

SELECTION OF BEARING TYPE

Selection of bearing type considering the magnitude and direction of load

The magnitude and direction of loads greatly influence the selection of bearings.

Generally, for the same dimensions, the cylindrical roller bearing stands heavy loads than the deep groove balls bearing. The bearings with more rows of rolling elements, especially rollers have heavy load carrying capacity.

According to the load acting direction, the following situation are distinguished:

a) Radial load

Cylindrical roller bearings without ribs at one of the rings, with one row of rollers (type N or NU) or with two rows of rollers (type NN or NNU) and needle roller bearings are to be used.

b) Axial load

Thrust balls or roller bearings according to the load magnitude, are to be used. The simple effect thrust roller bearings can be loaded only in a single direction and the double effect thrust roller bearings can be loaded in both directions.

c) Combined load

The simultaneous action of radial and axial load means that on the roller bearing acts a combined load.

For light axial loads together with radial loads are used:

- deep groove ball bearings, single row. (Combined load supported rises if the radial clearance is greater than normal);

- Cylindrical roller bearings of the NUP and NJ+HJ types and spherical roller bearings.

- NJ type cylindrical roller bearings can only accommodate axial loads acting in a single direction and for axial displacement of the shaft in both directions it is recommended to mount roller bearings of the same type.

If the axial load is heavy, a thrust bearing must be mounted together with a radial roller bearing. The angular contact balls bearing or four-point contact bearings (Q or QJ type) used when axial load predominates are mounted with clearance fit for housing.

In case of combined loads in which heavy axial load predominates, angular contact ball bearings single or double rows taper roller bearings or spherical roller thrust bearings. The above are presented in figure 1. in which the black triangles indicate the loads direction for which the respective bearing was designed and the white triangles are indicating the possible loads.

The size of the bearings is selected considering the condition of life requirements ensuring for imposed conditions of load, rating life and reliability of operation. Selection is done on the basis of a characteristic variable: **basic load ratings**.

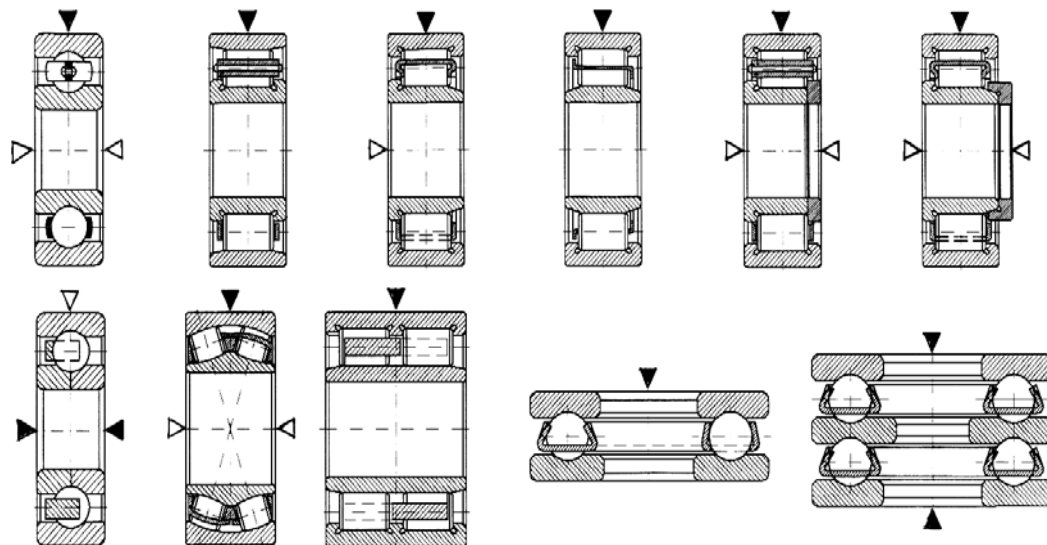


Figure 1

Selection of bearing type considering the alignment between shaft and housing

Angular misalignments occur generally when the shaft bends under the operating load or when bearings adjoint parts have form or position deviations.

In such cases, self-aligning ball bearings, spherical roller bearings or spherical roller thrust bearings should be used.

A certain bearing bent angle can compensate for errors of alignment and maximum angle values are shown for each type in the introductory texts of the table sections.

When misalignments should be compensated, radial and axial clearance are important. The larger the clearance, the greater the possibility of self-aligning.

If the misalignment exceeds the permissible values shown in the introductory texts of the bearing tables, the bearing rating life decreases. The greater the ratio F_r/C_{0r} , the shorter the rating life. If $0.1 < F_r/C_{0r} < 3$, the rating life decreases with about 25%.

Selection of bearing type considering the operating temperature

Maximum operating temperature to which the bearings designed for normal applications can be used is of 120°C. Over this temperature in the material of the contact elements (rings and rolling elements) there are produced structural transformations with *negative implications* over the dimensional stability and physical and mechanical characteristics which determine the resistance to contact fatigue and, through implication, to the life of the bearing.

Thus, at higher temperatures it is recommended to use special bearings having the component parts made of special steel brands or stabilized through thermal treatments. These bearings have special symbols.

Remark: When the working conditions of bearing allow great temperature differences in operation for the two rings (interior and exterior) we recommend the use of bearings with radial clearance greater than normal (groups C3, C4, C5)

Selection of bearing internal clearance

In most cases, while operating, bearings should have a small radial clearance that can be defined as "the possible value of displacement in radial direction of one bearing ring in relation to the other without parts deformations".

While operating, bearing internal clearance is different from the one at delivery, since the latter is reduced when mounting bearings with a certain tight fit.

Under operating conditions, internal clearance change is also caused by different temperatures between the outer and inner ring. Bearings are generally delivered with a normal radial or axial clearance according to the values shown for each rolling bearing group.

The decrease in radial clearance due to the tight fit and operating temperature is considered to be between 60-80% of the tightening value, depending on bearing series and size.

After the clearance in bearings has been decreased, a large enough operational clearance should remain, so that the lubricant film shouldn't be destroyed.

Deep groove ball bearings should have an operational clearance close to zero. There may be often a light-preload, due to the point-contact between the rolling elements and raceways.

Small-sized cylindrical roller and needle roller bearings should have an operational clearance of 5-10 μm and larger-sized bearings a clearance of 10-30 μm .

Bearing producers can also manufacture - at request-bearings with radial and axial clearance smaller (C1 and C2) or larger (C3, C4 and C5) than normal, so that the most favorable operating conditions for bearings should be assured.

Cylindrical and needle roller bearings can be manufactured with interchangeable rings (no special designation) and with non interchangeable rings (suffix NA).

Bearings with non interchangeable parts have a smaller radial clearance than bearings with interchangeable parts.

Changing rings from one bearing to another is not allowed.

In case of bearings with interchangeable parts, the rings may be changed and the values of radial clearance will be not altered.



Bearing types and technical characteristics

Table 1 shows qualitative results of each group of bearings, considering the main technical characteristics.

Bearing type is selected depending on the technical characteristics required by a certain application.

A suggestive graphic symbol has been determined for each main technical characteristics. Thus, a proper bearing for each purpose can be easily chosen. According to the specifications in this catalogue, the proper type and size of bearing can be selected, together with all manufacturing and operating technical conditions.



Bearing types and their characteristics

		Purely radial load	Purely axial load	Combined load	Moment load	Tolerance class	Quiet running	High speed	High stiffness	Compensation of misalignment	Low friction	Shock resistance	Located bearing	Non located bearing	Axial displacement possible in bearing	
Deep groove ball bearings: –single row –double row																
Self-aligning ball bearings																
Double row angular contact ball bearings																
Cylindrical roller bearings: NU, N																
	NJ, NU+HJ															
	NUP, NJ+HJ															
	NNU, NN															
	NCFV, NJ23VH															
Support rollers																
Spherical roller bearings																
Taper roller bearings –single row																
Thrust ball bearings:	–single direction															
	–double direction															



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Angular contact thrust ball bearings: - single direction, RY		☐	☐	○	☐	☐	☐	☐	☐	○	☐	○	○	○	○
	- double direction, 2344	○	☐	○	○	●	☐	☐	☐	○	☐	○	○	○	○
Cylindrical roller thrust bearings 811, 893		○	☐	○	○	☐	☐	☐	☐	○	☐	●	○	○	○
Rulmenti axiali cu ace		○	☐	○	○	☐	☐	☐	☐	○	☐	●	○	○	○

● - excellent ☐ - poor
 ☐ - good ○ - unsuitable
 ☐ - fair → - single direction
 ← - double direction