

TECHNICAL INSIGHT

A PUBLICATION OF NSK EUROPE

Choosing the right bearing and arrangement – A step-by-step guide

Various criteria are used when choosing bearings. A selection procedure is used to determine which bearing is best suited to a specific industrial application. During this process, bearings are examined closely from different viewpoints, such as speed and operating conditions. There is no specified standard procedure, but it is advisable to consider experience with comparable applications or case studies.

The list of possible applications for rolling bearings is virtually endless – they are used in a very wide range of conditions and in different operating environments. In fact, the range of operating conditions and bearing requirements is increasing further as technology rapidly advances. Considering the following parameters will help you choose the right bearing from the large number of designs and sizes available:

Selecting the bearing type

1. Installation space

There is a set amount of installation space, so the bearing type must fit. The space available is used to determine the bore size and the outer diameter.

2. Load rating

Various bearings with different load ratings will fit in the installation space available. Roller bearings have a higher load rating than ball bearings of the same size and can cope with shock loads better. The decision rests on which bearing will deliver the required performance.

3. Speed

Many factors affect the speed, such as the bearing type, size, cage type and lubrication method. If conventional grease lubrication is used, deep-groove ball bearings achieve the highest permissible speed and axial ball bearings the lowest.

4. Skewing of the inner/outer rings

Inner and outer rings should not be tilted, but they are always slightly askew. This happens when the shaft is deformed due to loading or when compensation is needed for dimensional errors. The permissible level of skewing depends on the bearing type and operating conditions. This allowable angle is usually very small. If more skewing is required, options such as self-aligning ball bearings, self-aligning roller bearings or special bearing units are recommended.

5. Rigidity

Loading deforms the bearing, starting with the areas of contact between the rolling elements and the raceway. Bearing rigidity is the term used to describe the relationship between the bearing load and the elastic deformation of the inner and outer rings and the rolling elements. Roller bearings are suitable in cases where high rigidity is needed. Rigidity can also be increased by preloading angular-contact ball bearings or tapered roller bearings, for example.

6. Running noise and torque

Rolling bearings generate minimal running noise and torque. If required, deep-groove ball bearings and cylindrical roller bearings can be made to run even more quietly. Deep-groove ball bearings are recommended for use in electric motors and measuring instruments where low levels of noise and friction are key considerations.

7. Running accuracy

There are different ways of determining how accurately bearings run. Precision classes depend on the bearing type. If precision running is required, deep-groove ball bearings, angular-contact ball bearings and cylindrical roller bearings are the best choice.

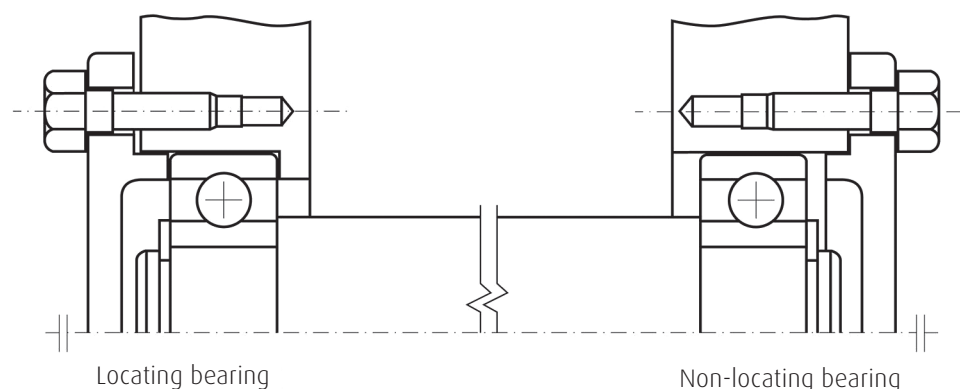
8. Installation and removal

Installation and removal methods vary by bearing type. If the bearing can be taken apart, it is easier to install and remove. Cylindrical roller bearings, tapered roller bearings and needle roller bearings generally fall into this category. They are the best choice if regular inspections are made. Self-aligning ball bearings and self-aligning roller bearings with tapered bores (with or without sleeves) are harder to mount because the internal clearance is adjusted during the installation process.

Selecting the bearing arrangement

1. Locating/non-locating bearing arrangement

- › Consists of a locating bearing and a non-locating bearing: the bearings cannot be axially preloaded
- › The locating bearing can absorb radial and axial forces
- › The rings of the locating bearing must be secured axially on the shaft and inside the housing to prevent displacement
- › The non-locating bearing only absorbs radial forces and allows for axial displacement
- › This displacement can either take place in the bearing itself (cylindrical roller bearings in N/NU design) or be ensured by using a point-loaded ring with a close sliding fit in inseparable bearings

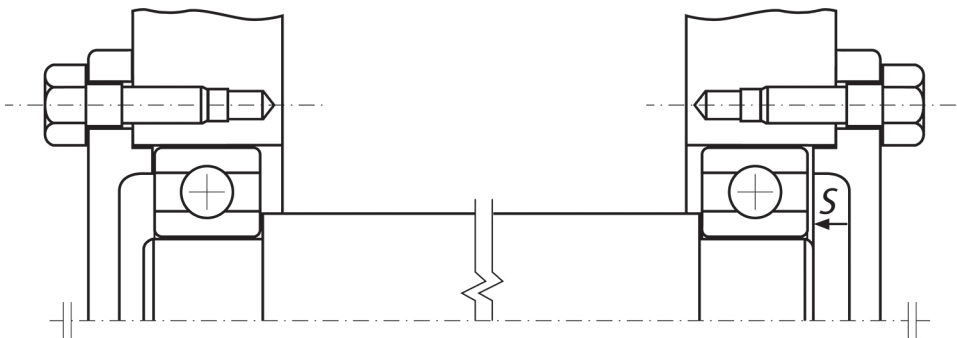


2. Semi-locating bearing arrangement

- › Both bearings absorb axial forces in a single direction
- › Either floating or fixed bearings can be used

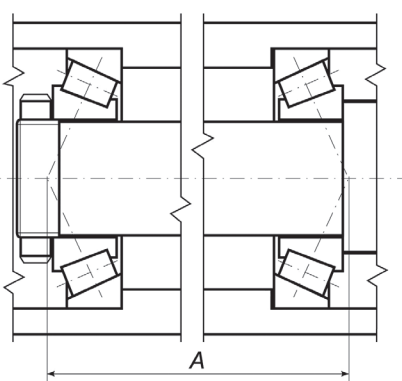
2.1 Semi-locating bearing arrangement with floating bearings

- › Can be used when no close axial guidance is needed
- › Inseparable bearings are secured so that each bearing permits axial play in one direction by using a point-loaded ring with a close sliding fit
- › In separable bearings (cylindrical roller bearings in NJ design), this shifting takes place within the bearing – a close sliding fit may not be used

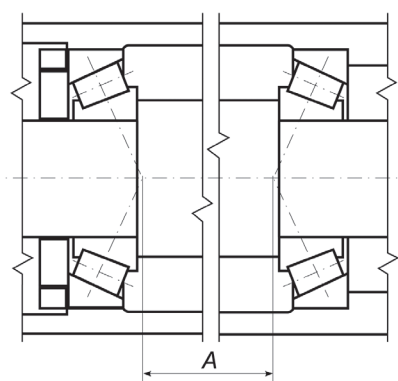


2.2 Semi-locating bearing arrangement with fixed bearings

- › Angular-contact ball bearings or tapered roller bearings are arranged symmetrically, for example, and held in place – fixings are used to adjust the bearing system axially to working play and/or a preload
- › Both face-to-face and back-to-back arrangements exist
- › The distance between the apexes of the contact cones is used as the bearing spacing
- › This distance – also known as the span – is larger with a back-to-back arrangement than with a face-to-face arrangement
- › A back-to-back arrangement is the best option if minimal tilting clearance is required
- › If the shaft is warmer than the housing – as in the majority of applications – the following applies:
 - When using a face-to-face arrangement, play will always decrease during operation
 - When using a back-to-back arrangement, there are three different scenarios:
 1. If the apexes of the contact cones touch, thermal expansion in the different areas will cancel itself out and play will remain the same
 2. If the apexes of the contact cones overlap, operating play will decrease
 3. If the apexes of the contact cones do not overlap, operating play will increase



a)



b)