1. Selection of bearing type

Each type of bearing displays characteristic features which make it suitable for a certain application. Therefore, many bearing types and constructive versions have been developed so that they can satisfy various demands for rolling bearing. Taking into account the great number of factors to be considered when selecting a bearing type, no general rule can be given.

We give further the most important criteria to be considered when selecting the bearing type.

Selection of bearing type, considering the load magnitude and direction

Radial load

Deep groove ball bearings are the most suitable types of bearings for light and moderate pure radial loads. For heavy radial load and where large-diameter shafts are used, double row cylindrical roller bearings are the adequate choice. Needle roller bearings are recommended in case of limited space and heavy loads.

Axial load

For pure axial loads, single direction thrust ball bearings are used in case of loads acting in one direction. For loads acting in both directions, double direction thrust ball bearings are used. Angular contact thrust ball bearings and single or double row angular contact ball bearings are used in case of light or moderate pure axial loads at moderate speeds.

For light axial loads at high speeds, deep groove ball bearings are suitable. Under the axial load, a contact angle different from 0° is generated in these bearings and therefore they operate as angular contact ball bearings. In order to increase axial load carrying capacity, a larger clearance should be selected (C3, C4,etc.)

For moderate axial loads at high speeds, angular contact ball bearings in tandem arrangement are used so that they can take over loads acting in both directions. Four-point contact ball bearings, QJ type, are also used.

Combined load

In order to carry combined radial and axial loads acting simultaneously, bearings with a contact angle different from 0° are used. The greater the contact angle, the greater the axial load carrying capacity.

Self-aligning ball bearings, spherical roller bearings or cylindrical roller bearings, NJ, NUP, NJ + HJ types, can also accommodate combined loads of certain values. But there are some limit values of the ratio F_a/F_r, which are shown in bearing tables and cannot be exceeded. Cylindrical roller bearings can carry axial loads by means of the sliding friction on ribs. For this reason, the load is limited according to the indications on page 251.

Bearings which accommodate only one direction axial loads should always be mounted in pairs so that they can carry axial loads in both directions.

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, cylindrical 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 $0,1 < F_{0r}/C_{0r} < 3$, the rating life decreases with about 25%.

Selection of bearing type considering the operating temperature

Bearings are generally used up to a temperature of maximum +120°C. In case of higher temperatures, bearings with special heat treatments should be used, in accordance with specifications on page 27.

Sealed bearings, 2RS type, should be used at operating temperatures up to +80°C. If this temperature is exceeded, the efficacy of lubricants is considerably reduced.

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

URB bearing producers can manufacture bearings of various types and sizes so that they can meet the customers' requirements assuring a proper reliability for various applications.

Table 1.1 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 characteristic. 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

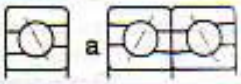
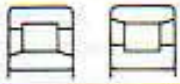
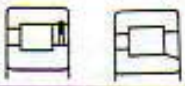
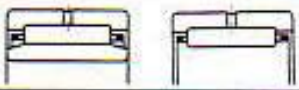
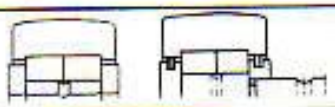
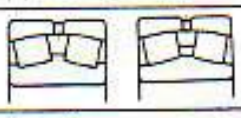
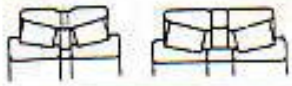
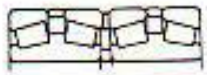
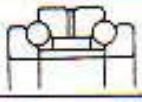
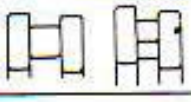
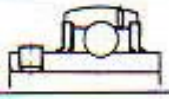
- excellent - good - fair	- poor - unsuitable - single direction - double direction	Purely radial load	Purely axial load	Combined load
Deep groove ball bearing: - single row				
- double row				
Self-aligning ball bearings				
Angular contact ball bearings				
High precision angular contact ball bearings				
Four-point contact ball bearings				
Angular contact ball bearings double row				
Cylindrical roller bearings: NU, N				
NJ, NU+HJ				
NUP, NJ+HJ				
NNU, NN				
NCF, NJ23 VH				
Needle roller bearings NA				
Drawn cup needle roller bearings RHNA				
Needle roller and cage assemblies K, KK				

Table 1.1

Moment load	Tolerance class	Quiet running	High speed	High stiffness	Compensation of misalignement	Low friction	Shock resistence	Located bearing	Non - located bearing	Axial displacement possible in bearing
◔	●	●	●	◑	◔	●	◑	◕	◑	○
◑	◑	◑	◑	◑	○	◕	◑	◑	◑	○
○	◑	◕	◕	◑	●	◑	○	◑	◑	○
◑	◑	◑	◑	◕	○	◑	◕	●	○	○
◑	●	●	●	◕	○	◕	◑	●	○	○
◑	◑	◑	◕	◑	○	◑	◑	◕	◔	○
◑	◑	◑	◑	◕	○	◑	◑	◕	◕	○
○	◕	◕	●	◕	◔	◕	●	○	○	●
○	◕	◑	●	◕	◔	◕	●	◑	◑	◑
○	◕	◑	●	◕	◔	◕	●	◑	◑	◑
○	●	◕	●	●	○	◕	●	○	●	●
○	◑	◔	◔	●	◔	◔	●	◑	◑	◑
○	◑	◑	◑	◑	○	◔	●	○	●	●
○	◑	◑	◑	◑	○	◔	◑	○	●	●
○	◑	◑	◑	◑	○	◔	◑	○	●	●

- excellent - good - fair	- poor - unsuitable - single direction - double direction	Purely radial load	Purely axial load	Combined load
Support rollers, cam followers		●	◔	◔
Spherical roller bearings		●	◑ ↔	◔
Taper roller bearings: - single row		●	◑ →	●
- double row		●	◑ ↔	●
- four row		●	◑ ↔	●
Thrust ball bearings: - single direction		○	◑ →	○
- double direction		○	◑ ↔	○
Angular contact thrust ball bearings - single direction, Ry		◔	◑ →	○
- double direction, 2344		○	◑ ↔	○
Thrust bearings - cylindrical roller 811, 893		○	● →	○
- tapered roller 951		○	● →	○
Needle roller thrust bearings		○	◑ →	○
Crossed tapered roller bearings		●	● ↔	●
Spherical roller thrust bearings		◔	● →	◔
Deep groove ball bearings with spherical outer surface and extended inner ring		◔	◑ ↔	◑
Slewing bearings		◑	◑ ↔	◑

Moment load	Tolerance class	Quiet running	High speed	High stiffness	Compensation of misalignement	Low friction	Shock resistence	Locating bearing	Non - locating bearing	Axial displacement possible in bearing
○	◑	◑	◔	◑	◑	◔	◑	○	◑	◑
○	◑	◑	◑	◕	●	◑	●	◕	◑	○
◔	◕	◑	◕	◕	◔	◑	●	◕	○	○
◔	◕	◑	◑	●	○	◑	●	●	○	○
◔	◑	◑	◑	●	○	◑	●	●	○	○
○	◕	◔	◑	◑	○	◑	○	○	○	○
○	◕	◔	◑	◑	○	◑	○	○	○	○
◔	◑	◔	◑	◑	○	◑	○	○	○	○
○	●	◕	◕	◑	○	◑	○	○	○	○
○	◑	◔	◔	◕	○	◔	●	○	○	○
○	◑	◔	◔	◕	○	◔	●	○	○	○
○	◑	◔	◔	◕	○	◔	●	○	○	○
●	◕	◑	◑	●	○	◑	●	●	○	○
○	◑	◔	◑	◕	●	◔	◕	◕	○	○
○	◑	◑	◑	◑	○	◑	◑	◑	○	○
●	◑	◔	○	●	○	◑	●	●	○	○