3. Load ratings

Dynamic load rating C

The dynamic load rating C is a load of constant magnitude under which 90% of a statistically significant number of apparently identical bearings would reach a theoretical life of 50 km without the apparent appearance of metal fatigue.

Static load rating Co

The static load rating Co is defined as the load that would cause a permanent deformation equal to1/10,000 of the ball diameter at the most stressed contact point.

3.1 Life of a Linear Ball Bearing

Repeated stresses onto the contact surfaces could lead to material fatigue. This will lead to the appearance of surface pitting. The life of the unit is defined as the duration before the appearance of pitting.

3.1.1 Rated life (L)

The rated life L is the total travelled distance which 90% of a statistically significant number of apparently identical bearings would reach under the same operating conditions without the apparent appearance of metal fatigue.

$$L = \left(\frac{C}{P}\right)^3 \cdot 50 \quad \text{.....(1)}$$

L = rated life [km]
C = dynamic load ratings [N]
P = equivalent dynamic load [N]

When a system is subjected to a load equal to the dynamic load rating C the resulting life equal the rated life (50 km). The theoretical life of a linear bearing is affected by the load and by the operating conditions (temperature, vibration, shocks, load distribution, etc.). In such cases the theoretical life is calculated with the help of equation 2.

$$L = \left(\frac{f_H \cdot F_T \cdot f_C \cdot C}{F_w \cdot P}\right)^3 50 \quad \text{.....(2)}$$

L = Rated life[km]
C = Dynamic load rating [N]
P = Equivalent dynamic load [N]
f_h = Hardness factor (see fig. 8)
f_t = Temperature factor (see fig. 9)
f_c = Contact coefficient (see table 4)
f_w = Load factor (see table 5)

The following equation (3) allows the conversion of the rated life in hours. .....(3)

$$L_h = \left(\frac{L \cdot 10}{2 \cdot l_s \cdot 1 \cdot 60}\right)^3$$

L_h = rated life [hours]
L_s = stroke length [m]
L = rated life [km]
n_1 = operating frequency [strokes/min]

• Hardness factor (f_H)

The load ratings for the linear bearing are calculated with the raceway hardness equal or higher than 58 HRC. When the raceway hardness is reduced, the load rating of the bearing is also reduced and must be corrected using the accompanying chart (Fig.7).

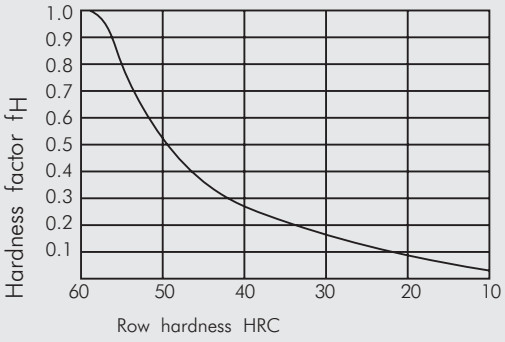

Fig. 7 Raceway hardness factor

• Temperature factor (f_T)

When a linear bearing operates at temperatures in excess of 100 deg. C, its hardness is affected and son is its ability to carry load. The load rating can be corrected by using the accompanying chart (Fig.8).

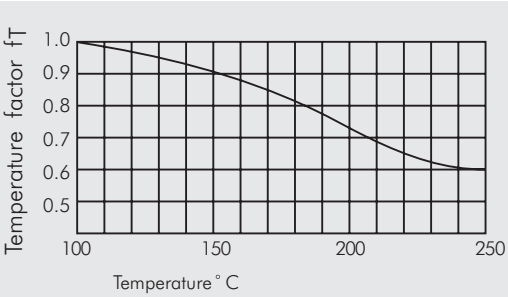

Fig. 8 Temperature factor

• Contact factor (f_c)

Load biasing, attributed to mounting errors and multiple bearing assemblies can be accounted for by using the coefficient in table 3.1 .

Table 3.1 Contact factor

Number of bearings for shaft	Contact factor fc
1	1,00
2	0,81
3	0,72
4	0,66
5	0,61

• Load factor (f_w)

The loads acting on the linear units include payload, inertial effects during acceleration and deceleration as well as moment loads. All of these factors are difficult to assess and are further complicated by the potential presence of shocks and vibrations. A more practical solution involves the use of the coefficients in table 3.2.

Table 3.2 Contact factor

Operating conditions	f_w
Low speed operations (<15 m/min) without shocks	1 - 1,5
Medium speed operation (60m/min) without shocks	1,5 - 2
High speed operations (>60m/min) with shocks	2 - 3,5