearings, plain bearings, and linear technology. Leading manufacturers and operators in industry and the automotive sector trust in the quality we provide, as we offer a technically perfect and economical solution for almost every application. INA plain bearings increase the functional reliability of machines and processes. With competent technical advice and a global sales network, we actively contribute to lowering total costs (TCO) for our customers.

The Schaeffler Group has been producing and selling a variety of high-quality plain bearings under the INA brand for more than 75 years. This includes plain bushings with ELGOGLIDE and ELGOTEX as well as metal-polymer composite plain bearings. In addition, there is the tried and tested range of spherical plain bearings and rod ends, which has been the driving force behind plain bearing technology for decades.

Customers not only value the extensive technology portfolio but, first and foremost, our expert advice. Our products are an equally convincing success in both standardized applications and in project-related solutions that we develop in conjunction with our business partners.

Schaeffler plain bearings stand for certified reliability – they are subject to repeated qualifications and optimizations at in-house test laboratories and by external institutions. The result: Quality products and expert application advice from a single source.

We hope the following pages inspire you.

Plain bushings

The efficient all-rounder

Plain bushings are used in rotating and oscillating motion as well as in short or long stroke linear motion. In the maintenance-free segment, Schaeffler also offers plain bushings with ELGOGLIDE fabric and ELGOTEX filament wound bushings in addition to the metal-polymer composite plain bearings.



Metal/polymer composite bushings

Composite bushings are plain bearings for very small radial and axial design envelopes. The bushings, which are offered with steel and bronze backings, are available as bushings, flanged bushings, thrust washers, and strips. Designs with a bronze backing have high corrosion-resistance, good thermal conductivity, and are anti-magnetic. Composite bushings are particularly suitable for applications where minimal friction is required.

Designs

- **E40:** Maintenance-free material
- **E50:** Low-maintenance material



ELGOTEX filament wound bushings

Bearing positions subjected to heavy loads, e.g. in commercial vehicles, conveyor systems, and agricultural machinery, are usually equipped with solid section plain bearings lubricated with grease or oil. ELGOTEX plain bushings are ideally suited to replace bronze or steel bearings requiring maintenance, as they offer environmentally-friendly technology. The filament wound bushings are maintenance-free, corrosion-free and exhibit low wear and low friction.

Designs

- **Standard ELGOTEX**
- **ELGOTEX-WA bushings:** For under-water applications. ELGOTEX-WA bushings are used in rudder systems, for example, and are certified by Germanischer Lloyd.



Maintenance-free plain bushings with ELGOGLIDE

Plain bushings with ELGOGLIDE fabric are available in a heavy-duty design. They can support higher forces than conventional plain bushings and can therefore be used to replace steel, bronze, and plastic plain bearings. Thanks to the high-performance sliding layer ELGOGLIDE, our products are extremely durable and are especially suited to small swivel motions. Their particularly low friction values also make them an ideal choice for applications requiring minimal friction. Key areas of application are wind turbines, industrial trucks or cranes.

Spherical plain bearings and rod ends

From maintenance-free to requiring maintenance

Spherical plain bearings and rod ends from Schaeffler increase the performance of machines and systems, vehicles and devices. Durable and capable of supporting heavy loads, they ensure reliable operation – even in the most demanding conditions.



Maintenance-free spherical plain bearings with ELGOGLIDE

Under the ELGOGLIDE brand, we provide high-performance, maintenance-free sliding materials based on PTFE fabric. These are particularly suitable for applications where minimal friction is required.

Designs

For differing requirements, the following are available:

• ELGOGLIDE

The standard material for very high dynamic contact pressures from 25 N/mm² to 300 N/mm² and a long operating life.

• ELGOGLIDE-W11

The material for dynamic contact pressures from 1 N/mm² to 150 N/mm², with low coefficients of friction even at low contact pressures.



Maintenance-free spherical plain bearings with PTFE composite material

For the small diameter range, we offer maintenance-free spherical plain bearings with a PTFE-based composite material as the sliding material. The portfolio extends over a diameter range of 6 mm – 30 mm.

Designs

For differing dimension series, the following are available:

• PTFE composite materials

The sliding material is a plastic composite which is applied to a supporting body.

• PTFE film

The sliding material is a metal fabric material.



Spherical plain bearings requiring maintenance

Spherical plain bearings requiring maintenance comprise a steel/steel or steel/bronze sliding contact surface. These bearings must be lubricated to prevent metallic contact and thus wear to the bearings. Steel/steel bearings have a manganese phosphated surface.

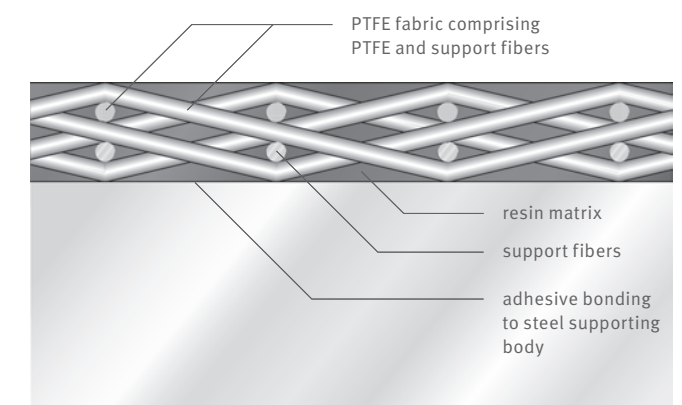
As a result, the bearings fulfill high requirements for wear resistance and the effective separation of the metallic surfaces gives optimum running-in characteristics.



Rod ends

In addition to spherical plain bearings, Schaeffler also offers a wide range of rod ends:

- maintenance-free and requiring maintenance
- with internal and external thread
- with corrosion protection
- with clamping and welding facility

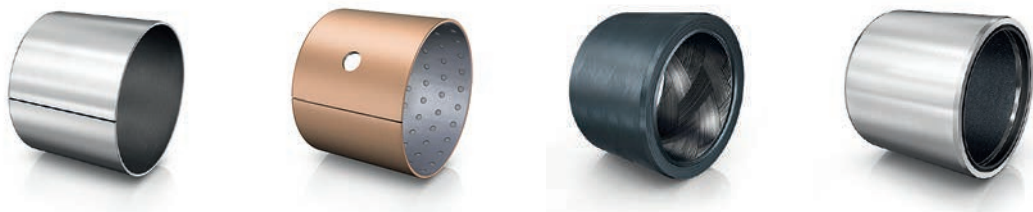


Structure of the ELGOGLIDE fabric

In addition to our standard portfolio we also offer customer and application-specific products.

We will be happy to assist you.

Plain bushings



Product family	Metal/polymer bushing E40	Metal/polymer bushing E50	ELGOTEX filament wound bushing	ELGOGLIDE bushing
Motion	Oscillating / rotating / linear	Oscillating / rotating / linear	Oscillating / rotating / linear	Oscillating / rotating / linear
Maintenance	Maintenance-free	Low maintenance	Maintenance-free	Maintenance-free
	Dry running	Lubricant without solid lubricant	Dry running	Dry running
Series	EGB Bushing EGBZ Bushing, inch dimensions EGF Flanged bushings EGW Thrust washers EGS Strips	EGB Bushing EGBZ Bushing, inch dimensions EGW Thrust washers EGS Strips	ZWB Bushing ZWB...WA Bushing, water-resistant	ZGB Bushing
Bore diameter Catalog range ¹⁾	3 mm to 300 mm	8 mm to 100 mm	20 mm to 200 mm	30 mm to 200 mm
Load-carrying capacity	Dynamic 140 MPa	70 MPa	140 MPa (ZWB...WA 50 MPa)	300 MPa
	Static 250 MPa	140 MPa	200 MPa (ZWB...WA 150 MPa)	300 MPa
Operating temperature	−200°C to +280°C	−40°C to +110°C	−20°C to +130°C	−50°C to +150°C
Permissible velocity	v 2.50 m/s	v 2.50 m/s	v 0.18 m/s	v 0.30 m/s
Friction	μ 0.03 to 0.25	μ 0.02 to 0.2	μ 0.03 to 0.2	μ 0.02 to 0.2
Benefits	<ul style="list-style-type: none">• According to DIN ISO 3547• High load-carrying capacity• Low coefficient of friction• Low wear• Suitable for hydrodynamic operation• Suitable for media lubrication• Bronze design: resistant to moisture and seawater, non-corrosive	<ul style="list-style-type: none">• According to DIN ISO 3547• High load-carrying capacity• Low coefficient of friction• Low wear• Suitable for hydrodynamic operation• No relubrication required, initial lubrication sufficient for the operating life• Bronze design: resistant to moisture and seawater, non-corrosive	<ul style="list-style-type: none">• According to DIN ISO 4379• High load-carrying capacity• Low coefficient of friction• Low wear• Very low weight• Resistant to media• Resistant to shocks and vibrations	<ul style="list-style-type: none">• According to DIN ISO 4379• Very high load-carrying capacity• Low coefficient of friction• Low wear• Long rating life• High operational reliability• Lower total costs in use (TCO)
Designs	<ul style="list-style-type: none">• Half-cups• Ball cups• Molded parts	<ul style="list-style-type: none">• Half-cups	<ul style="list-style-type: none">• RS seal	<ul style="list-style-type: none">• RS seal

¹⁾ Special dimensions available for all types.

Spherical plain bearings



Steel / steel ²⁾	Steel / bronze ²⁾	PTFE composite material or foil ²⁾	ELGOGLIDE spherical plain bearings ²⁾	Glass fiber reinforced plastic with PTFE
Oscillating / tilting motions	Oscillating / tilting motions	Oscillating / tilting motions	Oscillating / tilting motions	Oscillating / tilting motions
Requires maintenance	Requires maintenance	Maintenance-free	Maintenance-free	Low maintenance
Lubricant with solid lubricant	Lubricant without solid lubricant	Dry running	Dry running	Lubricant without solid lubricant
GE...DO ISO 12240-1, series E GE...FO ISO 12240-1, series G GE...LO ISO 12240-1, series W GE...HO Cylindrical extensions GE...ZO Inch dimensions GE...SX ISO 12240-2 GE...AX ISO 12240-3	GE...PB ISO 12240-1, series K	GE...UK ISO 12240-1, series E GE...FW ISO 12240-1, series G GE...PW ISO 12240-1, series K	GE...UK-2RS ISO 12240-1, series E GE...FW-2RS ISO 12240-1, series G GE...DW ISO 12240-1, series C GE...SW ISO 12240-2 GE...AW ISO 12240-3	GE...DF ISO 12240-1, series C
6 mm to 1000 mm	5 mm to 30 mm	5 mm to 30 mm	17 mm to 1000 mm	320 mm to 670 mm
100 MPa	50 MPa	100 MPa	300 MPa	80 MPa
500 MPa (300 MPa GE...ZO)	125 MPa	250 MPa	500 MPa	120 MPa
−60°C to +200°C	−60°C to +250°C	−50°C to +200°C	−50°C to +150°C	−20°C to +75°C
v 0.10 m/s	v 0.10 m/s	v 0.40 m/s, 0.21 m/s	v 0.30 m/s	v 0.12 m/s
μ 0.08 to 0.22	μ 0.1 to 0.25	μ 0.05 to 0.2	μ 0.02 to 0.2	μ 0.05 to 0.25
<ul style="list-style-type: none">• Initial greasing prior to delivery for optimized running-in behavior• Reduced total costs (TCO) due to increase in operating life compared with the competition• Increased operational reliability• Tilting can be compensated up to 17° (FO series)	<ul style="list-style-type: none">• Long rating life• Reliability• High operational reliability• Large application temperature range	<ul style="list-style-type: none">• Long operating life• High operational reliability• Cost-efficient due to maintenance-free operation• Low coefficient of friction	<ul style="list-style-type: none">• Very long operating life and long sliding distance• High operational reliability• Cost-efficient due to maintenance-free operation• Low coefficient of friction• Downsizing courtesy of high load carrying capacity• Tilting can be compensated up to 17° (FW series)	<ul style="list-style-type: none">• High operational reliability• Corrosion protection and sealing against contamination by lubrication• Low coefficient of friction• Can be used for large and small swivel angles• Absorbs vibrations
<ul style="list-style-type: none">• Modified radial internal clearance• Dimensional stability• Asymmetric bearings• Bellows• RS/TS seals			<ul style="list-style-type: none">• Corrosion protection• RS/TS seals• Asymmetric bearings• Four point contact bearings	<ul style="list-style-type: none">• Corrosion protection• Axial spherical plain bearings also available by agreement with the customer

²⁾ These spherical plain bearings are also available as a version with rod ends.

Diverse areas of application – Plain bearings in use



Motorcycles



Opencast mining machinery



Agricultural machinery

Installation points in agricultural machinery

- Hinges
- Seating systems
- Steering
- Suspensions
- Linkage
- Shift systems
- Pedals
- Axes



Robotic arms



Forklifts



Construction machinery

Installation points in construction machinery

- Chassis
- Mirror adjustment
- Hydraulic cylinders
- Hydraulic pump valves
- Armrest
- Arm joints
- Windscreen wipers



Trucks



Drilling platforms



Fluid technology (Source: KSB)

Installation points in fluid technology

- Hydraulic motors
- Liquid pumps
- Valves
- Gear pumps
- Hydraulic cylinders
- Butterfly valves

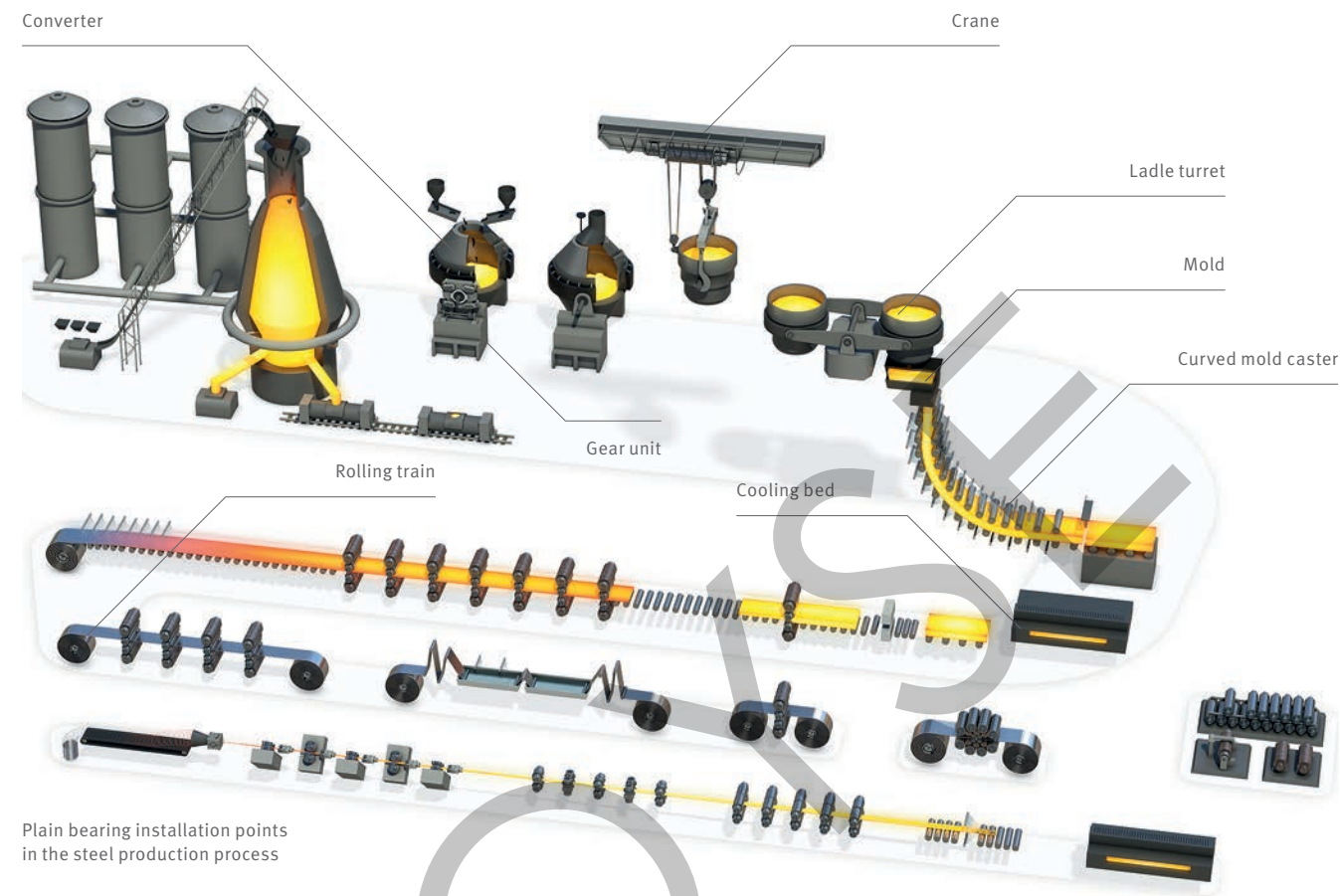
For steelworks ...

Applications
Steel production

... Schaeffler offers solutions for various points in the steel production process. All the way from the converter to the ladle turret, mold, and curved mold caster, through to the cooling bed, the Schaeffler portfolio can provide the right plain bearings.

Special spherical plain bearings with Durotect P coating for converter bearing arrangements

Steel is produced from pig iron in converters. A filled converter vessel has a total mass of up to approximately 2,000 t. Durable plain bearings are used to mount the vessel in the supporting ring, which in turn is supported in the converter housing with a swivel facility for the casting process. As a result of the slow swivel motions occurring under a heavy weight and shock loads, the bearings must have an extraordinarily high static load carrying capacity. For this reason, Schaeffler offers spherical plain bearings with a special Durotect P coating.



Plain bearing installation points in the steel production process

Spherical plain bearing in the ladle turret

For the carrying arm linkages of the ladle turret, the start of the continuous casting line, maintenance-free ELGOGLIDE spherical plain bearings are available. Alternatively, depending on the design of the ladle turret, spherical plain bearings with plastic sliding plates composed of glass fiber and PTFE can also be used.

The spherical plain bearings with fibre reinforced plastic sliding plates ...

- ... are maintenance-free.
- ... have a high load carrying capacity.
- ... can support shocks.
- ... have a small design.
- ... are suitable for oscillating motion.
- ... require no maintenance work.
- ... can be reconditioned.
- ... have a very long operating life.

Schaeffler has been successfully supplying bearings for ladle turrets since 1975. Depending on the turret size, with capacities of 150 t/h to 500 t/h, bearings in the nominal size range of 180 mm to 600 mm are used.



Radial spherical plain bearings with Durotect P coating



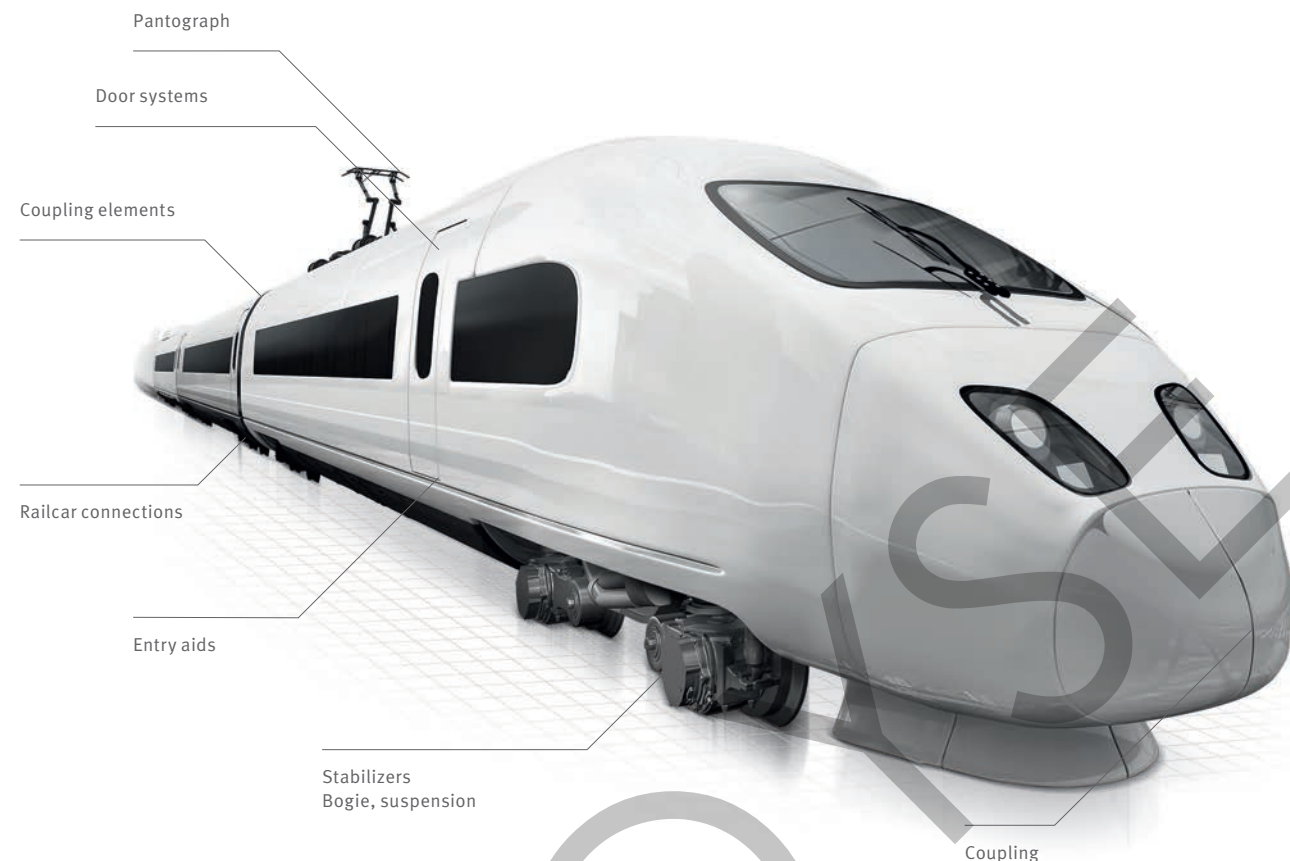
Converter

Ladle turret



Axial spherical plain bearing with plastic sliding plates

... Schaeffler plain bearings are used at multiple points. For example in trams, subways, and high-speed trains.



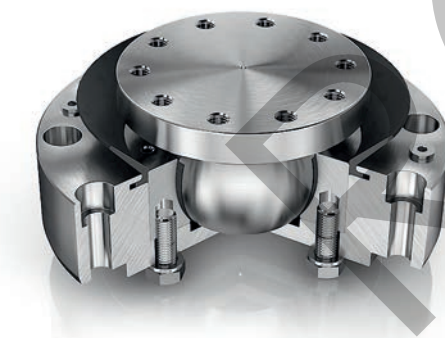
Bearing support solutions for railcar bodies and bogies

There are various bearing arrangement options available for connecting railcar bodies to each other and to bogies.

Radial spherical plain bearings: In the connection of railcars, both maintenance-free versions with ELGOGLIDE sliding fabric and radial spherical plain bearings requiring maintenance, with or without a rod end, are used. These bearings can be supplied with corrosion protection and are characterized by high performance, a long operating life, and low friction.

Axial/angular contact spherical plain bearings: If high axial forces occur, then axial and angular contact spherical plain bearings are the right solution. Particularly in the maintenance-free version with ELGOGLIDE, they feature a higher than average performance and long operating life.

Central joint system: An advantageous alternative is the complete central joint in the form of a ready-to-install unit, which considerably simplifies the surrounding structure. The bearing unit itself has an integral anti-lift system.



System solution for central joint bearing arrangements



Maintenance-free radial spherical plain bearing for stabilizing railcar bodies and for the suspension of shock absorbers

Highest demands on spherical plain bearings

Freedom from maintenance and a long operating life are important factors in the selection of spherical plain bearings for modern rail vehicles. For this reason, increasing numbers of customers are opting for maintenance-free spherical plain bearings. For example, in small dimensions for door

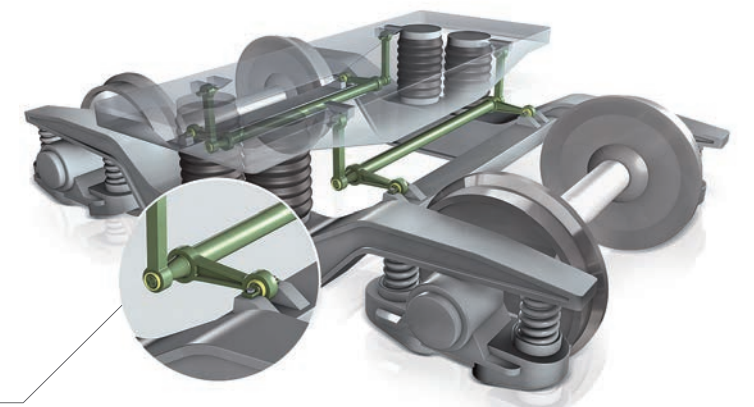
systems, medium-size bearings for tilting technology, or large dimensions in couplings. In all applications, plain bearings are characterized by a high load-carrying capacity, exceptional reliability, and long operating life.



Schaeffler plain bearings are also put to use at many points in trams

Faster en route with tilting technology

Vehicles with tilting technology can achieve significantly higher speeds on conventional tracks than conventional vehicles. Maintenance-free spherical plain bearings with ELGOGLIDE fabric are used in the main tilting mechanism. Highly dynamic systems for stabilizing railcar bodies (for example, the anti-roll bar) are fitted with maintenance-free special spherical plain bearings with specially developed bellows.



Installation point example of a maintenance-free spherical plain bearing with bellows in tilting technology

Plain bearings in agricultural machinery

There is always a great deal of pressure to increase productivity in agricultural engineering. Thanks to the dependable components and system solutions supplied by Schaeffler, manufacturers are able to reduce their total costs. The range

of standard bearings is particularly sophisticated. It is perfectly complemented by customer-specific solutions – sometimes unconventional, but surprisingly simple. We always place great importance on good sealing and ease of assembly.



Highest demands on plain bearings

Agricultural machinery needs to work very productively and reliably – under extremely difficult conditions and often round the clock. In the summer, the dust makes it necessary for the bearing arrangements to be well sealed. In the spring and fall, hard soil conditions put the mechanical stability of the machine parts to a hard test.

Constant vibrations and jarring shocks make for constant strain in all seasons. Schaeffler spherical plain bearings are specially designed to help increase the efficiency and performance of agricultural machinery under these harsh conditions.

Special solutions for offshore applications

Schaeffler spherical plain bearings can be found in many offshore applications, from dredgers to oil platforms.

In addition to often having an extremely high load-carrying capacity, the bearings in offshore applications must be resistant to corrosion and operate entirely maintenance-free for the duration of their operating life. To ensure this, Schaeffler offers customer-specific solutions with a special offshore coating. To comply with the high safety regulations, products can also be supplied with certifications, as provided by Lloyds Register for example.



The world's largest special ship for the assembly and disassembly of oil drilling platforms

Dredgers

A cutting suction dredger is a working ship either with or without its own drive that removes solid material from the bottom of the body of water. In this application, a spherical plain bearing supports the rotary motions that take place between the hull and the pipeline. To ensure a long operating life and low levels of wear for such applications, Schaeffler has created a special system of lubrication grooves, which are designed in such a way that the grease is evenly distributed, even during small swivel motions, thus ensuring optimum lubrication.

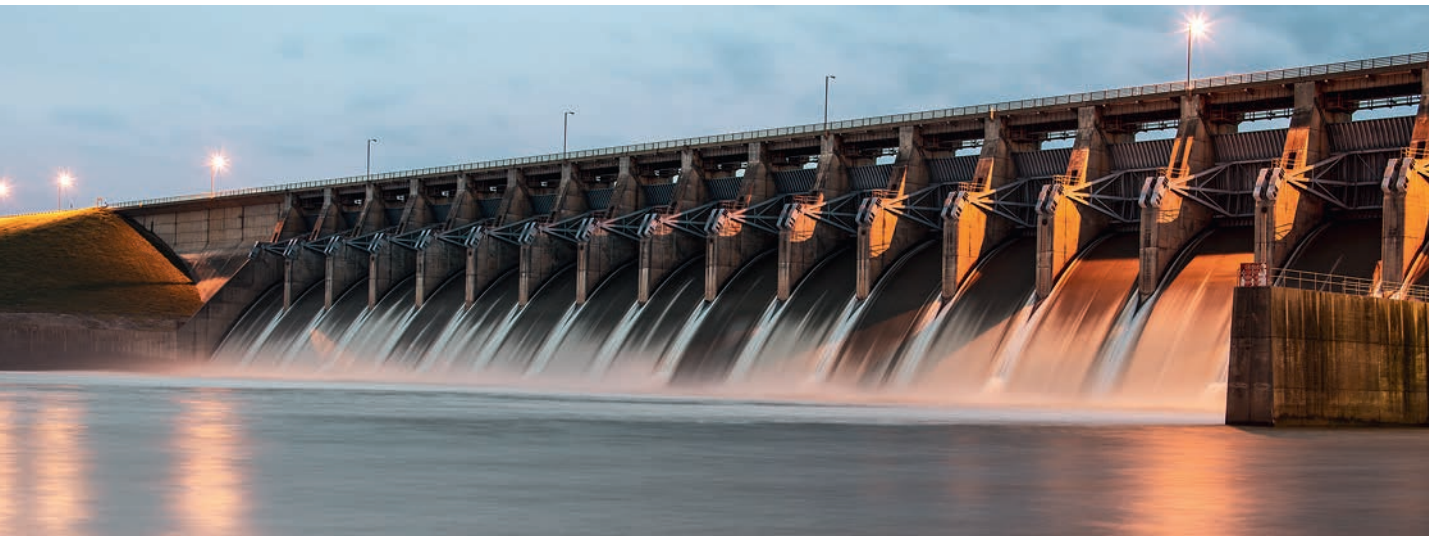
The operating conditions encountered in offshore applications also require special protection against corrosion while maintaining optimal sliding properties. To this end, Schaeffler offers customer-specific solutions with special coatings. This ensures a combination of high operational reliability and low maintenance outlay for the customer.



Dredger

Bearing arrangements in buildings and structures ...

Applications
Infrastructure



Dam with spherical plain bearings in the tide gates

... are sensitive interfaces – for both water and land. They must frequently support weights totaling several tons, withstand extreme heat and biting cold, and are exposed to sandstorms or aggressive salt water. In some cases, they must even be earthquake-proof.



Spherical plain bearings in glass roof construction

For gigantic roof architectures that must withstand the wind and weather, spherical plain bearings provide the required motion and length compensation in the steel construction. Maintenance-free spherical plain bearings are put to use everywhere. The benefits are obvious – after all, relubricating the bearing positions would be a task only aerialists could perform.

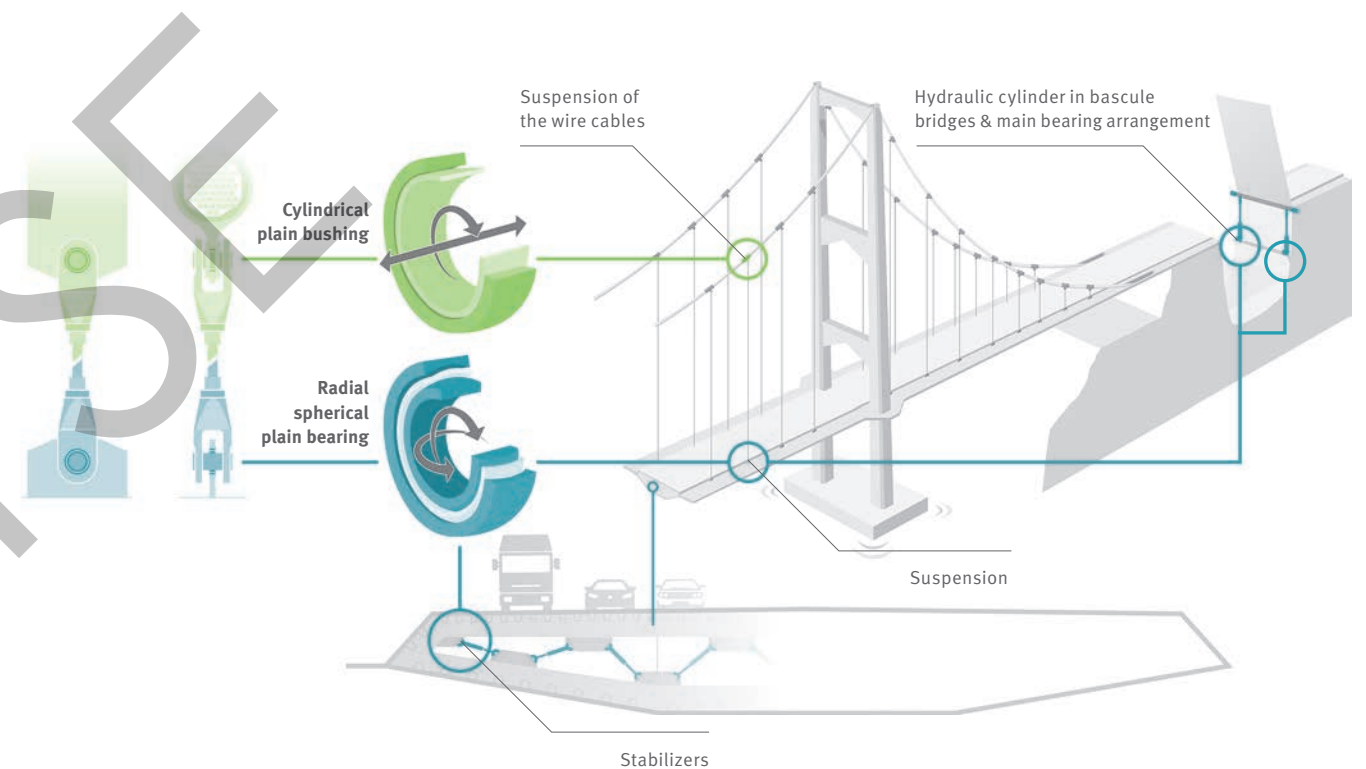
In many applications, the inner ring bores of the bearings are additionally coated with ELGOGLIDE, allowing both angular motions and weather-related changes in axial length to be easily compensated over a range of several millimeters. Even moisture, usually the main enemy of every bearing arrangement, does not stand a chance here, as the fabric sliding layer is connected securely to the steel support body and is resistant to moisture. In addition, bearing arrangements in building applications often have to be designed for a particularly long operating life of 50 to 100 years.

Roof glazing with spherical plain bearings

Bridge bearing arrangements with ELGOGLIDE

Regardless of whether a double bascule bridge or a hydraulic, balance or swing bridge design is involved, the situation definitely calls for high-performance plain bearings with ELGOGLIDE sliding fabric, as these bearings are completely maintenance-free and have a long operating life.

After all, there is hardly any time for maintenance work on a bridge application if it is a main traffic route. For example, harbor bridges have to be opened and closed several times a day to allow shipping traffic to pass through. This means extremely heavy work for all of the bearing positions in the movable bridge segments.



Cylindrical plain bushing

The bearings are particularly suitable for small swivel motions, but also permit axial motion. Durable, capable of supporting heavy loads, and available in low maintenance and maintenance-free designs.

Radial spherical plain bearing

The bearings combine the strengths of cylindrical plain bearings with the ability to compensate for swivel motions and misalignments, which, in the case of bridges, are particularly prevalent in the area of the roadway. Radial spherical plain bearings are also used in the suspension of the hydraulic cylinders on bascule and swivel bridges.



Bascule and suspension bridges

Renewable energies



Plain bearings in the rotor blade adjustment of wind turbines

In order to regulate the performance of the wind turbine, the blade angle is always adjusted optimally to the wind speed via the pitch bearing. In wind turbines with hydraulic blade angle adjustment, maintenance-free INA plain bearings are used. The bearings used must ensure that the blades can be adjusted reliably and uniformly under all operating conditions.



Plain bearings in solar applications

Plain bearings are ideally suited to the slow and precise swivel motions in solar energy systems. They can support high forces and are suitable for both high unilateral and alternating loads, e.g. due to changing wind directions. As a result, the long collector chains in such a system can be aligned with the course of the sun from east to west to an accuracy of tenths of a millimeter.

Application specific solutions and consultation



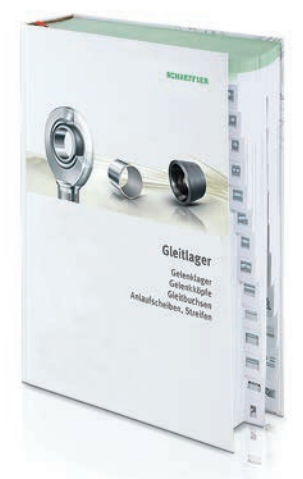
Special application-specific solutions

In close development partnerships with our customers from over 60 industrial sectors, we are constantly developing new solutions which are subsequently offered as catalog products. These are often ready-to-fit components or complete assemblies. The surrounding structure is taken into consideration from the very beginning of the development process so that expensive changes to the adjacent construction are no longer necessary and the overall solution is cost-effective for the customer.

A wide range of the Schaeffler Group's technical expertise is incorporated in the development of special solutions, for example:

- **Materials and surfaces**
If plain bearings are to be used in corrosive media, we work with special materials and our own coatings developed in-house, such as Corrotext.
- **Sealing concepts**
For heavily contaminated environments, we offer RS/TS seals to complement our plain bearings.
- **Condition monitoring**
Condition monitoring is a reliable method of detecting system damage at an early stage and avoiding unplanned downtimes. We can help you find the most suitable monitoring solution for your system.

We will be happy to assist you.



Detailed information on all products can be found in our plain bearing catalog (HG1).

Further information can be found at:
medias.schaeffler.com

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