**5. ROLLING CONTACT BEARING**

|  |  |
| --- | --- |
| SLIDING CONTACT BEARING | ROLLING CONTACT BEARING |
| Friction is more | Friction is less |
| Static Friction > Running friction | Static Friction ≈ Running friction (Antifriction bearing) |

Elements of Rolling Contact Bearing:

1) Rotating member 2) Support 3) Inner Race 4) Outer Race 5) Rolling Element 6) Cage

**TYPES OF ROLLING CONTACT BEARING:**

|  |  |
| --- | --- |
| **As Per Rotating Element** | |
| **Sphere** | **Cylinder** |
| Balls as Rotating Element | Cylinder as Rotating Element |
| Point Contact => Stress ↑ => Life ↓ | Line Contact => Stress ↓ => Life ↑ |
| 1. Deep Groove Ball Bearing: Radial load and Slight thrust | 1. Cylindrical Roller Bearing: Radial space requires more and roller size is more. |
| 2. Angular Contact Ball Bearing: Both Radial and One directional Thrust Load | 2. Needle Roller Bearing: More Load can take and roller size is less. |
| 3. Thrust Ball Bearing: No Radial Bur Thrust Load in Both Direction | 3. Spherical Roller Bearing: Radial and small Thrust. Used for small miss alignment. |
| 4. Self-Aligning Ball Bearing: Oscillate about axis | 4. Tapered Roller Bearing: Radial and thrust Load |
|  | 5. Thrust Roller Bearing: Only Thrust load. |

**DESIGNATION OF ROLLING CONTACT BEARING:**

|  |  |
| --- | --- |
| **W-X-Y-Z**  **Y-Z = Shaft Diameter**  Y-Z \*5 = Diameter  00 = 10mm  01 = 12mm  02 = 15mm  03 = 17mm | d = Bore Diameter  D = Outside Diameter  B = Bearing Width  H = Bearing Height  r = Chamfer Radius  ∝ = Contact Angle |
| **W = Bearing Type**  0 = Double raw angular contact ball bearing  1 = Self aligning ball bearing  **2 = Spherical Roller Bearing**  **3 = Tapered Roller Bearing**  4 = Double Raw Deep Groove Ball Bearing  5 = Thrust Ball Bearing  6 = Single Raw Deep Groove Ball Bearing  7 = Single Raw Angular Contact Ball Bearing  **8 = Cylindrical Roller Thrust Bearing** | **X = Dimension Series = Load Caring Capacity**  1 = Extra light Series  2 = Light Series  3 = Moderate Series  4 = Heavy Series  5 = Extra Heavy Series |

**Static load Caring Capacity (Co):** It’s minimum static load that bearing can be withstand to avoid maximum deformation of 0.0001d.

**Co** = Kd2~~Z~~/5 (For ball bearing) Where, K = Constant that accounts for curvature at point of contact and stiffness of bearing element, Z = No of rolling elements, d = diameter of shaft

**Co** = lKd2~~Z~~/5 (Roller Bering) Where, l = length of line of contact in roller bearing

**Bearing Life (Life of one bearing):** No. of revolution/hours (at constant speed) to fatigue failure.

**Reliability:** % No. of bearing is in service.

**Rating Life** (Life of group of bearing): It’s minimum possible life of the group of bearings for 90% reliability.

**Median Life** (Average life) (L50): % No. of bearings in service = 50%

L50 > L10

**Min. Criteria of life** (For group of bearing)**:** 106 Revolution = 1 Million revolution

**Dynamic Load Capacity (C):** It’s maximum load that can be applied over a bearing for a minimum rating life of 106 Revolution. It also called as Dynamic load rating, Catalogue load. Used for selection of bearing.

**Equivalent Radial load:**

Fe = Fr for , And For ,

Where, Fe = Equivalent radial load

Fr = Radial load

Fa = Axial load

Cv = Service Factor (>1)

X = Radial load Factor

Y = Axial load factor

V = Race Rotation factor

= 1 (Inner race rotation)

= 1.2 (Outer race rotation)

**Load-Life Relationship:**

Where, L10 = Rating Life (in Million revolution)

C = Dynamic load rating/ Catalogue load/ Dynamic Load Capacity

K = 3 (For ball bearing)

= 10/3 (For roller bearing)

N = Speed of Rotation (RPM)

Life in hours

**Reliability-Life Relationship:**

Where, a = 6.84

b = 1.17

R = Reliability

L = Life of group of bearing

R = 90% => L = L10. Hence L50 = 5 L10

**Cumulative Damage: , Where,,**

**IMPORTANT POINT:**

1)

Where, = Life at R = 90%

Where F = Fe = = Load Acting on bearings

2)And Average L50 = 5 L10

3)

Where, K = 3 (For ball bearing)

= 10/3 (For roller bearing)