Mounted Bearing Units – General Information and Load Calculations

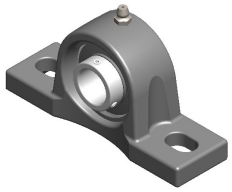
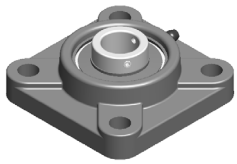
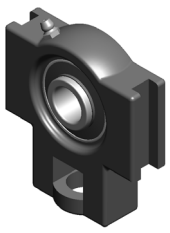
The information provided in this technical document will cover general information and nomenclature for the various products.

General Description

Mounted Bearing Units are designed to allow for the static mis-alignment of the bearing inside the housing because of the spherical shape of the outer diameter of the bearing insert and the concave shape of the inner diameter of the housing. This design allows the bearing unit to adjust for initial shaft mis-alignment which helps reduce abnormal bearing load. The allowable aligning angle of standard ball bearing units is 3º, while units with covers is 1º. Note, the Mounted Bearing Unit is not designed to swivel dynamically.

Nomenclature

The chart below shows the basic series of products listed in the AST online catalog. Most of the Mounted Bearing Units are available in a variety of housing materials, and with many bearing options. Once the basic product type and size are selected you may wish to contact the AST sales department for other options.

General Description	Image
Two bolt, pillow block, mounted bearing units, cast iron housing, inch or metric dimensioned shaft sizes. UCP series	
Four bolt, flange mount, mounted bearing units, cast iron housing, inch or metric dimensioned shaft sizes. UCF series	
Two bolt, flange mount, mounted bearing units, cast iron housing, inch or metric dimensioned shaft sizes. UCFL series	
Take-up mounted bearing units, cast iron housing, inch or metric dimensioned shaft sizes. UCT series	

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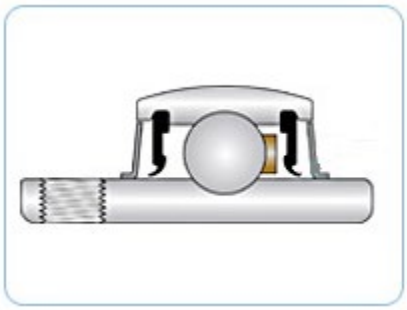
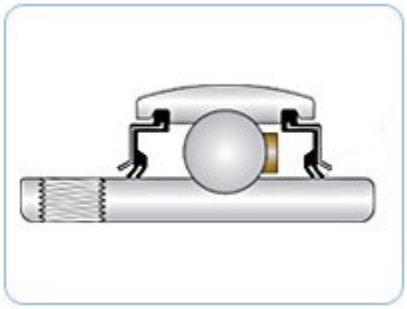
Bearing sealing

Mounted bearing units are available with several different seal designs, the common ones are shown below.

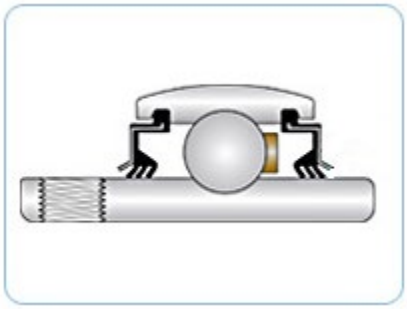
Single lip contact seal (also available as a non-contact design for high speed applications)



Double lip contact seal



Triple lip contact seal



Rating life of bearings

When ball bearing units are installed and operated on a piece of machinery eventually a failure will occur. The period of operation until the unit cannot be used due to failure is called the bearing life. Bearing failure is caused by two main reasons. The first is fatigue of bearing material, and the second is lubricant degradation. The life is figured on whichever fails first. Proper bearing lubrication will eliminate grease degradation and allow full bearing life to be achieved. If the bearing units are run without replenishment of the grease the bearing life will have to be factored by either the grease life or the bearing life. During installation, care must be taken not to damage the bearing. Proper bearing maintenance and lubrication will ensure long bearing life.

Basic rating life and basic load rating

Basic rating life

When a bearing is rotated under load the raceways and the rolling elements are continuously exposed to load. Damage, such as scaling (flaking or peeling), eventually appears on the material, and the total rotating frequency until the damage appears is called the “fatigue limit of the bearing”. Fatigue limit of the bearing can vary greatly even if the bearings have the same structure, dimensions, materials, machining methods, and are operated under the same conditions. To account for this variation, a group of the same bearings operating under the same conditions are tested, and the total rotating frequency of 90% of the bearings operating with no damage due to rotating fatigue (90% reliability) is called the basic load rating.

Basic load rating

Dynamic ratings are determined by placing a pure radial load on a radial bearing or by placing a central axial load on a thrust bearing. The dynamic rating is the load that the bearing will withstand for one million cycles before failure of the bearing. These ratings are referred to as the **basic dynamic radial load rating** (*C*r) or the **basic dynamic axial load rating** (*C*a) These values are indicated in the catalog as the basic dynamic radial load rating (*C*r), and the value is shown in the dimensional table.

Calculation of rating life

The relationship between the basic rating life, the basic dynamic load rating, and the dynamic equivalent load of the ball bearing is indicated in **Formula (4.1)**. If the ball bearing unit is being used at a fixed rotating speed, the life is indicated as time. This is shown in **Formula (4.2)**.

(Total rotating frequency) $$L_{10} = \left(\frac{C_r}{P_r}\right)^3 \quad \cdots\cdots\cdots\cdots (4.1)$$

(Time) $$L_{10h} = \frac{10^6}{60n}\left(\frac{C_r}{P_r}\right)^3 \quad \cdots\cdots (4.2)$$

Whereas,

L_{10}: Basic rating life, 10^6 rotations

L_{10h}: Basic rating life, hr

C_r: Basic dynamic load rating, N

P_r: Dynamic equivalent load, N
(see **“5 Bearing load”**)

n: Rotating speed, min^{-1}

Calculation of the basic rating life using the life factor (*f* h) and the speed factor (*f* n) in **Formula (4.2)** are shown below.

$$L_{10h} = 500\, f_h^{\,3} \quad \text{(4.3)}$$

$$\text{Life factor} \quad f_h = f_n \cdot \frac{C_r}{P_r} \quad \text{(4.4)}$$

$$\text{Speed factor} \quad f_n = \left(\frac{10^6}{500 \times 60n}\right)^{1/3}$$

$$= (0.03n)^{-1/3} \quad \text{(4.5)}$$

Values of f_n, f_h and L_{10h} can be found using the nomogram of **Fig. 4.1**.

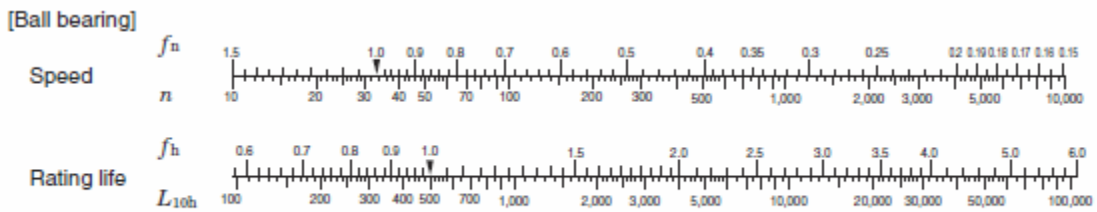


Fig. 4.1 Relation between basic rating life (L_{10h}) and rotating speed (n), speed factor (f_n), and life factor (f_h)