9 Design of shaft and housing.

9.1 Roughness and accuracy of shaft and housing.

When in service, if the accuracy of shaft and housing is too low, bearing will not work .For example:
Low or not good enough accuracy of shoulders will cause misalignment of inner rings and outer rings. In this situation ,centralized load will be added to the bearings, and resulting in fatigue life reduction and even cages broken or raceway burn.

The housing demands sufficient rigidity, high rigidity is good for load distribution.

Generally speaking, turning or fine boring can make shaft and housing accurate enough. But high requirement of running accuracy and noise need ground finish for final process.

When arrange two bearings in one-piece housings, the fitting surface should adopt ‘go’ structure.

In general conditions, shaft housing accuracy class and roughness refer to Table 9.1.

Table 9.1 Precision accuracy of shaft and housing

Items	Accuracy class of bearing	Class shaft	Housing bore
Roundness tolerance	class 0 , class 6	IT3—IT4	IT4—IT5
	class 5, class 4	IT2—IT3	IT2—IT3
Clindricity tolerance	class 0 , class 6	IT3—IT4	IT4—IT5
	class 5, class 4	IT2—IT3	IT2—IT3
End face run-out of Shoulders	class 0 , class 6	IT3	IT3—IT4
	class 5, class 4	IT3	IT3
Roughness degree of matching surface (Ra)	Small size bearing	0.8	1.6
	Large bearing	1.6	3.2

Remarks:
IT figures of standard tolerance refer to attached list of reference sample.

9.2 Mounting dimensions.

Shoulder height of shaft or housing should be larger than maximal allowable dimension of bearing chamfer, and contact with flat part of bearing end face. Fillet radius should be smaller than minimal allowable dimension of bearing chamfer in order not to affect mounting. Usually, we describe it in table 9.2.Shoulder height of bearing taking big axial load should be a bit larger than figures in the following table.

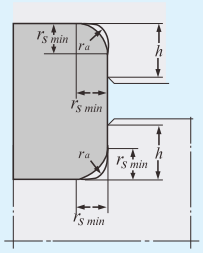

Table 9.2 Shoulder height and fillet radius Unit:mm

Chamfer dimension r_{smin}	Shoulder height h (Min)	Fillet radius R (Max)
0.1	0.4	0.1
0.15	0.6	0.15
0.2	0.8	0.2
0.3	1.25	0.3
0.6	2.5	0.6
1	3	1
1.1	3.5	1
1.5	4.25	1.5
2	5	2
2.1	6	2
2.5	6	2
3	7	2.5
4	9	3
5	11	4
6	14	5
7.5	18	6
9.5	22	8
12	27	10
15	32	12
19	38	15

In order to decrease stress concentration and to increase strength of shaft , when maximum fillet radius should be larger than dimension of bearing chamfer (fig. 9.1 a), or shoulder is too low to get sufficient contact area, a spacer is used between bearing and shaft shoulder. (fig9.1b)

The cutting allowance of ground finish for shaft and housing see Table 9.3

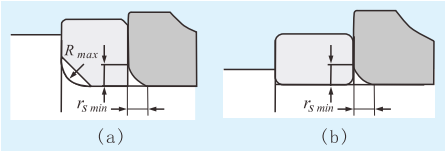

Fig. 9.1 Bearing mounting with spacers

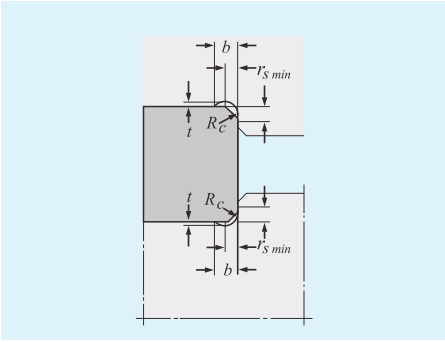

Table 9.3 Grinding cutter relieving dimension Unit:mm

Chamfer dimension r_{smin}	Cutter relieving dimension		
	b	t	R_c
1	2	0.2	1.3
1.1	2.4	0.3	1.5
1.5	3.2	0.4	2
2	4	0.5	2.5
2.1	4	0.5	2.5
3	4.7	0.5	3
4	5.9	0.5	4
5	7.4	0.6	5
6	8.6	0.6	6
7.5	10	0.6	7

9.3 Sealing device

Sealing device of bearing is made to prevent dirt such as dust, moisture, metal powder etc from entering. At the same time, it can prevent internal lubrication of bearing from leaking. So, no matter what running conditions, sealing device must keep its sealing, dust proof functions constantly. It must make bearing easy to dismount, mount and maintain, with no abnormal friction and burn.

Sealing device can be classified into contact type and non-contact type according to its structure.

9.3.1 Non-contact sealing

Non-contact sealing is a kind of sealing with small internal clearance. So, it is zero friction, small temperature rise and no abrasion. Non-contact sealing is suitable for high-speed rotating.

The simplest form of non-contact sealing is to decrease radial internal clearance and form sealing. This kind of sealing is suitable for use in grease lubrication, dry condition with little dust.

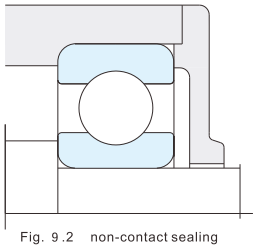

Fig. 9.2 non-contact sealing

To make several concentric circle oil grooves in diameter of bearing housing is a way to improve sealing. Please refer to fig. 9.3.In grease lubrication, these grooves can keep grease, so it can keep dirt out.