

Summary

- Fixed/locating bearing: Prevents axial movement of the shaft in relation to the housing and absorbs radial and axial forces
- Floating/non-locating bearing: Axial relative movements are permitted as well as absorption of radial forces, precise axial guidance is not required
- Adjusted bearing: Bearing rings of two opposed bearings are preloaded against each other; precise guidance is required in the application
- Fully floating arrangement: characterised by axial play; no tight axial guidance required
- O-arrangement: Low misalignment of the bearings, wide support base
- X-arrangement: High misalignment of the bearings, low support base

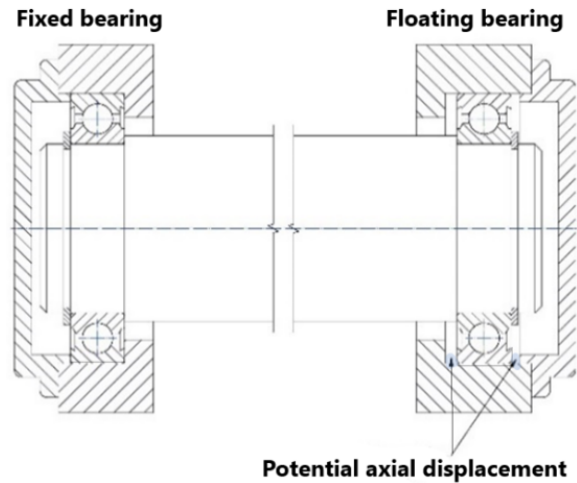
Do I choose a fixed bearing arrangement, an adjusted bearing arrangement or a floating bearing arrangement? This question is important when designing a shaft system. The three variants naturally have their advantages and disadvantages.

Definition of fixed/floating bearing arrangement

First of all, it is important to know that shafts or axles are basically supported by at least one pair of bearings in the axial as well as in the radial direction. The bearing that is to prevent axial movement of the shaft in relation to the housing is called a fixed or locating bearing. For this purpose, the bearing must always be secured axially on the shaft and in the housing using suitable abutments. This axial securing can sometimes be done by means of a [locknut](#) or [circlip](#).

Fixed and floating bearings

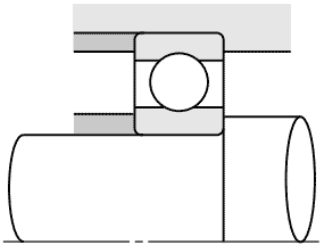
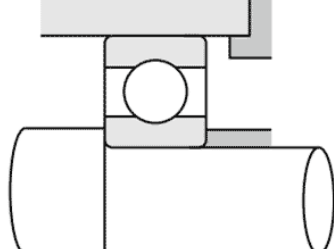
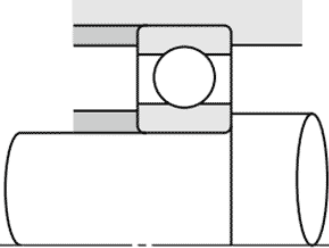
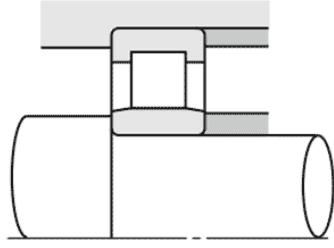
In order to compensate for thermal expansion and manufacturing tolerances, another bearing, a so-called floating bearing, is required. As can be seen in the illustration of the fixed and floating bearing, the axial displacement occurs in the housing. However, this axial displacement can also be made possible on the shaft or within the bearing itself (for example in the case of a [cylindrical roller bearing](#) of the NU or N design). In each case, the axial securing takes place on the shaft or in the housing. In the case of a cylindrical roller bearing (NU or N design from NTN), where the axial displacement occurs within the bearing, both the inner ring and the outer ring are axially secured.



The illustration of a fixed and floating bearing arrangement

Bearing arrangement (differentiation between fixed and floating bearing side)			
Arrangement		Comment	Application examples
Fixed bearing side	Floating bearing side		

Fixed and floating bearings

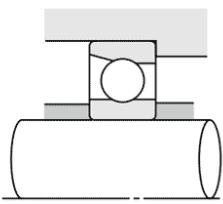
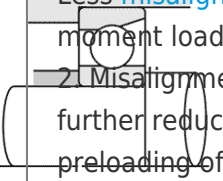
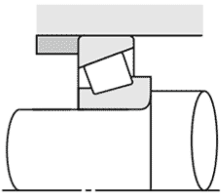

Bearing arrangement (differentiation between fixed and floating bearing side)			
		<ol style="list-style-type: none"> 1. General arrangement for all machines. 2. For radial loads, but also supports axial loads. 	<ul style="list-style-type: none"> • Small pumps • Motor vehicle gearboxes
		<ol style="list-style-type: none"> 1. Suitable for low installation errors and shaft deflection or for high speed applications. 2. The floating bearing side is easily movable, even with expansion and contraction of the shaft. 	<ul style="list-style-type: none"> • Medium size electric motors • Fans

Here you will find a general overview of fixed and floating bearing arrangements

The adjusted bearing arrangement

Fixed and floating bearings

In addition to the fixed and floating bearing arrangement, there is also the adjusted bearing arrangement. Adjustment means that the rings of two bearings are displaced until either the desired **preload** or the desired clearance is achieved. This results in more accurate guidance and higher bearing stiffness. **Tapered roller bearings** and **angular contact ball bearings** are mainly used for this “adjustment”, but many other rolling bearing types (such as **deep groove ball bearings**) are also suitable for an adjusted bearing arrangement. In order to align two bearings against each other, there are three possible bearing arrangements: The **O**, **X** and **tandem arrangement**. The table shows the O and X arrangements.

Bearing arrangement (adjusted bearings)		
Arrangement	Comment	Application examples
 <p>O-arrangement (Back to Back)</p>	 <ol style="list-style-type: none"> 1. Larger support width → Less misalignment under moment load 2. Misalignment can be further reduced by additional preloading of the bearings. 	<ul style="list-style-type: none"> • Machine tool spindles
 <p>X-arrangement (Face to Face)</p>	 <ol style="list-style-type: none"> 1. Lower support width → More misalignment possible 2. Sensitivity to temperature fluctuations 	<ul style="list-style-type: none"> • Reduction gear • Front and rear differential of motor vehicles

You can find more information on the O and X arrangement [here](#).

However, it has to be taken into account that adjusted bearings also have disadvantages. For

the “adjustment”, considerably more time is needed during assembly than for a fixed/floating bearing. The reason for this is, for example, the setting of a defined clearance or [preload](#).

The fully floating bearing arrangement

Another bearing arrangement that essentially has a lot in common with the adjusted bearing arrangement is the fully floating bearing arrangement. In contrast to the adjusted bearing, this always involves some axial play, which is why there is no precise axial guidance with the floating bearing. The amount of axial clearance s is predetermined by the designer in the case of a floating bearing arrangement, so that the bearings are not subjected to axial distortion under any circumstances. A floating bearing arrangement is chosen for gearboxes, for example, if the gearing requires a free axial position or the axial guidance accuracy does not have to be particularly high.

[Angular contact ball bearings](#) and [tapered roller bearings](#), both of which must be adjusted, are conversely unsuitable for the fully floating bearing arrangement. The most prevalent rolling bearing types that are suitable for a floating bearing arrangement are summarised in the list.

- [Spherical roller bearing](#)
- [Deep groove ball bearing](#)
- [Cylindrical roller bearing](#)

In addition to the three bearings, other rolling bearing types can of course also be used to create a fully floating bearing arrangement.

You may also be interested in

[Bearing clearance, operating clearance and preload](#)

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Fixed and floating bearings

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The tapered roller bearing

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