

9. Limiting Speed

As bearing speed increases, the temperature of the bearing also increases due to friction heat generated in the bearing interior. If the temperature continues to rise and exceeds certain limits, the efficiency of the lubricant drastically decreases, and the bearing can no longer continue to operate in a stable manner. Therefore, the maximum speed at which it is possible for the bearing to continuously operate without the generation of excessive heat beyond specified limits, is called the limiting speed (r/min).

The limiting speed of a bearing depends on the type of bearing, bearing dimensions, type of cage, load, lubricating conditions, and cooling conditions.

The limiting speeds listed in the bearing tables for grease and oil lubrication are for standard NTN bearings under normal operating conditions, correctly installed, using the suitable lubricants with adequate supply and proper maintenance. Moreover, these values are based on normal load conditions ($P \leq 0.09C$, $F_a/F_r \leq 0.3$). For ball bearings with contact seals (LLU type), the limiting speed is determined by the peripheral lip speed of the seal.

For bearings to be used under heavier than normal load conditions, the limiting speed values listed in the bearing tables must be multiplied by an adjustment factor. The adjustment factors f_L and f_c are given in Figs. 9.1 and 9.2.

Also when radial bearings are mounted on vertical shafts, lubricant retentions and cage guidance are not favorable compare to horizontal shaft mounting. Therefore, the limiting speed should be reduced to approximately 80% of the listed speed.

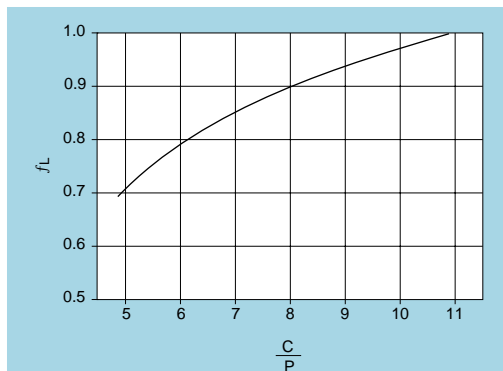


Fig. 9.1 Value of adjustment factor f_L depends on bearing load

For speeds other than those mentioned above, and for which data is incomplete, please consult NTN.

It is possible to operate precision bearings with high speed specification cages at speeds higher than those listed in the bearing tables, if special precautions are taken. These precautions should include the use of forced oil circulation methods such as oil jet or oil mist lubrication.

Under such high speed operating conditions, when special care is taken, the standard limiting speeds given in the bearing tables can be adjusted upward. The maximum speed adjustment values, f_B , by which the bearing table speed can be multiplied, are shown in Table 9.1. However, for any application requiring speeds greater than the standard limiting speed, please consult NTN.

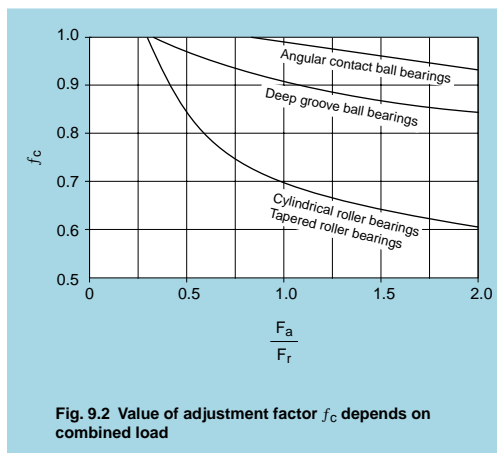


Fig. 9.2 Value of adjustment factor f_c depends on combined load

Table 9.1 Adjustment factor, f_B , for Limiting Speeds

Type of bearing	Adjustment factor f_B
Deep groove ball bearings	3.0
Angular contact ball bearings	2.0
Cylindrical roller bearings	2.5
Tapered roller bearings	2.0