4.3 Fit selection

Selection of a proper fit is dependent upon thorough analysis of bearing operating conditions, including consideration of:

- Shaft and housing material, wall thickness, finished surface accuracy, etc.
- Machinery operating conditions (nature and magnitude of load, rotational speed, temperature, etc.)

4.3.1 "Tight fit," "transition fit," or "loose fit"

For raceways under rotating loads, a tight fit is necessary. (Refer to Table 4.1) "Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction. For raceways under static loads, on the other hand, a loose fit is sufficient.
(Example) Rotating inner ring load the direction of the radial load on the inner ring is rotating relatively.

For non-separable bearings, such as Deep Groove Ball Bearings, it is generally recommended that either the inner ring or outer ring be given a loose fit.

Table 4.1 Radial load and bearing

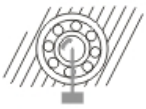
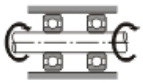
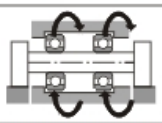
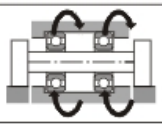
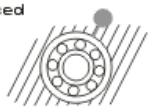
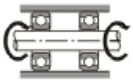
Illustration	Bearing rotation		Ring load	Fit
Static load 		Inner ring: Rotating Outer ring: Stationary	Rotating inner ring load	Inner ring: Tight fit
Unbalanced load 		Inner ring: Stationary Outer ring: Rotating	Static outer ring load	Outer ring: Loose fit
Static load 		Inner ring: Stationary Outer ring: Rotating	Static inner ring load	Inner ring: Loose fit
Unbalanced load 		Inner ring: Rotating Outer ring: Stationary	Rotating outer ring load	Outer ring: Tight fit

Table 3.7 Outer rings

Nominal Outside diameter D mm over	incl.	Outer ring radial runout K_{ea} class 0	class 6	class 5 max.	class 4	class 2	Outside surface inclination S_D class 5	class 4 max.	class 2	Outside ring axial runout S_{ea} ❻ class 5	class 4 max.	class 2	Outer ring width deviation $\triangle_{Cs}$ all type	Outer ring width variation V_{Cs} class 0,6	class 5	class 4 max.	class 2
6	18	1.5	8	5	3	1.5	8	4	1.5	8	5	1.5	Identical to $\triangle_{Bs}$ of inner ring of same bearing	Identical to V_{Bs} and V_{ls} of inner ring of same bearing	5	2.5	1.5
18	30	1.5	9	6	4	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
30	50	2.0	10	7	5	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
50	80	2.5	13	8	5	4.0	8	4	1.5	10	5	4.0			6	3.0	1.5
80	120	3.5	18	10	6	5.0	9	5	2.5	11	6	5.0			8	4.0	2.5
120	150	4.0	20	11	7	5.0	10	5	2.5	13	7	5.0			8	5.0	2.5
150	180	4.5	23	13	8	5.0	10	5	2.5	14	8	5.0			8	5.0	2.5
180	250	5.0	25	15	10	7.0	11	7	4.0	15	10	7.0			10	7.0	4.0

Note: ❺ The dimensional difference $\triangle_{Ds}$ of outer diameter to be applied for classes 4 and 2 is the same as the tolerance of dimensional difference $\triangle_{Dmp}$ of average outer diameter. However, the dimensional difference is applied to diameter series 0,1,2,3 and 4 against Class 4, and also to all the diameter series against Cfass 2.
❻ To be applied in case snap rings are not installed on the bearings.
❼ To be applied for Deep Groove Ball Bearings and Angular Contact Ball Bearings.

4. Bearing fits

4.1 Interference

For rolling bearings, inner and outer rings are fixed on the shaft or in the housing so that relative movement does not occur between fitted surfaces during operation or under load. This relative movement (referred to as "creep") between the fitted surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. To help prevent this creeping movement, bearing rings and the shaft or housing are installed with one of three interference fits, a "tight fit" (also called shrink fit), "transition fit," or "loose fit" (also called clearance fit), and the degree of interference between their fitted surfaces varies.

The most effective way to fix the fitted surfaces between a bearing's raceway and shaft or housing is to apply a "tight fit." The advantage of this tight fit for thin walled bearings is that it provides uniform load support over the entire ring circumference without any loss of load carrying capacity. However, with a tight fit, ease of installation and disassembly is lost. And when using a non-separable bearing as the floating-side bearing, axial displacement is not possible. For this reason, a tight fit cannot be recommended in all cases.

4.2 The necessity of a proper fit

In some cases, improper fit may lead to damage and shorten bearing life, therefore it is necessary to make a careful analysis in selecting a proper fit. Some of the negative conditions caused by improper fit are listed below.

- Raceway cracking, early peeling and displacement of raceway
- Raceway and shaft or housing abrasion caused by creeping and fretting corrosion
- Seizing caused by loss of internal clearances
- Increased noise and lowered rotational accuracy due to raceway groove deformation