

FAG Wheel Bearings

Product Overview





Schaeffler in the Automotive Aftermarket – more innovation, more quality and more service.

Schaeffler in the Automotive Aftermarket – always the first choice for vehicle repair.

Whenever a vehicle needs to go to the garage, our products and repair solutions are first choice to fix them. With our system competence in transmission, engine, and chassis, we are a reliable partner around the world. Whether passenger cars, light and heavy commercial vehicles, or tractors – our optimally tuned components allow fast and professional parts replacement.

Our products are based on a comprehensive systems approach. Innovation, technical expertise, and the highest material and manufacturing quality make us not only one of the leading development partners for vehicle manufacturers, but also a pioneering provider of value-retaining spare parts and complete repair solutions for clutches and clutch release systems, engine, and transmission applications, and chassis applications in original-equipment quality – right up to the appropriate special tools.

With our FAG brand, we are the specialist for chassis repair and supply a wide range of products and repair solutions. Our portfolio for this includes wheel bearings, steering and suspension parts, drive shaft assemblies, and strut mountings. By using state-of-the-art sealing and surface coating technologies, we offer the same high level of quality throughout the entire portfolio. Every individual component, including the smallest accessory part, is developed and tested according to Schaeffler quality standards. Therefore, our products ensure safe and agile road handling in every driving situation.

Schaeffler REPERT – the service brand for garage professionals.

SCHAEFFLER
REPERT

With REPERT, we offer a comprehensive service package for our products and repair solutions. Looking for specific information about damage diagnosis? Are you in need of particular tools to help make your everyday garage routine easier? Whether online portal, service hotline, installation instructions and videos, training seminars, or events – you get all technical services from a single source.

Register now for free, in just a few clicks, at: www.repxpert.com.



Allrounder wheel bearing



Function

Wheel bearings are an essential component of the chassis system. The load-bearing parts of the vehicle are called “chassis” (also known as the vehicle frame). These parts must support the functional elements, transmission, body and payload, and stabilise the vehicle against external and internal forces. The wheel bearing transfers the force of the transmission to the wheels and should therefore manifest as little friction as possible. At the same time, it bears the weight of the vehicle via the roller bearings.

In addition to simply transferring forces, wheel bearings are involved in various tasks in modern vehicles. Wheel bearings provide rotational speed signals for the increasing number of driver assistance systems in modern vehicles (like ABS or ESP) and transfer them to the control units.

Primary functions include:

- Enabling low-resistance rotations of the wheels
- Transferring axial and radial forces
- Support for wheel hub, wheel and brake disc or brake drum
- Sending rotational speed signals (in vehicles with driver assistance systems like ABS, ESP, etc.)

Requirements for wheel bearings:

- Precise wheel guidance
- Low friction
- Low weight for reduced CO₂
- High bearing stiffness/rigidity (stability)
- Reduction in unsprung masses, which contributes to better driving dynamics
- Absorption of external forces
- Greater comfort (e.g. minimal noise)
- High quality and safety
- Long service life
- Thermal stability
- Corrosion resistance
- Low maintenance
- Simple assembly/disassembly
- Sustainability (environment and disposal)

Growing business potential

A bright future for Wheel Bearing repairs

Latest studies on the global macroeconomic development showcase a steady increase of the global car park. As wheel bearings are part of any drive concept, (no matter if combustion engine, hybrids or fully electric vehicles) this will result in higher volumes and thus also repair cases.

Additionally, we see a trend towards an average rise of mileage per vehicle. This leads to higher loads on all vehicle components, of course also including wheel bearings. Thus, we estimate for a higher repair potential within the coming years.

A third factor that will favor the business of wheel bearing repairs is the average vehicle age. Research forecasts a growing vehicle lifetime, reaching over 14.5 years by 2026. This will go along with wear parts – such as wheel bearings – being replaced several times throughout the vehicle’s lifetime.

Positive macroeconomic outlook*



* Sources: Schaeffler Market Intelligence, Statista, IHS and Frost & Sullivan, Schaeffler Market intelligence

Wheel bearings throughout the generations

Single tapered roller bearings arranged in pairs are becoming increasingly uncommon today. They are being replaced by wheel bearing compact units that are able to take on more and more peripheral functions from generation to generation. This trend is also evident in the garage environment. For example, in the past, garages had to lubricate tapered roller bearings during assembly, and regularly perform setting work during an inspection. This isn't necessary with compact bearings.

The following overview illustrates wheel bearing development over the years, with all wheel bearing types currently in use in modern vehicles.



1



2



3



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11



8



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12



13



14

- 1 **Standard tapered roller bearing**
Dismountable tapered roller bearing
- 2 **Generation 1**
Double-row angular ball bearing with/without multipole encoder
- 3 **Generation 1T**
Double-row angular tapered roller bearing with/without multipole encoder
- 4 **Generation 1**
Double-row angular ball bearing with snap ring, with/without multipole encoder
- 5 **Generation 2**
Double-row, sealed angular ball bearing with conventional encoder
- 6 **Generation 2**
Double-row, sealed angular ball bearing with multipole encoder
- 7 **Generation 2D**
Double-row, sealed tapered roller bearing
- 8 **Generation 2.1**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder and snap ring (driven wheel)
- 9 **Generation 2.1**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder and snap ring
- 10 **Generation 3**
Double-row, sealed angular ball bearing with orbitally formed shoulder
- 11 **Generation 3**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder and sensor
- 12 **Generation 3.2**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder
- 13 **Generation 3.2**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder, face spline and LFT
- 14 **Generation 3.2 Eco-hub-flange design**
Double-row, sealed angular ball bearing with orbitally formed shoulder, multipole encoder, face spline and LFT

FAG innovations

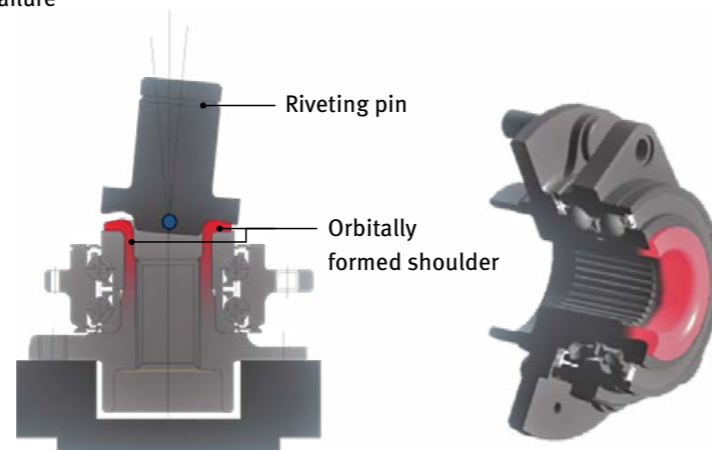
With over 2,000 patent applications a year, Schaeffler can claim top spot when it comes to innovation. The following FAG developments in the area of wheel bearings are worthy of particular mention.

Orbitally formed shoulder

All wheel bearings must be set after installation. In the case of compact bearings, this is done by tightening the central nuts or central screw to the manufacturer-specified tightening torque immediately after assembly. During the service life of the wheel bearing, a wide range of factors can affect the overall connection of axle shaft, wheel bearing, and screw or nut. The result: bearing clearance increases, which can lead to premature failure of the bearing.

The orbitally formed shoulder ensures a solid connection of the hub and bearing rings, which reliably sets the required bearing clearance. This significantly reduces potential assembly errors. Today, the orbitally formed shoulder is a worldwide standard in wheel bearing production.

During production, a "riveting pin" moves back and forth on the cold steel to transform the rear section of the wheel hub. Tensioning the bearing assembly sets the required bearing clearance, which remains constant over the lifetime of the bearing. The orbitally formed shoulder is used in Generation 2 and Generation 3 compact bearings.



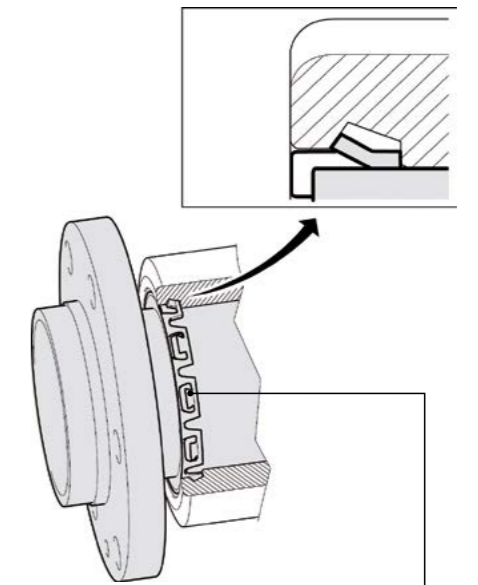
Snap ring

Most Generation 1 wheel bearings are secured against axial movement in the axle carrier with a circlip. Rings are used that can be assembled and disassembled in a groove in the axle carrier using pliers.

Generation 2 wheel bearings have a flange that often serves as the wheel hub. This means it is not possible to mount a standard circlip.

To safely secure the wheel bearings in the axle carrier, FAG therefore developed a circlip for Generation 2 wheel bearings – the "snap ring". This is connected to the outer ring and locks into the corresponding groove in the axle carrier during assembly.

The snap ring is used with some Generation 1 bearings and with most Generation 2 bearings.



Snap ring



Face spline

Usually, the forces are transferred between the drive shaft and wheel hub via a radial gearing system. To meet vehicle manufacturer's growing CO₂ reduction requirements, a new transfer variant was developed.

With the patented face spline, FAG has developed a wheel bearing that simplifies assembly, increases the transferable torque by 50%, saves 10% of weight, thus reducing CO₂ emissions, and increases the driving dynamics of the vehicle.

The face spline is positioned axially on the drive shaft and at the transmission-side end of the wheel hub. This is realised thanks to the larger diameter of the gearing crown. It is used on Generation 3 wheel bearings. During production, the orbitally formed shoulder and face spline are made in a single step. The riveting pin, which forms the orbitally formed shoulder with staggered movements, also forms the face spline at the same time.



Face spline on the hinged bell of the drive shaft



Face spline on the orbitally formed shoulder

Seal lip, which prevents corrosion in the face spline

Low friction torque seal (LFT)

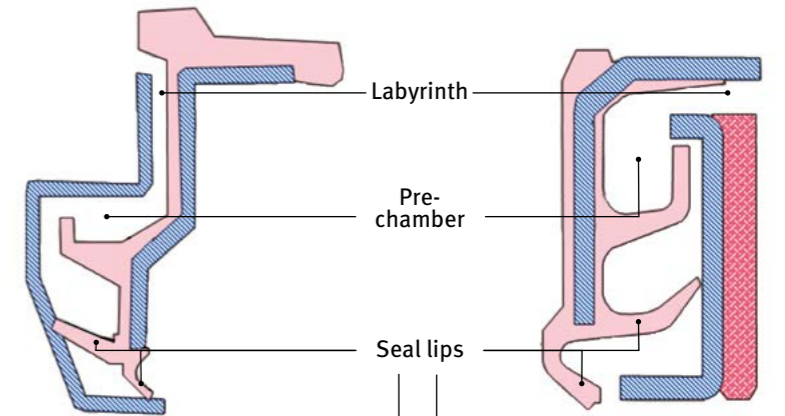
There are numerous variants of wheel bearing seals. All have multiple seal lips that seal the contact surface with the rotating bearing ring. When these touch, friction occurs, which on the one hand is necessary, and on the other is obstructive.

FAG has therefore developed a low friction torque seal with fewer seal lips. At the same time, a seal concept was designed that resembles a labyrinth.

The design prevents external moisture and dirt near the delicate seal lips, which means the seal now only needs two seal lips. A small detail when considering the component as a whole. But with huge benefits. Bearing friction is reduced by 50%, which has a positive impact on fuel consumption and CO₂ emissions.

Wheel-side LFT design

Transmission-side LFT design



Schaeffler future innovations



Optimized ECO-Hub flange design saves weight

In order to meet the steadily increasing requirements for weight and the associated reduction in CO₂ emissions, FAG also relies on an optimized ECO-Hub flange design. This enables a weight reduction of the wheel bearings of up to 20%*.

In order to avoid any deterioration in load carrying and durability, a special induction hardening process is used in production. This creates special stiffness in the flange and outer ring area – guaranteeing maximum safety and functionality.

(*Compared to wheel bearings without flange optimization. Source: Schaeffler Analysis 2020)

Weight optimized ECO-Hub flange

- Flange and outer ring with optimized rigidity
- 20% weight saving due to optimized ECO-Hub flange design*

(Source: Schaeffler Analysis 2020)



Schaeffler is steadily expanding its involvement in autonomous mobility based on intelligent chassis systems. Within the last months, Schaeffler has presented a variety of technologies that will pave the way for autonomous driving:

- **Space Drive 3 Add-ON** is the third generation of its Space Drive drive-by-wire system
- **Force-Feedback Handwheel Actuator (HWA)** will replace the conventional steering wheel
- **Rolling Chassis** is a vehicle platform that opens the way to completely new forms of autonomous mobility

Space Drive ready for production

Schaeffler's Space Drive steer-by-wire system transmits driving and steering commands to the vehicle wheels via purely electronic signals, opening the way for autonomous driving. The technology has been proven in the field, with more than a billion accident-free kilometers and is undergoing fine-tuning under extreme conditions in motorsports. The latest generation, Space Drive 3 Add-ON, is ready for small-volume production. The Space Drive system is triple redundant for maximum safety and meets the exacting functional safety requirements of ISO 26262.

HWA opens up completely new possibilities

Schaeffler has recently unveiled its force-feedback handwheel actuator (HWA), a mechatronic solution that replaces the conventional steering wheel and mechanical steering column. This reduces the amount of space required for the steering system and opens up completely new possibilities for the design of cab interiors – such as the ability to stow the wheel in the center console when in (semi-)autonomous driving mode. The system can further suppress undesirable feedback, such as vibrations from uneven road surfaces, and supports variable steering gear ratios, enabling new driving dynamics functions.

Rolling Chassis: technologies for new mobility solutions Schaeffler's rolling chassis, a modular vehicle platform, will enable new, driverless mobility solutions for passenger and freight transport. Its flexible architecture supports a broad array of steering and drive variants to suit customer requirements – everything from single electric axles in combination with central steering to implementations incorporating four Schaeffler corner modules. Each one allows a steering angle of up to 90 degrees and comprises a wheel hub motor and a wheel suspension system incorporating air suspension that enables the vehicle to "kneel" for greater ease of access. In addition it contains an actuator for electromechanical steering and a brake mechanism.



Rolling Chassis: One platform for all driving functions

FAG WheelSet at a glance

FAG has been an expert in precision bearings since 1883. The company's years of experience in manufacturing wheel bearings – a part that has to handle particularly high load – is a considerable advantage for garages, which benefit from FAG's expertise. Since 2005, FAG wheel bearings have been available in the spare parts market, and the manufacturer's wheel bearings are now among the most sought-after products of their kind.

Garage experts appreciate quality, which is why they rely on FAG's experience. For these experts, the durability and precision of the parts they install are particularly important because wheel bearings are crucial for safety. At FAG, quality is ensured at every stage of the manufacturing process – materials, development, production and testing all meet the most stringent requirements. FAG is also a supplier much in demand by car manufacturers, who also rely on the firm's excellent quality.

Innovations from FAG pave the way for the automotive industry. FAG not only invented and patented the ball grinding machine for perfect balls, for instance, but also the orbitally formed shoulder, which ensures that the bearing clearance is defined and set from the outset. This has made it easier and safer to replace wheel bearings in the garage.

The snap ring and the face spline make it easier to assemble wheel bearings of Generation 2.1 and higher, thus ensuring greater safety and faster repairs, while the low friction torque seal (LFT) protects modern FAG wheel bearings effectively from contamination and ensures greater efficiency by reducing the amount of friction.

And since FAG ensures that every repair can be carried out in the simplest possible manner, FAG packages include all of the accessory parts required to perform professional repair work, alongside the wheel bearing itself.

FAG WheelSet – from experts to experts

Safe: Highest quality in wheel bearings and necessary accessories. This ensures a particularly long service life and satisfied garage customers.

Customized: Includes all accessories for replacement as recommended by the vehicle manufacturer. If necessary, even extended by additional, vehicle-specific components for a professional repair.

Future-proof: Current patents (e.g. face spline and low friction torque) demonstrate the great inventive spirit of the Schaeffler engineers. The latest wheel bearing designs convince with high torque transmission and thus form the future standard for electrically powered vehicles.

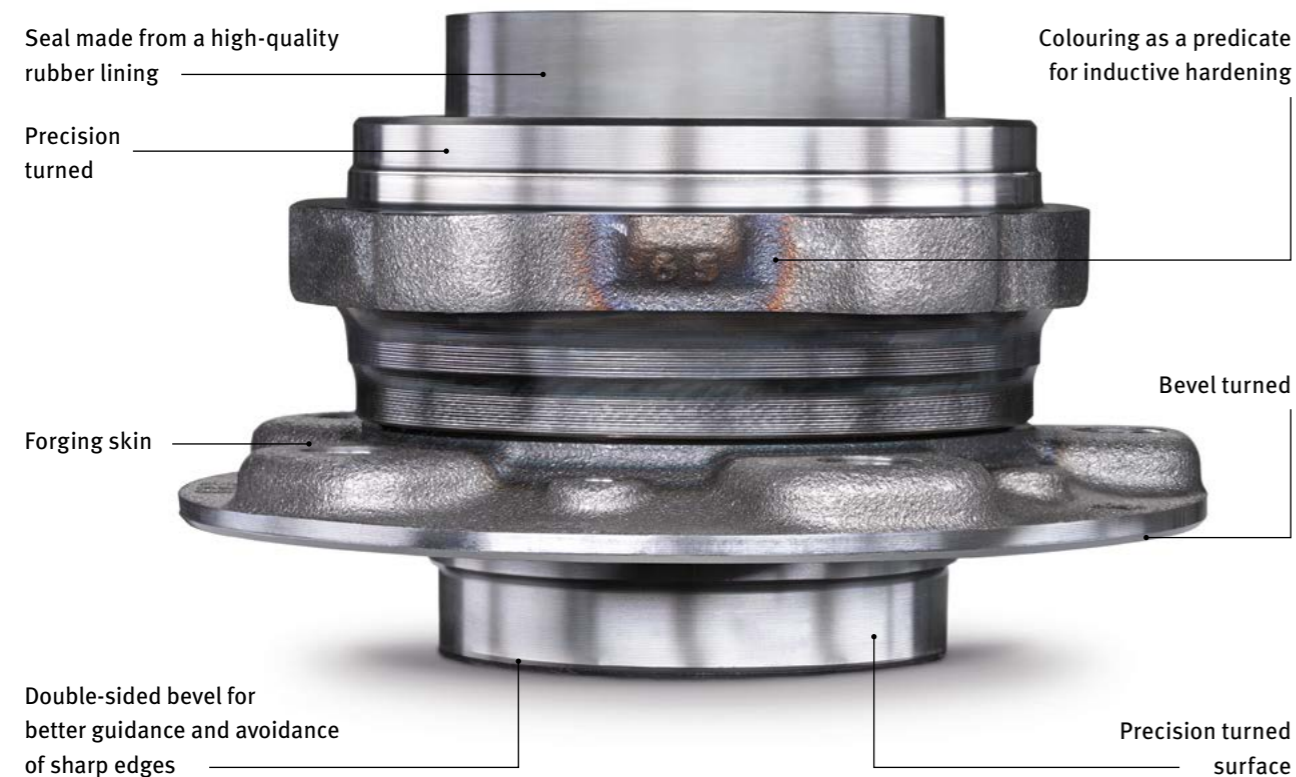
Schaeffler offers garage professionals a wide range of services for wheel bearing repair. Technical editors work on new content every day, such as vehicle-specific installation instructions and videos, as well as technical brochures and service information.

These are available 24/7 in the Schaeffler REPERT online portal. There you will also find the TecDoc based, cross-manufacturer online catalog, which can quickly find the right spare part. If necessary, this is supplemented by vehicle-specific repair instructions, maintenance data and working values (RMI) from our partner TecAlliance.

Learn more about Schaeffler's FAG Wheel Bearing range.



www.aftermarket.schaeffler.com/wheelbearing



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May 2022

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