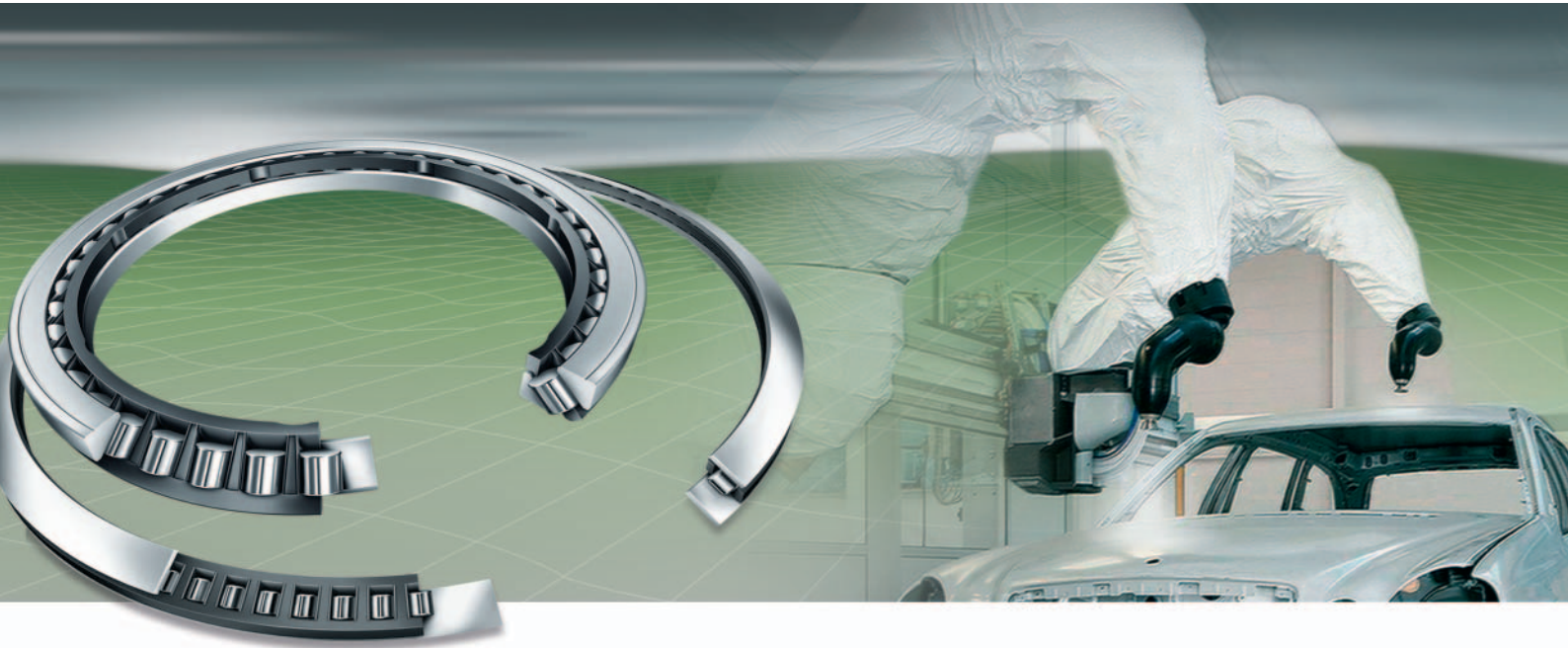




FAG



High precision and super light

Angular contact roller bearings from INA

High precision and super light

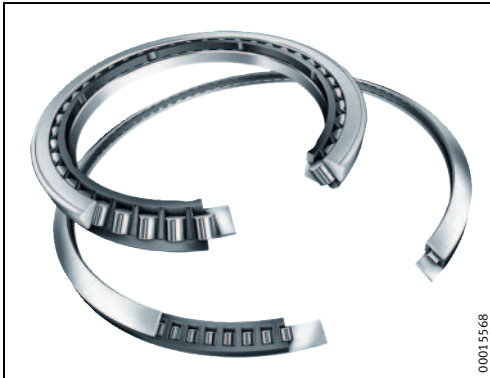


Figure 1 · Angular contact roller bearings AXS and SGL

High precision and super light – these characteristics are now of central importance in numerous industrial applications. Industrial robots, handling equipment and high precision transmissions, for example, are becoming increasingly compact and lightweight. At the same, the requirements for rigidity, positional accuracy and rating life are increasing.

Schaeffler Group Industrial has developed the new series of angular contact roller bearings AXS and SGL specially for these applications and these bearings are already in use in a large number of applications. They offer new design potential and, in comparison with the bearing types conventionally used, represent a particularly economical solution, Figure 1.

The limits of conventional ball and roller bearings

New technical applications increasingly require lightweight, high precision bearing arrangements with high load carrying capacity. In order to fulfil these requirements, appropriate ball bearings, angular contact ball bearings or four point contact bearings were used in the past. Where extremely high and also combined loads occur, comprising axial, radial and tilting moment loads, tapered roller bearing sets or crossed roller bearings are used. Furthermore, thin section bearings offer the possibility of reducing design envelope and mass. The small cross-section of these bearings and the rolling contacts of the balls, however, lead to lower basic load rating values. The load carrying capacity, rigidity and rating life are considerably reduced.

In numerous applications in machine building, conventional bearings are

reaching their performance limits and can only fulfil the high requirements on a conditional basis. This applies, for example, to transmission engineering, automation and robotics technology and in some cases even to medical equipment. Bearing types such as thin section bearings also require high precision ground bearing seats and particular care in mounting, which incurs considerable work in production and mounting.

Interesting alternatives

The two angular contact roller bearing series AXS and SGL represent an alternative here of technical and economic interest. They are rolling bearings with cylindrical rollers and raceways arranged at an angle to the bearing axis, Figure 2.

The particular feature of the AXS series is the conical bearing rings that are reminiscent of thin disc springs. These special rolling bearing rings are

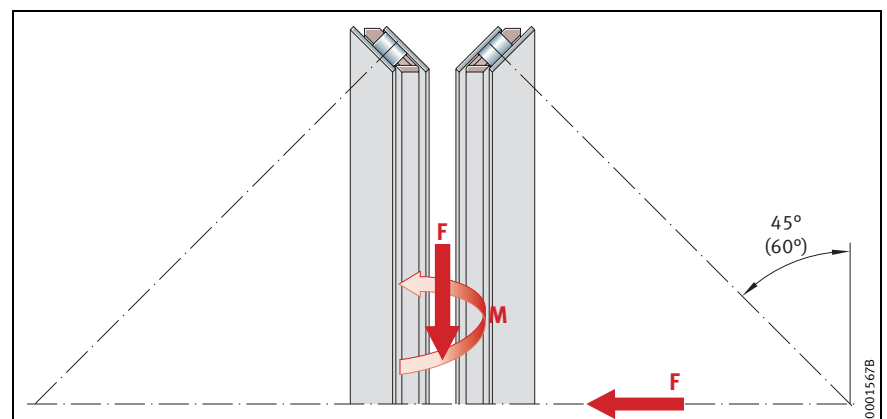


Figure 2 · Two angular contact roller bearings AXS in an O arrangement – ideal for combined loads

manufactured using forming technology. This requires particular know-how in production technology, which the Schaeffler Group has possessed for many years and uses for a widely varying range of products. The intelligent use of the forming technology allows extremely light designs with high load carrying capacity.

The particularly high precision of the SGL bearings is achieved by the use of machined, ground bearing rings with a triangular profile. The roller and cage assembly runs between these two hardened bearing rings. The cylindrical rollers are guided by a cage made from wear-resistant plastic.

The SGL bearings always have a bearing contact angle of 45°, while AXS bearings are designed with a contact angle of 45° or 60° depending on the load situation and area of application. The new series are produced in a diameter range from 8 mm to 200 mm.

AXS – lightweight with high load carrying capacity

The angular contact roller bearing AXS makes a convincing case mainly through its low mass and minimal design envelope together with considerable basic load ratings, *Figure 3*.

Bearing ring thicknesses starting at one millimetre and low radial bearing section heights show clearly the design possibilities of this bearing series for miniaturisation. The roller and cage assemblies comprise cylindrical rollers that are snapped into high strength plastic cages with a very small pitch.

As a result, high basic load ratings are achieved. These allow, for example, in swivel type operation, both high load and high bearing preload.

In specific applications, this can be used to increase the tilting rigidity further.

The maximum utilisation of the design envelope and the use of cylindrical rollers

explain the significant increase in basic load ratings and rigidity in comparison with thin section ball bearings.

AXS bearings can be mounted very easily and securely. Due to the geometrically identical bearing rings, there is no risk of mixing during the mounting process. Turned bearing seats are adequate for location of the formed bearing rings. Angular contact roller bearings AXS are predominantly used in applications with swivel operation.

SGL – precise and rigid

Bearings of the SGL series are used in preference where not only high load carrying capacity but also high accuracy and rigidity is required, *Figure 4* and *Figure 5*, page 4.

In conjunction with the line contact of the cylindrical rollers, the machined, precisely ground triangular section bearing rings allow highly precise and rigid bearing arrangements, *Figure 6*, page 4.



Figure 3 - Angular contact roller bearings AXS



Figure 4 · Angular contact roller bearings SGL

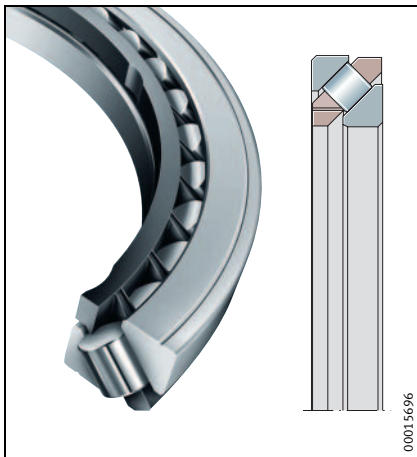


Figure 5 · Angular contact roller bearings SGL, details

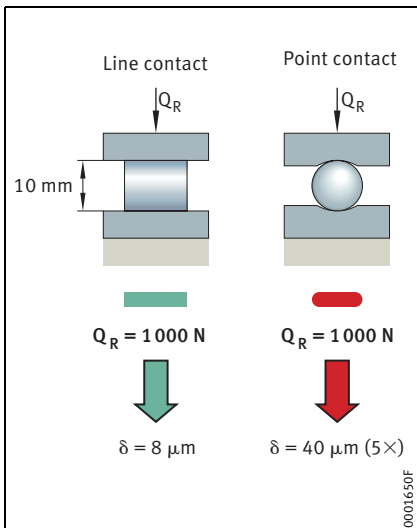


Figure 6 · Comparison: Point and line contact

The diagram shows that, for the same dimensions, the SGL angular contact roller bearings have significantly higher tilting rigidity than the angular contact ball bearings conventionally used, *Figure 7*.

Bearings of the SGL series conform to dimension series 18 and are thus directly interchangeable with series 718.

Other cross-sections can be produced as required.

The use of quadratic rolling elements (diameter $d = \text{length } l$) gives a significant improvement in the kinematic conditions in the SGL bearing. The rolling behaviour of these rolling elements is practically ideal. The bearing gives particularly uniform and low-friction running and is suitable for high speeds.

SGL bearings are predominantly used in an O arrangement. The resulting large

support distances increase the rigidity of the bearing arrangement.

Depending on the requirements, the bearing arrangement can be easily set to a condition ranging from bearing clearance to bearing preload.

Application examples

For the hand axis of a paint robot, bearings of series AXS open up new possibilities with optimised costs for supporting several axes in extremely thin-walled designs, *Figure 8*, page 5. The small bearing cross-section allows compact construction. The small mass of the bearings together with their large diameter facilitates a lightweight design with high load carrying capacity that offers a considerable amount of space for the passage of paint hoses.

The bearing positions are greased for life with a special grease and are thus maintenance-free.

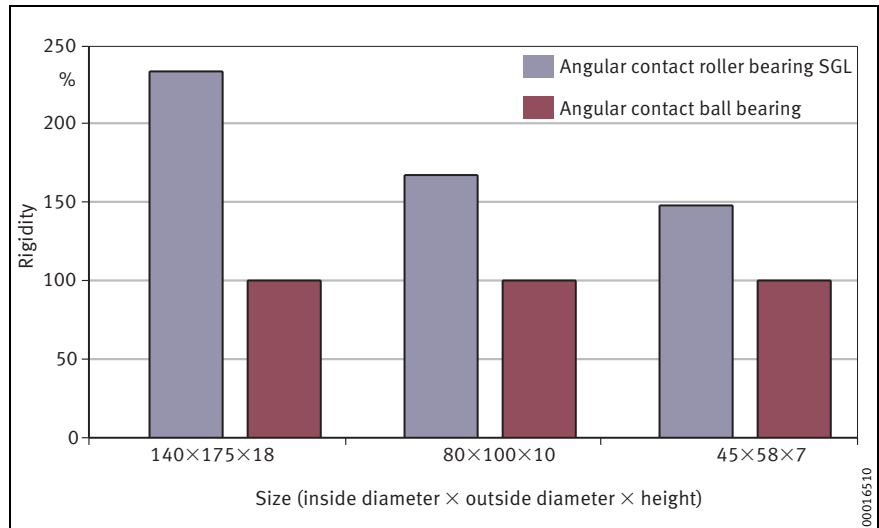


Figure 7 · Tilting rigidity

AXS bearings are already firmly established in tracking systems for solar power installations, *Figure 9*. The small cross-section and the high load carrying capacity and rigidity are of decisive importance here. These characteristics give high flexibility in design and allow compact transmissions for secure, quiet and low-vibration support of the solar mirrors. The result is technically and economically optimised drives that, while having significantly reduced mass, can reliably withstand the high loads that occur, for example, due to gusts of wind. A further wide area of application for bearings of the AXS series is in medical equipment. In the ceiling mounts used in operating theatres, these bearings are used with success. They make a convincing case through the smooth-running, jolt-free positioning of medical apparatus.



Figure 9 · Tracking systems for solar mirrors

In addition, the large bearing cross-section allows the passage of supply lines that, in the case of operating theatres, cannot be laid across the floor.

Precision transmissions are in a continuous process of optimisation, *Figure 10*. Due to the requirements for reduced design envelope, minimal friction, low heat generation, smooth running or high tilting rigidity, critical demands are made on the capabilities even of the bearings used.

It is clear that, in this situation, standard bearings reach the limits of their performance or the requirements are beyond these limits. With increasing frequency, the angular contact ball bearings or crossed roller bearings conventionally used in transmission output bearing arrangements are being replaced by SGL angular contact roller bearings. The line contact and O arrangement make a convincing case here and, furthermore, increase the rating life.

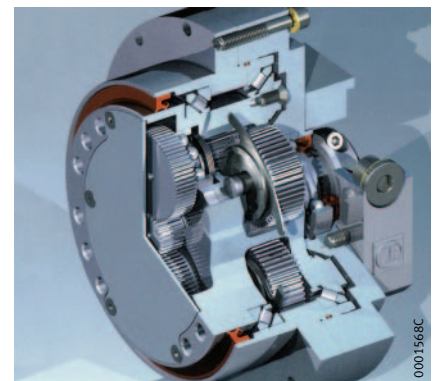


Figure 10 · Precision transmissions with SGL bearings



Figure 8 · Paint robot

Summary

The new angular contact roller bearings AXS and SGL are already represented in many applications. They are an ideal addition to the existing wide range of rolling bearings from Schaeffler Group Industrial. In addition to the advantages described, these bearings offer any engineer an interesting economic solution. They are the answer to demands for increased performance and miniaturisation.



Your contact

Rainer Gebauer

Telephone +49 9132 82-2237

E-Mail

rainer.gebauer@schaeffler.com

Schaeffler KG

Industriestraße 1 – 3

91074 Herzogenaurach (Germany)