White Paper

Speed of Bearings

- **Limiting Speed of Bearings**

The rotation of the rolling bearings is limited to certain limits. During operating condition the increase in speed of the bearing also led to the increase of temperature because of the friction. The maximum speed at which bearing can be operated continuously without failure and excessive heat generation, such speed can be determined by the formula called as limiting speed of the bearings. The factors which affect the limiting speed of the bearings are, bearing type and size, cage form and material, applied load, lubrication method, and heat dissipation method including design of the bearing's surroundings.

The limiting speeds can be given as $C/P \geq 12.5$ and $Fa/Fr \leq 0.25$ for the bearings of standard design and subjected to normal loads.

Different lubricants are used for different operating speed. Lubricants used for the high speed have different characteristics. When the limiting speeds increases to more than 70 % of the bearing limiting speed special type of oil or lubricants should be used, else contact NIBL.

- **Correction of Limiting Speed of Bearings**

The limiting speed must be corrected to obtain the corrected limiting speed when, the load on the bearing P exceeds 8 % of the basic load rating of bearing C, or when the axial load on bearing Fa exceeds 25 % of the radial load of bearing Fr, by using below mention equation –

$$n_a = f1 \cdot f2 \cdot n$$

n_a = Corrected limited speed (rpm)

f1 = Correction coefficient determined from Fig. 4.1

f2 = Correction coefficient determined from Fig. 4.2

n = Limiting speed under normal load condition

F_a = Axial load (N)

F_r = Radial load (N)

P = Dynamic equivalent load (N)

C = Basic dynamic load (N)

While selecting the bearing in the case where the operating speed is more than the limiting speed the factors like desired bearing, then the accuracy grade of the bearing, internal clearance class of the bearing, cage used in the bearing and bearing material, type of lubrication, etc., must be carefully studied .In such a case, forced circulation oil lubrication, jet lubrication, oil mist lubrication, or oil-air lubrication must be used.

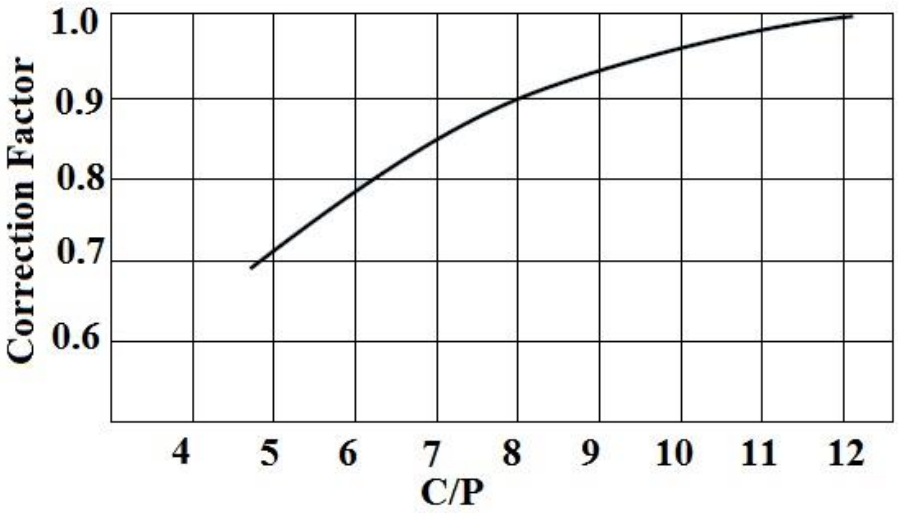

Fig. 4.1 Limiting speed correction factor variation with load ratio

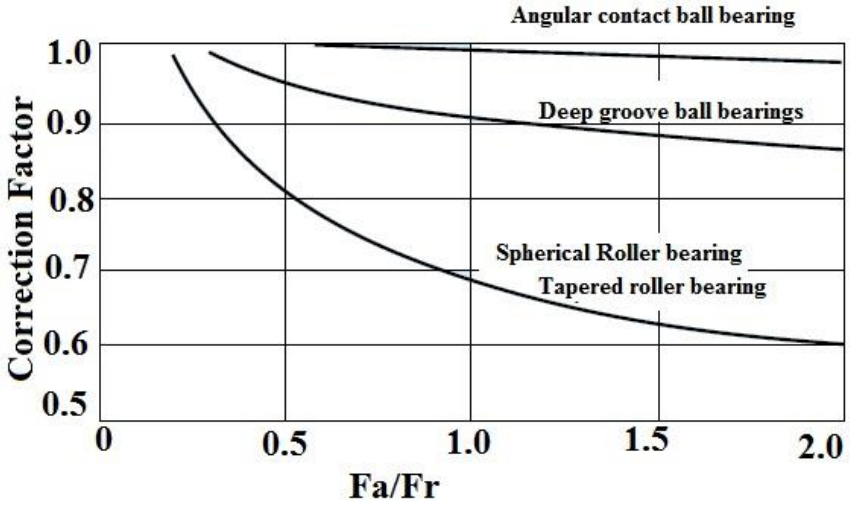

Fig.4.2 Limiting speed correction factor for combined radial and axial bearings

- **Limiting Speed for Rubber Contact Seals for Ball Bearings**

The maximum permissible speed for contact rubber sealed bearings (2RS type) is determined mainly by the sliding surface speed of the inner circumference of the seal. These allowable rubbing speeds vary depending upon seal rubber material.

Bearing Types	Correction Factor
Cylindrical Roller Bearings (single row)	2
Needle Roller Bearings(except broad width)	2
Tapered Roller Bearings	2
Spherical Roller Bearings	1.5
Deep Groove Ball Bearings	2.5
Angular Contact Ball Bearings(except matched bearings)	1.5

Table.4.1 Limiting Speed Correction Factor for High-Speed Application