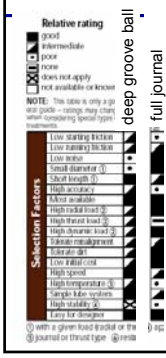
Rolling-Element Bearings

- Types
  - » Ball Bearings
  - » Roller Bearings
- Selection of rolling-element bearings

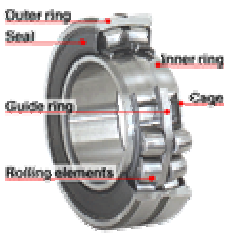
Comparing Rolling to Journal

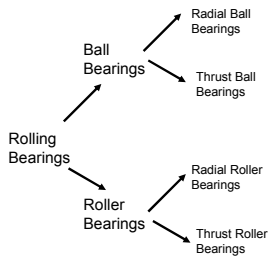


- Rolling Bearing are better because:
  - *low starting and good operating friction*
  - *radial and thrust loads*
  - *no self-excited instabilities*
  - *less space axially*
  - *can seal lubricant in bearing*
- Journal Bearings are better because:
  - *fatigue failure not a problem*
  - *less space radially*
  - *less noise*
  - *more tolerant to misalignment*
  - *less expensive, except for oiling system*
  - *less operating friction*

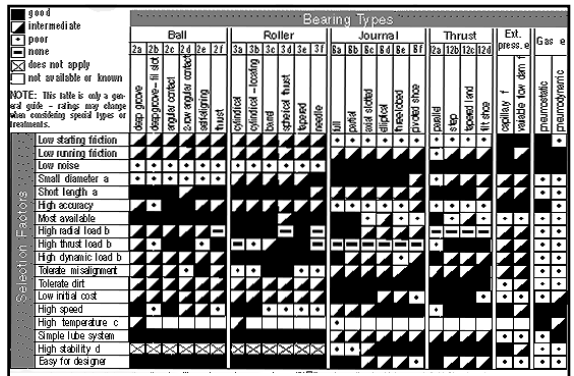
pg. 654 in Norton

Rolling-Element Bearings





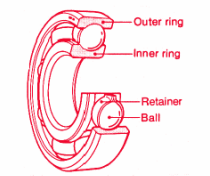
Which one to choose? → Next page

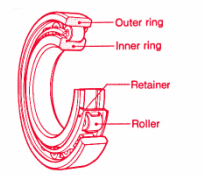


Reprinted From: "Design Data" Teague & Dunn, Machine Elements
See http://www.engineersedge.com/bearing_application.htm

Ball Bearings vs Roller Bearings

Ball Bearings versus Roller Bearings	
Ball	**Roller**
High speed	Higher radial load support
Axial thrust	Usually seperable





A) Ball Bearings

- good for smaller sizes, lighter loads

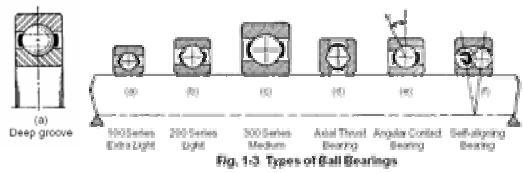


Fig. 1-3 Types of Ball Bearings

B) Roller Bearings

- good for larger sizes, heavier loads
- handle shock and impact loading well

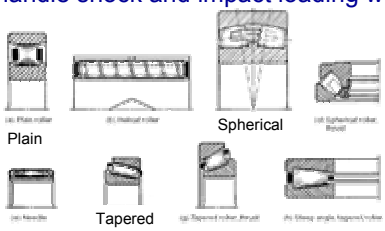
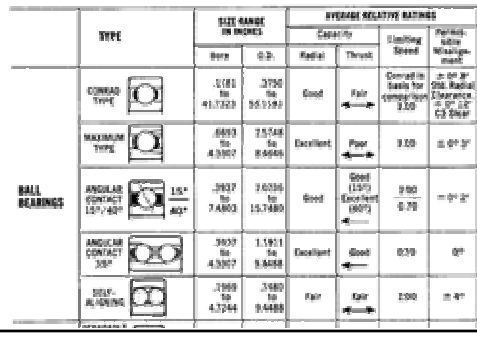


Fig. 1-2 Radial and Thrust Roller Bearings

Figure 10-21, Pg. 658 in Norton

Rolling Element Comparisons



Selection of Rolling Element Bearings

Once a bearing type suited to the application is chosen, selection of appropriate-size bearing depends on the magnitude of loads and the desired fatigue life.

Basic Dynamic Load Rating (C):

Ball Bearings $\Rightarrow$ $L = \left(\frac{C}{P}\right)^3$

Roller Bearings $\Rightarrow$ $L = \left(\frac{C}{P}\right)^{10/3}$

L = Expected bearing life (expressed in millions of revolutions)
C = Dynamic load rating (Capacity)
P = Constant applied load

see Figure 10-23 for Ball Bearings, pp. 662

Basic Static Load Rating (C_o):

see Figure 10-23, pp. 662 for Ball Bearings

Selection of Rolling Element Bearings

Combined Radial and Thrust Loads:

$$P = XVF_r + YF_a$$

If $\frac{F_a}{VF_r} \le e$ $\Rightarrow$ X = 1 and Y = 0

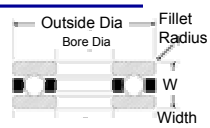
X=Radial factor (see Figure 10-24)
Y=Thrust factor (see Figure 10-24)
V=Rotation factor (see Figure 10-24)
F_r=Radial load
F_a=Axial Load
e = minimum ratio between axial and radial loads (see Figure 10-24)

Rolling Element Analysis

- Calculate P
- Specify the number of cycles
- Calculate C
- Choose a bearing from the manufacturer's catalog based on C, C_0

Bearing Selection

Ex: Figure 10-23
Dimensions and Load Ratings for 6300 Series Ball Bearings (FAG Bearings Corp.)



BEARING NUMBER*	BORE mm	BORE inch	O. DIAM. mm	O. DIAM. inch	WIDTH mm	WIDTH inch	H	S	t	MAX. FILLET RADIUS r inch	APPROX. WEIGHT lb.	n_g LIMITING SPEED rpm	C DYNAMIC LOAD RATING lb.	C_o STATIC LOAD RATING lb.
6300	10	.3937	35	1.3780	11	.4331	.125	1.562	.044	.025	.13	22000	1400	850
6301	12	.4724	37	1.4567	12	.4724	.125	1.625	.044	.040	.15	20000	1700	1040
6302	15	.5906	42	1.6535	13	.5118	.125	1.821	.044	.040	.20	18000	1930	1200
6303	17	.6693	47	1.8504	14	.5512	.141	2.074	.044	.040	.25	16000	2320	1460
6304	20	.7874	52	2.0472	15	.5906	.141	2.276	.044	.040	.34	14000	3000	1930
6305	25	.9843	62	2.4409	17	.6693	.195	2.665	.067	.040	.58	11000	3800	2550