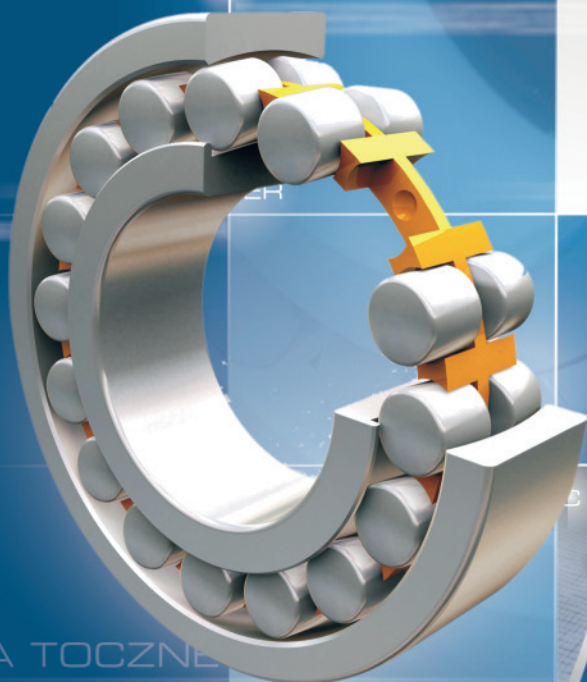


7. SPHERICAL ROLLER BEARINGS

ROLLING BEARINGS

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TABLES:**7. SPHERICAL ROLLER BEARINGS****7.1. Single-row and double-row spherical roller bearings****7.2. Spherical roller bearings with adapter sleeve****7.3. Spherical roller bearings with withdrawal sleeve****INTRODUCTION:****7. Single-row and double-row spherical roller bearings****7.1. Dimension series**

- **202.. 203..** - single-row with cylindrical bore
- **202 K.. 203 K..** - single-row with tapered bore (1:12)
- **238.. 239.. 230.. 240.. 231.. 241.. 222.. 232.. 223.. 233..** - double-row with cylindrical bore
- **238..K 239..K 230..K 231..K 222..K 232..K 223..K 233..K** - double-row with tapered bore (1:12)
- **240..K30 241..K30** - double-row with tapered bore (1:30)

7.2. Structure

Spherical roller bearings are inseparable self-aligning bearings designed for supporting heavy and combined loads. Single-row spherical roller bearings have one row of spherical rollers, spherical track of the outer ring and one track of the inner ring, whereas double-row spherical roller bearings have two rows of spherical rollers, spherical track of the outer ring and two tracks of the inner ring. They are made with a cylindrical bore for mounting directly on the shaft or with a tapered bore of 1:12 taper (K) for mounting on adapter sleeves or withdrawal sleeves. 240- and 241-series are manufactured with a tapered bore of 1:30 taper (K30) and mounted on sleeves of the same taper. The key feature of most of the spherical roller bearings is a lubricating groove and three lubricating holes on the outer ring, most often marked with the W33 symbol.



Fig.30 Single-row spherical roller bearings

7.3. Cages

Cages stamped from steel sheet are the most popular among spherical roller bearings, especially in small-sized bearing types. In bigger bearings solid steel or brass cages are implemented. There are also custom-made spherical roller bearings with cages made of polyamide strengthened with glass fiber.



Fig.31 Double-row spherical roller bearing

7.4. Features

Spherical roller bearings represent a specific variant of self-aligning bearings, in which balls have been replaced with other rolling elements – namely with spherical rollers. They possess all features typical of self-aligning ball bearings as well as some unique features, setting them apart from other bearing types. Because of the design of their rolling elements and the fact that the contact surface of rolling elements with tracks is very large, these bearings are characterized by the high load carrying capacity, twice up to three times the capacity of self-aligning ball bearings. Angular placement of spherical rollers in relation to the bearing axis allows them to carry considerable axial loads in both directions and to support, at the same time, radial loads. This structure also guarantees resistance to errors of alignment and shaft deflections. Spherical roller bearings, when operated normally with rotating inner ring can tilt (to compensate alignment deviations) by $0,5^\circ$ from the central position. At smaller load even by 2° , if the surrounding construction allows that. When the outer ring rotates the angular displacement capability is smaller. Standard spherical roller bearings are heat-stabilized to the temperature above 120°C . For smaller bearings the limiting temperature is usually at 150°C and for bigger usually at 200°C . Spherical roller bearings with a solid polyamide cage are adapted for continuous operation in temperatures not higher than 100°C .

7.5. Application

Spherical roller bearings are applied in all branches of industry and transport thanks to their features. They often assume very responsible duties and are operated under extreme conditions. They successfully substitute for other bearings, which are often not able to support at the same time heavy radial loads and axial loads in both directions. Despite the fact that they are neither cheap nor simple in construction, they often seem to be indispensable.

7.6. Mounting on sleeves

Spherical roller bearings as self-aligning ball bearings can be mounted on the shaft in two ways: directly on the shaft or with the help of the adapter sleeve (H) or withdrawal sleeve (AH). Generally the sleeves help mount or dismount bearings and in many cases also make the bearing mounting construction easier. Requirements regarding accuracy of the shaft making are lower in case of assembly with the help of sleeves than in cases of direct assembly on the shaft. Spherical roller bearings must have a tapered bore – K-mark behind the symbol – to be mounted with the help of a sleeve. Normally, taper of the tapered bore is 1:12 and only 240- and 241-series have taper of 1:30 – K30 sign. Adapter sleeves are more popular because they allow to mount bearings both on the levelled shaft and on the out-standing one. Their mounting and dismounting is easier than in case of withdrawal sleeves and moreover they do not require any additional fixing on the shaft. But security of sleeve units seems to be the most important factor. In case of bearing damage most often the shaft itself also gets damaged, and in the sleeve systems the shaft is definitely better protected.

7.7. Comparing features of self-aligning ball bearings and spherical roller bearings

Parameters/ bearing type	2210	22210	2310	22310
Basic load ratings -dynamic C [kN]	33,8	84,5	63,7	176,0
Rotational speed (grease) [r/min]	6300	5000	5300	3400

The table shown above serves as a comparison of capabilities of both types of self-aligning bearings. Whereas rotational parameters are similar, the load capacity of spherical roller bearings is nearly three times the load capacity of self-aligning ball bearings. Structure of rolling elements and angular position of spherical rollers in relation to the shaft axis allow to carry considerable axial loads in both directions. To be sure, self-aligning ball bearings also carry axial load in both directions, but definitely smaller ones. In this connection it is worthwhile to implement appropriately dimensioned spherical roller bearing if we are not sure, if the planned self-aligning ball bearing is capable of meeting all construction requirements.