

## 7 Bearing Fits

### 7.1 Fitting

For rolling bearings, inner and outer rings are fixed on the shaft or in the housing so that relative movement does not occur between fitting surfaces during operation or under load. This relative movement between the fitting surfaces of the bearing and the shaft or housing can occur in a radial direction, an axial direction, or in the direction of rotation. Types of fitting include tight, transition and loose fitting, which may be selected depending on whether or not there is interference.

The most effective way to fix the fitting 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.

### 7.2 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 investigation in selecting a proper fit. Some of the bearing failure caused by improper fit are listed below.

- Raceway cracking, early flaking and displacement of raceway
- Raceway and shaft or housing abrasion caused by creeping and fretting corrosion
- Seizing caused by negative internal clearances

- Increased noise and deteriorated rotational accuracy due to raceway groove deformation

Please refer to insert pages A-96 ~ A-99 for information concerning diagnosis of these conditions.

### 7.3 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.)

#### 7.3.1 "Tight fit" or "Loose fit"

- (1) For raceways under rotating loads, a tight fit is necessary. (Refer to **Table 7.1** "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
- (2) 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 7.1 Radial load and bearing fit**

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

### 7.3.2 Recommended Fits

Bearing fit is governed by the selection tolerances for bearing shaft diameters and housing bore diameters.

Widely used fits for 0 Class tolerance bearings and various shaft and housing bore diameter tolerances are shown in **Table 7.1**.

Generally-used, standard fits for most types of bearings and operating conditions are shown in **Tables 7.2 - 7.7**.

**Table 7.2:** Fits for radial bearings

**Table 7.3:** Fits for thrust bearings

**Table 7.4:** Fits for electric motor bearings

**Table 7.6:** Fits for inch series tapered roller bearings (ANSI Class 4)

**Table 7.7:** Fits for inch series tapered roller bearings (ANSI Class 3 and 0)

**Table 7.5.** shows fits and their numerical values.

For special fits or applications, please consult NTN Engineering.

### 7.3.3 Interference minimum and maximum values

The following points should be considered when it is necessary to calculate the interference for an application:

- In calculating the minimum required amount of interference keep in mind that:
  - 1) interference is reduced by radial loads
  - 2) interference is reduced by differences between bearing temperature and ambient temperature
  - 3) interference is reduced by variation of fitting surfaces
- The upper limit value should not exceed 1/1000 of the shaft diameter.

Required interference calculations are shown below.

#### (1) Radial loads and required interference

Interference of the inner ring and shaft decreases when a radial load is applied to the bearing. The interference required to secure effective interference is expressed by formulae (7.1) and (7.2).

$$\begin{aligned} F_r &> 0.3 C_{or} \\ \Delta_{dF} &= 0.08 (d \cdot F_r / B)^{1/2} \quad \left. \begin{array}{l} \text{N} \\ \{ \text{kgf} \} \end{array} \right\} \dots\dots\dots(7.1) \\ &= 0.25 (d \cdot F_r / B)^{1/2} \end{aligned}$$

$$\begin{aligned} F_r &> 0.3 C_{or} \\ \Delta_{dF} &= 0.02 (F_r / B) \quad \left. \begin{array}{l} \text{N} \\ \{ \text{kgf} \} \end{array} \right\} \dots\dots\dots(7.2) \\ &= 0.2 (F_r / B) \end{aligned}$$

Where,

- $\Delta_{dF}$  : Required effective interference according to radial load  $\mu\text{m}$
- $d$  : Bearing bore diameter mm
- $B$  : Inner ring width mm
- $F_r$  : Radial load N { kgf }
- $C_{or}$  : Basic static load rating N { kgf }

#### (2) Temperature difference and required interference

Interference between inner rings and steel shafts is reduced as a result of temperature increases (difference between bearing temperature and ambient temperature,  $\Delta T$ ) caused by bearing rotation. Calculation of the minimum required amount of interference in such cases is

shown in formula (7.3).

$$\Delta_{dF} = 0.0015 \cdot d \cdot \Delta T \dots\dots\dots(7.3)$$

- $\Delta_{dF}$  : Required effective interference for temperature difference  $\mu\text{m}$
- $\Delta T$  : Difference between bearing temperature and ambient temperature  $^{\circ}\text{C}$
- $d$  : Bearing bore diameter mm

#### (3) Fitting surface variation and required interference

Interference decreases because the fitting surface is smoothed by fitting (surface roughness is reduced). The amount the interference decreases depends on roughness of the fitting surface. It is generally necessary to anticipate the following decrease in interference.

- For ground shafts: 1.0 ~ 2.5  $\mu\text{m}$
- For lathed shafts: 5.0 ~ 7.0  $\mu\text{m}$

#### (4) Maximum interference

When bearing rings are installed with an interference fit, tension or compression stress may occur along their raceways. If interference is too great, this may cause damage to the rings and reduce bearing life. You should try to obtain the previously described upper limit.

### 7.3.4 Other details

- (1) Tight interference fits are recommended for,
  - Operating conditions with large vibration or shock loads
  - Applications using hollow shafts or housings with thin walls
  - Applications using housings made of light alloys or plastic
- (2) Small interference fits are preferable for,
  - Applications requiring high running accuracy
  - Applications using small sized bearings or thin walled bearings
- (3) Consideration must also be given to the fact that fit selection will effect internal bearing clearance selection. (refer to page insert A-58)

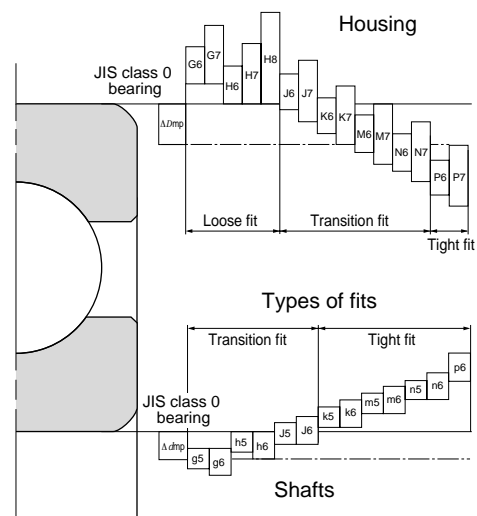


Fig 7.1 State of fitting

(4) A particular type of fit is recommended for SL type cylindrical roller bearings.(See page C-44.)

**Table 7.2 General standards for radial bearing fits (JIS Class 0, 6X, 6)**

**Table 7.2 (1) Tolerance class of shafts commonly used for radial bearings (classes 0, 6X and 6)**

Conditions	Ball bearings		Cylindrical roller bearing Tapered roller bearing		Spherical roller bearing		Shaft tolerance class	Remarks	
	Shaft diameter (mm)								
	Over	Under	Over	Under	Over	Under			
Cylindrical bore bearing (Classes 0, 6X and 6)									
Inner ring rotational load or load of undetermined direction	Light load <sup>①</sup> or fluctuating load	18 100	18 100 200	40 140	40 140 200			h5 js6 k6 m6	When greater accuracy is required js5, k5, and m5 may be substituted for js6, k6, and m6.
	Ordinary load <sup>①</sup>	18 100 140 200	18 100 140 200 280	40 100 140 200	40 100 140 200 400	40 65 100 140 280	40 65 100 140 280 500	js5 k5 m5 m6 n6 p6 r6	Alteration of inner clearances to accommodate fit is not a consideration with single-row angular contact bearings and tapered roller bearings. Therefore, k5 and m5 may be substituted for k6 and m6.
	Heavy load <sup>①</sup> or impact load			50 140 200	140 200	50 100 140	100 140 200	n6 p6 r6	Use bearings with larger internal clearances than CN clearance bearings.
Inner ring static load	Inner ring must move easily over shaft	Overall shaft diameter						g6	When greater accuracy is required use g5. For large bearings, f6 will suffice for to facilitate movement.
	Inner does not have to move easily over shaft	Overall shaft diameter						h6	When greater accuracy is required use h5.
Center axial load	Overall shaft diameter						js6	Generally, shaft and inner rings are not fixed using interference.	
Tapered bore bearing (class 0) (with adapter or withdrawal sleeve)									
Overall load	Overall shaft diameter						h9/IT5 <sup>②</sup>	h10/IT7 <sup>②</sup> will suffice for power transmitting shafts.	

**Table 7.2 (2) Fit with shaft (fits for tapered bore bearings (Class 0) with adapter assembly/withdrawal sleeve)**

All loads	All bearing types	All shaft diameters	Tolerance class	h9 / IT5 <sup>②</sup>	General applications
				h10/ IT7 <sup>②</sup>	Transmission shafts, etc.

① Standards for light loads, normal loads, and heavy loads

- Light loads: equivalent radial load  $0.06 C_r$
- Normal loads:  $0.06 C_r < \text{equivalent radial load} < 0.12 C_r$
- Heavy loads:  $0.12 C_r < \text{equivalent radial load}$

② IT5 and IT7 show shaft roundness tolerances, cylindricity tolerances, and related values.

Note: All values and fits listed in the above tables are for solid steel shafts.

Table 7.2 (3) Tolerance class of housing bore commonly used for radial bearings (classes 0, 6X and 6)

Housing	Conditions			Toleration class of housing bore	Remarks
	Types of load	Outer ring axial <sup>②</sup> direction movement			
Single housing or divided housing	Outer ring static load	All types of loads	Able to move.	H7	G7 will suffice for large bearings or bearings with large temperature differential between the outer ring and housing.
		Light load <sup>①</sup> or ordinary load <sup>①</sup>	Able to move.	H8	—
		Shaft and inner ring become hot.	Able to move easily.	G7	F7 will suffice for large bearings or bearings with large temperature differential between the outer ring and housing.
Single housing	Indeterminate load	Requires precision rotation with light or ordinary loads.	As a rule, cannot move.	K6	Primarily applies to roller bearings.
			Able to move.	JS6	Primarily applies to ball bearings.
		Requires quiet operation.	Able to move.	H6	—
	Indeterminate load	Light or ordinary load	Able to move.	JS7	If precision is required, JS6 and K6 are used in place of JS7 and K7.
		Ordinary load or heavy load <sup>①</sup>	As a rule, cannot move.	K7	
		Large impact load	Cannot move.	M7	
	Outer ring rotational load	Light or fluctuating load	Cannot move.	M7	—
		Ordinary or heavy load	Cannot move.	N7	Primarily applies to ball bearings.
		Heavy load or large impact load with thin housing	Cannot move.	P7	Primarily applies to roller bearings.

① Standards for light loads, normal loads, and heavy loads

- Light loads: equivalent radial load 0.06  $C_r$
- Normal loads: 0.06  $C_r$  < equivalent radial load 0.12  $C_r$
- Heavy loads: 0.12  $C_r$  < equivalent radial load

② Indicates whether or not outer ring axial displacement is possible with non-separable type bearings.

Note 1: All values and fits listed in the above tables are for cast iron or steel housings.

2: If only center axial load is applied to the bearing, select a tolerance class that provides clearance for the outer ring in the axial direction.

**Table 7.3 Standard fits for thrust bearings (JIS Class 0 and 6)**

**Table 7.3 (1) Shaft fits**

Bearing type	Load conditions	Fit	Shaft diameter mm over      incl.	Tolerance class
All thrust bearings	Centered axial load only	Transition fit	All sizes	js6 or h6
Spherical roller thrust bearings	Combined load Inner ring static load or Inner ring rotating load Indeterminate load	Transition fit	All sizes	js6
		Tight fit	— ~ 200 200 ~ 400 400 ~	k6 or js6 m6 or k6 n6 or m6

**Table 7.3 (2) Housing fits**

Bearing type	Load conditions	Fit	Tolerance class	Remarks
All thrust bearings	Centered axial load only	Loose fit	Select a tolerance class that will provide clearance between outer ring and housing.	
			H8	Greater accuracy required with thrust ball bearings
Spherical roller thrust bearings	Combined load Outer ring static load Indeterminate load or outer ring rotating load	Transition fit	H7	—
			K7	Normal operating conditions
			M7	For relatively large radial loads

Note: All values and fits listed in the above tables are for cast iron or steel housings.

**Table 7.4 Fits for electric motor bearings**

Bearing type	Shaft fits		Housing fits	
	Shaft diameter mm over      incl.	Tolerance class	Housing bore diameter	Tolerance class
Deep groove ball bearings	~ 18 18 ~ 100 100 ~ 160	j5 k5 m5	All sizes	H6 or J6
Cylindrical roller bearings	~ 40 40 ~ 160 160 ~ 200	k5 m5 n6	All sizes	H6 or J6

**Table 7.5 Numeric value table of fitting for radial bearing of 0 class**

**Table 7.5 (1) Fitting against shaft**

Nominal bore diameter of bearing  <i>d</i> mm over incl.	Mean bore diameter deviation <sup>①</sup>  $\Delta d_{mp}$ high low		g5		g6		h5		h6		j5		js5		j6	
			bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft
3 6	0	-8	4T ~ 9L	4T ~ 12L	8T ~ 5L	8T ~ 8L	11T ~ 2L	10.5T ~ 2.5L	14T ~ 2L							
6 10	0	-8	3T ~ 11L	3T ~ 14L	8T ~ 6L	8T ~ 9L	12T ~ 2L	11T ~ 3L	15T ~ 2L							
10 18	0	-8	2T ~ 14L	2T ~ 17L	8T ~ 8L	8T ~ 11L	13T ~ 3L	12T ~ 4L	16T ~ 3L							
18 30	0	-10	3T ~ 16L	3T ~ 20L	10T ~ 9L	10T ~ 13L	15T ~ 4L	14.5T ~ 4.5L	19T ~ 4L							
30 50	0	-12	3T ~ 20L	3T ~ 25L	12T ~ 11L	12T ~ 16L	18T ~ 5L	17.5T ~ 5.5L	23T ~ 5L							
50 80	0	-15	5T ~ 23L	5T ~ 29L	15T ~ 13L	15T ~ 19L	21T ~ 7L	21.5T ~ 6.5L	27T ~ 7L							
80 120	0	-20	8T ~ 27L	8T ~ 34L	20T ~ 15L	20T ~ 22L	26T ~ 9L	27.5T ~ 7.5L	33T ~ 9L							
120 140 140 160 160 180	0	-25	11T ~ 32L	11T ~ 39L	25T ~ 18L	25T ~ 25L	32T ~ 11L	34T ~ 9L	39T ~ 11L							
180 200 200 225 225 250	0	-30	15T ~ 35L	15T ~ 44L	30T ~ 20L	30T ~ 29L	37T ~ 13L	40T ~ 10L	46T ~ 13L							
250 280 280 315	0	-35	18T ~ 40L	18T ~ 49L	35T ~ 23L	35T ~ 32L	42T ~ 16L	46.5T ~ 11.5L	51T ~ 16L							
315 355 355 400	0	-40	22T ~ 43L	22T ~ 54L	40T ~ 25L	40T ~ 36L	47T ~ 18L	52.5T ~ 12.5L	58T ~ 18L							
400 450 450 500	0	-45	25T ~ 47L	25T ~ 60L	45T ~ 27L	45T ~ 40L	52T ~ 20L	58.5T ~ 13.5L	65T ~ 20L							

① Above table is not applicable to tapered roller bearings whose bore diameter *d* is 30mm or less.

**Table 7.5 (2) Fitting against housing**

Nominal outside diameter of bearing  <i>D</i> mm over incl.	Mean outside diameter deviation <sup>②</sup>  $\Delta D_{mp}$ high low		G7		H6		H7		J6		J7		Js7		K6	
			housing	bearing	housing	bearing	housing	bearing	housing	bearing	housing	bearing	housing	bearing	housing	bearing
6 10	0	-8	5L ~ 28L	0 ~ 17L	0 ~ 23L	4T ~ 13L	7T ~ 16L	7.5T ~ 15.5L	7T ~ 10L							
10 18	0	-8	6L ~ 32L	0 ~ 19L	0 ~ 26L	5T ~ 14L	8T ~ 18L	9T ~ 17L	9T ~ 10L							
18 30	0	-9	7L ~ 37L	0 ~ 22L	0 ~ 30L	5T ~ 17L	9T ~ 21L	10.5T ~ 19.5L	11T ~ 11L							
30 50	0	-11	9L ~ 45L	0 ~ 27L	0 ~ 36L	6T ~ 21L	11T ~ 25L	12.5T ~ 23.5L	13T ~ 14L							
50 80	0	-13	10L ~ 53L	0 ~ 32L	0 ~ 43L	6T ~ 26L	12T ~ 31L	15T ~ 28L	15T ~ 17L							
80 120	0	-15	12L ~ 62L	0 ~ 37L	0 ~ 50L	6T ~ 31L	13T ~ 37L	17.5T ~ 32.5L	18T ~ 19L							
120 150	0	-18	14L ~ 72L	0 ~ 43L	0 ~ 58L	7T ~ 36L	14T ~ 44L	20T ~ 38L	21T ~ 22L							
150 180	0	-25	14L ~ 79L	0 ~ 50L	0 ~ 65L	7T ~ 43L	14T ~ 51L	20T ~ 45L	21T ~ 29L							
180 250	0	-30	15L ~ 91L	0 ~ 59L	0 ~ 76L	7T ~ 52L	16T ~ 60L	23T ~ 53L	24T ~ 35L							
250 315	0	-35	17L ~ 104L	0 ~ 67L	0 ~ 87L	7T ~ 60L	16T ~ 71L	26T ~ 61L	27T ~ 40L							
315 400	0	-40	18L ~ 115L	0 ~ 76L	0 ~ 97L	7T ~ 69L	18T ~ 79L	28.5T ~ 68.5L	29T ~ 47L							
400 500	0	-45	20L ~ 128L	0 ~ 85L	0 ~ 108L	7T ~ 78L	20T ~ 88L	31.5T ~ 76.5L	32T ~ 53L							

② Above table is not applicable to tapered roller bearings whose outside diameter *D* is 150mm or less.

Note: Fitting symbol "L" indicates clearance and "T" indicates interference.

Unit  $\mu\text{m}$ 

js6		k5		k6		m5		m6		n6		p6		r6		Nominal bore diameter of bearing  $d$ mm over incl.
bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	bearing	shaft	
12T ~ 4L		14T ~ 1T		17T ~ 1T		17T ~ 4T		20T ~ 4T		24T ~ 8T		28T ~ 12T	-	-		3 6
12.5T ~ 4.5L		15T ~ 1T		18T ~ 1T		20T ~ 6T		23T ~ 6T		27T ~ 10T		32T ~ 15T	-	-		6 10
13.5T ~ 5.5L		17T ~ 1T		20T ~ 1T		23T ~ 7T		26T ~ 7T		31T ~ 12T		37T ~ 18T	-	-		10 18
16.5T ~ 6.5L		21T ~ 2T		25T ~ 2T		27T ~ 8T		31T ~ 8T		38T ~ 15T		45T ~ 22T	-	-		18 30
20T ~ 8L		25T ~ 2T		30T ~ 2T		32T ~ 9T		37T ~ 9T		45T ~ 17T		54T ~ 26T	-	-		30 50
24.5T ~ 9.5L		30T ~ 2T		36T ~ 2T		39T ~ 11T		45T ~ 11T		54T ~ 20T		66T ~ 32T	-	-		50 80
31T ~ 11L		38T ~ 3T		45T ~ 2T		48T ~ 13T		55T ~ 13T		65T ~ 23T		79T ~ 37T	-	-		80 120
37.5T ~ 12.5L		46T ~ 3T		53T ~ 3T		58T ~ 15T		65T ~ 15T		77T ~ 27T		93T ~ 43T	113T ~ 63T 115T ~ 65T 118T ~ 68T			120 140 140 160 160 180
44.5T ~ 14.5L		54T ~ 4T		63T ~ 4T		67T ~ 17T		76T ~ 17T		90T ~ 31T		109T ~ 50T	136T ~ 77T 139T ~ 80T 143T ~ 84T			180 200 200 225 225 250
51T ~ 16L		62T ~ 4T		71T ~ 4T		78T ~ 20T		87T ~ 20T		101T ~ 34T		123T ~ 56T	161T ~ 94T 165T ~ 98T			250 280 280 315
58T ~ 18L		69T ~ 4T		80T ~ 4T		86T ~ 21T		97T ~ 21T		113T ~ 37T		138T ~ 62T	184T ~ 108T 190T ~ 114T			315 355 355 400
65T ~ 20L		77T ~ 5T		90T ~ 4T		95T ~ 23T		108T ~ 23T		125T ~ 40T		153T ~ 68T	211T ~ 126T 217T ~ 132T			400 450 450 500

 Unit  $\mu\text{m}$ 

K7		M7		N7		P7		Nominal outside diameter of bearing  $D$ mm over incl.
housing	bearing	housing	bearing	housing	bearing	housing	bearing	
10T ~ 13L		15T ~ 8L		19T ~ 4L		24T ~ 1T		6 10
12T ~ 14L		18T ~ 8L		23T ~ 3L		29T ~ 3T		10 18
15T ~ 15L		21T ~ 9L		28T ~ 2L		35T ~ 5T		18 30
18T ~ 18L		25T ~ 11L		33T ~ 3L		42T ~ 6T		30 50
21T ~ 22L		30T ~ 13L		39T ~ 4L		51T ~ 8T		50 80
25T ~ 25L		35T ~ 15L		45T ~ 5L		59T ~ 9T		80 120
28T ~ 30L		40T ~ 18L		52T ~ 6L		68T ~ 10T		120 150
28T ~ 37L		40T ~ 25L		52T ~ 13L		68T ~ 3T		150 180
33T ~ 43L		46T ~ 30L		60T ~ 16L		79T ~ 3T		180 250
36T ~ 51L		52T ~ 35L		66T ~ 21L		88T ~ 1T		250 315
40T ~ 57L		57T ~ 40L		73T ~ 24L		98T ~ 1T		315 400
45T ~ 63L		63T ~ 45L		80T ~ 28L		108T ~ 0		400 500

**Table 7.6 General fitting standards for tapered roller bearings using US customary unit (ANSI class 4)**

**Table 7.6 (1) Fit with shaft**

Unit  $\mu\text{m}$

Operating conditions		Nominal bearing bore diameter $d$ mm		Bore diameter tolerance $\Delta d_s$		Shaft diameter tolerance		Fitting <sup>①</sup>		Remark
		over	incl.	high	low	high	low	max	min	
Inner ring rotational load	Ordinary load	~ 76.2		+13	0	+ 38	+ 25	38T	~ 12T	Applicable when slight impact load is applied as well.
		76.2 ~ 304.8		+25	0	+ 64	+ 38	64T	~ 13T	
		304.8 ~ 609.6		+51	0	+127	+ 76	127T	~ 25T	
		609.6 ~ 914.4		+76	0	+190	+114	190T	~ 38T	
Inner ring rotational load	Heavy load Impact load	~ 76.2		+13	0	+ 64	+ 38	38T	~ 12T	0.5 $\mu\text{m}$ mean interference per 1 mm of inner ring bore diameter. Minimum interference is 25 $\mu\text{m}$ . Tolerance for the shaft is adjusted to match tolerance of bearing bore diameter.
		76.2 ~ 304.8		+25	0					
		304.8 ~ 609.6		+51	0					
		609.6 ~ 914.4		+76	0					
Outer ring rotational load	Inner ring does not have to move easily over shaft with ordinary load.	~ 76.2		+13	0	+ 13	0	13T	~ 13L	Not applicable when impact load is applied.
		76.2 ~ 304.8		+25	0	+ 25	0	25T	~ 25L	
		304.8 ~ 609.6		+51	0	+ 51	0	51T	~ 51L	
		609.6 ~ 914.4		+76	0	+ 76	0	76T	~ 76L	
Outer ring rotational load	Inner ring must move easily over shaft with ordinary load.	~ 76.2		+13	0	0	- 13	0	~ 13L	
		76.2 ~ 304.8		+25	0	0	- 25	0	~ 50L	
		304.8 ~ 609.6		+51	0	0	- 51	0	~ 102L	
		609.6 ~ 914.4		+76	0	0	- 76	0	~ 152L	

**Table 7.6 (2) Fit with housing**

Unit  $\mu\text{m}$

Operating conditions		Nominal bearing outer diameter $D$ mm		Outer diameter tolerance $\Delta D_s$		Housing bore diameter tolerance		Fitting <sup>①</sup>		Types of fit
		over	incl.	high	low	high	low	max	min	
Inner ring rotational load	When used on floating- or fixed side	~ 76.2		+25	0	+ 76	+ 51	26L	~ 76L	loose fit
		76.2 ~ 127.0		+25	0	+ 76	+ 51	26L	~ 76L	
		127.0 ~ 304.8		+25	0	+ 76	+ 51	26L	~ 76L	
		304.8 ~ 609.6		+51	0	+152	+102	51L	~ 152L	
Inner ring rotational load	When outer ring is adjusted in axial direction	~ 76.2		+25	0	+ 25	0	25T	~ 25L	transition fit
		76.2 ~ 127.0		+25	0	+ 25	0	25T	~ 25L	
		127.0 ~ 304.8		+25	0	+ 51	0	25T	~ 51L	
		304.8 ~ 609.6		+51	0	+ 76	+ 26	25T	~ 76L	
Inner ring rotational load	When outer ring is not adjusted in axial direction	~ 76.2		+25	0	- 13	- 38	63T	~ 13T	tight fit
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load	When outer ring is not adjusted in axial direction	~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load		~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load		~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load		~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load		~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	
Outer ring rotational load		~ 76.2		+25	0	- 13	- 38	63T	~ 13T	
		76.2 ~ 127.0		+25	0	- 25	- 51	76T	~ 25T	
		127.0 ~ 304.8		+25	0	- 25	- 51	76T	~ 25T	
		304.8 ~ 609.6		+51	0	- 25	- 76	127T	~ 25T	

① Fitting symbol "L" indicates clearance and "T" indicates interference.

**Table 7.7 General fitting standards for tapered roller bearings using US customary unit (ANSI classes 3 and 0)**

**Table 7. (1) Fit with shaft**

Unit  $\mu\text{m}$

Operating conditions		Nominal bearing bore diameter $d$ mm		Bore diameter tolerance $\Delta_{ds}$		Shaft diameter tolerance		Fitting <sup>①</sup>	
		over	incl.	high	low	high	low	max	min
Inner ring rotational load	Precision machine tool spindles	~ 304.8		+13	0	+ 30	+ 18	30T	~ 5T
		304.8 ~ 609.6		+25	0	+ 64	+ 38	64T	~ 13T
		609.6 ~ 914.4		+38	0	+102	+ 64	102T	~ 26T
	Heavy load Impact load High-speed rotation	~ 76.2		+13	0	Minimum interference is 0.25 $\mu\text{m}$ per inner ring bore diameter.			
76.2 ~ 304.8		+13	0						
304.8 ~ 609.6		+25	0						
609.6 ~ 914.4		+38	0						
Outer ring rotational load	Precision machine tool spindles	~ 304.8		+13	0	+ 13	0	30T	~ 5T
		304.8 ~ 609.6		+25	0	+ 25	0	64T	~ 13T
		609.6 ~ 914.4		+38	0	+102	0	102T	~ 26T

Note: For class 0, bearing bore diameter  $d$  applies to 241.3 mm or less.

**Table 7.7 (2) Fit with housing**

Unit  $\mu\text{m}$

Operating conditions		Nominal bearing outer diameter $D$ mm		Outer diameter tolerance $\Delta_{Ds}$		Housing bore diameter tolerance		Fitting <sup>①</sup>		Type of fit
		over	incl.	high	low	high	low	max	min	
Inner ring rotational load	When used for floating-side	~ 152.4		+13	0	+ 38	+ 25	12L	~ 38L	loose fit
		152.4 ~ 304.8		+13	0	+ 38	+ 25	12L	~ 38L	
		304.8 ~ 609.6		+25	0	+ 64	+ 38	13L	~ 64L	
		609.6 ~ 914.4		+38	0	+ 89	+ 51	13L	~ 89L	
	When used for fixed side	~ 152.4		+13	0	+ 25	+ 13	0	~ 25L	loose fit
		152.4 ~ 304.8		+13	0	+ 25	+ 13	0	~ 25L	
		304.8 ~ 609.6		+25	0	+ 51	+ 25	0	~ 51L	
		609.6 ~ 914.4		+38	0	+ 76	+ 38	0	~ 76L	
When outer ring is adjusted in axial direction	~ 152.4		+13	0	+ 13	0	13T	~ 13L	transition fit	
	152.4 ~ 304.8		+13	0	+ 13	0	13T	~ 13L		
	304.8 ~ 609.6		+13	0	+ 25	0	25T	~ 25L		
	609.6 ~ 914.4		+38	0	+ 38	0	38T	~ 38L		
When outer ring is not adjusted in axial direction	~ 152.4		+13	0	0	- 13	26T	~ 0	tight fit	
	152.4 ~ 304.8		+13	0	0	- 25	38T	~ 0		
	304.8 ~ 609.6		+25	0	0	- 25	50T	~ 0		
	609.6 ~ 914.4		+38	0	0	- 38	76T	~ 0		
Outer ring rotational load	Ordinary load When outer ring is not adjusted in axial direction	~ 152.4		+13	0	- 13	- 25	38T	~ 13T	tight fit
		152.4 ~ 304.8		+13	0	- 13	- 38	51T	~ 13T	
		304.8 ~ 609.6		+25	0	- 13	- 38	63T	~ 13T	
		609.6 ~ 914.4		+38	0	- 13	- 51	89T	~ 13T	

① Fitting symbol "L" indicates clearance and "T" indicates interference.

Note: For class 0, bearing outer diameter  $D$  applies to 304.8 mm or less.