# 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:

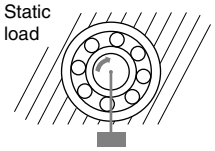
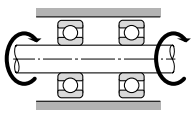
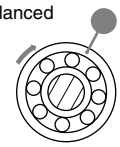
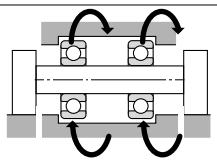
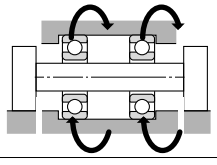
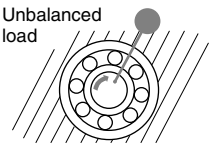
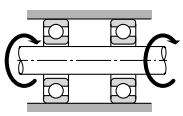
- Shaft and housing material, wall thickness, finished surface accuracy, etc.
- Machinery operating conditions (nature and magnitude of load, rotational speed, temperature, etc.)

### 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 |
|---|---|---|---|
| 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 |

### 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 **Fig. 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).

$$F_r \leqq 0.3\, C_{or}$$

$$\left.\begin{aligned} \Delta_{dF} &= 0.08\,(d \cdot F_r / B)^{1/2} \quad \text{N} \\ &= 0.25\,(d \cdot F_r / B)^{1/2} \quad \{\text{kgf}\} \end{aligned}\right\} \cdots\cdots\cdots (7.1)$$

$$F_r > 0.3\, C_{or}$$

$$\left.\begin{aligned} \Delta_{dF} &= 0.02\,(F_r / B) \quad \text{N} \\ &= 0.2\,(F_r / B) \quad \{\text{kgf}\} \end{aligned}\right\} \cdots\cdots\cdots (7.2)$$

Where,

$\Delta_{dF}$ : Required effective interference according to radial load $\mu$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).

$$\Delta_{dT} = 0.0015 \cdot d \cdot \Delta T \cdots\cdots\cdots (7.3)$$

$\Delta_{dT}$ : Required effective interference for temperature difference $\mu$m
$\Delta T$ : Difference between bearing temperature and ambient temperature ˚C
$d$ : Bearing bore diameter mm

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

Interference decreases because the fitting surface is smoothened 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 $\mu$m
For lathed shafts: 5.0～7.0 $\mu$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)

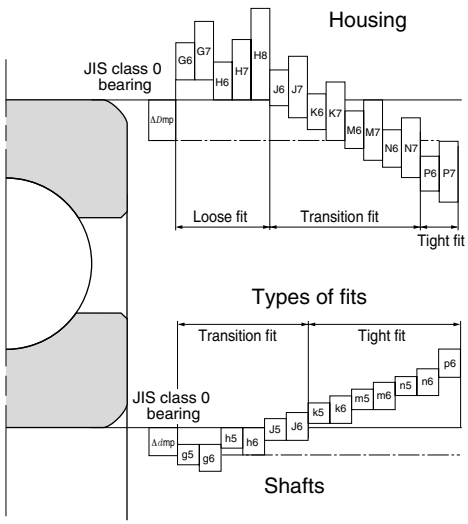



**Fig 7.1 State of fitting**

(4) A particular type of fit is recommended for SL type cylindrical roller bearings.

### 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 ❶ or fluctuating load | —<br>18<br>100<br>— | 18<br>100<br>200<br>— | —<br>—<br>40<br>140 | —<br>40<br>140<br>200 | —<br>—<br>—<br>— | —<br>—<br>—<br>— | h5<br>js6<br>k6<br>m6 | When greater accuracy is required js5, k5, and m5 may be substituted for js6, k6, and m6. |
| | Ordinary ❶ load | —<br>18<br>100<br>140<br>200<br>—<br>— | 18<br>100<br>140<br>200<br>280<br>—<br>— | —<br>—<br>40<br>100<br>140<br>200<br>— | —<br>40<br>100<br>140<br>200<br>400<br>— | —<br>—<br>40<br>65<br>100<br>140<br>280 | —<br>40<br>65<br>100<br>140<br>280<br>500 | js5<br>k5<br>m5<br>m6<br>n6<br>p6<br>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 ❶ or impact load | —<br>—<br>— | —<br>—<br>— | 50<br>140<br>200 | 140<br>200<br>— | 50<br>100<br>140 | 100<br>140<br>200 | n6<br>p6<br>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 interferance. |
| Tapered bore bearing (class 0) (with adapter or withdrawal sleeve) | | | | | | | | | |
| Overall load | | Overall shaft diameter | | | | | | h9/IT5 ❷ | h10/IT7 ❷ 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 ❷ | General applications |
|---|---|---|---|---|---|
| | | | | h10/ IT7 ❷ | Transmission shafts, etc. |

❶ 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

❷ 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)**

| Conditions | | | | Toleration class of housing bore | Remarks |
|---|---|---|---|---|---|
| Housing | Types of load | | Outer ring axial ❷ 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 ❶ or ordinary load ❶ | 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 | | 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 ❶ | 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. |

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

Light loads: equivalent radial load $\leqq 0.06\ C_r$

Normal loads: $0.06\ C_r <$ equivalent radial load $\leqq 0.12\ C_r$

Heavy loads: $0.12\ C_r <$ equivalent radial load

❷ 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 | Transition fit | All sizes | | js6 |
| | | Inner ring rotating load or Indeterminate load | Transition fit | — | 200 | k6 or js6 |
| | | | | 200 | 400 | m6 or k6 |
| | | | Tight fit | 400 | | 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 | | H7 | — |
| | | Indeterminate load or outer ring rotating 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 bearings | — | 18 | j5 | All sizes | H6 or J6 |
| | 18 | 100 | k5 | | |
| | 100 | 160 | m5 | | |
| Cylindrical roller bearings | — | 40 | k5 | All sizes | H6 or J6 |
| | 40 | 160 | m5 | | |
| | 160 | 200 | n6 | | |

## 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 $d$ mm | | Mean bore diameter deviation ❶ $\Delta_{dmp}$ | | g5 | g6 | h5 | h6 | j5 | js5 | j6 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft | bearing shaft |
| over | incl. | high | low | | | | | | | |
| 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 | 0 | -25 | 11T～32L | 11T～39L | 25T～18L | 25T～25L | 32T～11L | 34T ～ 9L | 39T～11L |
| 140 | 160 | | | | | | | | | |
| 160 | 180 | | | | | | | | | |
| 180 | 200 | 0 | -30 | 15T～35L | 15T～44L | 30T～20L | 30T～29L | 37T～13L | 40T ～10L | 46T～13L |
| 200 | 225 | | | | | | | | | |
| 225 | 250 | | | | | | | | | |
| 250 | 280 | 0 | -35 | 18T～40L | 18T～49L | 35T～23L | 35T～32L | 42T～16L | 46.5T～11.5L | 51T～16L |
| 280 | 315 | | | | | | | | | |
| 315 | 355 | 0 | -40 | 22T～43L | 22T～54L | 40T～25L | 40T～36L | 47T～18L | 52.5T～12.5L | 58T～18L |
| 355 | 400 | | | | | | | | | |
| 400 | 450 | 0 | -45 | 25T～47L | 25T～60L | 45T～27L | 45T～40L | 52T～20L | 58.5T～13.5L | 65T～20L |
| 450 | 500 | | | | | | | | | |

❶ 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 $D$ mm | | Mean outside diameter deviation ❷ $\Delta_{Dmp}$ | | G7 | H6 | H7 | J6 | J7 | Js7 | K6 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing | housing bearing |
| over | incl. | high | low | | | | | | | |
| 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 |

❷ 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 μm

| js6 | | k5 | | k6 | | m5 | | m6 | | n6 | | p6 | | r6 | | Nominal bore diameter of bearing d mm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| bearing | shaft | bearing | shaft | bearing | shaft | bearing | shaft | bearing | shaft | bearing | shaft | bearing | shaft | bearing | shaft | over | incl. |
| 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<br>115T～ 65T<br>118T～ 68T | | 120<br>140<br>160 | 140<br>160<br>180 |
| 44.5T～14.5L | | 54T～4T | | 63T～4T | | 67T～17T | | 76T～17T | | 90T～31T | | 109T～50T | | 136T～ 77T<br>139T～ 80T<br>143T～ 84T | | 180<br>200<br>225 | 200<br>225<br>250 |
| 51T ～16L | | 62T～4T | | 71T～4T | | 78T～20T | | 87T～20T | | 101T～34T | | 123T～56T | | 161T～ 94T<br>165T～ 98T | | 250<br>280 | 280<br>315 |
| 58T ～18L | | 69T～4T | | 80T～4T | | 86T～21T | | 97T～21T | | 113T～37T | | 138T～62T | | 184T～108T<br>190T～114T | | 315<br>355 | 355<br>400 |
| 65T ～20L | | 77T～5T | | 90T～4T | | 95T～23T | | 108T～23T | | 125T～40T | | 153T～68T | | 211T～126T<br>217T～132T | | 400<br>450 | 450<br>500 |

Unit μm

| K7 | | M7 | | N7 | | P7 | | Nominal outside diameter of bearing D mm | |
|---|---|---|---|---|---|---|---|---|---|
| housing | bearing | housing | bearing | housing | bearing | housing | bearing | over | incl. |
| 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 μm

| Operating conditions | | Nominal bearing bore diameter $d$ mm over | incl. | Bore diameter tolerance $\Delta_{ds}$ high | low | Shaft diameter tolerance high | low | Fitting ❶ max | min | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |
| | Heavy load Impact load | | ~ 76.2 | +13 | 0 | + 64 | + 38 | 38T ~ | 12T | |
| | | 76.2 ~ | 304.8 | +25 | 0 | 0.5 μm mean interference per 1 mm of inner ring bore diameter. Minimum interference is 25 μm. Tolerance for the shaft is adjusted to match tolerance of bearing bore diameter. | | | | |
| | | 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 | |
| | 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 μm

| Operating conditions | | Nominal bearing outer diameter $D$ mm over | incl. | Outer diameter tolerance $\Delta_{Ds}$ high | low | Housing bore diameter tolerance high | low | Fitting ❶ max | min | Types of fit |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |
| | | 609.6 ~ | 914.4 | +76 | 0 | +229 | +152 | 76L ~ | 229L | |
| | 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 | |
| | | 609.6 ~ | 914.4 | +76 | 0 | +127 | + 51 | 25T ~ | 127L | |
| | 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 | |
| | | 609.6 ~ | 914.4 | +76 | 0 | - 25 | -102 | 178T ~ | 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 | |
| | | 609.6 ~ | 914.4 | +76 | 0 | - 25 | -102 | 178T ~ | 25T | |

❶ 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 $\mu$m

| Operating conditions | | Nominal bearing bore diameter $d$ mm over | incl. | Bore diameter tolerance $\Delta_{ds}$ high | low | Shaft diameter tolerance high | low | Fitting ❶ 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 $\mu$m per 1 mm of 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 $\mu$m

| Operating conditions | | Nominal bearing outer diameter $D$ mm over | incl. | Outer diameter tolerance $\Delta_{Ds}$ high | low | Housing bore diameter tolerance high | low | Fitting ❶ max | min | Type of fit |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 | |
| | | 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 | |
| | | 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 | |

❶ Fitting symbol "L" indicates clearance and "T" indicates interference.
Note: For class 0, bearing outer diameter $D$ applies to 304.8 mm or less.