4. BEARING LIFE OF FBJ PILLOW BLOCK UNITS

Any bearing, even operating under normal conditions, the surfaces of the raceway and rolling elements are constantly being subjected to repeated compressive stresses which cause flaking of these surfaces to occur. This flaking is due to material fatigue and will eventually cause the bearings to fail.

When bearing is stationary, still the rolling elements are subjected to static loads. This leads to a plastic total deformation of rolling element and raceway of about 0.0001 of the rolling element diameter at the most heavily loaded contact area.

The life of bearing is regarded as expired when the revolution fatigue is produced on the rolling face of bearing. In reference with this life, the Load rating is defined where the load is applied under certain conditions.

The life of each bearing is defined as the total number of revolution until the first flaking mark due to fatigue appears. When the number of rotation is constant, it is shown by the total time until the first flaking mark appears. Even if same type of bearings of excellent materials with same design and finished by the same heat treatment and manufacturing processes are driven under the same conditions, the lives of bearings scatter to some extent due to uncontrollable differences in them. Therefore, it is not adequate to use the mean life as the standard life of bearings.

The rated Life is defined here as the total number of rotations or time of driving after which 90% of the bearings of a group under test remains without fatigue.

The basic load rating is the pure radial load of constant direction and magnitude which gives the rated life of 10^6rotations when the outer ring is fixed and the inner ring is rotated. There exists the following relationship between the basic load rating and the life.

$$Ln = \left(\frac{C}{P}\right)^K$$

Where, **Ln :** rated life in total number of rotations which unit is $\mathbf{10^6}$ rotations.
(When **Ln = 3**, it means **3** million rotations.)
C : basic load rating [**kgf**]
K : coefficient(3 for ball bearing and $\frac{10}{3}$ for roller bearing)
P : load (equivalent radial load) [**kgf**]

When the bearings are installed to an apparatus rotating at a constant number of rotation, the lives are mostly estimated by driving hours, and the following equation which is modified by the above equation is used.

$$Lh = \frac{10^6}{60}\frac{Ln}{n} = \frac{10^6}{60n}\left(\frac{C}{P}\right)^K = \frac{50000}{3n}\left(\frac{C}{P}\right)^K$$

where **Lh :** rated life time in total rotating time, [**hour**]
n : speed of rotation, [**r.p.m.**]

The above equation can be modified to give an equation which is convenient to actual designing

$$Lh = 500fh^K$$

$$fh = fn \cdot \frac{C}{P}$$

$$fn = \left(\frac{33.3}{n}\right)^{\frac{1}{K}}$$

where, **fh :** life factor
fn : speed factor

Please refer to the nomogram at the right hand, which shows the values of **n:fn** and **Lh:fh** for the ball bearing.