1 PV Limit Value

The selection of the materials indicated in this catalog depends on the use conditions: load, circumferential speed, components of atmosphere, and temperature. Among these conditions, load (N) and circumferential speed V (m/s) substantially decide durable years of a bearing. The product of the two values is used as a PV value for determining whether to use the material or not. The method of calculating the PV value is as follows.

$$\text{Bearing Pressure P (MPa)} = \frac{\text{Bearing Load (N)}}{\text{Bearing Length (m)} \times \text{Shaft Diameter (m)} \times 10^6}$$

$$\text{Circumferential Speed V (m/s)} = \frac{\pi \times \text{Shaft Diameter(m)} \times \text{Number of Revolutions (rpm)}}{60}$$

The above values are all applicable to cases where normal durable years are required for continuous or semi-continuous operation. If a short operating time is allowed, a larger PV value can be adopted. General PV limit values vary depending on a mating metal and use conditions. However, rough indications are as follows.

Use Environment Conditions	Maximum PV Value (MPa·m/s)	Coefficient of Friction
If Used in Atmosphere	**0.49**	**0.1~0.3**
If Used in Liquid	**4.9**	**0.01~0.03**

However, if the product is used in liquid, coefficient of friction, wear, and PV limit value will vary depending on the lubrication conditions of the sliding surface. If a thin liquid film is sufficiently formed on the sliding surface, the material is used in a range above 4.9 MPa·m/s in some cases. Therefore, if the material is used at a high PV value, it is necessary to also consider the shape effect in order to facilitate the formation of a thin lubricant film.

2 Allowable Pressure of Bearing

In cases where the bearing pressure is lower than 1.47 Mega Pascal (MPa), all types of our products will generally demonstrate satisfactory results. Our products can bear the pressure only in intermittent use if the pressure is between 1.47 and 2.94 MPa, and 2.94 MPa is the limit pressure.

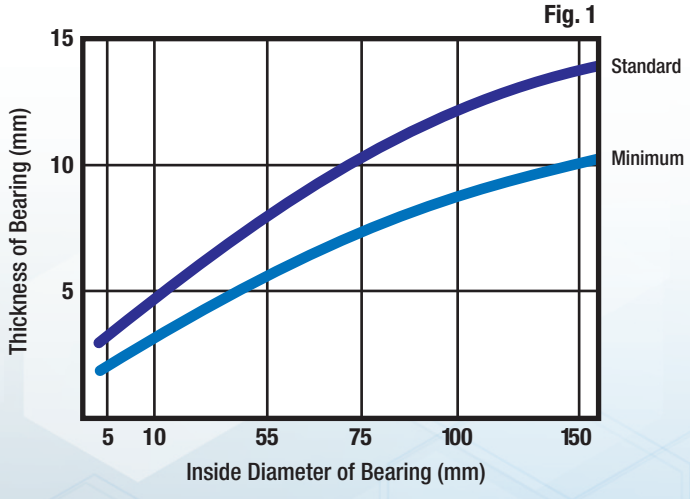
3 Polish of the Mating Material

With any of the materials, the finer polish of a mating material becomes, the smaller wear becomes. Therefore, the polish should preferably be Ra 0.4 or less. The degree of the polish substantially affects the durable years.

4 Thickness of Bearing

From the viewpoint of strength, the thickness of a carbon bearing must be larger than that of a metal bearing. The graph on the right shows the reference values.

Fig. 1



5 Oil Groove in the Bearing

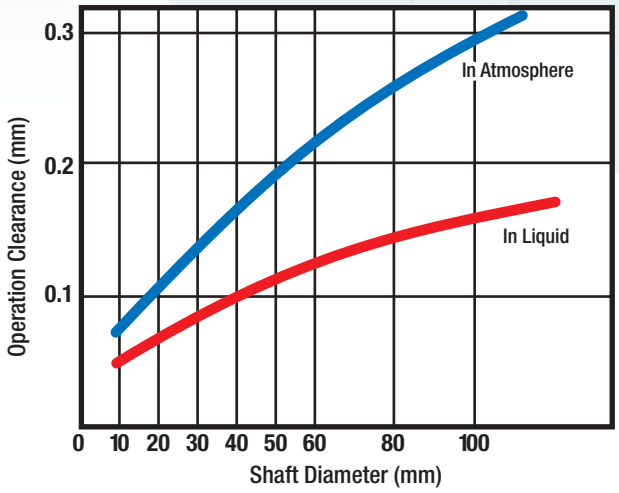
For sliding bearings, the sliding surface may pick up dusts, sludge and such depending on the use environment which will increase abrasion. To avoid this, it is common to make straight or spiral groove to the inner surface of the inner ring of the bearing to prevent picking up dusts and such, and to make it easier to cool the sliding surface, and to reduce abrasion.

6 Clearance Between Bearing and Shaft

The clearance between a bearing and a shaft needs to be as wide as indicated in Fig. 2, to take into consideration that degree of thermal expansion of a shaft material varies depending on a service temperature. However, it may vary according to the viscosity of the fluid and the accuracy required for the equipment to be used. However, a thermal expansion difference calculated at the service temperature, added with the necessary clearance, is regarded as the required clearance in principle. In addition, if the PV value is high, it is also necessary to consider sliding heat generation.

■Standard Clearance

Fig. 2



7 Method of Attaching Bearing

The following are methods of attaching a bearing to a housing.

1. Shrink fit	2. Press fit	3. Bonding

In the case of shrink fit or press fit, an inside diameter shrinks to the extent almost equivalent to a tightening margin. If an operation clearance is small, polish of inside diameter is required after the shrink fit.

Allowance for Thickness, Width, Length, Inside and Outside Diameter

(mm)

Classification of Nominal Dimensions	Allowance
Greater than or equal to 0.5 and less than or equal to 6	±0.1
Greater than 6 and less than or equal to 30	±0.2
Larger than 30 and not larger than 120	±0.3
Larger than 120 and not larger than 400	±0.5
Larger than 400 and not larger than 1000	±0.8

8 Machining Dimension Tolerance

If a drawing does not contain machining tolerance, the general machining tolerance under JIS B 0405 (medium class) is applied.

9 Measures Against Wear of Bearing

Inclusion of solid matter on a sliding surface increases powder abrasion of a bearing. Therefore, please prevent sludge from reaching the sliding surface as much as possible. In addition, sliding bearing is vulnerable to scratch abrasion. Therefore, please chamfer the mating surface to make it smooth. In addition, if electrolyte liquid is used, electric corrosion may occur. In such case, we recommend you to use metal-impregnated product.