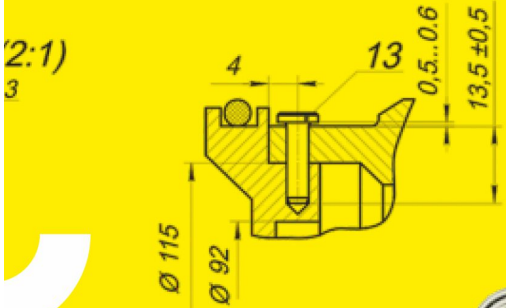


# ROLLING BEARINGS

Bearing Selection & Arrangement



This version supersedes all previously published versions. All the bearing mentioned in this catalogue are manufactured with normal tolerance class. We can, however, supply other class bearing against specific requirement.

The material and Information contained here are for general information purpose only. You should not rely upon the material or information provided herein for any basis for making any business, legal or other decisions.

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2 WHEELERS



3 WHEELERS



4 WHEELERS



TRACTORS



LCV, HCV



INDUSTRIES



RAILWAYS



AEROSPACE



## Products from NBC

Founded in 1946, NBC is India's first bearings manufacturer and the last word in quality and durability. In 2020, the company acquired leading European manufacturer, Kinex Bearings to further boost its expertise.

75 years since its beginning, NBC remains India's leading bearings manufacturer and exporter. NBC is also the world's only bearings manufacturer to receive the prestigious Deming Grand Prize for Total Quality Management.



Since the challenges faced by industry are many, NBC offers a diverse range of exceptional bearings. NBC bearings are available in sizes from 04 mm bore to 2000 mm outer diameter.



\* Products with special features like high temperature application, special heat treatment, coated roller/faces and cage options are also available across product range.

## 3.1 Bearing Selection Process

The bearing selection is primarily dependent on application to which they are subjected to. A detailed study considering load magnitude, misalignment, rotational speed, fit, preload, operating and environmental conditions etc. at location and equipment to which bearing to be installed will in fact suggest the proper bearing to be selected. Other factors playing vital role in bearing selection includes housing & shaft parameters and service life of equipment. The lubricant and sealing also plays a critical role. This is important as cleanliness has effect on bearing life. As a general guideline basic steps can be followed for selecting appropriate bearing as shown in the flow chart.

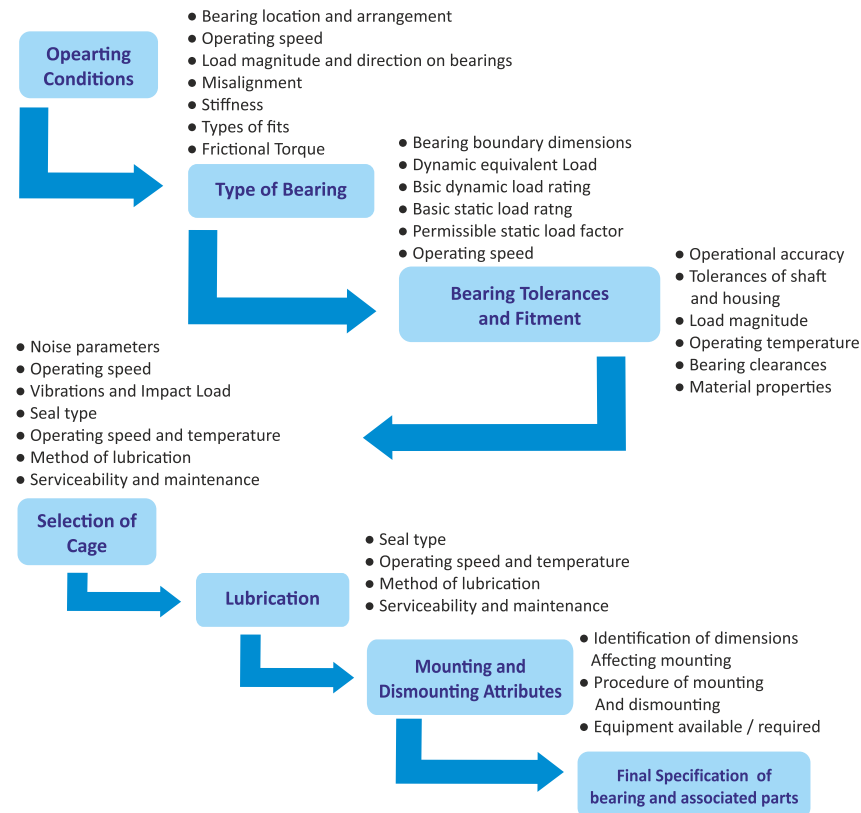


Figure 3.1 Flow Chart for Bearing Selection

### 3.1.1 Selection of type of bearing (Allowable installation space for bearing)

The limit of space available for bearing installation is a major factor according to which the type and size of bearing must be selected. Generally design of shaft initiates with fixing of shaft diameter followed by checking other parameters for feasible design. The bore of bearing is selected on the basis of shaft parameters. The wide variety of dimensions available in dimension series of rolling bearings provides the basis for selection of feasible bearing. The figure 3.2 shows the different types of bearing and dimension series of rolling bearing

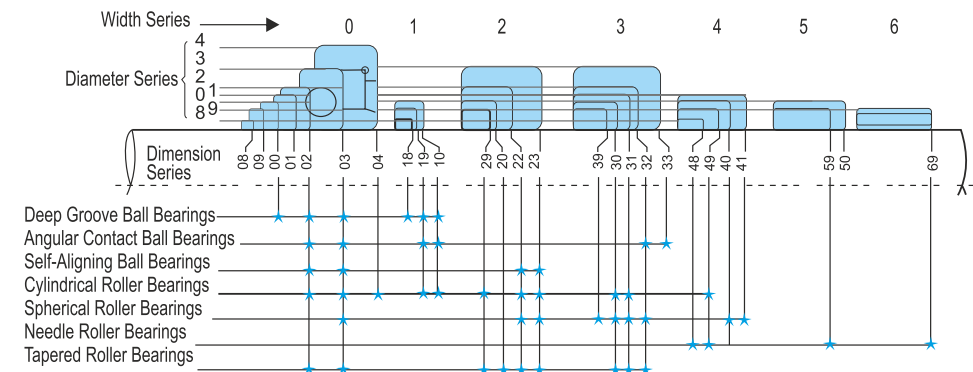


Figure 3.2 Different types of bearing and dimension series of rolling bearing

### 3.1.2 Load capacity and direction

Direction of load, magnitude of load and direction of application plays a vital role in selection of bearings. Apart from these vibration and impact also contributes significantly in bearing selection. It is seen that for shock / impact loads roller bearings have higher load capacity than ball bearings when bearings of the same dimension series are compared. The figure 3.3 shows the load capacity of different type of bearings.

Bearing Type	Radial Load Capacity				Axial load Capacity			
	1	2	3	4	1	2	3	4
Deep Groove Ball Bearing	1				1			
Angular Contact Ball Bearing	1	2			1	2	3	
Cylindrical Roller Bearing	1	2	3		1	2	3	
Taper Roller Bearing	1	2	3		1	2	3	4
Spherical Roller Bearing	1	2	3	4	1	2		

Figure 3.3 Load capacity of different type of bearings

### 3.1.3 Speed of rotation

Speed of rotation of particular type of bearing which in fact is allowable speed of bearing depends upon Bearing Size, Cage, Running accuracy, load magnitude and lubrication. It has been seen that generally ball bearings (both deep groove and angular contact) and cylindrical roller bearings are widely used in applications with requirement of high speed of rotation. The figure 3.4 shows the speed of rotation of different types of bearings with respect to each other.

Deep Groove Ball Bearing	Relative Permissible Speed				
	1	4	8	12	16
Deep Groove Ball Bearing	1	4			
Angular Contact Ball Bearing	1	4	8		
Cylindrical Roller Bearing	1	4			
Needle Roller Bearing	1	4			
Taper Roller Bearing	1	4			
Spherical Roller Bearing	1	4			
Thrust Bearing	1	4			

Figure 3.4. Speed of rotation of different types of bearings

### 3.1.4 Running accuracy

As bearings are designed for different applications which may consist of high running accuracy equipment such as rotary devices, spindle for machine tools etc. The tolerance class of 'class 5 or higher' is recommended in such type of applications. Deep groove ball bearing, Angular contact ball bearing and cylindrical roller bearings are precisely designed for applications with high accuracy requirement.

### 3.1.5 Rigidity

At the point of contact wherein rolling elements are in contact with bearing raceways under load, elastic deformation appears. This is known as rigidity of bearing. Elastic deformation in roller bearings in comparison to ball bearing is less under same loading conditions. It becomes essential for bearings to have sufficient rigidity for better performance as well to reach target life.

Ratio of bearing load to elastic deformation determines the rigidity of bearing. The rigidity of bearing can be enhanced by preload which gives bearing a negative clearance prior to operation. Mostly taper roller bearing and angular contact bearings are preloaded.

### 3.1.6 Misalignment of races and types of bearings

The shaft and housings plays a vital role in alignment particularly during operating conditions. Under the circumstances which causes accuracy in alignment such as shaft deflection under loads can leads to misalignment of inner and outer ring of bearing.

Misalignment which is excessive in nature can significantly damage the bearings involved. There is availability of bearings that can accommodate misalignments up to certain extent. It is always recommended to select such bearings in those conditions. Generally criteria for selection of bearings says higher the self-aligning capability of bearing, more is the misalignment it can accommodate.

Spherical roller bearings and self-aligning ball bearings can accommodate high misalignments followed by deep groove ball bearings and angular contact ball bearings. Cylindrical roller bearings can least accommodate misalignments.

### 3.1.7 Mounting and dismounting of bearings

Another way of classifying bearings depends upon their nature of separation based on which they are categorized into separable and non-separable types. Here separable type of bearings can offer ease of mounting and dismounting. Applications which require periodic inspections the separable type of bearings are recommended. The roller bearings such as taper roller bearings, cylindrical roller bearings and needle roller bearings are basically recommended for applications which require periodic mounting and dismounting. Also in case of spherical roller bearings with tapered bore and self-aligning ball bearings with tapered bore the use sleeve can ease the mounting of bearings.

### 3.1.8 Noise and torque

It is the level of precision to which the bearings are manufactured contribute to noise and torque outcomes. Here at NBC bearings high precisions are kept while manufacturing all types of bearings. Noise levels are many a times specified based on applications to meet the requirements as seen in the case of deep groove ball bearings and cylindrical roller bearings. Generally for very low noise and torque Deep groove ball bearings are recommended.

### 3.2 Selection of bearing arrangement

Generally, two or more bearings are used in various application for the purpose of supporting the operational load and locate & position the shaft. The operational load could be radial, axial or moment Loads. One important function of the bearing combination is to provide axial guidance of shaft. Axial guidance is the axial expansion of shaft without producing misalignment of shaft axis. The axial guidance or unrestricted expansion of shaft is possible by providing floating bearing. The combination becomes fixed and floating (free) bearing arrangement.

The following factors plays a vital role in bearing mounting arrangements.

- Location of bearings in arrangement for ease of mounting and dismounting.
- Variations in temperature leading to expansion and contraction of shaft.
- Deflection of shaft as well as errors during mounting (if any) causing misalignment in bearing.
- Bearing's ability to sustain loads at their mounting position.

Usually, bearing arrangement on shaft happens in way that bearing is mounted on fixed side followed by other bearing mounted on free side.

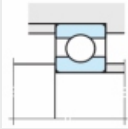
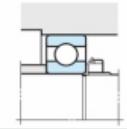
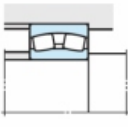
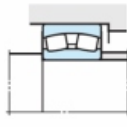
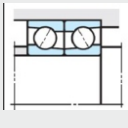
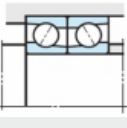
### Fixed side bearing:

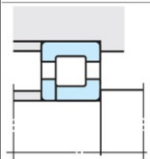
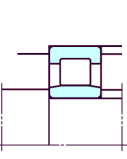
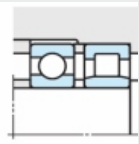

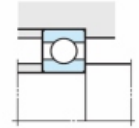

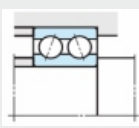
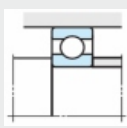
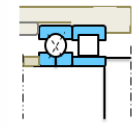
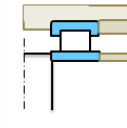
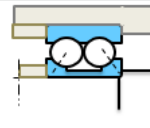
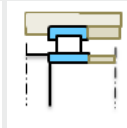
The bearing which prevents axial movement of the shaft relative to housing is fixed bearings. Fixed side bearing can support radial and axial loads. A bearing that can fix the axial movement in the direction must be selected.

### Floating side bearing:

The bearing which allows axial movement of shaft relative to housing is floating bearing. The floating side bearing has more freedom of movement to help compensate for misalignment and thermal expansion or contraction. Floating bearing arrangements are common with self-aligning ball bearings, deep groove ball bearings and spherical roller bearings.

**Table 3.2 Some Bearing arrangements and their applications**

Application	Fixed side	Free side	Remarks
Transmissions and Pumps			The arrangement can accommodate partial radial loads as well as axial loads.
Overhead crane wheels			The arrangement is suitable in cases where there is the possibility of errors due to mounting and deflection of shafts.
Machine tool spindles			The arrangement is suitable for cases where under the action of light load, high speed of rotation and high accuracy is desired.

Application	Fixed side	Free side	Remarks
Traction Motors			The arrangement is suitable for applications involving the requirement to withstand heavy loads and shock loads. Moreover, this arrangement can take the axial load. Additionally, it helps when interference is desired for both bearings.
Diesel Locomotive Transmission			The arrangement is used in applications with high speed and high radial load in the presence of axial load.
Blowers and medium sized electric motors			The arrangement is recommended for high-speed operating conditions but is not suitable in the case of shaft deflections.
Worm gear reducers			The arrangement is suitable for high axial load acting in both directions.
Screw Compressor Aircraft Engine Vertical Agitator			High axial, radial load and high speed, NU type CRB is for radial load and four-point contact ball axially clamped takes the axial thrust load in both direction
Pumps and Booster Fans			Over Hung Impeller with Reverse Thrust

## Bearing selection by NEI Advisory service:

Our Engineers will be pleased to recommend the most suitable bearing and best method of mounting for any specified conditions. If you wish to use this service you should send all relevant information on the following basis.

- Provide a drawing or sketch showing layout of the parts involved and position in which the bearings are to be fitted, giving size of shaft and any dimensions limiting the space available.
- Include a brief description of the mechanism if this is not clear from the drawing.
- Give provide the data for the speed, load on each bearing, operating temperature.
- Indicate any unusual features such as the possibility of shock or vibration, unbalanced load, high temperature, or the presence of dirt, moisture or fumes.
- Give the bearing life requirements and indicate whether the duty is continuous for 24 hours a day or only intermittent. If intermittent, give periods of running and stand by.
- If the working conditions vary considerably, give the normal duty and also the peak conditions with the frequency and duration of peaks. Say whether oil or grease lubrication is to be used. Say whether the bearings can be lined up accurately or bearing with alignment features are required.

### Please consult NEI

- If bearings are required in corrosion-resisting or in other special materials.
- If two bearings are mounted close together, special pairing of the two bearings may be necessary to ensure that they share the load.
- If the speed and temperature conditions are not provided for the information contained in this catalogue.

# 04 Load Rating and Life