BEARING

Types of bearing:- انواع الكراسي

1-Rolling contact bearing .

2- sliding bearing.

Rolling bearing :-

1-Ball bearing .

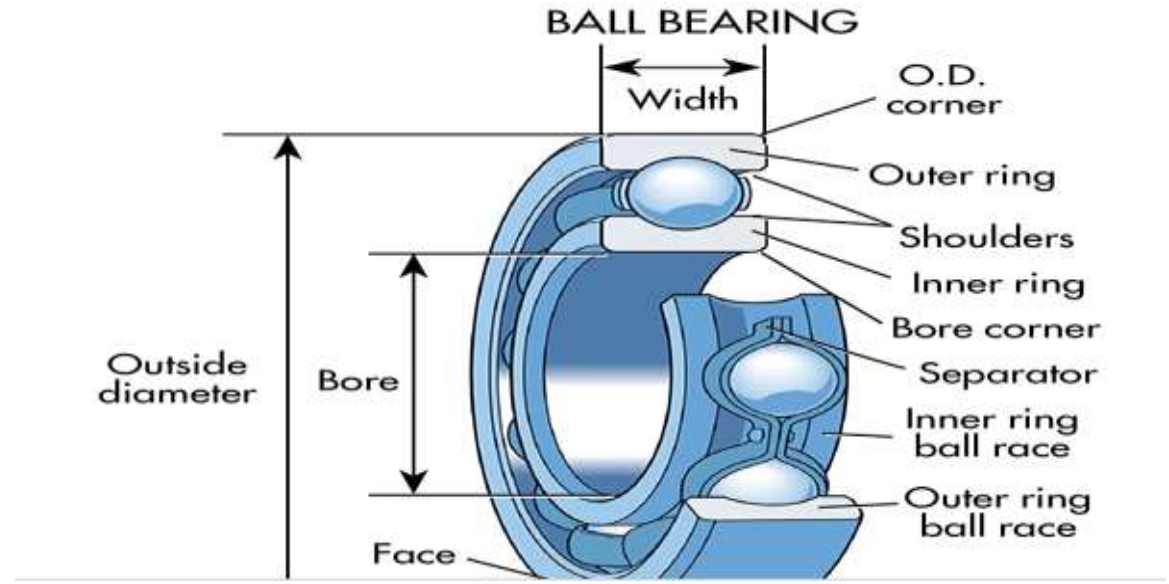
2-Roller bearing.

Loading :- الاحمال

1-Radial loading.

2-Thrust load.

Types of ball bearing



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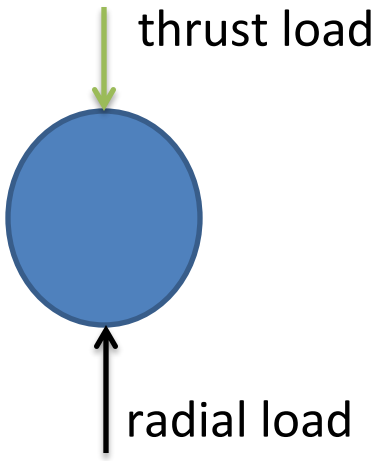
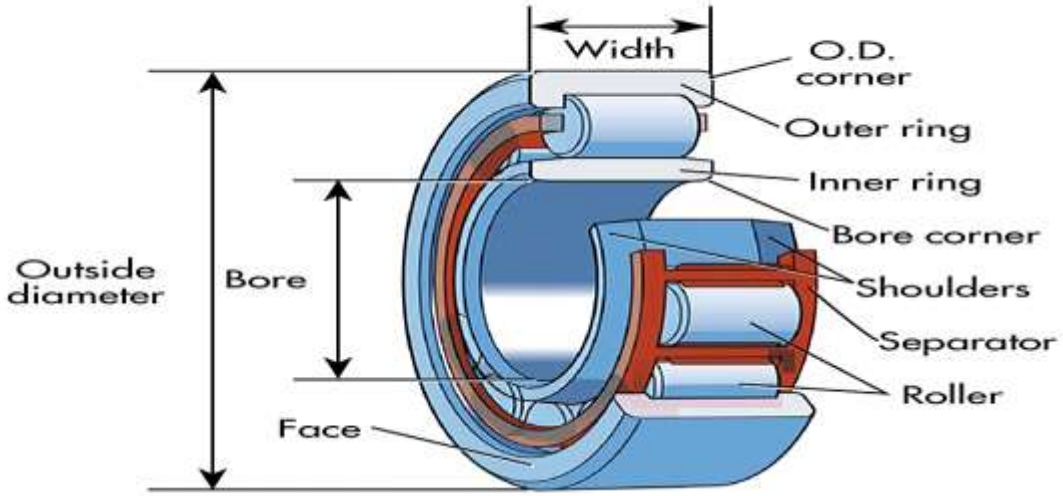
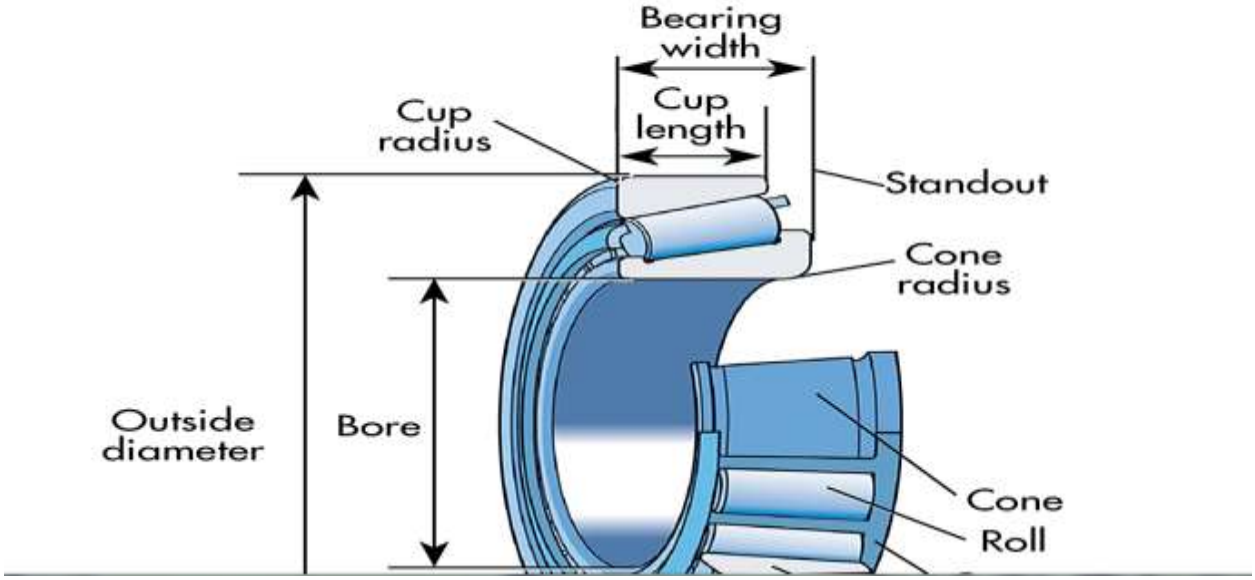


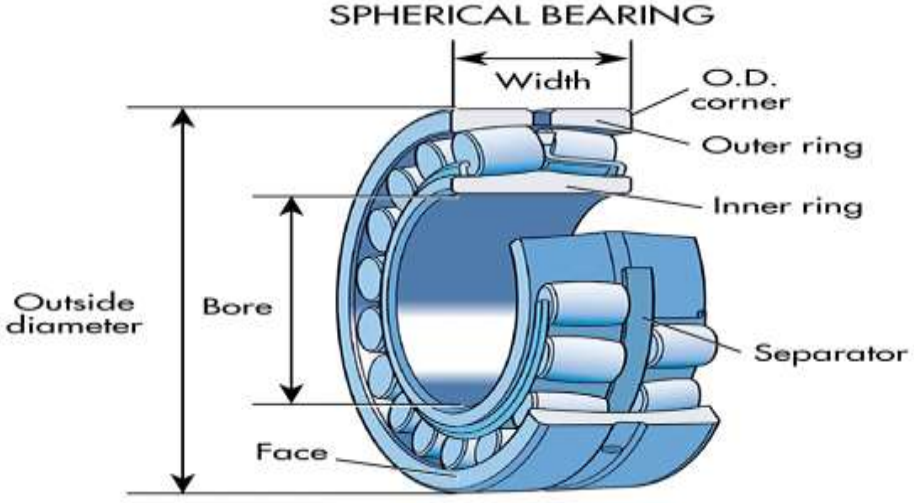
STRAIGHT ROLLER BEARING

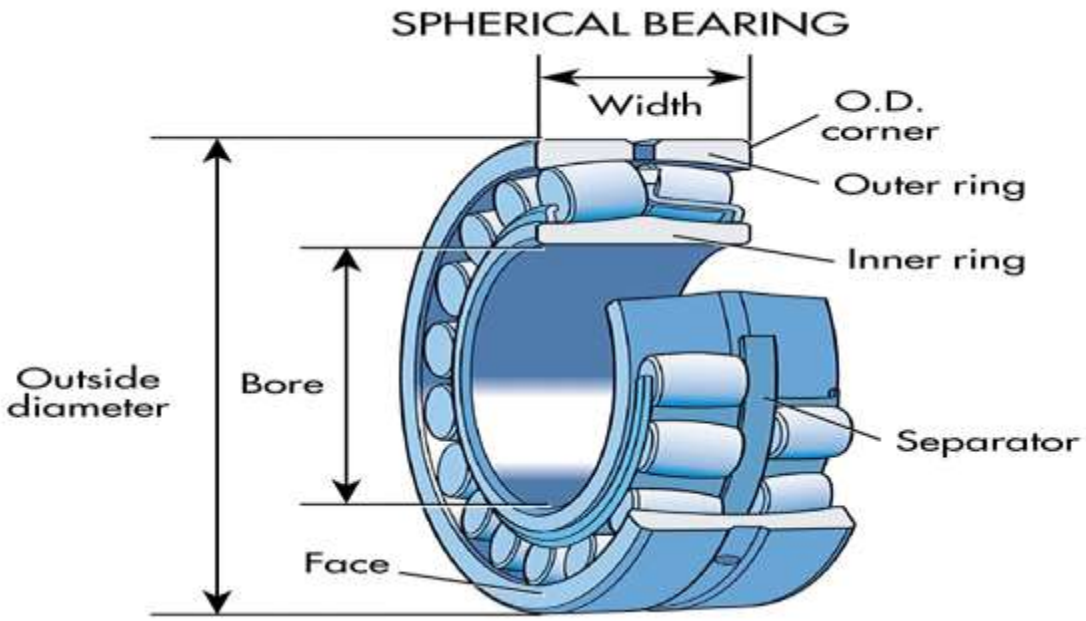


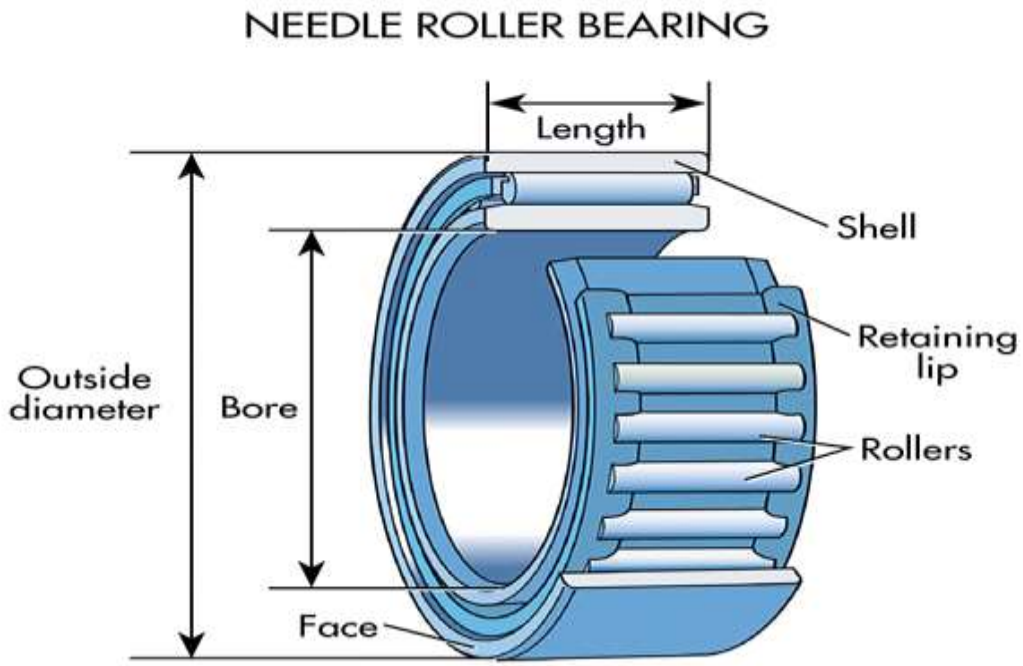
TAPERED ROLLER BEARING



SPHERICAL BEARING







Selection of radial ball bearing :-

- The data necessary of selection bearing as follow-
- Radial load –Thrust load—speed of shaft—life of bearing—condition of loading.
- $L = \left(\frac{fd}{fe}\right)^3 \times 10^6$----------(1)

L=life of bearing (r.p.m).

Fd=radial load(N .KN).

Fe=(radial +thrust load (N.KN).

=0.56 + Cr Cf +Ct fa----------(2)

Where – fa=axial load (N)

Fr=radial load (N).

Cr=bearing revolution –(table).

Ct=thrust factor –from (table).

Ex1 :-

Select single row –radial ball bearing for radial load (2.5 (Kn).axial load (2kn) and on operation speed (1750 rpm) For life equal *8 years).assume a steady load with no shock. and used (cr=1 , ct- 1.7).

N0 of bearing	Outer diam	Inner diam	fd	fs
322	55	45	66.5	50.5
320	54	50	61.6	55.5
312	56	50	62,5	48.8

Sol;-

Fr=2.5 kN----- =2500N

Fa= 2Kn--------- =2000N

N= 1750 rpm

L=8 X365 X 60 X1750 =1840 $X10^6$ rpm

Fe= 0.56 cr fr + ct fa

= 0.56 x 1 x 2500 + 1.7 x 2000 =4800N .

$$L = \left(\frac{fd}{fe}\right)^3 \times 10^6$$

$$1840 \times 10^6 = \left(\frac{fd}{fe}\right)^3 \times 10^6$$

Fd=5880.7N =58.8KN

From the table

Fs= statically load =58.8 KN

No of bearing from table(312)

Fd=62.85kn

Fs=48.49kn

Ex2 :-Find the radial load (fd)for bearing rev(750 rpm)for Thrust load(3.5 KN) and the life of bearing (10^3)hr.

Sol:- $L=10^3 \times 60 \times 750 = 45 \times 10^3$ hr

Fe= 3.5 KN = 3500 N

$$L = \left(\frac{fd}{fe}\right)^3 \times 10^6$$

$$45 \times 103 = \left(\frac{fd}{3500}\right) \times 106$$

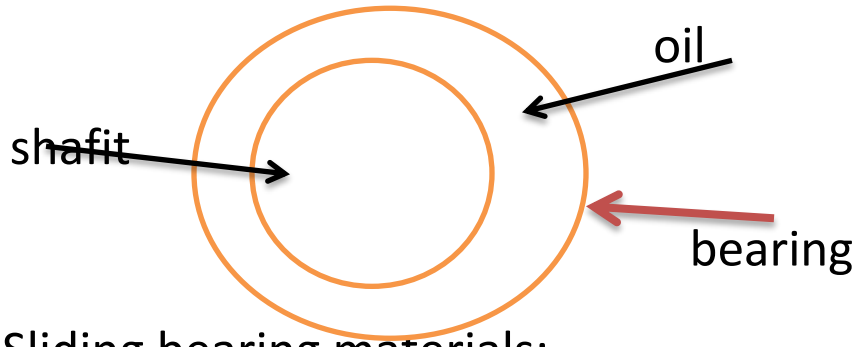
fd=57.75 KN.

Sliding bearing :-

Types:- 1-thick film bearing.

2-thin film bearing.

3-zero film bearing.



Sliding bearing materials:-

1-Babbitt materials (p 70----------140 kg/cm^2).

2-Tin bass Babbitt (البابايت القصديري)

3-lead bass Babbitt (البابايت الرصاصي)

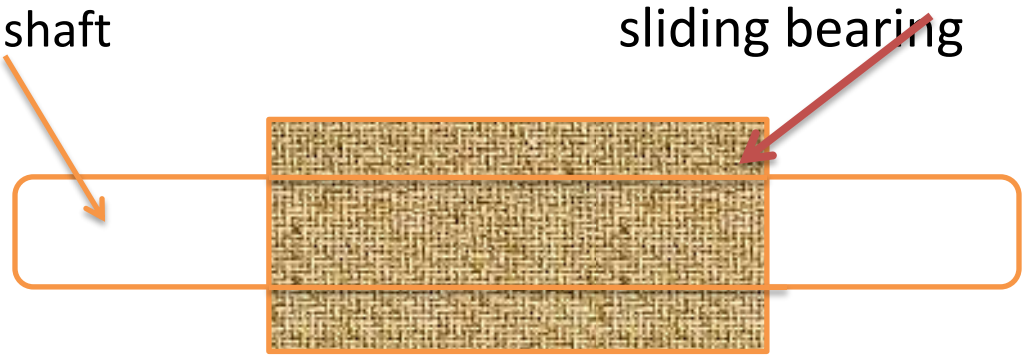
٤-Bronze materials (معدن بروز الدفع)

5- cast irons. Steel shaft. (حديد مطاوع)

6- silver (air graft engine) (معدن الفضة)

Lubricant ---------(low friction between the bearing &shaft
Reduction the heat generated).
(Liquid , semi liquid , solid)

Project area:-



The dimension of sliding bearing.

$$P = \frac{F}{lXd} \rightarrow L \times d = \frac{F}{d} \text{----------(1)}$$

L=Length of bearing (mm,cm).
d= shaft diameter (mm,cm).
p=bearing pressure (N /m^2).
F=radial load (N).

Heat generation bearing :-

Qg= f x F X V ----------(2).
F= coefficient of fraction.
F = load supported by bearing.
= p x L X d ---------- -- (3).
P=bearing pressure N/m^2
V=sliding velocity = $\frac{Nd}{60}$
N= R.P.M for shaft
F= 20 x $\frac{Z\,N}{P}$ X$\frac{d}{cd}$ +k
Z= viscosity lubricant

N= R.P.M

P=bearing pressure N/m^2

d=diameter of shaft (mm) (cm)

cd=clearance between the bush diameter & shaft diameter.

K=factor for correct for end leakage.

Ex2:-sliding bearing is used for a steam turbine .the data are -(radial load 11.5KN),shaft diamter7.5cm ,N=1440 rpm ,bearing pressure 1.2MN/m^2, liquid temp 65C^0) used d/cd 0.0001).Determine- the length of bearing &heat generation (used Q=8x10^6).

SOL:-

F=11.5 KN----------11.5 X10^3N

d=7.5 cm----------0.075 m

N=1440 rpm

P= 1.2MN/m^2--------1.2 x$10^6$$N/m^2$

$$P= \frac{F}{lXd}$$

$$1.2 \times 10^6 = \frac{11.5 \ x10^3}{L \ X0.075}$$

1.2 x10^6 x L X 0.075 =11.5 X10

L=0.127m

F= P X l x d

= 0.127 x 1.2 x10^6 x0.075= 114300kg

$$F=20 \ x\frac{Z\,N}{P} \ X\frac{d}{cd} + k$$

$$=20 \ x \ \frac{8\,x \ \ x10^6\ x\ 1440}{1.2\ x\ \ x10^6} \ X0.0001 + 1 \quad = 20.2 \text{ watt.}$$
