

# 8. THRUST BALL BEARINGS

ROLLING BEARINGS

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## INTRODUCTION:

## 8. Single-direction and double-direction thrust ball bearings

### 8.1. Dimension series

- **511.. 512.. 513.. 514..** - single-direction single-row
- **532..533..534..** – single-direction single-row, one spherical outer ring
- **522..523..524..** – double-direction double-row
- **542..543..544..** – double-direction double-row – both outer rings are spherical

With a bearing version equipped with a spherical ring or rings we use spherical washers of the following series:

- **U2.. U3.. U4..**

If we provide the washer's designation together with bearing symbol, we add "U" at the end of the symbol.

If the washer is an individual part, we quote U2..or U3.. and then the symbol of the inside diameter, e.g. a bearing with a washer: **53209 U**, a washer alone: **U209**.



Fig.32 Single-row single-direction thrust ball bearing with a spherical washer

### 8.2. Dimensional accuracy

Standard accuracy class for thrust ball bearings is the P0 normal class. Most types are also available in the P6 and also in P5 accuracy classes.

### 8.3. Structure

All types of thrust ball bearings are detachable. Single-direction thrust ball bearings consist of an inner ring mounted on the shaft, and outer ring seated in the bearing mounting and a cage with balls. Double-direction bearings consist of an inner ring mounted on the shaft, and two outer rings seated in the bearing mounting and two cages with balls. Outer rings of thrust ball bearings can have alternatively either flat or spherical mounting surface.

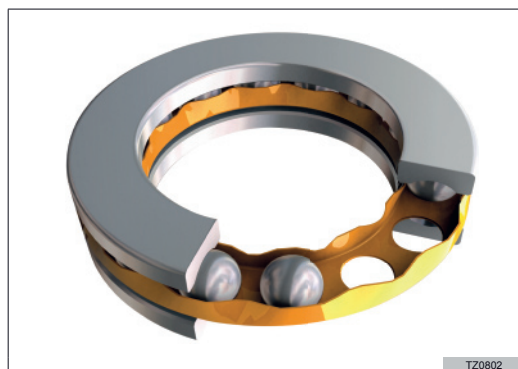


Fig.33 Single-row single-direction thrust ball bearing

### 8.4. Cages

Cages of thrust ball bearings are made of steel, sometimes of brass, especially in case of larger bearings.

### 8.5. Features

Thrust ball bearings are designed for supporting substantial axial load, however they cannot accommodate strictly radial load. Thrust ball bearings must be always subject to axial load because of centrifugal and gyroscopic forces occurring during rotation, whereas axial load should be at least three times the radial load. Minimal axial load values or corresponding initial grips can be calculated according to the formula shown below:

$$F_{a \min} \geq M \left( \frac{n}{1000} \right)^2$$

where  $F_{a \min}$  - means minimal axial load [N],

$M$  – coefficient of minimal load, the value of which is quoted in dimensional bearing tables,

$n$  – rotational speed of a bearing [revolutions per minute].

Axial load resulting from weight of elements leaning on the bearing and some external forces is usually higher than required minimal load. Otherwise the bearings should be subject of initial stress (e.g. with springs).

Single-direction bearings carry axial load in one direction, and double-direction bearings carry axial load in both directions.



Fig.34 Double-row double-direction thrust ball bearing

### 8.6. Misalignment

Thrust ball bearings with flat outer rings prevent any misalignment between the shaft and the bearing mounting from occurring. Bearings with spherical mount surface of the outer ring enable compensation of misalignment with the help of spherical washer with spherical concave surface or directly with spherical bearing seating.

### 8.7. Application

As the simplest type of bearings, the thrust ball bearings are widely applied in all branches of industry.

Simple construction, low price and the ability to carry considerable axial loads resulting from their construction puts the thrust ball bearings in the first row of all thrust bearings. Agriculture and machine-building industry are basic consumers of this bearing type.

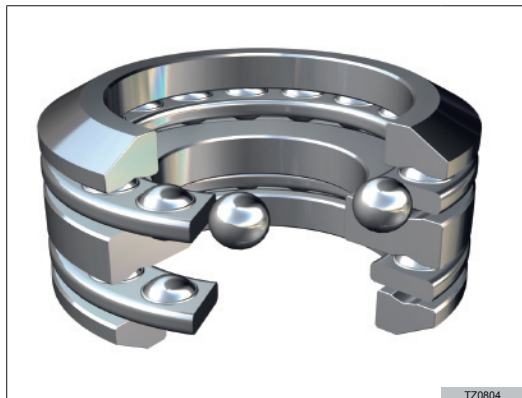


Fig.35 Double-row double-direction thrust ball bearing with spherical outer rings

### 8.8. Replaceability of parts of thrust ball bearings

Whereas the designation method of angular-contact thrust ball bearings, because of irreplaceability of individual parts, brings no special problems with it, some problems may arise with the thrust ball bearings - with proper interpreting the symbol of a bearing.

It involves replaceability of individual parts of bearings. To put it simply, some bearing elements of a given type can be used in bearings of another type.

It enhances considerably construction possibilities but on the other hand it somewhat impedes the designation system. The symbol of the bearing is always unambiguous, it defines clearly what elements the given bearing is to consist of, but the designation of individual elements may be not so clear.

The diagram presented below shows the construction principles of individual types. Elements that are marked with the same letters are identical and replaceable. Rolling elements' cages marked with circles in the diagram are identical with all series. When analyzing similarities one shall consider bearings with the same series of diameters and widths. The main difficulty is that some manufacturers introduce abbreviations to mark elements shared by different types of bearings. The abbreviation consists in omitting the digit that means the width of the series.

