7. Bearing fits

7.1 Resultant fits

For rolling bearings, it is necessary to fix inner and outer rings 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 mating 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 resultant fit include **tight**, **transition** and **loose fits**, which describe whether or not there is interference between the bearing and the shaft or housing.

The most effective way to fix the mating surfaces between a bearing and shaft or housing is to apply a "tight fit." The advantage of a 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, an improper fit may lead to damage and shorten bearing life. Therefore it is necessary to carefully select the proper fit. Some possible bearing failures caused by an 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 "16. Bearing Damage and Corrective Measures" 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, surface finish accuracy, etc.
- Machinery operating conditions (nature and magnitude of load, rotational speed, temperature, etc.)

7.3.1 "Tight fit" or "Loose fit"

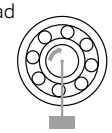
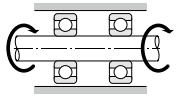
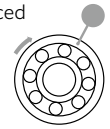
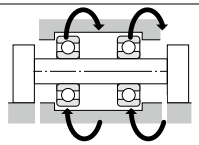
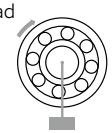
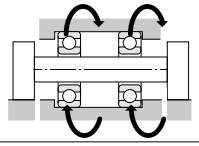
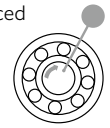
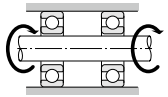
(1) For bearing rings under rotating loads, a **tight fit** is necessary. (Refer to **Table 7.1**) "Raceways under rotating loads" refers to raceways receiving loads rotating relative to their radial direction.

For bearing rings 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

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

7.3.2 Recommended fits

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

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

Generally-used, standard fits for most types of bearings and operating conditions are shown in **Tables 7.2** to **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: Inch series tapered roller bearings Fits of (ANSI/ABMA CLASS 4)
Table 7.7: Inch series tapered roller bearings Fits of (ANSI/ABMA CLASS 3, CLASS 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:

- Regarding minimum values,
  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 in mating surface
  4) interference is reduced by deformation
- The upper limit value should not exceed 1/ 1 000 of the shaft diameter.

Required interference calculations are shown below.

(1) Mating surface variation and interference

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

For ground shafts: 1.0 to 2.5 μm
For machined shafts: 5.0 to 7.0 μm

The interference including this decrease amount is called effective interference.

(2) 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 for installation to solid shafts is expressed by formulae (7.1) and (7.2) for each load condition.

General applications ($F_r \leqq 0.3C_{0r}$)

$$\Delta d_F = 0.08(d \cdot F_r / B)^{1/2} \quad \text{N} \quad \cdots\cdots\cdots\cdots (7.1)$$

Under heavy load conditions ($F_r > 0.3\ C_{0r}$)

$$\Delta d_F = 0.02(F_r / B) \quad \text{N} \quad \cdots\cdots\cdots\cdots (7.2)$$

Where:

Δd_F : Required effective interference according to radial load μm
d : Bearing bore mm
B : Inner ring width mm
F_r : Actual radial load, N
C_{0r} : Basic static load rating N

For solid shafts, please contact **NTN** Engineering.

(3) 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, ΔT) caused by bearing rotation. Calculation of the minimum required amount of interference in such cases is shown in formula (7.3).

$$\Delta d_T = 0.0015 \cdot d \cdot \Delta T \cdots\cdots\cdots\cdots (7.3)$$

Δd_T : Required effective interference for temperature difference μm
ΔT : Difference between inner ring temperature and ambient temperature °C
d : Bearing bore mm

(4) Maximum interference

When bearing rings are installed with an interference fit, tensile or compressive stress may occur along their raceways. If interference is too great, this may cause damage to the rings and reduce bearing life. The maximum stress due to the resultant fit must not exceed approximately 127 MPa for safety. If the value is to be exceeded, consult **NTN** Engineering.

See section "17.4 Resultant fit surface pressure" for the calculation method of maximum stress due to the resultant fit.

(5) Interference change amount when materials other than steel are used for shafts and housings

When materials other than steel are used for shafts and housings, the fits between the inner ring and the shaft and the outer ring and the housing change because of difference in the expansion coefficient of each material as the temperature rises during the rotation of the bearing. Therefore, it is necessary to set the resultant fit with expansion coefficients in consideration. The calculation formula of the change in interference is shown below.

$$\Delta d_{TE} = (\alpha_1 - \alpha_2) \times d \times \Delta T$$

Δd_{TE} : Change in interference caused by difference in the expansion coefficients mm

α_1 : Bearing expansion coefficient 1/°C

α_2 : Shaft and housing expansion coefficient 1/°C

d : Reference dimension of resultant fit mm

ΔT : Temperature increase by bearing rotation °C

(Expansion coefficient: See **Table 13.19** in "13. Bearing Materials.")

7.3.4 Other details

(1) Large interference fits are recommended for,
- Operating conditions with large vibrations 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 A-88.)

(4) A particular type of fit is recommended for SL type cylindrical roller bearings. (refer to page C-67.)

(5) Bearing dimensions are measured and managed at a temperature of 20°C.

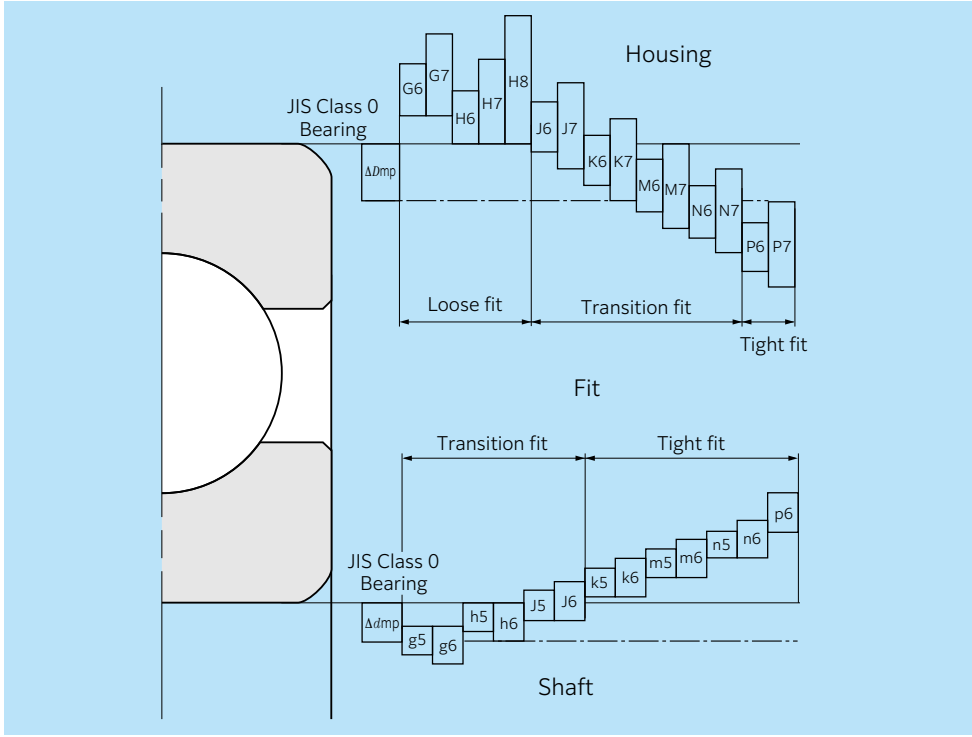


Fig 7.1 State of resultant fit

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)

Condition No.		Ball bearing		Cylindrical roller bearing Tapered roller bearing		Self-aligning roller bearing		Shaft tolerance class	Remarks
		Shaft diameter (mm)							
		Over	Incl.	Over	Incl.	Over	Incl.		
Cylindrical bore bearing (Classes 0, 6X and 6)									
Inner ring rotational load or load of undetermined direction	Light load [1] 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.
	Normal load [1]	— 18 100 140 200 — —	18 100 140 200 280 — —	— — 40 100 140 200 —	— 40 100 140 200 400 —	— — 40 65 100 140 280 500	— 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 [1] 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.
Static inner ring 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 to facilitate movement.
	Inner ring 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 resultant fits.
Tapered bore bearing (class 0) (with adapter or withdrawal sleeve)									
Full load		Overall shaft diameter						h9/IT5 [2]	h10/IT7 [2] 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)

Full load	All bearing types	Tolerance class	h9 / IT5 [2]	General applications
			H10 / IT7 [2]	Transmission shafts, etc.

1) Standards for light loads, normal loads, and heavy loads
- Light loads: dynamic equivalent radial load ≦ 0.05 Cr
- Normal loads: 0.05 Cr ≦ dynamic equivalent radial load ≦ 0.10 Cr
- Heavy loads: 0.10 Cr < dynamic 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 bores commonly used for radial bearings (classes 0, 6X and 6)

Conditions				Housing bore tolerance class	Remarks
Housing	Load type, etc.		Outer ring axial direction movement [3]		
Single housing or Divided housing	Static outer ring load	All types of loads	Yes	H7	G7 can be used for large bearings or bearings with large temperature differential between the outer ring and housing.
		Light [1] or ordinary load [1]	Yes	H8	—
		Shaft and inner ring become hot	Easily	G7	F7 be used for large bearings or bearings with large temperature differential between the outer ring and housing.
Single housing		Requires precise rotation under light or ordinary loads	As a rule, it cannot move.	K6	Primarily applies to roller bearings.
			Yes	Js6	Primarily applies to ball bearings.
		Requires low noise operation	Yes	H6	—
	Indeterminate load	Light or ordinary load	Yes	Js7	If high accuracy is required, Js6 and K6 are used in place of Js7 and K7.
		Ordinary or heavy load [1]	As a rule, it cannot move.	K7	
		High impact load	No	M7	—
	Rotating outer ring load	Light or fluctuating load	No	M7	—
		Ordinary or heavy load	No	N7	Primarily applies to ball bearings.
		Heavy load or large impact load with thin wall housing [2]	No	P7	Primarily applies to roller bearings.

1) Standards for light loads, normal loads, and heavy loads
- Light loads: dynamic equivalent radial load ≦ 0.05 Cr
- Normal loads: 0.05 Cr ≦ dynamic equivalent radial load ≦ 0.10 Cr
- Heavy loads: 0.10 Cr < dynamic equivalent radial load

2) The axial direction needs to be secured because the outer ring may move in the shaft direction, causing problems, depending on the use. (Example: planetary gear, etc.)
3) Indicates whether or not outer ring axial movement 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 a center axial load is applied to the bearing, select a tolerance class that provides clearance for the outer ring in the radial 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	Overall shaft diameter	js6 or h6
Self-aligning roller thrust bearing	Combined load	Static inner ring load	Transition fit	Overall shaft diameter	js6
		Rotating inner ring load or Indeterminate load	Transition fit	Up to 200	k6 or js6
				400 to 200	m6 or k6
			Tight fit	400 or more	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.	
Self-aligning roller thrust bearing	Combined load	Static outer ring load		H8	Greater accuracy required with thrust ball bearings
				H7	——
		Indeterminate load or Rotating outer ring load	Transition fit	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 bearing	～ 18	j5	All sizes	H6 or J6
	18 ～ 100	k5		
	100 ～ 160	m5		
Cylindrical roller bearing	～ 40	k5	All sizes	H6 or J6
	40 ～ 160	m5		
	160 ～ 200	n6		

Table 7.5 Numeric values associated with fits for radial bearing of class 0

Table 7.5 (1) Shaft fits

Unit: μm

Nominal bearing bore diameter d mm		Mean bore[1] diameter deviation Δ_{dmp}		g5	g6	h5	h6	j5	js5	j6	js6	k5	k6	m5	m6	n6	p6	r6	Nominal bearing bore diameter d mm	
Over	Incl.	Upper	Lower	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Bearing Shaft	Over	Incl.
3	6	0	−8	4T～ 9L	4T～ 12L	8T～ 5L	8T～ 8L	11T～ 2L	10.5T～ 2.5L	14T～ 2L	12T ～ 4L	14T～1T	17T～1T	17T～ 4T	20T～ 4T	24T～ 8T	28T～12T	– –	3	6
6	10	0	−8	3T～11L	3T～ 14L	8T～ 6L	8T～ 9L	12T～ 2L	11T ～ 3L	15T～ 2L	12.5T～ 4.5L	15T～1T	18T～1T	20T～ 6T	23T～ 6T	27T～10T	32T～15T	– –	6	10
10	18	0	−8	2T～14L	2T～ 17L	8T～ 8L	8T～11L	13T～ 3L	12T ～ 4L	16T～ 3L	13.5T～ 5.5L	17T～1T	20T～1T	23T～ 7T	26T～ 7T	31T～12T	37T～18T	– –	10	18
18	30	0	−10	3T～16L	3T～ 20L	10T～ 9L	10T～13L	15T～ 4L	14.5T～ 4.5L	19T～ 4L	16.5T～ 6.5L	21T～2T	25T～2T	27T～ 8T	31T～ 8T	38T～15T	45T～22T	– –	18	30
30	50	0	−12	3T～20L	3T～ 25L	12T～11L	12T～16L	18T～ 5L	17.5T～ 5.5L	23T～ 5L	20T ～ 8L	25T～2T	30T～2T	32T～ 9T	37T～ 9T	45T～17T	54T～26T	– –	30	50
50	80	0	−15	5T～23L	5T～ 29L	15T～13L	15T～19L	21T～ 7L	21.5T～ 6.5L	27T～ 7L	24.5T～ 9.5L	30T～2T	36T～2T	39T～11T	45T～ 11T	54T～20T	66T～ 32T	– –	50	80
80	120	0	−20	8T～27L	8T～ 34L	20T～15L	20T～22L	26T～ 9L	27.5T～ 7.5L	33T～ 9L	31T ～11L	38T～3T	45T～2T	48T～13T	55T～ 13T	65T～23T	79T～ 37T	– –	80	120
120 140 160	140 160 180	0	−25	11T～32L	11T～ 39L	25T～18L	25T～25L	32T～11L	34T ～ 9L	39T～11L	37.5T～12.5L	46T～3T	53T～3T	58T～15T	65T～ 15T	77T～27T	93T～ 43T	113T～ 63T 115T～ 65T 118T～ 68T	120 140 160	140 160 180
180 200 225	200 225 250	0	−30	15T～35L	15T～ 44L	30T～20L	30T～29L	37T～13L	40T ～10L	46T～13L	44.5T～14.5L	54T～4T	63T～4T	67T～17T	76T～ 17T	90T～31T	109T～ 50T	136T～ 77T 139T～ 80T 143T～ 84T	180 200 225	200 225 250
250 280	280 315	0	−35	18T～40L	18T～ 49L	35T～23L	35T～32L	42T～16L	46.5T～11.5L	51T～16L	51T ～16L	62T～4T	71T～4T	78T～20T	87T～ 20T	101T～34T	123T～ 56T	161T～ 94T 165T～ 98T	250 280	280 315
315 355	355 400	0	−40	22T～43L	22T～ 54L	40T～25L	40T～36L	47T～18L	52.5T～12.5L	58T～18L	58T ～18L	69T～4T	80T～4T	86T～21T	97T～ 21T	113T～37T	138T～ 62T	184T～108T 190T～114T	315 355	355 400
400 450	450 500	0	−45	25T～47L	25T～ 60L	45T～27L	45T～40L	52T～20L	58.5T～13.5L	65T～20L	65T ～20L	77T～5T	90T～4T	95T～23T	108T～ 23T	125T～40T	153T～ 68T	211T～126T 217T～132T	400 450	450 500

1) The above table is not applicable to tapered roller bearings whose bore diameter d is 30 mm or less.

Table 7.5 (2) Housing fits

Unit: μm

Nominal bearing bore diameter D mm		Mean bore[2] diameter deviation Δ_{Dmp}		G7	H6	H7	J6	J7	Js7	K6	K7	M7	N7	P7	Nominal bearing bore diameter D mm	
Over	Incl.	Upper	Lower	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Housing Bearing	Over	Incl.
6	10	0	−8	5L～ 28L	0～17L	0～ 23L	4T～13L	7T～16L	7.5T～15.5L	7T～10L	10T～13L	15T～ 8L	19T～ 4L	24T～ 1T	6	10
10	18	0	−8	6L～ 32L	0～19L	0～ 26L	5T～14L	8T～18L	9T ～17L	9T～10L	12T～14L	18T～ 8L	23T～ 3L	29T～ 3T	10	18
18	30	0	−9	7L～ 37L	0～22L	0～ 30L	5T～17L	9T～21L	10.5T～19.5L	11T～11L	15T～15L	21T～ 9L	28T～ 2L	35T～ 5T	18	30
30	50	0	−11	9L～ 45L	0～27L	0～ 36L	6T～21L	11T～25L	12.5T～23.5L	13T～14L	18T～18L	25T～11L	33T～ 3L	42T～ 6T	30	50
50	80	0	−13	10L～ 53L	0～32L	0～ 43L	6T～26L	12T～31L	15T ～28L	15T～17L	21T～22L	30T～13L	39T～ 4L	51T～ 8T	50	80
80	120	0	−15	12L～ 62L	0～37L	0～ 50L	6T～31L	13T～37L	17.5T～32.5L	18T～19L	25T～25L	35T～15L	45T～ 5L	59T～ 9T	80	120
120	150	0	−18	14L～ 72L	0～43L	0～ 58L	7T～36L	14T～44L	20T ～38L	21T～22L	28T～30L	40T～18L	52T～ 6L	68T～10T	120	150
150	180	0	−25	14L～ 79L	0～50L	0～ 65L	7T～43L	14T～51L	20T ～45L	21T～29L	28T～37L	40T～25L	52T～13L	68T～ 3T	150	180
180	250	0	−30	15L～ 91L	0～59L	0～ 76L	7T～52L	16T～60L	23T ～53L	24T～35L	33T～43L	46T～30L	60T～16L	79T～ 3T	180	250
250	315	0	−35	17L～104L	0～67L	0～ 87L	7T～60L	16T～71L	26T ～61L	27T～40L	36T～51L	52T～35L	66T～21L	88T～ 1T	250	315
315	400	0	−40	18L～115L	0～76L	0～ 97L	7T～69L	18T～79L	28.5T～68.5L	29T～47L	40T～57L	57T～40L	73T～24L	98T～ 1T	315	400
400	500	0	−45	20L～128L	0～85L	0～108L	7T～78L	20T～88L	31.5T～76.5L	32T～53L	45T～63L	63T～45L	80T～28L	108T～ 0	400	500

2) The above table is not applicable to tapered roller bearings whose outside diameter D is 150 mm or less.
Note: Fit symbol "**L**" indicates clearance and "**T**" indicates interference.

Bearing Fits
NTN
Commentary

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

Table 7.6 (1) Fit with shaft

Unit: μm

Operating conditions		Nominal bearing bore diameter d mm Over	Incl.	Bore diameter tolerance Δds Upper	Lower	Shaft diameter tolerance Upper	Lower	Fit 1)	Remarks
Rotating inner ring load	Normal load		76.2	+13	0	+ 38	+ 25	38T ~ 13T	Applicable when a 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	+191	+114	191T ~ 38T	
	Heavy load Impact load		76.2	+13	0	+ 64	+ 38	64T ~ 25T	0.5 μm mean interference per 1 mm of inner ring bore diameter. Minimum in terference is 25 μm. 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	+457	+381	457T ~ 305T	
Rotating outer ring load	Inner ring does not have to move easily over shaft with an 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	
	Inner ring must move easily over shaft with an ordinary load.		76.2	+13	0	0	−13	0 ~ 13L	
		76.2 ~	304.8	+25	0	0	−25	0 ~ 51L	
		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: μm

Operating conditions		Nominal bearing outside diameter D mm Over	Incl.	Outer diameter dimensional tolerance ΔDs Upper	Lower	Housing bore diameter tolerance Upper	Lower	Fit 1)	Types of fits
Rotating inner ring load	When used on floating or fixed side		76.2	+25	0	+ 76	+ 51	25L ~ 76L	Loose fit
		76.2 ~	127.0	+25	0	+ 76	+ 51	25L ~ 76L	
		127.0 ~	304.8	+25	0	+ 76	+ 51	25L ~ 76L	
		304.8 ~	609.6	+51	0	+152	+102	51L ~ 152L	
		609.6 ~	914.4	+76	0	+229	+152	76L ~ 229L	
	When outer ring is adjusted in the 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	+ 25	25T ~ 76L	
		609.6 ~	914.4	+76	0	+127	+ 51	25T ~ 127L	
	When outer ring is not adjusted in the axial direction		76.2	+25	0	− 13	− 38	64T ~ 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	
		609.6 ~	914.4	+76	0	− 25	−102	178T ~ 25T	
Rotating outer ring load	When outer ring is not adjusted in the axial direction		76.2	+25	0	− 13	− 38	64T ~ 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	
		609.6 ~	914.4	+76	0	− 25	−102	178T ~ 25T	

1) Fit symbol "**L**" indicates clearance and "**T**" indicates interference.

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

Table 7.7 (1) Fit with shaft

Unit: μm

Operating conditions		Nominal bearing bore diameter d mm Over	Incl.	Bore diameter tolerance Δds Upper	Lower	Shaft diameter tolerance Upper	Lower	Fit 1)
Rotating inner ring 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 ~ 25T
	Heavy load Shock load High-speed rotation		304.8	+13	0	Minimum interference is 0.25 μm per 1 mm of inner ring bore diameter		
		304.8 ~	609.6	+25	0			
		609.6 ~	914.4	+38	0			
Rotating outer ring 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 ~ 25T

Note: For class 0, bearing bore diameter d applies to 304.8 mm or less.

Table 7.7 (2) Fit with housing

Unit: μm

Operating conditions		Nominal bearing bore diameter D mm Over	Incl.	Outer diameter dimensional tolerance ΔDs Upper	Lower	Housing bore diameter tolerance Upper	Lower	Fit 1)	Types of fits
Rotating inner ring load	When used for floating-side		152.4	+13	0	+38	+25	13L ~ 38L	Loose fit
		152.4 ~	304.8	+13	0	+38	+25	13L ~ 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	
		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	+25	0	13T ~ 25L	
		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	25T ~ 0	Tight fit
		152.4 ~	304.8	+13	0	0	−25	38T ~ 0	
		304.8 ~	609.6	+25	0	0	−25	51T ~ 0	
		609.6 ~	914.4	+38	0	0	−38	76T ~ 0	
Rotating outer ring load	Normal load When outer ring is not adjusted in the axial direction		152.4	+13	0	−13	−25	38T ~ 13T	
		152.4 ~	304.8	+13	0	−13	−38	51T ~ 13T	
		304.8 ~	609.6	+25	0	−13	−38	64T ~ 13T	
		609.6 ~	914.4	+38	0	−13	−51	89T ~ 13T	

1) Fit symbol "**L**" indicates clearance and "**T**" indicates interference.
Note: For class 0, bearing outer diameter D applies to 304.8 mm or less.