Table 5.2 Bearing number composition and arrangement

Supplementary prefix code		Basic number						
		Bearing series			Bore diameter code		Contact angle code	
Special application/ material/ heat treatment code		Bearing series code	Dimension series code: Width/height series [1]	Dimension series code: Diameter series	Code	Bore diameter mm	Code [1]	Contact angle
4T-	4T tapered roller bearings	**Deep groove ball bearings (type code 6)**						
E-	Bearings using case hardened steel	67	(1)	7	/0.6	0.6	**Angular contact ball bearing**	
		68	(1)	8	/1.5	1.5	(A)	Standard contact angle 30°
F-	Stainless steel bearings	69	(1)	9	/2.5	2.5	B	Standard contact angle 40°
		160	(0)	0			C	Standard contact angle 15°
TS2-	Dimension stabilized bearing for high temperature use (to 160°C)	60	(1)	0	1	1	**Tapered roller bearing**	
		62	(0)	2	⋮	⋮	(B)	Contact angle over 10° to/including 17°
TS3-	Dimension stabilized bearing for high temperature use (to 200°C)	63	(0)	3	9	9	C	Contact angle over 17° to/including 24°
		Angular contact ball bearings (type code 7)					D	Contact angle over 24° to/including 32°
TS4-	Dimension stabilized bearing for high temperature use (to 250°C)	78	(1)	8	00	10		
		79	(1)	9	01	12		
		70	(1)	0	02	15		
		72	(0)	2	03	17		
		73	(0)	3				
		Self aligning ball bearings (type code 1, 2)						
		12	(0)	2	/22	22		
		13	(0)	3	/28	28		
		22	(2)	2	/32	32		
		23	(2)	3				
		Cylindrical roller bearings (type code NU, N, NF,NNU, NN, etc.)			04	20		
		NU10	1	0	05	25		
		NU2	(0)	2	06	30		
		NU22	2	2	⋮	⋮		
		NU3	(0)	3	88	440		
		NU23	2	3	92	460		
		NU4	(0)	4	96	480		
		NNU49	4	9				
		NN30	3	0	/500	500		
					/530	530		
		Tapered roller bearings (type code 3)			/560	560		
		329X	2	9		⋮		
		320X	2	0	/2 360	2 360		
		302	0	2	/2 500	2 500		
		322	2	2				
		303	0	3				
		303D	0	3				
		313X	1	3				
		323	2	3				
		Spherical roller bearings (type code 2)						
		239	3	9				
		230	3	0				
		240	4	0				
		231	3	1				
		241	4	1				
		222	2	2				
		232	3	2				
		213	1	3				
		223	2	3				
		Single direction thrust ball bearings (type code 5)						
		511	1	1				
		512	1	2				
		513	1	3				
		514	1	4				
		Cylindrical roller thrust bearings (type code 8)						
		811	1	1				
		812	1	2				
		893	9	3				
		Spherical thrust roller bearings (type code 2)						
		292	9	2				
		293	9	3				
		294	9	4				

1) Codes in ( ) are not shown in nominal numbers.
Note: Please consult **NTN** Engineering concerning bearing series codes, and supplementary prefix/suffix codes not listed in the above table.

Supplementary suffix codes							
Internal modifications code	Cage code	Seal / Shield code	Raceway external configuration code	Duplex arrangement code	Internal clearance [1] Preload code	Tolerance code [1]	Lubrication
U Internationally interchangeable tapered roller bearings	L1 High strength, machined brass cage	LB One-side synthetic rubber seal (non-contact type)	K Tapered inner ring bore, standard taper ratio 1:12	DB Back-to-back arrangement	C2 Internal clearance less than normal	(P0) JIS Class 0	/2AS Alvania Grease S2
R Non-internationally interchangeable tapered roller bearings	F1 Machined carbon steel cage	LLB Double-side synthetic rubber seal (non-contact type)	K30 Tapered inner ring bore, standard taper ratio 1:30	DF Face-to-face arrangement	(CN) Normal clearance	P6 JIS Class 6	/3AS Alvania Grease S3
ST Low torque tapered roller bearings	G1 High strength machined brass rivetless cage with square holes	LU One-side synthetic rubber seal (contact type)	N With snap ring groove	DT Tandem arrangement	C3 Internal clearance greater than normal	P5 JIS Class 5	/8A Alvania Grease EP2
HT Angular ball bearings and cylindrical roller bearings for high axial loads	G2 Pin type cage	LLU Double-side synthetic rubber seal (contact type)	NR Snap ring	D2 Two matched, paired bearings	C4 Internal clearance greater than C3	P4 JIS Class 4	/5K Multemp SRL
E High load capacity cylindrical roller bearing	J Pressed steel cage	LH One-side synthetic rubber seal (low-torque type)	D With oil hole	+α Spacer (α = spacer's standard width dimensions)	C5 Internal clearance greater than C4	P2 JIS Class 2	/LX11 Barrierta JFE552
EA ULTAGE series cylindrical roller bearings	T2 Molded resin cage	LLH Double-side synthetic rubber seal (low-torque type)	D1 Lubrication hole/lubrication groove		CM Radial internal clearance for electric motor use	−4 ABMA Class 4	/LP03 Solid grease
E ULTAGE series self aligning roller bearings	A Pressed steel cage (ULTAGE series self aligning roller bearings)	Z One-side steel Shield			/GL Light preload	−2 ABMA Class 2	
UTG ULTAGE series Large tapered roller bearing	M High strength, machined brass cage (ULTAGE series self aligning roller bearings)	ZZ Double-side steel Shield			/GN Normal preload	−3 ABMA Class 3	
					/GM Medium preload	−0 ABMA Class 0	
					/GH Heavy preload	−00 ABMA Class 00	

1) Codes in ( ) are not shown in nominal numbers.
Note: Please consult **NTN** Engineering concerning bearing series codes, and supplementary prefix/suffix codes not listed in the above table.

Boundary Dimensions and Bearing Number Codes NTN

Commentary

5.2.1 Numbers of inch series tapered roller bearings

The composition of numbers of inch series tapered roller bearings is specified by the American Bearing Manufacturers Association (ABMA). The inner ring component (CONE) and the outer ring (CUP) each have a corresponding number. **Table 5.3** shows the composition of these numbers. Each corresponding code is also described in more detail below.

Table 5.3 Bearing number composition

Prefix code	Contact angle code	Series number	Serial number	Suffix code
XX	○	○○○	○○	XX

Note: X in the table is represented by letters, and ○ is represented by numbers.

Load limit code

This code has 9 types from light loads to heavy loads:
EL, LL, L, LM, M, HM, H, HH, and EH.
"J" at the beginning of the code indicates metric bearings.

Contact angle code

This code indicates the contact angle of the series. The classification of each code is shown in **Table 5.3 (1)**.

Table 5.3 (1) Contact angle symbol

Code	Outer ring angle (contact angle × 2)	
	Inc.	Below
1	0°	24°
2	24°	25°30′
3	25°30′	27°
4	27°	28°30′
5	28°30′	30°30′
6	30°30′	32°30′
7	32°30′	36°
8	36°	45°
9	45°(Excluding thrust bearings)	

Suffix code

This code consists of either one or two letters. It is used when the appearance and the inside of the standard type are changed.

Serial number

The serial number of the outer ring is 10 to 19.
The serial number of the inner ring is 30 to 49.
Serial numbers exceeding the above are 20 to 29. The outer ring starts from 20, and the inner ring starts from 29 in the opposite direction.

Series number

A number that is determined by internal specifications.

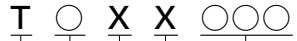
5.2.2 Numbers of metric tapered roller bearings based on ISO355

Dimension series previously not covered by 3XX are regulated under JIS B 1512. These dimension series are specified in ISO355 and consist of series codes of the angle, diameter, and width. In addition, the inner ring subunit and the outer ring are internationally interchangeable. The composition of bearing numbers are shown in **Table 5.4**. The series codes of the dimension series are shown in **Table 5.4 (1) to (3)**.

Table 5.4 Bearing number composition

Tapered roller bearing code	Dimension series			Bore diameter code
	Angle series	Diameter series	Width series	
T	○	X	X	○○○

Note: X in the table is represented by letters, and ○ is represented by numbers.



Tapered roller bearing code

Angle series code

This code represents the contact angle.
The classification is shown in **Table 5.4 (1)**.

Diameter series code

This code represents the ratio of the bearing outside diameter to the bearing inner diameter. The classification is shown in **Table 5.4 (2)**.

Table 5.4 (1) Angle series code

Code	Contact angle α	
	Over	Incl.
2	10°	13°52′
3	13°52′	15°59′
4	15°59′	18°55′
5	18°55′	23°
6	23°	27°
7	27°	30°

Table 5.4 (2) Diameter series code

Code	$\frac{D}{d^{0.77}}$	
	Over	Incl.
B	3.4	3.8
C	3.8	4.4
D	4.4	4.7
E	4.7	5
F	5	5.6
G	5.6	7

Note: Quantifiers
d: Nominal inner diameter
D: Nominal outside diameter

Bore diameter code

The bearing bore diameter is represented in mm.
Example) 040: bore diameter dimension 40 mm

Width series code

This code represents the ratio of the assembly width to the difference between the outer diameter and inner diameter of the single row bearing.
The classification is shown in **Table 5.4 (3)**.

Table 5.4 (3) Width series code

Code	$\frac{T}{(D-d)^{0.95}}$	
	Over	Incl.
B	0.50	0.68
C	0.68	0.80
D	0.80	0.88
E	0.88	1

Note: Quantifiers
d: Nominal inner diameter
D: Nominal outside diameter
T: Assembly width of single row bearing

Table 6.4 Tolerance of radial bearings (except tapered roller bearings)

Table 6.4 (1) Inner rings

Unit: μm

Nominal bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}										Variation of bore diameter in a single plane V_{dsp}															
		Class 0		Class 6		Class 5		Class 4[1]		Class 2[1]		Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4				
												Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Max.					Max.					Max.				
0.6[4]	2.5	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
2.5	10	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
10	18	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
18	30	0	−10	0	−8	0	−6	0	−5	0	−2.5	13	10	6	5	2.5	10	8	5	4	2.5	8	6	5	4	2.5
30	50	0	−12	0	−10	0	−8	0	−6	0	−2.5	15	13	8	6	2.5	12	10	6	5	2.5	9	8	6	5	2.5
50	80	0	−15	0	−12	0	−9	0	−7	0	−4	19	15	9	7	4	19	15	7	5	4	11	9	7	5	4
80	120	0	−20	0	−15	0	−10	0	−8	0	−5	25	19	10	8	5	25	19	8	6	5	15	11	8	6	5
120	150	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
150	180	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
180	250	0	−30	0	−22	0	−15	0	−12	0	−8	38	28	15	12	8	38	28	12	9	8	23	17	12	9	8
250	315	0	−35	0	−25	0	−18	—	—	—	—	44	31	18	—	—	44	31	14	—	—	26	19	14	—	—
315	400	0	−40	0	−30	0	−23	—	—	—	—	50	38	23	—	—	50	38	18	—	—	30	23	18	—	—
400	500	0	−45	0	−35	—	—	—	—	—	—	56	44	—	—	—	56	44	—	—	—	34	26	—	—	—
500	630	0	−50	0	−40	—	—	—	—	—	—	63	50	—	—	—	63	50	—	—	—	38	30	—	—	—
630	800	0	−75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
800	1 000	0	−100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 000	1 250	0	−125	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 600	2 000	0	−200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

1) The dimensional difference Δ_{ds} of the measured bore diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and also to all the diameter series for Class 2.

Variation of mean bore diameter V_{dmp}					Radial runout of inner ring of assembled bearing K_{ia}					Perpendicularity of inner ring face with respect to the bore S_d			Axial runout of inner ring of assembled bearing S_{ia}[2]			Deviation of a single inner ring width Δ_{Bs}								Variation of inner ring width V_{Bs}				
																Normal bearings					Duplex bearings[3]							
Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 0		Class 6		Class 5	Class 0		Class 6		Class 5	Class 4		
Max.					Max.					Max.			Max.			Upper	Lower	Upper	Lower	Class 4 Upper	Class 2 Upper	Lower	Upper	Lower	Upper	Lower	Class 4 Upper	Class 4 Lower
6	5	3	2	1.5	10	5	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−40	0	−40	0	−40	—	—	0	−250	12	12	5	2.5	1.5
6	5	3	2	1.5	10	6	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−120	0	−40	0	−40	0	−250	0	−250	15	15	5	2.5	1.5
6	5	3	2	1.5	10	7	4	2.5	1.5	7	3	1.5	7	3	1.5	0	−120	0	−80	0	−80	0	−250	0	−250	20	20	5	2.5	1.5
8	6	3	2.5	1.5	13	8	4	3	2.5	8	4	1.5	8	4	2.5	0	−120	0	−120	0	−120	0	−250	0	−250	20	20	5	2.5	1.5
9	8	4	3	1.5	15	10	5	4	2.5	8	4	1.5	8	4	2.5	0	−120	0	−120	0	−120	0	−250	0	−250	20	20	5	3	1.5
11	9	5	3.5	2	20	10	5	4	2.5	8	5	1.5	8	5	2.5	0	−150	0	−150	0	−150	0	−380	0	−250	25	25	6	4	1.5
15	11	5	4	2.5	25	13	6	5	2.5	9	5	2.5	9	5	2.5	0	−200	0	−200	0	−200	0	−380	0	−380	25	25	7	4	2.5
19	14	7	5	3.5	30	18	8	6	2.5	10	6	2.5	10	7	2.5	0	−250	0	−250	0	−250	0	−500	0	−380	30	30	8	5	2.5
19	14	7	5	3.5	30	18	8	6	5	10	6	4	10	7	5	0	−250	0	−250	0	−250	0	−500	0	−380	30	30	8	5	4
23	17	8	6	4	40	20	10	8	5	11	7	5	13	8	5	0	−300	0	−300	0	−300	0	−500	0	−500	30	30	10	6	5
26	19	9	—	—	50	25	13	—	—	13	—	—	15	—	—	0	−350	0	—	—	—	0	−500	0	—	35	35	13	—	—
30	23	12	—	—	60	30	15	—	—	15	—	—	20	—	—	0	−400	0	—	—	—	0	−630	0	—	40	40	15	—	—
34	26	—	—	—	65	35	—	—	—	—	—	—	—	—	—	0	−450	—	—	—	—	—	—	—	—	50	45	—	—	—
38	30	—	—	—	70	40	—	—	—	—	—	—	—	—	—	0	−500	—	—	—	—	—	—	—	—	60	50	—	—	—
55	—	—	—	—	80	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	70	—	—	—	—
75	—	—	—	—	90	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	80	—	—	—	—
94	—	—	—	—	100	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	100	—	—	—	—
120	—	—	—	—	120	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	120	—	—	—	—
150	—	—	—	—	140	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	140	—	—	—	—

2) Applies to ball bearings such as deep groove ball bearings and angular ball bearings.
3) Applies to individual raceway rings manufactured for combined bearing use.
4) The nominal bore diameter of bearings of 0.6 mm is included in this dimensional division.

Table 6.4 (2) Outer rings

Unit: μm

Nominal outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}										Variation of outside diameter in a single plane[6] V_{Dsp} Open bearing															
		Class 0		Class 6		Class 5		Class 4[5]		Class 2[5]		Diameter series 9					Diameter series 0, 1					Diameter series 2, 3, 4				
												Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2	Class 0	Class 6	Class 5	Class 4	Class 2
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Max.					Max.					Max.				
2.5[8]	6	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
6	18	0	−8	0	−7	0	−5	0	−4	0	−2.5	10	9	5	4	2.5	8	7	4	3	2.5	6	5	4	3	2.5
18	30	0	−9	0	−8	0	−6	0	−5	0	−4	12	10	6	5	4	9	8	5	4	4	7	6	5	4	4
30	50	0	−11	0	−9	0	−7	0	−6	0	−4	14	11	7	6	4	11	9	5	5	4	8	7	5	5	4
50	80	0	−13	0	−11	0	−9	0	−7	0	−4	16	14	9	7	4	13	11	7	5	4	10	8	7	5	4
80	120	0	−15	0	−13	0	−10	0	−8	0	−5	19	16	10	8	5	19	16	8	6	5	11	10	8	6	5
120	150	0	−18	0	−15	0	−11	0	−9	0	−5	23	19	11	9	5	23	19	8	7	5	14	11	8	7	5
150	180	0	−25	0	−18	0	−13	0	−10	0	−7	31	23	13	10	7	31	23	10	8	7	19	14	10	8	7
180	250	0	−30	0	−20	0	−15	0	−11	0	−8	38	25	15	11	8	38	25	11	8	8	23	15	11	8	8
250	315	0	−35	0	−25	0	−18	0	−13	0	−8	44	31	18	13	8	44	31	14	10	8	26	19	14	10	8
315	400	0	−40	0	−28	0	−20	0	−15	0	−10	50	35	20	15	10	50	35	15	11	10	30	21	15	11	10
400	500	0	−45	0	−33	0	−23	—	—	—	—	56	41	23	—	—	56	41	17	—	—	34	25	17	—	—
500	630	0	−50	0	−38	0	−28	—	—	—	—	63	48	28	—	—	63	48	21	—	—	38	29	21	—	—
630	800	0	−75	0	−45	0	−35	—	—	—	—	94	56	35	—	—	94	56	26	—	—	55	34	26	—	—
800	1 000	0	−100	0	−60	—	—	—	—	—	—	125	75	—	—	—	125	75	—	—	—	75	45	—	—	—
1 000	1 250	0	−125	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 250	1 600	0	−160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 600	2 000	0	−200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2 000	2 500	0	−250	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5) The dimensional difference Δ_{Ds} of the measured outer diameter applied to Classes 4 and 2 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outer diameter within a plane. However, the dimensional difference is applied to diameter series 0, 1, 2, 3 and 4 for Class 4, and also to all the diameter series for Class 2.

Variation of outside diameter in a single plane V_{DSp}[6] Sealed/shield bearings diameter Diameter series 2,3,4 Class 0 Class 6 Max.		Variation of mean outside diameter V_{Dmp}					Radial runout of outer ring of assembled bearing K_{ea}					Perpendicularity of outer ring outside surface with respect to the face S_D			Axial runout of outer ring of assembled bearing S_{ea}[7]			Deviation of a single outer ring width Δ_{Cs} All classes	Variation of outer ring width V_{Cs}			
		Class 0		Class 6		Class 5	Class 0		Class 6		Class 5	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2		Class 0,6	Class 5	Class 4	Class 2
Max.							Max.					Max.			Max.				Max.			
10	9	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5	8	5	1.5			5	2.5	1.5
10	9	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5	8	5	1.5			5	2.5	1.5
12	10	7	6	3	2.5	2	15	9	6	4	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
16	13	8	7	4	3	2	20	10	7	5	2.5	8	4	1.5	8	5	2.5			5	2.5	1.5
20	16	10	8	5	3.5	2	25	13	8	5	4	8	4	1.5	10	5	4			6	3	1.5
26	20	11	10	5	4	2.5	35	18	10	6	5	9	5	2.5	11	6	5			8	4	2.5
30	25	14	11	6	5	2.5	40	20	11	7	5	10	5	2.5	13	7	5			8	5	2.5
38	30	19	14	7	5	3.5	45	23	13	8	5	10	5	2.5	14	8	5			8	5	2.5
—	—	23	15	8	6	4	50	25	15	10	7	11	7	4	15	10	7			10	7	4
—	—	26	19	9	7	4	60	30	18	11	7	13	8	5	18	10	7			11	7	5
—	—	30	21	10	8	5	70	35	20	13	8	13	10	7	20	13	8			13	8	7
—	—	34	25	12	—	—	80	40	23	—	—	15	—	—	23	—	—			15	—	—
—	—	38	29	14	—	—	100	50	25	—	—	18	—	—	25	—	—			18	—	—
—	—	55	34	18	—	—	120	60	30	—	—	20	—	—	30	—	—			20	—	—
—	—	75	45	—	—	—	140	75	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	—	—	160	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	—	—	190	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	—	—	220	—	—	—	—	—	—	—	—	—	—			—	—	—
—	—	—	—	—	—	—	250	—	—	—	—	—	—	—	—	—	—			—	—	—

6) Applies to cases where snap rings are not installed on the bearings.
7) Applies to ball bearings such as deep groove ball bearings and angular ball bearings.
8) The nominal bore diameter of bearings of 2.5 mm is included in this dimensional division.

Table 6.5 Tolerance of tapered roller bearings (metric series)

Table 6.5 (1) Inner rings

Unit: μm

Nominal bore diameter d mm		Deviation of mean bore diameter in a single plane Δ_{dmp}						Variation of bore diameter in a single plane V_{dsp}				Variation of mean bore diameter V_{dmp}				Radial runout of inner ring of assembled bearing K_{ia}				Perpendicularity of inner ring face with respect to the bore S_d	
		Class 0 Class 6×		Class 6 [1] Class 5		Class 4 [2]		Class 0				Class 0				Class 0				Class 5	Class 4
								Class 6×	Class 6 [1]	Class 5	Class 4	Class 6×	Class 6 [1]	Class 5	Class 4	Class 6×	Class 6 [1]	Class 5	Class 4		
		Max.						Max.				Max.				Max.				Max.	
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower														
10	18	0	−12	0	−7	0	−5	12	7	5	4	9	5	5	4	15	7	5	3	7	3
18	30	0	−12	0	−8	0	−6	12	8	6	5	9	6	5	4	18	8	5	3	8	4
30	50	0	−12	0	−10	0	−8	12	10	8	6	9	8	5	5	20	10	6	4	8	4
50	80	0	−15	0	−12	0	−9	15	12	9	7	11	9	6	5	25	10	7	4	8	5
80	120	0	−20	0	−15	0	−10	20	15	11	8	15	11	8	5	30	13	8	5	9	5
120	180	0	−25	0	−18	0	−13	25	18	14	10	19	14	9	7	35	18	11	6	10	6
180	250	0	−30	0	−22	0	−15	30	22	17	11	23	16	11	8	50	20	13	8	11	7
250	315	0	−35	—	—	—	—	35	—	—	—	26	—	—	—	60	—	—	—	—	—
315	400	0	−40	—	—	—	—	40	—	—	—	30	—	—	—	70	—	—	—	—	—

1) Class 6 is the **NTN** standard class.
2) The dimensional difference Δ_{ds} of the measured bore diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{dmp} of the mean bore diameter within a plane.

Table 6.5 (2) Outer rings

Unit: μm

Nominal outside diameter D mm		Deviation of mean outside diameter in a single plane Δ_{Dmp}						Variation of outside diameter in a single plane V_{Dsp}				Variation of mean outside diameter V_{Dmp}				Radial runout of outer ring of assembled bearing K_{ea}				Perpendicularity of outer ring outside surface with respect to the face S_D [3]	
		Class 0 Class 6×		Class 6 [1] Class 5		Class 4 [4]		Class 0				Class 0				Class 0				Class 5	Class 4
								Class 6×	Class 6 [1]	Class 5	Class 4	Class 6×	Class 6 [1]	Class 5	Class 4	Class 6×	Class 6 [1]	Class 5	Class 4		
		Max.						Max.				Max.				Max.				Max.	
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower														
18	30	0	−12	0	−8	0	−6	12	8	6	5	9	6	5	4	18	9	6	4	8	4
30	50	0	−14	0	−9	0	−7	14	9	7	5	11	7	5	5	20	10	7	5	8	4
50	80	0	−16	0	−11	0	−9	16	11	8	7	12	8	6	5	25	13	8	5	8	4
80	120	0	−18	0	−13	0	−10	18	13	10	8	14	10	7	5	35	18	10	6	9	5
120	150	0	−20	0	−15	0	−11	20	15	11	8	15	11	8	6	40	20	11	7	10	5
150	180	0	−25	0	−18	0	−13	25	18	14	10	19	14	9	7	45	23	13	8	10	5
180	250	0	−30	0	−20	0	−15	30	20	15	11	23	15	10	8	50	25	15	10	11	7
250	315	0	−35	0	−25	0	−18	35	25	19	14	26	19	13	9	60	30	18	11	13	8
315	400	0	−40	0	−28	0	−20	40	28	22	15	30	21	14	10	70	35	20	13	13	10
400	500	0	−45	—	—	—	—	45	—	—	—	34	—	—	—	80	—	—	—	—	—
500	630	0	−50	—	—	—	—	60	—	—	—	38	—	—	—	100	—	—	—	—	—

3) Does not apply to bearings with flange.
4) The dimensional difference Δ_{Ds} of the measured outer diameter applied to Class 4 is the same as the tolerance of dimensional difference Δ_{Dmp} of the mean outer diameter within a plane.

Unit: μm

Axial runout of inner ring of assembled bearing S_{ia} Class 4 Max.	Deviation of a single inner ring width Δ_{Bs} Class 0 Class 6		Class 6×		Class 5 Class 4		Deviation of the actual assembled bearing width Δ_{Ts} Class 0 Class 6		Class 6×		Class 5 Class 4	
	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
3	0	−120	0	−50	0	−200	+200	0	+100	0	+200	−200
4	0	−120	0	−50	0	−200	+200	0	+100	0	+200	−200
4	0	−120	0	−50	0	−240	+200	0	+100	0	+200	−200
4	0	−150	0	−50	0	−300	+200	0	+100	0	+200	−200
5	0	−200	0	−50	0	−400	+200	−200	+100	0	+200	−200
7	0	−250	0	−50	0	−500	+350	−250	+150	0	+350	−250
8	0	−300	0	−50	0	−600	+350	−250	+150	0	+350	−250
—	0	−350	0	−50	—	—	+350	−250	+200	0	—	—
—	0	−400	0	−50	—	—	+400	−400	+200	0	—	—

Unit: μm

Axial runout of outer ring of assembled bearing S_{ea} Class 4 Max.	Deviation of a single outer ring width Δ_{Cs} Class 0, Class 6 [1] Class 5, Class 4		Class 6× [5]	
	Upper	Lower	Upper	Lower
5	Depends on tolerance of Δ_{Bs} in relation to d of the same bearing		0	−100
5			0	−100
5			0	−100
6			0	−100
7			0	−100
8			0	−100
10			0	−100
10			0	−100
13			0	−100
—			0	−100
—			0	−100

5) Applies to bearings with a nominal bore diameter d over 10 mm and 400 mm or less.

Table 6.5 (3) Effective width of inner subunits and outer rings

Unit: μm

Nominal bore diameter d mm		Deviation of the actual effective width of inner subunit assembled with a master outer ring Δ_{T1s} Class 0		Class 6×		Deviation of the actual effective width of outer ring assembled with a master inner subunit Δ_{T2s} Class 0		Class 6×	
Over	Incl.	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower
10	18	+100	0	+50	0	+100	0	+50	0
18	30	+100	0	+50	0	+100	0	+50	0
30	50	+100	0	+50	0	+100	0	+50	0
50	80	+100	0	+50	0	+100	0	+50	0
80	120	+100	−100	+50	0	+100	−100	+50	0
120	180	+150	−150	+50	0	+200	−100	+100	0
180	250	+150	−150	+50	0	+200	−100	+100	0
250	315	+150	−150	+100	0	+200	−100	+100	0
315	400	+200	−200	+100	0	+200	−200	+100	0

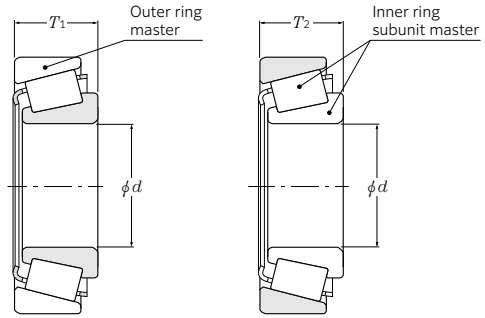


Table 7.2 General standards for radial bearing fits (JIS Class 0, 6X, 6)

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 8.7 Average raceway diameter (approximate expression)

Bearing type		Average raceway diameter	
		Inner ring	Outer ring
Ball bearing	All types	$1.05\ \frac{4d+D}{5}$	$0.95\ \frac{d+4D}{5}$
Self-aligning ball bearing	12	$1.03\ \frac{3d+D}{4}$	$0.97\ \frac{d+2D}{3}$
	13, 22	$1.03\ \frac{3d+D}{4}$	$0.97\ \frac{d+3D}{4}$
	23	$1.03\ \frac{4d+D}{5}$	$0.97\ \frac{d+4D}{5}$
Cylindrical roller bearing 1)	All types	$1.05\ \frac{3d+D}{5}$	$0.98\ \frac{d+3D}{4}$
Self-aligning roller bearing	Type B, type C, type 213	$\frac{2d+D}{3}$	$0.97\ \frac{d+4D}{5}$
	ULTAGE series	$\frac{3d+D}{4}$	$0.98\ \frac{d+5D}{6}$
Tapered roller bearing	All types	$\frac{3d+D}{4}$	$\frac{d+3D}{4}$

1) Average raceway diameter values shown for double-flange type.

(3) Reduced internal clearance due to inner/outer ring temperature difference.

During operation, normally the outer ring will range from 5 to 10°C cooler than the inner ring or rotating parts. However, if the cooling effect of the housing is large, the shaft is connected to a heat source, or a heated substance is conducted through the hollow shaft; the temperature difference between the two rings can be even greater. **The amount of internal clearance is thus further reduced** by the differential expansion of the two rings.

$$\delta_t = \alpha \cdot \Delta T \cdot D_o \quad \cdots\cdots(8.5)$$

δ_t : Reduced amount of clearance due to temperature differential of inner and outer rings, mm

α : Bearing material expansion coefficient 12.5×10^{-6}/°C

ΔT : Inner/outer ring temperature differential, °C

D_o : Outer ring raceway diameter, mm

Outer ring raceway diameter, D_o, values can be approximated by using formula (8.6) or (8.7).

For ball bearings and spherical roller bearings,

$$D_o = 0.20(d + 4.0D) \quad \cdots\cdots(8.6)$$

For roller bearings (except spherical roller bearings),

$$D_o = 0.25(d + 3.0D) \quad \cdots\cdots(8.7)$$

d : Bearing bore diameter, mm

D : Bearing outside diameter, mm

For the ULTAGE series bearings, consult **NTN** Engineering.

Note that the formula in item 8.2.2 only applies to steel bearings, shafts and housings.

"Operating clearance calculation (based on 3σ)" can be done by using the bearing technique calculation tool on the **NTN** website (https://www.ntnglobal.com).

Table 8.8 Radial internal clearance of deep groove ball bearings

Unit: μm

Nominal bearing bore diameter d mm		C2		CN		C3		C4		C5	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
—	2.5	0	6	4	11	10	20	—	—	—	—
2.5	6	0	7	2	13	8	23	—	—	—	—
6	10	0	7	2	13	8	23	14	29	20	37
10	18	0	9	3	18	11	25	18	33	25	45
18	24	0	10	5	20	13	28	20	36	28	48
24	30	1	11	5	20	13	28	23	41	30	53
30	40	1	11	6	20	15	33	28	46	40	64
40	50	1	11	6	23	18	36	30	51	45	73
50	65	1	15	8	28	23	43	38	61	55	90
65	80	1	15	10	30	25	51	46	71	65	105
80	100	1	18	12	36	30	58	53	84	75	120
100	120	2	20	15	41	36	66	61	97	90	140
120	140	2	23	18	48	41	81	71	114	105	160
140	160	2	23	18	53	46	91	81	130	120	180
160	180	2	25	20	61	53	102	91	147	135	200
180	200	2	30	25	71	63	117	107	163	150	230
200	225	2	35	25	85	75	140	125	195	175	265
225	250	2	40	30	95	85	160	145	225	205	300
250	280	2	45	35	105	90	170	155	245	225	340
280	315	2	55	40	115	100	190	175	270	245	370
315	355	3	60	45	125	110	210	195	300	275	410
355	400	3	70	55	145	130	240	225	340	315	460
400	450	3	80	60	170	150	270	250	380	350	510
450	500	3	90	70	190	170	300	280	420	390	570
500	560	10	100	80	210	190	330	310	470	440	630
560	630	10	110	90	230	210	360	340	520	490	690

Table 8.9 Radial internal clearance of self-aligning ball bearings

Nominal bearing bore diameter d mm Over	Incl.	Cylindrical bore bearing C2 Min.	C2 Max.	CN Min.	CN Max.	C3 Min.	C3 Max.	C4 Min.	C4 Max.	C5 Min.	C5 Max.
2.5	6	1	8	5	15	10	20	15	25	21	33
6	10	2	9	6	17	12	25	19	33	27	42
10	14	2	10	6	19	13	26	21	35	30	48
14	18	3	12	8	21	15	28	23	37	32	50
18	24	4	14	10	23	17	30	25	39	34	52
24	30	5	16	11	24	19	35	29	46	40	58
30	40	6	18	13	29	23	40	34	53	46	66
40	50	6	19	14	31	25	44	37	57	50	71
50	65	7	21	16	36	30	50	45	69	62	88
65	80	8	24	18	40	35	60	54	83	76	108
80	100	9	27	22	48	42	70	64	96	89	124
100	120	10	31	25	56	50	83	75	114	105	145
120	140	10	38	30	68	60	100	90	135	125	175
140	160	15	44	35	80	70	120	110	161	150	210

Table 8.10 (1) Radial internal clearance for duplex angular contact ball bearings

Unit: μm

Nominal bearing bore diameter d mm Over	Incl.	C1 Min.	C1 Max.	C2 Min.	C2 Max.	CN Min.	CN Max.	C3 Min.	C3 Max.	C4 Min.	C4 Max.
—	10	3	8	6	12	8	15	15	22	22	30
10	18	3	8	6	12	8	15	15	24	30	40
18	30	3	10	6	12	10	20	20	32	40	55
30	50	3	10	8	14	14	25	25	40	55	75
50	80	3	11	11	17	17	32	32	50	75	95
80	100	3	13	13	22	22	40	40	60	95	120
100	120	3	15	15	30	30	50	50	75	110	140
120	150	3	16	16	33	35	55	55	80	130	170
150	180	3	18	18	35	35	60	60	90	150	200
180	200	3	20	20	40	40	65	65	100	180	240

Note: The clearance group in the table is applied only to contact angles in the table below.

Contact angle symbol	Nominal contact angle	Applicable clearance [2]
C	15°	C1, C2
A [1]	30°	C2, CN, C3
B	40°	CN, C3, C4

1) Not indicated for bearing number.
2) For information concerning clearance other than applicable clearance, please contact **NTN** Engineering.

Table 8.10 (2) Radial internal clearance of double row angular contact ball bearings

Unit: μm

Nominal bearing bore diameter d mm Over	Incl.	C2 Min.	C2 Max.	CN Min.	CN Max.	C3 Min.	C3 Max.	C4 Min.	C4 Max.	C5 Min.	C5 Max.
10only		0	10	5	15	10	21	16	28	24	36
10	18	1	11	6	16	12	23	19	31	28	40
18	24	1	11	6	16	13	24	21	33	31	43
24	30	1	13	6	19	13	26	21	35	31	45
30	40	2	15	7	22	15	30	24	39	35	50
40	50	2	15	9	24	17	32	28	45	40	57
50	65	0	15	7	24	16	33	28	48	41	61
65	80	1	17	11	31	21	42	34	56	50	74
80	100	3	20	13	36	25	49	40	65	58	67

Table 8.11 Radial internal clearance of bearings for electric motor

Unit: μm

Nominal bearing bore diameter d mm Over	Incl.	Radial internal clearance CM Deep groove ball bearing Min.	Deep groove ball bearing Max.	Cylindrical roller bearing Min.	Cylindrical roller bearing Max.
10	18	4	11	—	—
18	24	5	12	—	—
24	30	5	12	15	30
30	40	9	17	15	30
40	50	9	17	20	35
50	65	12	22	25	40
65	80	12	22	30	45
80	100	18	30	35	55
100	120	18	30	35	60
120	140	24	38	40	65
140	160	24	38	50	80
160	180	—	—	60	90
180	200	—	—	65	100

Note: 1. Suffix CM is added to bearing numbers.
Example: 6205 ZZ CM
2. Clearance not interchangeable for cylindrical roller bearings.

Unit: μm

Tapered bore bearing C2 Min.	C2 Max.	CN Min.	CN Max.	C3 Min.	C3 Max.	C4 Min.	C4 Max.	C5 Min.	C5 Max.	Nominal bearing bore diameter d mm Over	Incl.
—	—	—	—	—	—	—	—	—	—	2.5	6
—	—	—	—	—	—	—	—	—	—	6	10
—	—	—	—	—	—	—	—	—	—	10	14
—	—	—	—	—	—	—	—	—	—	14	18
7	17	13	26	20	33	28	42	37	55	18	24
9	20	15	28	23	39	33	50	44	62	24	30
12	24	19	35	29	46	40	59	52	72	30	40
14	27	22	39	33	52	45	65	58	79	40	50
18	32	27	47	41	61	56	80	73	99	50	65
23	39	35	57	50	75	69	98	91	123	65	80
29	47	42	68	62	90	84	116	109	144	80	100
35	56	50	81	75	108	100	139	130	170	100	120
40	68	60	98	90	130	120	165	155	205	120	140
45	74	65	110	100	150	140	191	180	240	140	160

Table 8.12 Interchangeable radial internal clearance for cylindrical roller bearing (cylindrical bore)

Unit: μm

Nominal bearing bore diameter d mm Over	Incl.	C2 Min.	C2 Max.	CN Min.	CN Max.	C3 Min.	C3 Max.	C4 Min.	C4 Max.	C5 Min.	C5 Max.
—	10	0	25	20	45	35	60	50	75	—	—
10	24	0	25	20	45	35	60	50	75	65	90
24	30	0	25	20	45	35	60	50	75	70	95
30	40	5	30	25	50	45	70	60	85	80	105
40	50	5	35	30	60	50	80	70	100	95	125
50	65	10	40	40	70	60	90	80	110	110	140
65	80	10	45	40	75	65	100	90	125	130	165
80	100	15	50	50	85	75	110	105	140	155	190
100	120	15	55	50	90	85	125	125	165	180	220
120	140	15	60	60	105	100	145	145	190	200	245
140	160	20	70	70	120	115	165	165	215	225	275
160	180	25	75	75	125	120	170	170	220	250	300
180	200	35	90	90	145	140	195	195	250	275	330
200	225	45	105	105	165	160	220	220	280	305	365
225	250	45	110	110	175	170	235	235	300	330	395
250	280	55	125	125	195	190	260	260	330	370	440
280	315	55	130	130	205	200	275	275	350	410	485
315	355	65	145	145	225	225	305	305	385	455	535
355	400	100	190	190	280	280	370	370	460	510	600
400	450	110	210	210	310	310	410	410	510	565	665
450	500	110	220	220	330	330	440	440	550	625	735

Table 8.13 Non-interchangeable radial internal clearance for cylindrical roller bearing

Unit: μm

Nominal bearing bore diameter d mm		Cylindrical bore bearing											
		C1NA		C2NA		NA [1]		C3NA		C4NA		C5NA	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
—	10	5	10	10	20	20	30	35	45	45	55	—	—
10	18	5	10	10	20	20	30	35	45	45	55	65	75
18	24	5	10	10	20	20	30	35	45	45	55	65	75
24	30	5	10	10	25	25	35	40	50	50	60	70	80
30	40	5	12	12	25	25	40	45	55	55	70	80	95
40	50	5	15	15	30	30	45	50	65	65	80	95	110
50	65	5	15	15	35	35	50	55	75	75	90	110	130
65	80	10	20	20	40	40	60	70	90	90	110	130	150
80	100	10	25	25	45	45	70	80	105	105	125	155	180
100	120	10	25	25	50	50	80	95	120	120	145	180	205
120	140	15	30	30	60	60	90	105	135	135	160	200	230
140	160	15	35	35	65	65	100	115	150	150	180	225	260
160	180	15	35	35	75	75	110	125	165	165	200	250	285
180	200	20	40	40	80	80	120	140	180	180	220	275	315
200	225	20	45	45	90	90	135	155	200	200	240	305	350
225	250	25	50	50	100	100	150	170	215	215	265	330	380
250	280	25	55	55	110	110	165	185	240	240	295	370	420
280	315	30	60	60	120	120	180	205	265	265	325	410	470
315	355	30	65	65	135	135	200	225	295	295	360	455	520
355	400	35	75	75	150	150	225	255	330	330	405	510	585
400	450	45	85	85	170	170	255	285	370	370	455	565	650
450	500	50	95	95	190	190	285	315	410	410	505	625	720

1) For bearings with normal clearance, only NA is added to bearing numbers. Example: NU310NA

Table 8.14 Axial internal clearance for double row and duplex tapered roller bearings (metric series)

Unit: μm

Nominal bearing bore diameter d mm		Contact α ≦ 27° (e ≦ 0.76)								Contact α > 27° (e > 0.76)								Nominal bearing bore diameter d mm	
		C2		CN		C3		C4		C2		CN		C3		C4			
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Over	Incl.
18	24	25	75	75	125	125	170	170	220	10	30	30	50	50	70	70	90	18	24
24	30	25	75	75	125	145	195	195	245	10	30	30	50	60	80	80	100	24	30
30	40	25	95	95	165	165	235	210	280	10	40	40	70	70	100	90	120	30	40
40	50	20	85	85	150	175	240	240	305	10	40	40	70	80	110	110	140	40	50
50	65	20	85	110	175	195	260	280	350	10	40	50	80	90	120	130	160	50	65
65	80	20	110	130	220	240	325	325	410	10	50	60	100	110	150	150	190	65	80
80	100	45	150	150	260	280	390	390	500	20	70	70	120	130	180	180	230	80	100
100	120	45	175	175	305	350	480	455	585	20	70	70	120	150	200	210	260	100	120
120	140	45	175	175	305	390	520	500	630	20	70	70	120	160	210	210	260	120	140
140	160	60	200	200	340	400	540	520	660	30	100	100	160	180	240	240	300	140	160
160	180	80	220	240	380	440	580	600	740	—	—	—	—	—	—	—	—	160	180
180	200	100	260	260	420	500	660	660	820	—	—	—	—	—	—	—	—	180	200
200	225	120	300	300	480	560	740	720	900	—	—	—	—	—	—	—	—	200	225
225	250	160	360	360	560	620	820	820	1 020	—	—	—	—	—	—	—	—	225	250
250	280	180	400	400	620	700	920	920	1 140	—	—	—	—	—	—	—	—	250	280
280	315	200	440	440	680	780	1 020	1 020	1 260	—	—	—	—	—	—	—	—	280	315
315	355	220	480	500	760	860	1 120	1 120	1 380	—	—	—	—	—	—	—	—	315	355
355	400	260	560	560	860	980	1 280	1 280	1 580	—	—	—	—	—	—	—	—	355	400
400	500	300	600	620	920	1 100	1 400	1 440	1 740	—	—	—	—	—	—	—	—	400	500
500	560	350	650	750	1 050	1 250	1 550	1 650	1 950	—	—	—	—	—	—	—	—	500	560
560	630	400	700	850	1 150	1 400	1 700	1 850	2 150	—	—	—	—	—	—	—	—	560	630

Note: 1. This table applies to bearings contained in the catalog. For information concerning other bearings or bearings using US customary units, please contact **NTN** Engineering.
2. The correlation of axial internal clearance (Δa) and radial internal clearance (Δr) is expressed as $\Delta r = 0.667 \times e \times \Delta a$.
e: Constant (see dimensions table)
3. The table does not apply to the bearing series 329X, 330, 322C, and 323C, 303C, and T4CB.

Unit: μm

Tapered bore bearing												Nominal bearing bore diameter d mm	
C9NA [2]		C0NA [2]		C1NA		C2NA		NA [1]		C3NA			
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Over	Incl.
5	5	7	17	10	20	20	30	35	45	45	55	—	10
5	10	7	17	10	20	20	30	35	45	45	55	10	18
5	10	7	17	10	20	20	30	35	45	45	55	18	24
5	10	10	20	10	25	25	35	40	50	50	60	24	30
5	12	10	20	12	25	25	40	45	55	55	70	30	40
5	15	10	20	15	30	30	45	50	65	65	80	40	50
5	15	10	20	15	35	35	50	55	75	75	90	50	65
10	20	15	30	20	40	40	60	70	90	90	110	65	80
10	25	20	35	25	45	45	70	80	105	105	125	80	100
10	25	20	35	25	50	50	80	95	120	120	145	100	120
15	30	25	40	30	60	60	90	105	135	135	160	120	140
15	35	30	45	35	65	65	100	115	150	150	180	140	160
15	35	30	45	35	75	75	110	125	165	165	200	160	180
20	40	30	50	40	80	80	120	140	180	180	220	180	200
20	45	35	55	45	90	90	135	155	200	200	240	200	225
25	50	40	65	50	100	100	150	170	215	215	265	225	250
25	55	40	65	55	110	110	165	185	240	240	295	250	280
30	60	45	75	60	120	120	180	205	265	265	325	280	315
30	65	45	75	65	135	135	200	225	295	295	360	315	355
35	75	50	90	75	150	150	225	255	330	330	405	355	400
45	85	60	100	85	170	170	255	285	370	370	455	400	450
50	95	70	115	95	190	190	285	315	410	410	505	450	500

2) C9NA, C0NA and C1NA clearances are applied only to precision bearings of JIS Class 5 and higher.

Table 8.15 Radial internal clearance of spherical roller bearings

Unit: μm

Nominal bearing bore diameter d mm		Cylindrical bore bearing									
		C2		CN		C3		C4		C5	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
14	18	10	20	20	35	35	45	45	60	60	75
18	24	10	20	20	35	35	45	45	60	60	75
24	30	15	25	25	40	40	55	55	75	75	95
30	40	15	30	30	45	45	60	60	80	80	100
40	50	20	35	35	55	55	75	75	100	100	125
50	65	20	40	40	65	65	90	90	120	120	150
65	80	30	50	50	80	80	110	110	145	145	180
80	100	35	60	60	100	100	135	135	180	180	225
100	120	40	75	75	120	120	160	160	210	210	260
120	140	50	95	95	145	145	190	190	240	240	300
140	160	60	110	110	170	170	220	220	280	280	350
160	180	65	120	120	180	180	240	240	310	310	390
180	200	70	130	130	200	200	260	260	340	340	430
200	225	80	140	140	220	220	290	290	380	380	470
225	250	90	150	150	240	240	320	320	420	420	520
250	280	100	170	170	260	260	350	350	460	460	570
280	315	110	190	190	280	280	370	370	500	500	630
315	355	120	200	200	310	310	410	410	550	550	690
355	400	130	220	220	340	340	450	450	600	600	750
400	450	140	240	240	370	370	500	500	660	660	820
450	500	140	260	260	410	410	550	550	720	720	900
500	560	150	280	280	440	440	600	600	780	780	1 000
560	630	170	310	310	480	480	650	650	850	850	1 100
630	710	190	350	350	530	530	700	700	920	920	1 190
710	800	210	390	390	580	580	770	770	1 010	1 010	1 300
800	900	230	430	430	650	650	860	860	1 120	1 120	1 440
900	1 000	260	480	480	710	710	930	930	1 220	1 220	1 570
1 000	1 120	290	530	530	780	780	1 020	1 020	1 330	1 330	1 720
1 120	1 250	320	580	580	860	860	1 120	1 120	1 460	1 460	1 870
1 250	1 400	350	640	640	950	950	1 240	1 240	1 620	1 620	2 080

Table 8.16 Axial internal clearance of four points contact ball bearings

Unit: μm

Nominal bearing bore diameter d mm		C2		CN		C3		C4	
Over	Incl.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
17	40	26	66	56	106	96	146	136	186
40	60	36	86	76	126	116	166	156	206
60	80	46	96	86	136	126	176	166	226
80	100	56	106	96	156	136	196	186	246
100	140	66	126	116	176	156	216	206	266
140	180	76	156	136	196	176	236	226	296
180	220	96	176	156	216	196	256	246	316

Unit: μm

Tapered bore bearing										Nominal bearing bore diameter d mm	
C2		CN		C3		C4		C5			
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Over	Incl.
—	—	—	—	—	—	—	—	—	—	14	18
15	25	25	35	35	45	45	60	60	75	18	24
20	30	30	40	40	55	55	75	75	95	24	30
25	35	35	50	50	65	65	85	85	105	30	40
30	45	45	60	60	80	80	100	100	130	40	50
40	55	55	75	75	95	95	120	120	160	50	65
50	70	70	95	95	120	120	150	150	200	65	80
55	80	80	110	110	140	140	180	180	230	80	100
65	100	100	135	135	170	170	220	220	280	100	120
80	120	120	160	160	200	200	260	260	330	120	140
90	130	130	180	180	230	230	300	300	380	140	160
100	140	140	200	200	260	260	340	340	430	160	180
110	160	160	220	220	290	290	370	370	470	180	200
120	180	180	250	250	320	320	410	410	520	200	225
140	200	200	270	270	350	350	450	450	570	225	250
150	220	220	300	300	390	390	490	490	620	250	280
170	240	240	330	330	430	430	540	540	680	280	315
190	270	270	360	360	470	470	590	590	740	315	355
210	300	300	400	400	520	520	650	650	820	355	400
230	330	330	440	440	570	570	720	720	910	400	450
260	370	370	490	490	630	630	790	790	1 000	450	500
290	410	410	540	540	680	680	870	870	1 100	500	560
320	460	460	600	600	760	760	980	980	1 230	560	630
350	510	510	670	670	850	850	1 090	1 090	1 360	630	710
390	570	570	750	750	960	960	1 220	1 220	1 500	710	800
440	640	640	840	840	1 070	1 070	1 370	1 370	1 690	800	900
490	710	710	930	930	1 190	1 190	1 520	1 520	1 860	900	1 000
530	770	770	1 030	1 030	1 300	1 300	1 670	1 670	2 050	1 000	1 120
570	830	830	1 120	1 120	1 420	1 420	1 830	1 830	2 250	1 120	1 250
620	910	910	1 230	1 230	1 560	1 560	2 000	2 000	2 470	1 250	1 400

For spherical roller bearings, **Table 15.1** (applied to ULTAGE series) and **Table 15.2** (applied to other bearings besides ULTAGE series) indicates the predetermined interference which will be achieved as a result of the radial internal clearance decrease, or the distance the bearing has been driven onto the shaft.

For conditions such as heavy loads, high speeds, or when there is a large temperature differential between inner and outer rings, etc. which require large interference fits, bearings with a minimum radial internal clearance of C3 or greater should be used. **Table 15.1** and **Table 15.2** list the maximum values for radial internal clearance decrease and axial displacement. The remaining clearance in mounted bearings with tapered bores must be greater than the minimum allowable residual clearance listed in **Table 15.1** or **Table 15.2**.

For self-aligning ball bearings, a predetermined interference can be obtained by tightening the nut until the radial internal clearance becomes about half the size before the fitting. After installation, check that the bearing lightly and smoothly rotates.

Table 15.1 Tapered bore spherical roller bearings (ULTAGE series installation) Unit: mm

Nominal bearing bore diameter d mm		Reduction of radial internal clearance		Axial displacement drive up				Nut rotation angle ° (approx.)				Minimum residual radial internal clearance		
				Taper, 1:12		Taper, 1:30		Taper, 1:12		Taper, 1:30				
Over	Inc.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	CN	C3	C4
24	30	0.010	0.015	0.15	0.20	—	—	36	48	—	—	0.015	0.025	0.040
30	40	0.015	0.020	0.25	0.30	—	—	60	72	—	—	0.015	0.030	0.045
40	50	0.020	0.025	0.35	0.40	—	—	84	96	—	—	0.020	0.035	0.055
50	65	0.025	0.030	0.40	0.45	—	—	72	81	—	—	0.025	0.045	0.065
65	80	0.035	0.040	0.50	0.60	—	—	90	108	—	—	0.030	0.055	0.080
80	100	0.040	0.050	0.60	0.70	—	—	108	126	—	—	0.030	0.060	0.090
100	120	0.055	0.065	0.80	0.90	1.80	2.30	144	162	324	414	0.035	0.070	0.105
120	140	0.065	0.075	0.90	1.00	1.95	2.70	162	180	351	486	0.045	0.085	0.125
140	150	0.075	0.090	1.00	1.20	2.35	3.10	180	216	423	558	0.040	0.090	0.140
150	160	0.075	0.090	1.00	1.20	2.35	3.10	120	144	282	372	0.040	0.090	0.140
160	180	0.080	0.100	1.10	1.40	2.80	3.55	132	168	336	426	0.040	0.100	0.160
180	200	0.090	0.110	1.20	1.50	3.20	3.95	144	180	384	474	0.050	0.110	0.180
200	225	0.110	0.130	1.50	1.80	3.85	4.60	135	162	347	414	0.050	0.120	0.190
225	250	0.120	0.140	1.60	1.90	4.20	4.95	144	171	378	446	0.060	0.130	0.210
250	280	0.130	0.160	1.60	2.10	4.25	5.40	144	189	383	486	0.060	0.140	0.230
280	305	0.150	0.180	1.90	2.40	4.45	5.70	171	216	401	513	0.060	0.150	0.250
305	315	0.150	0.180	1.90	2.40	4.45	5.70	137	173	320	410	0.060	0.150	0.250
315	355	0.160	0.190	2.10	2.50	5.10	6.10	151	180	367	439	0.080	0.170	0.280
355	400	0.180	0.220	2.30	3.00	5.75	7.50	166	216	414	540	0.080	0.180	0.300
400	450	0.210	0.250	3.00	3.60	—	—	216	259	—	—	0.080	0.190	0.320

Note: The nut rotation angle may only be applied when a nut having the same inner diameter code as the bearing is used.

Table 15.2 Tapered bore spherical roller bearings (installation of other series besides ULTAGE) Unit: mm

Nominal bearing bore diameter d mm		Reduction of radial internal clearance		Axial displacement drive up				Nut rotation angle ° (approx.)				Minimum residual radial internal clearance		
				Taper, 1:12		Taper, 1:30		Taper, 1:12		Taper, 1:30				
Over	Inc.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	CN	C3	C4
30	40	0.020	0.025	0.35	0.40	—	—	84	96	—	—	0.010	0.025	0.040
40	50	0.025	0.030	0.40	0.45	—	—	96	108	—	—	0.015	0.030	0.050
50	65	0.030	0.035	0.45	0.60	—	—	81	108	—	—	0.020	0.040	0.060
65	80	0.040	0.045	0.60	0.70	—	—	108	126	—	—	0.025	0.050	0.075
80	100	0.045	0.055	0.70	0.80	1.75	2.25	126	144	315	405	0.025	0.055	0.085
100	120	0.050	0.060	0.75	0.90	1.90	2.25	135	162	342	405	0.040	0.075	0.110
120	140	0.065	0.075	1.10	1.20	2.75	3.00	198	216	495	540	0.045	0.085	0.130
140	150	0.075	0.090	1.20	1.40	3.00	3.75	216	252	540	675	0.040	0.090	0.140
150	160	0.075	0.090	1.20	1.40	3.00	3.75	144	168	360	450	0.040	0.090	0.140
160	180	0.080	0.100	1.30	1.60	3.25	4.00	156	192	390	480	0.040	0.100	0.160
180	200	0.090	0.110	1.40	1.70	3.50	4.25	168	204	420	510	0.050	0.110	0.180
200	225	0.100	0.120	1.60	1.90	4.00	4.75	144	171	360	428	0.060	0.130	0.200
225	250	0.110	0.130	1.70	2.00	4.25	5.00	153	180	383	450	0.070	0.140	0.220
250	280	0.120	0.150	1.90	2.40	4.75	6.00	171	216	428	540	0.070	0.150	0.240
280	305	0.130	0.160	2.00	2.50	5.00	6.25	180	225	450	563	0.080	0.170	0.270
305	315	0.130	0.160	2.00	2.50	5.00	6.25	144	180	360	450	0.080	0.170	0.270
315	355	0.150	0.180	2.40	2.80	6.00	7.00	173	202	432	504	0.090	0.180	0.290
355	400	0.170	0.210	2.60	3.30	6.50	8.25	187	238	468	594	0.090	0.190	0.310
400	450	0.200	0.240	3.10	3.70	7.75	9.25	223	266	558	666	0.090	0.200	0.330
450	500	0.210	0.260	3.30	4.00	8.25	10.0	238	288	594	720	0.110	0.230	0.370
500	560	0.240	0.300	3.70	4.60	9.25	11.5	222	276	555	690	0.110	0.240	0.380
560	630	0.260	0.330	4.00	5.10	10.0	12.5	240	306	600	750	0.130	0.270	0.430
630	670	0.300	0.370	4.60	5.70	11.5	14.5	276	342	690	870	0.140	0.300	0.480
670	710	0.300	0.370	4.60	5.70	11.5	14.5	237	293	591	746	0.140	0.300	0.480
710	800	0.340	0.430	5.30	6.70	13.3	16.5	273	345	684	849	0.140	0.320	0.530
800	900	0.370	0.470	5.70	7.30	14.3	18.5	293	375	735	951	0.170	0.370	0.600
900	1 000	0.410	0.530	6.30	8.20	15.8	20.5	284	369	711	923	0.180	0.400	0.660
1 000	1 120	0.450	0.580	6.80	8.70	17.0	22.5	306	392	765	1 013	0.190	0.450	0.720
1 120	1 250	0.490	0.630	7.40	9.40	18.5	24.5	—	—	—	—	0.200	0.490	0.790

Note: The nut rotation angle may only be applied when a nut having the same inner diameter code as the bearing is used.