8. BEARING TOLERANCES

8.1 Bearing Tolerance Standards

The tolerances for the boundary dimensions and running accuracy of rolling bearings are specified by ISO 492/199/582 (Accuracies of Rolling Bearings). Tolerances are specified for the following items:

Regarding bearing accuracy classes, besides ISO normal accuracy, as the accuracy improves there are Class 6X (for tapered roller bearings), Class 6, Class 5, Class 4, and Class 2, with Class 2 being the highest in ISO. The applicable accuracy classes for each bearing type and the correspondence of these classes are shown in Table 8.1.

- Accuracy of Rolling Bearings
  - Tolerances for Dimensions — Items necessary to mount bearings on shafts or in housings
    - Tolerances for bore and outside diameters, ring width and bearing width
    - Tolerances for inscribed and circumscribed circle diameters of rollers
    - Tolerances for chamfer dimensions
    - Tolerances for width variation
    - Tolerances for tapered bore diameters
  - Running Accuracy — Items necessary to specify the runout of rotating machine parts
    - Permissible radial runout of inner and outer rings
    - Permissible face runout with raceway inner and outer rings
    - Permissible inner ring face runout with bore
    - Permissible outer ring variation of outside surface generatrix inclination with face
    - Permissible raceway to back face thickness variation of thrust bearings

Table 8. 1 Bearing Types and Tolerance Classes

Bearing Types		Applicable Tolerance Classes					Applicable Tables	Reference Pages
Deep Groove Ball Bearings		Normal	Class 6	Class 5	Class 4	Class 2	Table 8.2	A60 to A63
Angular Contact Ball Bearings		Normal	Class 6	Class 5	Class 4	Class 2		
Self-Aligning Ball Bearings		Normal	Class 6 equivalent	Class 5 equivalent	—	—		
Cylindrical Roller Bearings		Normal	Class 6	Class 5	Class 4	Class 2		
Needle Roller Bearings (solid type)		Normal	Class 6	Class 5	Class 4	—		
Spherical Roller Bearings		Normal	Class 6	Class 5	—	—		
Tapered Roller Bearings	Metric Design	Normal Class 6X	—	Class 5	Class 4	—	Table 8.3	A64 to A67
	Inch Design	ANSI/ABMA CLASS 4	ANSI/ABMA CLASS 2	ANSI/ABMA CLASS 3	ANSI/ABMA CLASS 0	ANSI/ABMA CLASS 00	Table 8.4	A68 and A69
Magneto Bearings		Normal	Class 6	Class 5	—	—	Table 8.5	A70 and A71
Thrust Ball Bearings		Normal	Class 6	Class 5	Class 4	—	Table 8.4	A72 to A74
Thrust Spherical Roller Bearings		Normal	—	—	—	—	Table 8.7	A75
Equivalent standards (Reference) JIS(1)		Class 0	Class 6	Class 5	Class 4	Class 2	—	—
DIN(2)		P0	P6	P5	P4	P2	—	—
ANSI/ABMA(3)	Ball Bearings	ABEC 1	ABEC 3	ABEC 5 (CLASS 5P)	ABEC 7 (CLASS 7P)	ABEC 9 (CLASS 9P)	Table 8.2 [Table 8.8]	A60 to A63 (A76 and A77)
	Roller Bearings	RBEC 1	RBEC 3	RBEC 5	—	—		
	Tapered Roller Bearings	CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00	[Table 8.4]	(A68 and A69)

Notes (1) JIS : Japanese Industrial Standards (2) DIN : Deutsch Industrie Norm
(3) ANSI/ABMA : The American Bearing Manufacturers Association

Remarks The permissible limit of chamfer dimensions shall conform to Table 8.9 (Page A78), and the tolerances and permissible tapered bore diameters shall conform to Table 8.10 (Page A80).

(Reference) Rough definitions of the items listed for Running Accuracy and their measuring methods are shown in Fig. 8.1, and they are described in detail in ISO 5593 (Rolling Bearings-Vocabulary) and JIS B 1515 (Rolling Bearings-Tolerances) and elsewhere.

Supplementary Table

Running Accuracy	Inner Ring	Outer Ring	Dial Gauge
K_{ia}	Rotating	Stationary	A
K_{ea}	Stationary	Rotating	A
S_{ia}	Rotating	Stationary	B_1
S_{ea}	Stationary	Rotating	B_2
S_d	Rotating	Stationary	C
S_D	—	Rotating	D
S_i , S_e	Only the shaft or housing or central washer is to be rotated.		E

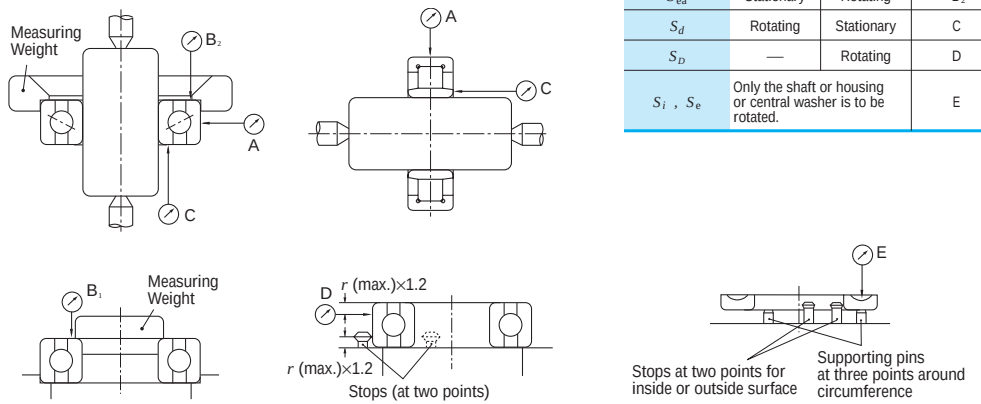


Fig. 8.1 Measuring Methods for Running Accuracy (summarized)

Symbols for Boundary Dimensions and Running Accuracy

d	Brg bore dia., nominal
Δ_{ds}	Deviation of a single bore dia.
Δ_{dmp}	Single plane mean bore dia. deviation
V_{dp}	Bore dia. Variation in a single radial plane
V_{dmp}	Mean bore dia. Variation
B	Inner ring width, nominal
Δ_{Bs}	Deviation of a single inner ring width
V_{Bs}	Inner ring width variation
K_{ia}	Radial runout of assembles brg inner ring
S_d	inner ring reference face (backface, where applicable) runout with bore
S_{ia}	Assembled brg inner ring face (back face) runout with raceway
S_i, S_e	Raceway to backface thickness variation of thrust brg
T	Brg width, nominal
Δ_{Ts}	Deviation of the actual brg width
D	Brg outside dia., nominal
Δ_{Ds}	Deviation of a single outside dia.
Δ_{Dmp}	Single plane mean outside dia. Deviation
V_{Dp}	Outside dia. Variation in a single radial plane
V_{Dmp}	Mean outside dia. Variation
C	Outer ring width, nominal
Δ_{Cs}	Deviation of a single outer ring width
V_{Cs}	Outer ring width variation
K_{ea}	Radial runout of assembled brg outer ring
S_D	Variation of brg outside surface generatrix inclination with outer ring reference face (backface)
S_{ea}	Assembled brg outer ring face (backface) runout with raceway

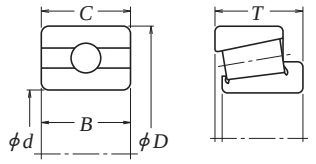


Table 8. 2 Tolerances for Radial Bearings

Table 8. 2. 1 Tolerances for Inner Rings and (excluding Tapered Roller Bearings)

Widths of Outer Rings

Nominal Bore Diameter d (mm) over	incl.	Δ_{dmp} (2) Normal high	Normal low	Class 6 high	Class 6 low	Class 5 high	Class 5 low	Class 4 high	Class 4 low	Class 2 high	Class 2 low	Δ_{ds} (2) Class 4 Diameter Series 0, 1, 2, 3, 4 high	Class 4 Diameter Series 0, 1, 2, 3, 4 low	Class 2 high	Class 2 low
0.6(1)	**2.5**	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
2.5	**10**	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
10	**18**	0	− 8	0	− 7	0	− 5	0	− 4	0	−2.5	0	− 4	0	−2.5
18	**30**	0	− 10	0	− 8	0	− 6	0	− 5	0	−2.5	0	− 5	0	−2.5
30	**50**	0	− 12	0	−10	0	− 8	0	− 6	0	−2.5	0	− 6	0	−2.5
50	**80**	0	− 15	0	−12	0	− 9	0	− 7	0	−4	0	− 7	0	−4
80	**120**	0	− 20	0	−15	0	−10	0	− 8	0	−5	0	− 8	0	−5
120	**150**	0	− 25	0	−18	0	−13	0	−10	0	−7	0	−10	0	−7
150	**180**	0	− 25	0	−18	0	−13	0	−10	0	−7	0	−10	0	−7
180	**250**	0	− 30	0	−22	0	−15	0	−12	0	−8	0	−12	0	−8
250	**315**	0	− 35	0	−25	0	−18	−	−	−	−	−	−	−	−
315	**400**	0	− 40	0	−30	0	−23	−	−	−	−	−	−	−	−
400	**500**	0	− 45	0	−35	−	−	−	−	−	−	−	−	−	−
500	**630**	0	− 50	0	−40	−	−	−	−	−	−	−	−	−	−
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	−	−	−	−	−	−	−	−	−	−	−	−

V_{dp} (2) Normal Diameter Series 9	0, 1	2, 3, 4	Class 6 Diameter Series 9	0, 1	2, 3, 4	Class 5 Diameter Series 9	0,1,2,3,4	Class 4 Diameter Series 9	0,1,2,3,4	Class 2 Diameter Series 0,1,2,3,4	V_{dmp} (2) Normal	Class 6	Class 5	Class 4	Class 2
max.			max.			max.		max.		max.	max.	max.	max.	max.	max.
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
10	8	6	9	7	5	5	4	4	3	2.5	6	5	3	2	1.5
13	10	8	10	8	6	6	5	5	4	2.5	8	6	3	2.5	1.5
15	12	9	13	10	8	8	6	6	5	2.5	9	8	4	3	1.5
19	19	11	15	15	9	9	7	7	5	4	11	9	5	3.5	2
25	25	15	19	19	11	10	8	8	6	5	15	11	5	4	2.5
31	31	19	23	23	14	13	10	10	8	7	19	14	7	5	3.5
31	31	19	23	23	14	13	10	10	8	7	19	14	7	5	3.5
38	38	23	28	28	17	15	12	12	9	8	23	17	8	6	4
44	44	26	31	31	19	18	14	−	−	−	26	19	9	−	−
50	50	30	38	38	23	23	18	−	−	−	30	23	12	−	−
56	56	34	44	44	26	−	−	−	−	−	34	26	−	−	−
63	63	38	50	50	30	−	−	−	−	−	38	30	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

Units : μm

Δ_{Bs} (or Δ_{Cs})(3) Single Bearing Normal Class 6 high	Normal Class 6 low	Class 5 Class 4 high	Class 5 Class 4 low	Class 2 high	Class 2 low	Combined Bearings (4) Normal Class 6 high	Normal Class 6 low	Class 5 Class 4 high	Class 5 Class 4 low	Class 2 high	Class 2 low	V_{Bs} (or V_{Cs}) Inner Ring (or Outer Ring) (3) Normal	Inner Ring Class 6	Inner Ring Class 5	Inner Ring Class 4	Inner Ring Class 2
max.		max.		max.		max.		max.		max.		max.	max.	max.	max.	max.
0	− 40	0	− 40	0	− 40	—	—	0	−250	0	−250	12	12	5	2.5	1.5
0	− 120	0	− 40	0	− 40	0	−250	0	−250	0	−250	15	15	5	2.5	1.5
0	− 120	0	− 80	0	− 80	0	−250	0	−250	0	−250	20	20	5	2.5	1.5
0	− 120	0	−120	0	−120	0	−250	0	−250	0	−250	20	20	5	2.5	1.5
0	− 120	0	−120	0	−120	0	−250	0	−250	0	−250	20	20	5	3	1.5
0	− 150	0	−150	0	−150	0	−380	0	−250	0	−250	25	25	6	4	1.5
0	− 200	0	−200	0	−200	0	−380	0	−380	0	−380	25	25	7	4	2.5
0	− 250	0	−250	0	−250	0	−500	0	−380	0	−380	30	30	8	5	2.5
0	− 250	0	−250	0	−250	0	−500	0	−380	0	−380	30	30	8	5	4
0	− 300	0	−300	0	−300	0	−500	0	−500	0	−500	30	30	10	6	5
0	− 350	0	−350	−	−	0	−500	0	−500	−	−	35	35	13	−	−
0	− 400	0	−400	−	−	0	−630	0	−630	−	−	40	40	15	−	−
0	− 450	−	−	−	−	−	−	−	−	−	−	50	45	−	−	−
0	− 500	−	−	−	−	−	−	−	−	−	−	60	50	−	−	−
0	− 750	−	−	−	−	−	−	−	−	−	−	70	−	−	−	−
0	−1 000	−	−	−	−	−	−	−	−	−	−	80	−	−	−	−
0	−1 250	−	−	−	−	−	−	−	−	−	−	100	−	−	−	−
0	−1 600	−	−	−	−	−	−	−	−	−	−	120	−	−	−	−
0	−2 000	−	−	−	−	−	−	−	−	−	−	140	−	−	−	−

K_{ia} Normal	Class 6	Class 5	Class 4	Class 2	S_d Class 5	Class 4	Class 2	S_{ia} (5) Class 5	Class 4	Class 2	Nominal Bore Diameter d (mm) over	incl.
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.		
10	5	4	2.5	1.5	7	3	1.5	7	3	1.5	**0.6**(1)	**2.5**
10	6	4	2.5	1.5	7	3	1.5	7	3	1.5	**2.5**	**10**
10	7	4	2.5	1.5	7	3	1.5	7	3	1.5	**10**	**18**
13	8	4	3	2.5	8	4	1.5	8	4	2.5	**18**	**30**
15	10	5	4	2.5	8	4	1.5	8	4	2.5	**30**	**50**
20	10	5	4	2.5	8	5	1.5	8	5	2.5	**50**	**80**
25	13	6	5	2.5	9	5	2.5	9	5	2.5	**80**	**120**
30	18	8	6	2.5	10	6	2.5	10	7	2.5	**120**	**150**
30	18	8	6	5	10	6	4	10	7	5	**150**	**180**
40	20	10	8	5	11	7	5	13	8	5	**180**	**250**
50	25	13	−	−	13	−	−	15	−	−	**250**	**315**
60	30	15	−	−	15	−	−	20	−	−	**315**	**400**
65	35	−	−	−	−	−	−	−	−	−	**400**	**500**
70	40	−	−	−	−	−	−	−	−	−	**500**	**630**
80	−	−	−	−	−	−	−	−	−	−	**630**	**800**
90	−	−	−	−	−	−	−	−	−	−	**800**	**1 000**
100	−	−	−	−	−	−	−	−	−	−	**1 000**	**1 250**
120	−	−	−	−	−	−	−	−	−	−	**1 250**	**1 600**
140	−	−	−	−	−	−	−	−	−	−	**1 600**	**2 000**

Notes (1) 0.6mm is included in the group.
(2) Applicable to bearings with cylindrical bores.
(3) Tolerance for width deviation and tolerance limits for the width variation of the outer ring should be the same bearing. Tolerances for the width variation of the outer ring of Class 5, 4, and 2 are shown in Table 8.2.2.
(4) Applicable to individual rings manufactured for combined bearings.
(5) Applicable to ball bearings such as deep groove ball bearings, angular contact ball bearings, etc.

Remarks 1. The cylindrical bore diameter "no-go side" tolerance limit (high) specified in this table does not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.
2. ABMA Std 20-1996: ABEC1·RBEC1, ABEC3·RBEC3, ABEC5·RBEC5, ABEC7·RBEC7, and ABEC9·RBEC9 are equivalent to Classes Normal, 6, 5, 4, and 2 respectively.

Table 8. 2 Tolerances for Radial Bearings

Table 8. 2. 2 Tolerances

Nominal Outside Diameter D (mm) over	incl.	Δ_{Dmp} Normal high	Normal low	Class 6 high	Class 6 low	Class 5 high	Class 5 low	Class 4 high	Class 4 low	Class 2 high	Class 2 low	Δ_{Ds} Class 4 Diameter Series 0, 1, 2, 3, 4 high	Class 4 low	Class 2 high	Class 2 low
2.5(1)	**6**	0	− 8	0	− 7	0	− 5	0	− 4	0	− 2.5	0	− 4	0	− 2.5
6	**18**	0	− 8	0	− 7	0	− 5	0	− 4	0	− 2.5	0	− 4	0	− 2.5
18	**30**	0	− 9	0	− 8	0	− 6	0	− 5	0	− 4	0	− 5	0	− 4
30	**50**	0	− 11	0	− 9	0	− 7	0	− 6	0	− 4	0	− 6	0	− 4
50	**80**	0	− 13	0	−11	0	− 9	0	− 7	0	− 4	0	− 7	0	− 4
80	**120**	0	− 15	0	−13	0	−10	0	− 8	0	− 5	0	− 8	0	− 5
120	**150**	0	− 18	0	−15	0	−11	0	− 9	0	− 5	0	− 9	0	− 5
150	**180**	0	− 25	0	−18	0	−13	0	−10	0	− 7	0	−10	0	− 7
180	**250**	0	− 30	0	−20	0	−15	0	−11	0	− 8	0	−11	0	− 8
250	**315**	0	− 35	0	−25	0	−18	0	−13	0	− 8	0	−13	0	− 8
315	**400**	0	− 40	0	−28	0	−20	0	−15	0	−10	0	−15	0	−10
400	**500**	0	− 45	0	−33	0	−23	−	−	−	−	−	−	−	−
500	**630**	0	− 50	0	−38	0	−28	−	−	−	−	−	−	−	−
630	**800**	0	− 75	0	−45	0	−35	−	−	−	−	−	−	−	−
800	**1 000**	0	−100	0	−60	−	−	−	−	−	−	−	−	−	−
1 000	**1 250**	0	−125	−	−	−	−	−	−	−	−	−	−	−	−
1 250	**1 600**	0	−160	−	−	−	−	−	−	−	−	−	−	−	−
1 600	**2 000**	0	−200	−	−	−	−	−	−	−	−	−	−	−	−
2 000	**2 500**	0	−250	−	−	−	−	−	−	−	−	−	−	−	−

Notes (1) 2.5mm is included in the group.
(2) Applicable only when a locating snap ring is not used.
(3) Applicable to ball bearings such as deep groove ball bearings and angular contact ball bearings.
(4) The tolerances for outer ring width variation of bearings of Classes Normal and 6 are shown in Table 8.2.1.

Remarks 1. The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.
2. ABMA Std 20-1996: ABEC1·RBEC1, ABEC3·RBEC3, ABEC5·RBEC5, ABEC7·RBEC7, and ABEC9· RBEC9 are equivalent to Classes Normal, 6, 5, 4, and 2 respectively.

(excluding Tapered Roller Bearings)

for Outer Rings

V_{Dp} (2) Normal Open Type Diameter Series 9	0, 1	2, 3, 4	Normal Shielded Sealed 2, 3, 4	Class 6 Open Type Diameter Series 9	0, 1	2, 3, 4	Class 6 Shielded Sealed 0,1,2,3,4	Class 5 Open Type Diameter Series 9	0,1,2,3,4	Class 4 Open Type Diameter Series 9	0,1,2,3,4	Class 2 Open Type Diameter Series 0,1,2,3,4	V_{Dmp} (2) Normal	Class 6	Class 5	Class 4	Class 2
max.				max.				max.		max.		max.	max.	max.	max.	max.	max.
10	8	6	10	9	7	5	9	5	4	4	3	2.5	6	5	3	2	1.5
10	8	6	10	9	7	5	9	5	4	4	3	2.5	6	5	3	2	1.5
12	9	7	12	10	8	6	10	6	5	5	4	4	7	6	3	2.5	2
14	11	8	16	11	9	7	13	7	5	6	5	4	8	7	4	3	2
16	13	10	20	14	11	8	16	9	7	7	5	4	10	8	5	3.5	2
19	19	11	26	16	16	10	20	10	8	8	6	5	11	10	5	4	2.5
23	23	14	30	19	19	11	25	11	8	9	7	5	14	11	6	5	2.5
31	31	19	38	23	23	14	30	13	10	10	8	7	19	14	7	5	3.5
38	38	23	−	25	25	15	−	15	11	11	8	8	23	15	8	6	4
44	44	26	−	31	31	19	−	18	14	13	10	8	26	19	9	7	4
50	50	30	−	35	35	21	−	20	15	15	11	10	30	21	10	8	5
56	56	34	−	41	41	25	−	23	17	−	−	−	34	25	12	−	−
63	63	38	−	48	48	29	−	28	21	−	−	−	38	29	14	−	−
94	94	55	−	56	56	34	−	35	26	−	−	−	55	34	18	−	−
125	125	75	−	75	75	45	−	−	−	−	−	−	75	45	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−

Units : μm

K_{ea} Normal	Class 6	Class 5	Class 4	Class 2	S_D Class 5	Class 4	Class 2	S_{ea} (3) Class 5	Class 4	Class 2	V_{Cs} (4) Class 5	Class 4	Class 2	Nominal Outside Diameter D (mm) over	incl.
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.		
15	8	5	3	1.5	8	4	1.5	8	5	1.5	5	2.5	1.5	**2.5** (1)	**6**
15	8	5	3	1.5	8	4	1.5	8	5	1.5	5	2.5	1.5	**6**	**18**
15	9	6	4	2.5	8	4	1.5	8	5	2.5	5	2.5	1.5	**18**	**30**
20	10	7	5	2.5	8	4	1.5	8	5	2.5	5	2.5	1.5	**30**	**50**
25	13	8	5	4	8	4	1.5	10	5	4	6	3	1.5	**50**	**80**
35	18	10	6	5	9	5	2.5	11	6	5	8	4	2.5	**80**	**120**
40	20	11	7	5	10	5	2.5	13	7	5	8	5	2.5	**120**	**150**
45	23	13	8	5	10	5	2.5	14	8	5	8	5	2.5	**150**	**180**
50	25	15	10	7	11	7	4	15	10	7	10	7	4	**180**	**250**
60	30	18	11	7	13	8	5	18	10	7	11	7	5	**250**	**315**
70	35	20	13	8	13	10	7	20	13	8	13	8	7	**315**	**400**
80	40	23	−	−	15	−	−	23	−	−	15	−	−	**400**	**500**
100	50	25	−	−	18	−	−	25	−	−	18	−	−	**500**	**630**
120	60	30	−	−	20	−	−	30	−	−	20	−	−	**630**	**800**
140	75	−	−	−	−	−	−	−	−	−	−	−	−	**800**	**1 000**
160	−	−	−	−	−	−	−	−	−	−	−	−	−	**1 000**	**1 250**
190	−	−	−	−	−	−	−	−	−	−	−	−	−	**1 250**	**1 600**
220	−	−	−	−	−	−	−	−	−	−	−	−	−	**1 600**	**2 000**
250	−	−	−	−	−	−	−	−	−	−	−	−	−	**2 000**	**2 500**

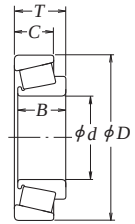
Table 8. 3 Tolerances for Metric Design Tapered Roller Bearings

Table 8. 3. 1 Tolerances for Inner Ring Bore Diameter and Running Accuracy

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}						Δ_{ds}		V_{dp}				V_{dmp}			
		Normal Class 6X		Class 6 Class 5		Class 4		Class 4		Normal Class 6X	Class 6	Class 5	Class 4	Normal Class 6X	Class 6	Class 5	Class 4
over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	max.	max.
10	**18**	0	− 8	0	− 7	0	− 5	0	− 5	8	7	5	4	6	5	5	4
18	**30**	0	−10	0	− 8	0	− 6	0	− 6	10	8	6	5	8	6	5	4
30	**50**	0	−12	0	−10	0	− 8	0	− 8	12	10	8	6	9	8	5	5
50	**80**	0	−15	0	−12	0	− 9	0	− 9	15	12	9	7	11	9	6	5
80	**120**	0	−20	0	−15	0	−10	0	−10	20	15	11	8	15	11	8	5
120	**180**	0	−25	0	−18	0	−13	0	−13	25	18	14	10	19	14	9	7
180	**250**	0	−30	0	−22	0	−15	0	−15	30	22	17	11	23	16	11	8
250	**315**	0	−35	0	−25	0	−18	0	−18	35	−	−	−	26	−	−	−
315	**400**	0	−40	0	−30	0	−23	0	−23	40	−	−	−	30	−	−	−
400	**500**	0	−45	0	−35	0	−27	0	−27	−	−	−	−	−	−	−	−
500	**630**	0	−50	0	−40	−	−	−	−	−	−	−	−	−	−	−	−
630	**800**	0	−75	0	−60	−	−	−	−	−	−	−	−	−	−	−	−

K_{ia}				S_d		S_{ia}
Normal Class 6X	Class 6	Class 5	Class 4	Class 5	Class 4	Class 4
max.	max.	max.	max.	max.	max.	max.
15	7	3.5	2.5	7	3	3
18	8	4	3	8	4	4
20	10	5	4	8	4	4
25	10	5	4	8	5	4
30	13	6	5	9	5	5
35	18	8	6	10	6	7
50	20	10	8	11	7	8
60	25	13	10	13	8	10
70	30	15	12	15	10	14
70	35	18	14	19	13	17
85	40	20	−	22	−	−
100	45	22	−	27	−	−



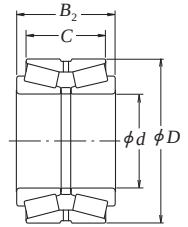
Remarks
1. The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.
2. Some of these tolerances conform to the NSK Standard.

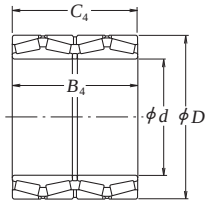
Table 8. 3. 2 Tolerances for Outer Ring Outside Diameter and Running Accuracy

Units : μm

Nominal Outside Diameter D (mm)		Δ_{Dmp}						Δ_{Ds}		V_{Dp}				V_{Dmp}			
		Normal Class 6X		Class 6 Class 5		Class 4		Class 4		Normal Class 6X	Class 6	Class 5	Class 4	Normal Class 6X	Class 6	Class 5	Class 4
over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	max.	max.
18	**30**	0	− 9	0	− 8	0	− 6	0	− 6	9	8	6	5	7	6	5	4
30	**50**	0	− 11	0	− 9	0	− 7	0	− 7	11	9	7	5	8	7	5	5
50	**80**	0	− 13	0	−11	0	− 9	0	− 9	13	11	8	7	10	8	6	5
80	**120**	0	− 15	0	−13	0	−10	0	−10	15	13	10	8	11	10	7	5
120	**150**	0	− 18	0	−15	0	−11	0	−11	18	15	11	8	14	11	8	6
150	**180**	0	− 25	0	−18	0	−13	0	−13	25	18	14	10	19	14	9	7
180	**250**	0	− 30	0	−20	0	−15	0	−15	30	20	15	11	23	15	10	8
250	**315**	0	− 35	0	−25	0	−18	0	−18	35	25	19	14	26	19	13	9
315	**400**	0	− 40	0	−28	0	−20	0	−20	40	28	22	15	30	21	14	10
400	**500**	0	− 45	0	−33	0	−23	0	−23	45	−	−	−	34	−	−	−
500	**630**	0	− 50	0	−38	0	−28	0	−28	50	−	−	−	38	−	−	−
630	**800**	0	− 75	0	−45	−	−	−	−	−	−	−	−	−	−	−	−
800	**1 000**	0	−100	0	−60	−	−	−	−	−	−	−	−	−	−	−	−

K_{ea}				S_D		S_{ea}
Normal Class 6X	Class 6	Class 5	Class 4	Class 5	Class 4	Class 4
max.	max.	max.	max.	max.	max.	max.
18	9	6	4	8	4	5
20	10	7	5	8	4	5
25	13	8	5	8	4	5
35	18	10	6	9	5	6
40	20	11	7	10	5	7
45	23	13	8	10	5	8
50	25	15	10	11	7	10
60	30	18	11	13	8	10
70	35	20	13	13	10	13
80	40	23	15	15	11	15
100	50	25	18	18	13	18
120	60	30	−	20	−	−
120	75	35	−	23	−	−





Remarks
1. The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.
2. Some of these tolerances conform to the NSK Standard.

Table 8. 3 Tolerances for Metric Design

Table 8. 3. 3 Tolerances for Width, Overall Bearing Width,

Tapered Roller Bearings

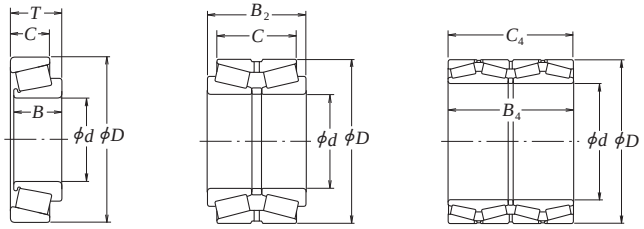
and Combined Bearing Width

Units : μm

Nominal Bore Diameter d (mm)		Δ_{Bs}						Δ_{Cs}						Δ_{Ts}					
		Normal Class 6		Class 6X		Class 5 Class 4		Normal Class 6		Class 6X		Class 5 Class 4		Normal Class 6		Class 6X		Class 5 Class 4	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
10	**18**	0	−120	0	−50	0	−200	0	−120	0	−100	0	−200	+200	0	+100	0	+200	−200
18	**30**	0	−120	0	−50	0	−200	0	−120	0	−100	0	−200	+200	0	+100	0	+200	−200
30	**50**	0	−120	0	−50	0	−240	0	−120	0	−100	0	−240	+200	0	+100	0	+200	−200
50	**80**	0	−150	0	−50	0	−300	0	−150	0	−100	0	−300	+200	0	+100	0	+200	−200
80	**120**	0	−200	0	−50	0	−400	0	−200	0	−100	0	−400	+200	−200	+100	0	+200	−200
120	**180**	0	−250	0	−50	0	−500	0	−250	0	−100	0	−500	+350	−250	+150	0	+350	−250
180	**250**	0	−300	0	−50	0	−600	0	−300	0	−100	0	−600	+350	−250	+150	0	+350	−250
250	**315**	0	−350	0	−50	0	−700	0	−350	0	−100	0	−700	+350	−250	+200	0	+350	−250
315	**400**	0	−400	0	−50	0	−800	0	−400	0	−100	0	−800	+400	−400	+200	0	+400	−400
400	**500**	0	−450	−	−	0	−800	0	−450	−	−	0	−800	+400	−400	−	−	+400	−400
500	**630**	0	−500	−	−	0	−800	0	−500	−	−	0	−800	+500	−500	−	−	+500	−500
630	**800**	0	−750	−	−	0	−800	0	−750	−	−	0	−800	+600	−600	−	−	+600	−600

Ring Width with Rollers Δ_{T1s}				Outer Ring Effective Width Deviation Δ_{T2s}				Overall Combined Bearing Width Deviation Δ_{B2s}		Δ_{B4s} , Δ_{C4s}		Nominal Bore Diameter d (mm)	
Normal		Class 6X		Normal		Class 6X		All classes of double-row bearings		All classes of four-row bearings			
high	low	high	low	high	low	high	low	high	low	high	low	over	incl.
+100	0	+ 50	0	+100	0	+ 50	0	+ 200	− 200	−	−	**10**	**18**
+100	0	+ 50	0	+100	0	+ 50	0	+ 200	− 200	−	−	**18**	**30**
+100	0	+ 50	0	+100	0	+ 50	0	+ 200	− 200	−	−	**30**	**50**
+100	0	+ 50	0	+100	0	+ 50	0	+ 300	− 300	+ 300	− 300	**50**	**80**
+100	−100	+ 50	0	+100	−100	+ 50	0	+ 300	− 300	+ 400	− 400	**80**	**120**
+150	−150	+ 50	0	+200	−100	+100	0	+ 400	− 400	+ 500	− 500	**120**	**180**
+150	−150	+ 50	0	+200	−100	+100	0	+ 450	− 450	+ 600	− 600	**180**	**250**
+150	−150	+100	0	+200	−100	+100	0	+ 550	− 550	+ 700	− 700	**250**	**315**
+200	−200	+100	0	+200	−200	+100	0	+ 600	− 600	+ 800	− 800	**315**	**400**
−	−	−	−	−	−	−	−	+ 700	− 700	+ 900	− 900	**400**	**500**
−	−	−	−	−	−	−	−	+ 800	− 800	+1 000	−1 000	**500**	**630**
−	−	−	−	−	−	−	−	+1 200	−1 200	+1 500	−1 500	**630**	**800**

Remarks The effective width of an inner ring with rollers T_1 is defined as the overall bearing width of an inner ring with rollers combined with a master outer ring.
The effective width of an outer ring T_2 is defined as the overall bearing width of an outer ring combined with a master inner ring with rollers.



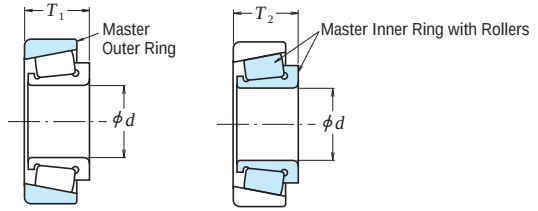


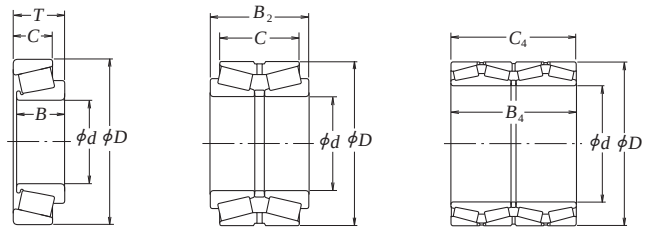
Table 8. 4 Tolerances for Inch Design Tapered Roller Bearings

(Refer to page A58 Table 8. 1 for the tolerance class "CLASS ★★ " that is the tolerance classes of ANSI/ABMA.)

Table 8. 4. 1 Tolerances for Inner Ring Bore Diameter

Units : μm

Nominal Bore Diameter d				Δ_{ds}					
over		incl.		CLASS 4, 2		CLASS 3, 0		CLASS 00	
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low
–	–	**76.200**	3.0000	+ 13	0	+13	0	+8	0
76.200	3.0000	**266.700**	10.5000	+ 25	0	+13	0	+8	0
266.700	10.5000	**304.800**	12.0000	+ 25	0	+13	0	–	–
304.800	12.0000	**609.600**	24.0000	+ 51	0	+25	0	–	–
609.600	24.0000	**914.400**	36.0000	+ 76	0	+38	0	–	–
914.400	36.0000	**1 219.200**	48.0000	+102	0	+51	0	–	–
1 219.200	48.0000	–	–	+127	0	+76	0	–	–



KBE KV

Table 8. 4. 2 Tolerances for Outer Ring Outside Diameter and Radial Runout of Inner and Outer Rings

Units : μm

Nominal Outside Diameter D				Δ_{Ds}						K_{ia}, K_{ea}				
over		incl.		CLASS 4, 2		CLASS 3, 0		CLASS 00		CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low	max.	max.	max.	max.	max.
–	–	**266.700**	10.5000	+ 25	0	+13	0	+8	0	51	38	8	4	2
266.700	10.5000	**304.800**	12.0000	+ 25	0	+13	0	+8	0	51	38	8	4	2
304.800	12.0000	**609.600**	24.0000	+ 51	0	+25	0	–	–	51	38	18	–	–
609.600	24.0000	**914.400**	36.0000	+ 76	0	+38	0	–	–	76	51	51	–	–
914.400	36.0000	**1 219.200**	48.0000	+102	0	+51	0	–	–	76	–	76	–	–
1 219.200	48.0000	–	–	+127	0	+76	0	–	–	76	–	76	–	–

Table 8. 4. 3 Tolerances for Overall Width and Combined Width

Units : μm

Nominal Bore Diameter d				Δ_{Ts}								Double-Row Bearings (KBE Type) Δ_{B2s}								Four-Row Bearings (KV Type) Δ_{B4s}, Δ_{C4s}	
over		incl.		CLASS 4		CLASS 2		CLASS 3			CLASS 0, 00	CLASS 4		CLASS 2		CLASS 3				CLASS 0,00		CLASS 4, 3	
								$D \leqq 508.000$ (mm)		$D > 508.000$ (mm)						$D \leqq 508.000$ (mm)		$D > 508.000$ (mm)					
(mm)	1/25.4	(mm)	1/25.4	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low	high	low
–	–	**101.600**	4.0000	+203	0	+203	0	+203	−203	+203	−203	+203	−203	+406	0	+406	0	+406	−406	+406	−406	+406	−406	+1 524	−1 524
101.600	4.0000	**304.800**	12.0000	+356	−254	+203	0	+203	−203	+203	−203	+203	−203	+711	−508	+406	−203	+406	−406	+406	−406	+406	−406	+1 524	−1 524
304.800	12.0000	**609.600**	24.0000	+381	−381	+381	−381	+203	−203	+381	−381	–	–	+762	−762	+762	−762	+406	−406	+762	−762	–	–	+1 524	−1 524
609.600	24.0000	–	–	+381	−381	–	–	+381	−381	+381	−381	–	–	+762	−762	–	–	+762	−762	+762	−762	–	–	+1 524	−1 524

Table 8. 5 Tolerances for Magneto Bearings and Width of Outer Rings

Table 8. 5. 1 Tolerances for Inner Rings

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}						V_{dp}			V_{dmp}			Δ_{Bs} (or Δ_{Cs}) (1)			
		Normal		Class 6		Class 5		Normal	Class 6	Class 5	Normal	Class 6	Class 5	Normal Class 6		Class 5	
over	incl.	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.	high	low	high	low
2.5	10	0	− 8	0	−7	0	−5	6	5	4	6	5	3	0	−120	0	− 40
10	18	0	− 8	0	−7	0	−5	6	5	4	6	5	3	0	−120	0	− 80
18	30	0	−10	0	−8	0	−6	8	6	5	8	6	3	0	−120	0	−120

V_{Bs} (or V_{Cs}) (1)		Δ_{Ts}		K_{ia}			S_d	S_{ia}
Normal Class 6	Class 5	Normal Class 6 Class 5		Normal	Class 6	Class 5	Class 5	Class 5
max.	max.	high	low	max.	max.	max.	max.	max.
15	5	+120	−120	10	6	4	7	7
20	5	+120	−120	10	7	4	7	7
20	5	+120	−120	13	8	4	8	8

Note (1) The width deviation and width variation of an outer ring is determined according to the inner ring of the same bearing.

Remarks The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

Table 8. 5. 2 Tolerances for Outer Rings

Units : μm

Nominal Outside Diameter D (mm)		Δ_{Dmp}												V_{Dp}		
		Bearing Series E						Bearing Series EN								
		Normal		Class 6		Class 5		Normal		Class 6		Class 5		Normal	Class 6	Class 5
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	max.	max.	max.
6	18	+ 8	0	+7	0	+5	0	0	− 8	0	−7	0	−5	6	5	4
18	30	+ 9	0	+8	0	+6	0	0	− 9	0	−8	0	−6	7	6	5
30	50	+11	0	+9	0	+7	0	0	−11	0	−9	0	−7	8	7	5

V_{Dmp}			K_{ea}			S_{ea}	S_D
Normal	Class 6	Class 5	Normal	Class 6	Class 5	Class 5	Class 5
max.	max.	max.	max.	max.	max.	max.	max.
6	5	3	15	8	5	8	8
7	6	3	15	9	6	8	8
8	7	4	20	10	7	8	8

Remarks The outside diameter "no-go side" tolerances (low) do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

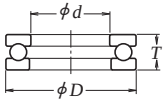
Table 8. 6 Tolerances for Thrust Ball Bearings

Table 8. 6. 1 Tolerances for Shaft Washer Bore Diameter and Running Accuracy

Units : μm

Nominal Bore Diameter d or d_2 (mm)		Δ_{dmp} or Δ_{d2mp}				V_{dp} or V_{d2p}		S_i or S_e (1)			
		Normal Class 6 Class 5		Class 4		Normal Class 6 Class 5	Class 4	Normal	Class 6	Class 5	Class 4
over	incl.	high	low	high	low	max.	max.	max.	max.	max.	max.
–	18	0	− 8	0	− 7	6	5	10	5	3	2
18	30	0	− 10	0	− 8	8	6	10	5	3	2
30	50	0	− 12	0	−10	9	8	10	6	3	2
50	80	0	− 15	0	−12	11	9	10	7	4	3
80	120	0	− 20	0	−15	15	11	15	8	4	3
120	180	0	− 25	0	−18	19	14	15	9	5	4
180	250	0	− 30	0	−22	23	17	20	10	5	4
250	315	0	− 35	0	−25	26	19	25	13	7	5
315	400	0	− 40	0	−30	30	23	30	15	7	5
400	500	0	− 45	0	−35	34	26	30	18	9	6
500	630	0	− 50	0	−40	38	30	35	21	11	7
630	800	0	− 75	0	−50	–	–	40	25	13	8
800	1 000	0	−100	–	–	–	–	45	30	15	–
1 000	1 250	0	−125	–	–	–	–	50	35	18	–

Note (1) For double-direction bearings, the thickness variation doesn't depend on the bore diameter d_2 , but on d for single-direction bearings with the same D in the same diameter series.
The thickness variation of housing washers, S_e, applies only to flat-seat thrust bearings.



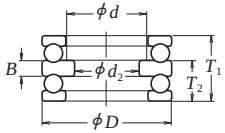
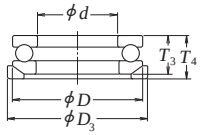


Table 8. 6. 2 Tolerances for Outside Diameter of Housing Washers and Aligning Seat Washers

Units : μm

Nominal Outside Diameter of Bearing or Aligning Seat Washer D or D_3 (mm)		Δ_{Dmp}						V_{Dp}		Aligning Seat Washer Outside Diameter Deviation Δ_{D3s}	
		Flat Seat Type				Aligning Seat Washer Type					
		Normal Class 6 Class 5		Class 4		Normal Class 6		Normal Class 6 Class 5	Class 4	Normal Class 6	
over	incl.	high	low	high	low	high	low	max.	max.	high	low
10	18	0	− 11	0	− 7	0	− 17	8	5	0	− 25
18	30	0	− 13	0	− 8	0	− 20	10	6	0	− 30
30	50	0	− 16	0	− 9	0	− 24	12	7	0	− 35
50	80	0	− 19	0	−11	0	− 29	14	8	0	− 45
80	120	0	− 22	0	−13	0	− 33	17	10	0	− 60
120	180	0	− 25	0	−15	0	− 38	19	11	0	− 75
180	250	0	− 30	0	−20	0	− 45	23	15	0	− 90
250	315	0	− 35	0	−25	0	− 53	26	19	0	−105
315	400	0	− 40	0	−28	0	− 60	30	21	0	−120
400	500	0	− 45	0	−33	0	− 68	34	25	0	−135
500	630	0	− 50	0	−38	0	− 75	38	29	0	−180
630	800	0	− 75	0	−45	0	−113	55	34	0	−225
800	1 000	0	−100	–	–	–	–	75	–	–	–
1 000	1 250	0	−125	–	–	–	–	–	–	–	–
1 250	1 600	0	−160	–	–	–	–	–	–	–	–



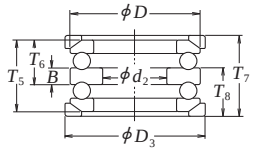


Table 8. 6. 3 Tolerances for Thrust Ball Bearing Height and Central Washer Height

Units : μm

Nominal Bore Diameter d (1) (mm)		Flat Seat Type				Aligning Seat Washer Type				With Aligning Seat Washer				Height Deviation of Central Washer Δ_{Bs}	
		Δ_{Ts} or Δ_{T2s}		Δ_{T1s}		Δ_{T3s} or Δ_{T6s}		Δ_{T5s}		Δ_{T4s} or Δ_{T8s}		Δ_{T7s}			
		Normal, Class 6 Class 5, Class 4		Normal, Class 6 Class 5, Class 4		Normal Class 6		Normal Class 6		Normal Class 6		Normal Class 6		Normal, Class 6 Class 5, Class 4	
over	incl.	high	low	high	low	high	low	high	low	high	low	high	low	high	low
–	30	0	− 75	+ 50	−150	0	− 75	+ 50	−150	+ 50	− 75	+150	−150	0	− 50
30	50	0	−100	+ 75	−200	0	−100	+ 75	−200	+ 50	−100	+175	−200	0	− 75
50	80	0	−125	+100	−250	0	−125	+100	−250	+ 75	−125	+250	−250	0	−100
80	120	0	−150	+125	−300	0	−150	+125	−300	+ 75	−150	+275	−300	0	−125
120	180	0	−175	+150	−350	0	−175	+150	−350	+100	−175	+350	−350	0	−150
180	250	0	−200	+175	−400	0	−200	+175	−400	+100	−200	+375	−400	0	−175
250	315	0	−225	+200	−450	0	−225	+200	−450	+125	−225	+450	−450	0	−200
315	400	0	−300	+250	−600	0	−300	+250	−600	+150	−275	+550	−550	0	−250

Note (1) For double-direction bearings, its classification depends on d for single-direction bearings with the same D in the same diameter series.

Remarks Δ_{Ts} in the table is the deviation in the respective heights T in figures below.

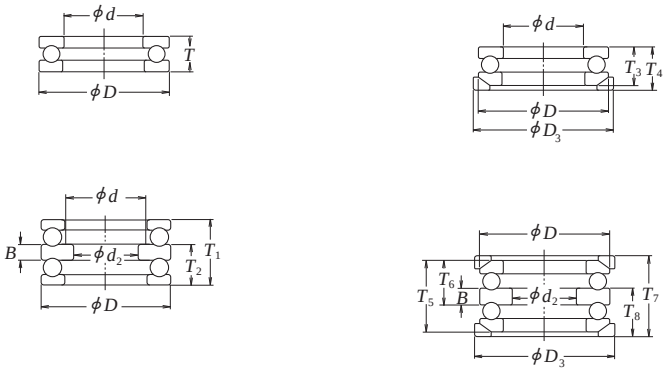


Table 8. 7 Tolerances for Thrust Spherical Roller Bearings

Table 8. 7. 1 Tolerances for Bore Diameters of Shaft Rings and Height (Class Normal)

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}		V_{dp}	Reference		
					S_d	Δ_{Ts}	
over	incl.	high	low	max.	max.	high	low
50	80	0	−15	11	25	+150	−150
80	120	0	−20	15	25	+200	−200
120	180	0	−25	19	30	+250	−250
180	250	0	−30	23	30	+300	−300
250	315	0	−35	26	35	+350	−350
315	400	0	−40	30	40	+400	−400
400	500	0	−45	34	45	+450	−450

Remarks The bore diameter "no-go side" tolerances (high) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

Table 8. 7. 2 Tolerances for Housing Ring Diameter (Class Normal)

Units : μm

Nominal Outside Diameter D (mm)		Δ_{Dmp}	
over	incl.	high	low
120	180	0	− 25
180	250	0	− 30
250	315	0	− 35
315	400	0	− 40
400	500	0	− 45
500	630	0	− 50
630	800	0	− 75
800	1 000	0	−100

Remarks The outside diameter "no-go side" tolerances (low) specified in this table do not necessarily apply within a distance of 1.2 times the chamfer dimension r (max.) from the ring face.

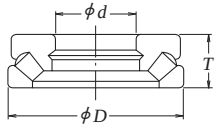


Table 8. 8 Tolerances of Instrument Ball Bearings (Inch design)
CLASS 5P, CLASS 7P, and CLASS 9P (ANSI/ABMA Equivalent)

(1) Tolerances for Inner Rings and Width of Outer Rings

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}				Δ_{ds}				V_{dp}		V_{dmp}		Δ_{Bs}	
		CLASS 5P CLASS 7P		CLASS 9P		CLASS 5P CLASS 7P		CLASS 9P		CLASS 5P CLASS 7P	CLASS 9P	CLASS 5P CLASS 7P	CLASS 9P	Single Brgs	
														CLASS 5P CLASS 7P CLASS 9P	
over	incl.	high	low	high	low	high	low	high	low	max.	max.	max.	max.	high	low
–	10	0	−5.1	0	−2.5	0	−5.1	0	−2.5	2.5	1.3	2.5	1.3	0	−25.4
10	18	0	−5.1	0	−2.5	0	−5.1	0	−2.5	2.5	1.3	2.5	1.3	0	−25.4
18	30	0	−5.1	0	−2.5	0	−5.1	0	−2.5	2.5	1.3	2.5	1.3	0	−25.4

(or Δ_{Cs})		V_{Bs}			K_{ia}			S_{ia}			S_d		
Combined Brgs (1) CLASS 5P CLASS 7P CLASS 9P		CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P
high	low	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.
0	−400	5.1	2.5	1.3	3.8	2.5	1.3	7.6	2.5	1.3	7.6	2.5	1.3
0	−400	5.1	2.5	1.3	3.8	2.5	1.3	7.6	2.5	1.3	7.6	2.5	1.3
0	−400	5.1	2.5	1.3	3.8	3.8	2.5	7.6	3.8	1.3	7.6	3.8	1.3

Note (1) Applicable to bearings for which the axial clearance (preload) is to be adjusted by combining two selected bearings.
Remarks For the CLASS 3P and the tolerances of Metric design Instrument Ball Bearings, it is advisable to consult NSK.

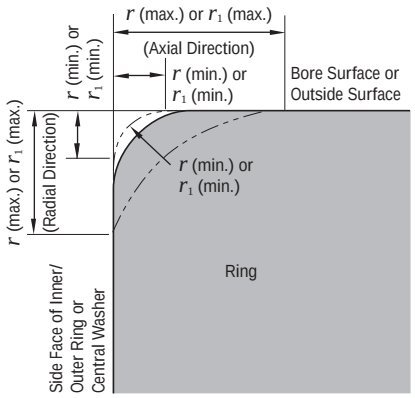
(2) Tolerances for Outer Rings

Units : μm

Nominal Outside Diameter D (mm)		Δ_{Dmp}				Δ_{Ds}						V_{Dp}			V_{Dmp}		
		CLASS 5P CLASS 7P		CLASS 9P		CLASS 5P CLASS 7P				CLASS 9P		CLASS 5P CLASS 7P		CLASS 9P	CLASS 5P CLASS 7P		CLASS 9P
						Open		Shielded Sealed		Open		Open	Shielded Sealed	Open	Open	Shielded Sealed	Open
over	incl.	high	low	high	low	high	low	high	low	high	low	max.	max.	max.	max.	max.	max.
–	18	0	−5.1	0	−2.5	0	−5.1	+1	−6.1	0	−2.5	2.5	5.1	1.3	2.5	5.1	1.3
18	30	0	−5.1	0	−3.8	0	−5.1	+1	−6.1	0	−3.8	2.5	5.1	2	2.5	5.1	2
30	50	0	−5.1	0	−3.8	0	−5.1	+1	−6.1	0	−3.8	2.5	5.1	2	2.5	5.1	2

V_{Cs} (1)			S_D			K_{ea}			S_{ea}			Deviation of Flange Outside Diameter Δ_{D1s}		Deviation of Flange Width Δ_{C1s}		Flange Backface Runout with Raceway (2) S_{ea1}
CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P	CLASS 7P	CLASS 9P	CLASS 5P CLASS 7P		CLASS 5P CLASS 7P		CLASS 5P CLASS 7P
max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	max.	high	low	high	low	max.
5.1	2.5	1.3	7.6	3.8	1.3	5.1	3.8	1.3	7.6	5.1	1.3	0	−25.4	0	−50.8	7.6
5.1	2.5	1.3	7.6	3.8	1.3	5.1	3.8	2.5	7.6	5.1	2.5	0	−25.4	0	−50.8	7.6
5.1	2.5	1.3	7.6	3.8	1.3	5.1	5.1	2.5	7.6	5.1	2.5	0	−25.4	0	−50.8	7.6

Notes (1) Applicable to flange width variation for flanged bearings.
(2) Applicable to flange back face.



r : Chamfer Dimension of Inner/Outer Ring
r_1 : Chamfer Dimension of Inner/Outer Ring (Front Side) or of Central Washer of Thrust Ball Bearings

Remarks The precise shape of chamfer surfaces has not been specified but its profile in the axial plane shall not intersect an arc of radius r (min.) or r_1 (min.) touching the side face of an inner ring or central washer and bore surface, or the side face of an outer ring and outside surface.

Table 8. 9 Chamfer Dimension Limits (for Metric Design Bearings)

Table 8. 9. 1 Chamfer Dimension Limits for Radial Bearings (excluding Tapered Roller Bearings)

Units : mm

Permissible Chamfer Dimension for Inner/ Outer Rings r (min.) or r_1 (min.)	Nominal Bore Diameter d over	Nominal Bore Diameter d incl.	Permissible Chamfer Dimension for Inner/Outer Rings r (max.) or r_1 (max.) Radial Direction	Permissible Chamfer Dimension for Inner/Outer Rings r (max.) or r_1 (max.) Axial Direction	Reference Corner Radius of Shaft or Housing r_a max.
0.05	–	–	0.1	0.2	0.05
0.08	–	–	0.16	0.3	0.08
0.1	–	–	0.2	0.4	0.1
0.15	–	–	0.3	0.6	0.15
0.2	–	–	0.5	0.8	0.2
0.3	–	40	0.6	1	0.3
	40	–	0.8	1	
0.6	–	40	1	2	0.6
	40	–	1.3	2	
1	–	50	1.5	3	1
	50	–	1.9	3	
1.1	–	120	2	3.5	1
	120	–	2.5	4	
1.5	–	120	2.3	4	1.5
	120	–	3	5	
2	–	80	3	4.5	2
	80	220	3.5	5	
	220	–	3.8	6	
2.1	–	280	4	6.5	2
	280	–	4.5	7	
2.5	–	100	3.8	6	2
	100	280	4.5	6	
	280	–	5	7	
3	–	280	5	8	2.5
	280	–	5.5	8	
4	–	–	6.5	9	3
5	–	–	8	10	4
6	–	–	10	13	5
7.5	–	–	12.5	17	6
9.5	–	–	15	19	8
12	–	–	18	24	10
15	–	–	21	30	12
19	–	–	25	38	15

Remarks For bearings with nominal widths less than 2mm, the value of r (max.) in the axial direction is the same as that in the radial direction.

Table 8. 9. 2 Chamfer Dimension Limits for Tapered Roller Bearings

Units : mm

Permissible Chamfer Dimension for Inner/ Outer Rings r (min.)	Nominal Bore or Nominal Outside Diameter (1) d or D over	Nominal Bore or Nominal Outside Diameter (1) d or D incl.	Permissible Chamfer Dimension for Inner/ Outer Rings r (max.) Radial Direction	Permissible Chamfer Dimension for Inner/ Outer Rings r (max.) Axial Direction	Reference Corner Radius of Shaft or Housing r_a max.
0.15	–	–	0.3	0.6	0.15
0.3	–	40	0.7	1.4	0.3
	40	–	0.9	1.6	
0.6	–	40	1.1	1.7	0.6
	40	–	1.3	2	
1	–	50	1.6	2.5	1
	50	–	1.9	3	
1.5	–	120	2.3	3	1.5
	120	250	2.8	3.5	
	250	–	3.5	4	
2	–	120	2.8	4	2
	120	250	3.5	4.5	
	250	–	4	5	
2.5	–	120	3.5	5	2
	120	250	4	5.5	
	250	–	4.5	6	
3	–	120	4	5.5	2.5
	120	250	4.5	6.5	
	250	400	5	7	
	400	–	5.5	7.5	
4	–	120	5	7	3
	120	250	5.5	7.5	
	250	400	6	8	
	400	–	6.5	8.5	
5	–	180	6.5	8	4
	180	–	7.5	9	
6	–	180	7.5	10	5
	180	–	9	11	

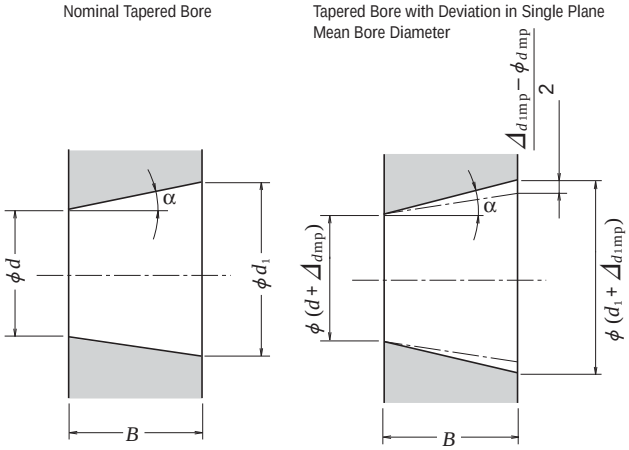
Note (1) Inner Rings are classified by d and Outer Rings by D.

Table 8. 9. 3 Chamfer Dimension Limits for Thrust Bearings

Units : mm

Permissible Chamfer Dimension for Shaft (or Central)/Housing Washers r (min.) or r_1 (min.)	Permissible Chamfer Dimension for Shaft (or Central)/Housing Washers r (max.) or r_1 (max.) Radial or Axial Direction	Reference Corner Radius of Shaft or Housing r_a max.
0.05	0.1	0.05
0.08	0.16	0.08
0.1	0.2	0.1
0.15	0.3	0.15
0.2	0.5	0.2
0.3	0.8	0.3
0.6	1.5	0.6
1	2.2	1
1.1	2.7	1
1.5	3.5	1.5
2	4	2
2.1	4.5	2
3	5.5	2.5
4	6.5	3
5	8	4
6	10	5
7.5	12.5	6
9.5	15	8
12	18	10
15	21	12
19	25	15

Table 8.10 Tolerances for Tapered Bores (Class Normal)



d : Nominal Bore Diameter
d_1 : Theoretical Diameter of Larger End of Tapered Bore
Taper 1:12 $d_1 = d + 1/12\ B$ Taper 1:30 $d_1 = d + /30\ B$
Δ_{dmp} : Single Plane Mean Bore Diameter Deviation in Theoretical Diameter of Smaller End of Bore
Δ_{d1mp} : Single Plane Mean Bore Diameter Deviation in Theoretical Diameter of Larger End of Bore
V_{dp} : Bore diameter variation in a single radial plane
B : Nominal Inner Ring width
α : Half of Taper Angle of Tapered Bore

Taper 1:12
α =2°23′9.4
=2.38594°
=0.041643 rad

Taper 1:30
α =57′17.4
=0.95484°
=0.016665 rad

Taper 1 : 12

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp} (1) (2)
over	incl.	high	low	high	low	max.
18	**30**	+33	0	+21	0	13
30	**50**	+39	0	+25	0	16
50	**80**	+46	0	+30	0	19
80	**120**	+54	0	+35	0	22
120	**180**	+63	0	+40	0	40
180	**250**	+72	0	+46	0	46
250	**315**	+81	0	+52	0	52
315	**400**	+89	0	+57	0	57
400	**500**	+97	0	+63	0	63
500	**630**	+110	0	+70	0	70
630	**800**	+125	0	+80	0	–
800	**1 000**	+140	0	+90	0	–
1 000	**1 250**	+165	0	+105	0	–
1 250	**1 600**	+195	0	+125	0	–

Notes (1) Applicable to all radial planes of tapered bores.
(2) Not applicable to diameter series 7 and 8.

Taper 1 : 30

Units : μm

Nominal Bore Diameter d (mm)		Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp} (1) (2)
over	incl.	high	low	high	low	max.
80	**120**	+20	0	+35	0	22
120	**180**	+25	0	+40	0	40
180	**250**	+30	0	+46	0	46
250	**315**	+35	0	+52	0	52
315	**400**	+40	0	+57	0	57
400	**500**	+45	0	+63	0	63
500	**630**	+50	0	+70	0	70

Notes (1) Applicable to all radial planes of tapered bores.
(2) Not applicable to diameter series 7 and 8.
Remarks For a value exceeding 630 mm, please contact NSK.

8.2 Selection of Accuracy Classes

For general applications, Class Normal tolerances are adequate in nearly all cases for satisfactory performance, but for the following applications, bearings having an accuracy class of 5,4 or higher are more suitable.
For reference, in Table 8.11, examples of applications and appropriate tolerance classes are listed for various bearing requirements and operating conditions.

Table 8. 11 Typical Tolerance Classes for Specific Applications (Reference)

Bearing Requirement, Operating Conditions	Examples of Applications	Tolerance Classes
High running accuracy is required	VTR Drum Spindles	P5
	Magnetic Disk Spindles for Computers	P5, P4, P2
	Machine-Tool Main Spindles	P5, P4, P2
	Rotary Printing Presses	P5
	Rotary Tables of Vertical Presses, etc.	P5, P4
	Roll Necks of Cold Rolling Mill Backup Rolls	Higher than P4
	Slewing Bearings for Parabolic Antennas	Higher than P4
Extra high speed is required	Dental Drills	CLASS 7P, CLASS 5P
	Gyroscopes	CLASS 7P, P4
	High Frequency Spindles	CLASS 7P, P4
	Superchargers	P5, P4
	Centrifugal Separators	P5, P4
	Main Shafts of Jet Engines	Higher than P4
Low torque and low torque variation are required	Gyroscope Gimbals	CLASS 7P, P4
	Servomechanisms	CLASS 7P, CLASS 5P
	Potentiometric Controllers	CLASS 7P