Ball Bearing Units

Ball Bearing Units offer a convenient method of applying highly reliable rolling contact bearings to applications without the necessity of manufacturing a bearing housing.

Generally Ball Bearing Units have following features.

- Self-aligning capability
- Sealed
- Easy to mount and dismount
- Interchangeability with foreign made units
- Many types suitable for applications Additionally NACHI Ball Bearing Units have the advantages of easy to use and high reliability.
- Anti-rotation pin on outer ring
- Eccentric collar type is also available
- Base for mount locating pin

Since Ball Bearings for units have the same geometry as deep groove ball bearing, load rating, reliability and other functions are equal with them of deep-groove ball bearing.

1. Designations

Number arrangement of Bearing Units and Ball bearings is shown as follows.

(1) Bearing Unit Numbers

C UK P 210 C CT4HR5 +H2310

- **Accessory No.**
  - Adapter sleeves
  - Frame of take-up type
- **Supplementary symbol**
  - Internal clearance
  - For high or low temperature
- **Bearing dimension series no.**
- **Housing type symbol**
  - Pillow,Flange etc
- **Bearing type symbol**
  - Cylindrical bore (With eccentric collar)
  - Tapered bore
- **Cover symbol**
  - C : Pressed steel or cast iron cover with seal
  - E : End cover of pressed steel
  - CE: End cover of cast iron
- **Covered housing symbol**
  - C: For cast iron cover

(2) Ball Bearing Numbers

UG 208 C3HR4 +ER

- **Accessory symbol**
  - Eccentric collar ER,AR
  - Adapter sleeve
- **Supplementary symbol**
  - Internal clearance
  - For high or low temperature
- **Dimension series (1)**
  - First number: Diameter series no.
  - 2nd and 3rd number : Bore diameter no.
- **Type symbol**
  - Set screw type : UC, B
  - Eccentric collar type : KH, U, UG
  - Adapter sleeve type : UK

Note (1) For type B bearings, a last digit of bore diameter number is used as dimension series number.

2.Tolerance

Tolerances for ball bearings and housings are shown as follows.

(1) Ball Bearing Tolerances

Tolerances of inner ring	Cylindrical bore : See Table 1 Tapered bore : See Table 5.7.1 (Technical Information) 1/12 taper bore
Tolerances of outer ring	Tolerance class 0 of Table 5.1.2 (Technical Information) Note : The lower limit of ΔD_{mp} is not applied within a distance of 1/4 of outer ring width from side faces.
Chamfer dimensions	See Table 2

(2) Bearing Unit Housing Tolerances

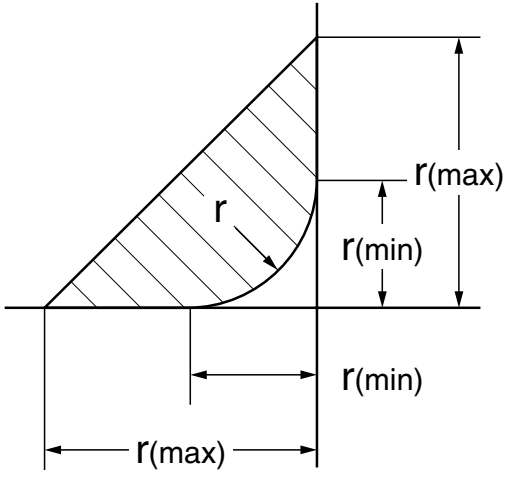
Spherical bearing seating of cast iron housing	See Table 3

Table 1. Tolerance of Inner Ring (Cylindrical bore)

Unit: μm

Bore dia. Nominal d (mm)		Single plane mean bore dia. deviation Δ_{dmp}		Bore dia. variation in a single radial plane V_{dp}	Deviation of a single inner ring width Δ_{Bs}		Radial runout of assembled bearing inner ring K_{ia} (referaence)	Deviation of (1) eccentric value of inner ring eccentric face Δ_{Hs}
Over	Incl.	High	Low	Max	High	Low	Max	
6	10	+12	0	8	0	−120	15	±100
10	18	+15	0	10	0	−120	15	±100
18	31.75	+18	0	12	0	−120	18	±100
31.75	50.8	+21	0	14	0	−120	20	±100
50.8	80	+24	0	16	0	−150	25	±100
80	120	+28	0	19	0	−200	30	–
120	180	+33	0	22	0	−250	35	–

Note (1) This deviation is used on the eccentric locking collar type bearings.



Remark The exact shape of the chamfer is not specified, but its contour will be in the area shown with oblique lines.

Table 2. Chamfer dimension Limits

Chamfer dimension Nominal r	r		Corner of shaft R
	Max	Min	Max
0.5	0.8	0.3	0.3
1	1.5	0.6	0.6
1.5	2	1	1
2	2.5	1.5	1
2.5	3	2	1.5
3	3.5	2.5	2
3.5	4	2.5	2
4	4.5	3	2.5
5	6	4	3

Table 3. Tolerance of cast iron housing

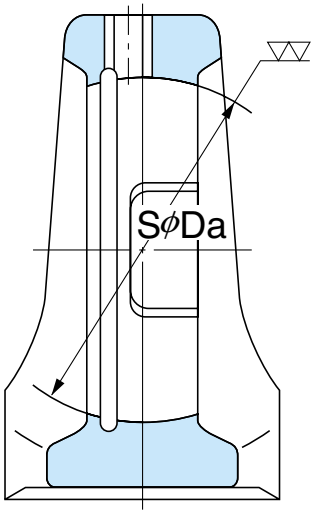
Unit: μm

Spherical bearing seating diameter nominal Da (mm)		Tolerance symbol H7			Tolerance symbol J7			Tolerance symbol K7		
		Deviation of single plane mean dia. of bearing seating ΔD_{am}		Bearing seating dia. variation in a single radial plane V_{Dap}	Deviation of single plane mean dia. of bearing seating ΔD_{am}		Bearing seating dia. variation in a single radial plane V_{Dap}	Deviation of single plane mean dia. of bearing seating ΔD_{am}		Bearing seating dia. variation in a single radial plane V_{Dap}
Over	Incl.	High	Low	Max	High	Low	Max	High	Low	Max
30	50	+25	0	10	+14	−11	10	+ 7	−18	10
50	80	+30	0	12	+18	−12	12	+ 9	−21	12
80	120	+35	0	14	+22	−13	14	+10	−25	14
120	180	+40	0	16	+26	−14	16	+12	−28	16
180	250	+46	0	18	+30	−16	18	+13	−33	18
250	315	+52	0	20	+36	−16	20	+16	−36	20

Notes: (1) Spherical bearing seat dimensions are divided into H7 for clearance fits and J7 and K7 for light interference fits. As NACHI bearings equipped with an anti-rotation pin to prevent outer race rotation, H7 is HACHI standard for the dimension.

(2) For rotating outer ring load or fluctuating load applications, J7 or K7 fitting practice should be used.

(3) Silver series of special alloy material are supplied with special tolerance.



3. Radial clearance of Ball Bearings

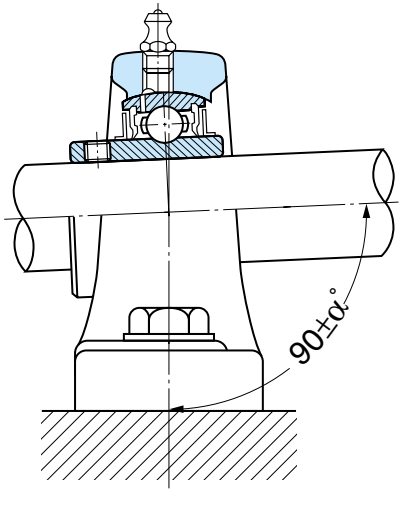
Cylindrical bore	See Table 6.1 (Technical Information) ; Radial internal clearance of deep-groove ball bearings (with Cylindrical bore)
Tapered bore	CT2 : CN for cylindrical bore CTN: C3 for cylindrical bore CT3 : C4 for cylindrical bore They are considered the inner ring expansion by fitting with an adapter sleeve.

4. Shaft Tolerance

For cylindrical bore bearings	● Normal load: Shaft tolerance h7, h8 or js7 ● Heavy or shock load: Shaft tolerance k6, k7 or m6
For tapered bore bearings with an adaptor sleeve	● Shaft tolerance h9

5. Maximum permissible misalignment angle

Normal permissible misalignment angle α is ±1.5° ~ 2.5° because it is restricted to grease supply.
Even if grease is not supplied, it is desirable to use at same limiting value.
If larger angles are needed, its angle is permissible to about ±5°.
The maximum misalignment angle of bearing units with a housing cover is ±1.0° ~ 1.8°, beyond this angle the inner diameter of the cover will interfere the shaft.
To prevent the unequal contact between seals and shaft, the heat generation and the dust intrusion, misalignment angle should be minimized.



6. Maximum permissible operating temperature

Since Bearing units are sometimes used at higher or lower temperature than normal, NACHI prepares the special specification shown in Table 4.
In case of Bearing units with high temperature specification, the decrease in basic load rating should be considered. And radial clearance should be larger than normal clearance.
NACHI standard radial clearance for high temperature applications is C3 HR4, C4 HR5 and C4 HR23 for cylindrical bore bearings and CT3 HR4, CT4 HR23 for tapered bore bearings.
If there is large temperature difference between inner ring and outer ring, radial internal clearance should be determined reasonably.

Notes 1. If operating temperature exceeds 150°C, careful investigation including radial internal clearance is required.
In such case, Please consult NACHI with operating conditions.
2. The grease shown in Table 4 must be supplied for relubrication. If the different grease are mixed,
lubrication ability can deteriorate. Before supplying different grease, please consult NACHI or grease manufacture.

Table 4. Operating Temperature Range

Series	Seal material	Grease	Operating temperature range (°C)	Slinger color
Silver series	Nitrile rubber (NBR)	Alvania Grease 2	– 10 ~ + 80	–
Standard	Nitrile rubber (NBR)	Alvania Grease 3	– 15 ~ +100	Black
HR4 for high temperature	Nitrile rubber (NBR)	Superlube 3	Normal temperature ~ +120	Yellow
HR5 for high temperature	Silicone rubber	Superlube 3	Normal temperature ~ +200	Yellow
HR23 for high temperature	Silicone rubber	Fluorine-contained Grease	Normal temperature ~ +230	Black
CR2A for low temperature	Silicone rubber	Aero Shell Grease 7	– 40 ~ +Normal temperature	White

7. Speed limit

Limiting speed of bearings is determined by the slip speed limit between the seal and inner ring or shaft.
Limiting speed of bearings is shown in the chart below. But this limiting speed should be decreased, if there are difference between shaft center and bearing center or a mixing resistance of grease for HR23 specification. When Bearing units are operated in excess of speed limit, please consult NACHI.

Limiting Speed for Bearing Units

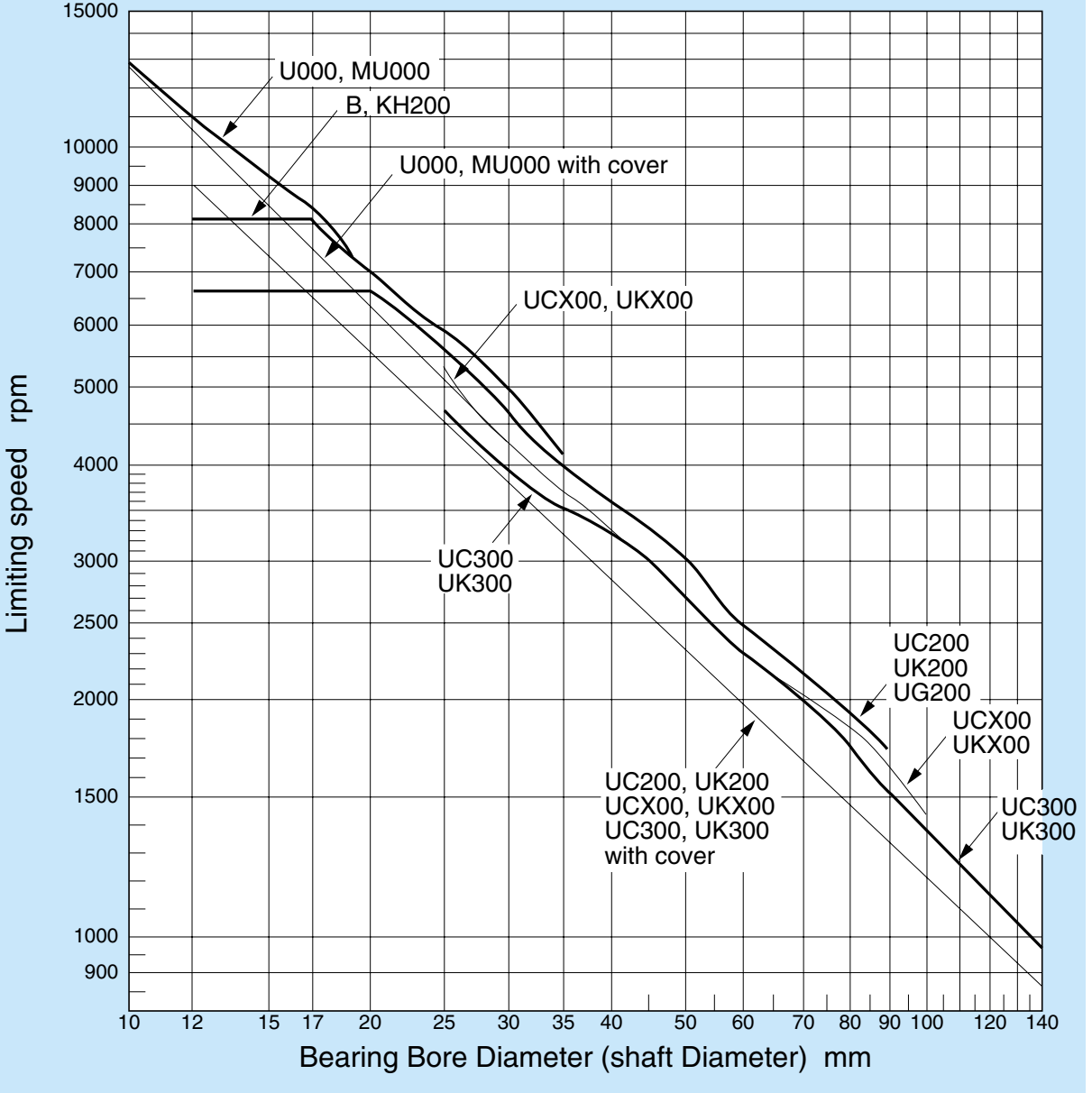


Table 5.1.2 Tolerance Values of Outer Ring (1/4)

Unit: μm

Bearing outside diameter Nominal D (mm)		Bearing outside diameter													
		Single plane mean outside diameter deviation Δ_{Dmp}										Deviation of a single outside diameter Δ_{Ds}			
		Class 0		Class 6		Class 5		Class 4		Class 2		Class 4		Class 2	
												Diameter series 0,1,2,3,4			
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	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	1000	0	−100	0	−60	–	–	–	–	–	–	–	–	–	–
1000	1250	0	−125	–	–	–	–	–	–	–	–	–	–	–	–
1250	1600	0	−160	–	–	–	–	–	–	–	–	–	–	–	–
1600	2000	0	−200	–	–	–	–	–	–	–	–	–	–	–	–
2000	2500	0	−250	–	–	–	–	–	–	–	–	–	–	–	–

Notes: (1) This diameter is included in this group.
(2) Applies before mounting and after removal of internal or external snap ring.
(3) Applies to radial ball bearings such as deep groove ball bearings, angular contact ball bearings.
(4) Outer ring width variation of class 0 and 6 are listed in Table 5.1.1.
(5) Applies to radial ball bearings such as deep groove ball bearing, angular contact ball bearings.

Remarks: The high deviation of bearing cylindrical bore diameter specified in this table does not apply within a distance of 1.2 × r (max) from the ring face.

Table 5.1.2 Tolerance Values of Outer Ring (2/4)

Unit: μm

Bearing outside diameter Nominal D (mm)		Bearing outside diameter												
		Outside diameter variation in a single radial plane (2) V_{Dp}												
		Class 0				Class 6				Class 5		Class 4		Class 2
		Open bearing			Seal · shield bearing	Open bearing			Seal · shield bearing	Open bearing		Open bearing		
		Diameter series				Diameter series				Diameter series		Diameter series		Open bearing
		7,8,9	0,1	2,3,4	2,3,4	7,8,9	0,1	2,3,4	0,1,2,3,4	7,8,9	0,1,2,3,4	7,8,9	0,1,2,3,4	
Over	Incl.	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
2.5(1)	6	10	8	6	10	9	7	5	9	5	4	4	3	2.5
6	18	10	8	6	10	9	7	5	9	5	4	4	3	2.5
18	30	12	9	7	12	10	8	6	10	6	5	5	4	4
30	50	14	11	8	16	11	9	7	13	7	5	6	5	4
50	80	16	13	10	20	14	11	8	16	9	7	7	5	4
80	120	19	19	11	26	16	16	10	20	10	8	8	6	5
120	150	23	23	14	30	19	19	11	25	11	8	9	7	5
150	180	31	31	19	38	23	23	14	30	13	10	10	8	7
180	250	38	38	23	–	25	25	15	–	15	11	11	8	8
250	315	44	44	26	–	31	31	19	–	18	14	13	10	8
315	400	50	50	30	–	35	35	21	–	20	15	15	11	10
400	500	56	56	34	–	41	41	25	–	23	17	–	–	–
500	630	63	63	38	–	48	48	29	–	28	21	–	–	–
630	800	94	94	55	–	56	56	34	–	35	26	–	–	–
800	1000	125	125	75	–	75	75	45	–	–	–	–	–	–
1000	1250	–	–	–	–	–	–	–	–	–	–	–	–	–
1250	1600	–	–	–	–	–	–	–	–	–	–	–	–	–
1600	2000	–	–	–	–	–	–	–	–	–	–	–	–	–
2000	2500	–	–	–	–	–	–	–	–	–	–	–	–	–

Notes: (1) This diameter is included in this group.
(2) Applies before mounting and after removal of internal or external snap ring.
(3) Applies to radial ball bearings such as deep groove ball bearings, angular contact ball bearings.
(4) Outer ring width variation of class 0 and 6 are listed in Table 5.1.1.
(5) Applies to radial ball bearings such as deep groove ball bearing, angular contact ball bearings.

Remarks: The high deviation of bearing cylindrical bore diameter specified in this table does not apply within a distance of 1.2 × r (max) from the ring face.

Table 5.1.2 Tolerance Values of Outer Ring (3/4)

Unit: μm

Bearing outside diameter Nominal D (mm)		Bearing outside diameter: Mean outside diameter variation (2) V_{Dmp}					Radial runout of assembled bearing outer ring K_{ea}					Variation of bearing outside suface generarix inclination with outer ring reference face S_D		
		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
Over	Incl.	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
2.5(1)	6	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5
6	18	6	5	3	2	1.5	15	8	5	3	1.5	8	4	1.5
18	30	7	6	3	2.5	2	15	9	6	4	2.5	8	4	1.5
30	50	8	7	4	3	2	20	10	7	5	2.5	8	4	1.5
50	80	10	8	5	3.5	2	25	13	8	5	4	8	4	1.5
80	120	11	10	5	4	2.5	35	18	10	6	5	9	5	2.5
120	150	14	11	6	5	2.5	40	20	11	7	5	10	5	2.5
150	180	19	14	7	5	3.5	45	23	13	8	5	10	5	2.5
180	250	23	15	8	6	4	50	25	15	10	7	11	7	4
250	315	26	19	9	7	4	60	30	18	11	7	13	8	5
315	400	30	21	10	8	5	70	35	20	13	8	13	10	7
400	500	34	25	12	–	–	80	40	23	–	–	15	–	–
500	630	38	29	14	–	–	100	50	25	–	–	18	–	–
630	800	55	34	18	–	–	120	60	30	–	–	20	–	–
800	1000	75	45	–	–	–	140	75	–	–	–	–	–	–
1000	1250	–	–	–	–	–	160	–	–	–	–	–	–	–
1250	1600	–	–	–	–	–	190	–	–	–	–	–	–	–
1600	2000	–	–	–	–	–	220	–	–	–	–	–	–	–
2000	2500	–	–	–	–	–	250	–	–	–	–	–	–	–

Notes: (1) This diameter is included in this group.
(2) Applies before mounting and after removal of internal or external snap ring.
(3) Applies to radial ball bearings such as deep groove ball bearings, angular contact ball bearings.
(4) Outer ring width variation of class 0 and 6 are listed in Table 5.1.1.
(5) Applies to radial ball bearings such as deep groove ball bearing, angular contact ball bearings.

Remarks: The high deviation of bearing cylindrical bore diameter specified in this table does not apply within a distance of $1.2 \times$ r (max) from the ring face.

Table 5.1.2 Tolerance Values of Outer Ring (4/4)

Bearing outside diameter Nominal D (mm)		Assembled bearing outer ring face runout with raceway S_{ea} (3)			Outer ring width variation V_{Cs} (4)		
		Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
Over	Incl.	Max	Max	Max	Max	Max	Max
2.5(1)	6	8	5	1.5	5	2.5	1.5
6	18	8	5	1.5	5	2.5	1.5
18	30	8	5	2.5	5	2.5	1.5
30	50	8	5	2.5	5	2.5	1.5
50	80	10	5	4	6	3	1.5
80	120	11	6	5	8	4	2.5
120	150	13	7	5	8	5	2.5
150	180	14	8	5	8	5	2.5
180	250	15	10	7	10	7	4
250	315	18	10	7	11	7	5
315	400	20	13	8	13	8	7
400	500	23	–	–	15	–	–
500	630	25	–	–	18	–	–
630	800	30	–	–	20	–	–
800	1000	–	–	–	–	–	–
1000	1250	–	–	–	–	–	–
1250	1600	–	–	–	–	–	–
1600	2000	–	–	–	–	–	–
2000	2500	–	–	–	–	–	–

Notes: (1) This diameter is included in this group.
(2) Applies before mounting and after removal of internal or external snap ring.
(3) Applies to radial ball bearings such as deep groove ball bearings, angular contact ball bearings.
(4) Outer ring width variation of class 0 and 6 are listed in Table 5.1.1.
(5) Applies to radial ball bearings such as deep groove ball bearing, angular contact ball bearings.

Remarks: The high deviation of bearing cylindrical bore diameter specified in this table does not apply within a distance of $1.2 \times r$ (max) from the ring face.

Table 5.7.1 1/12 Tapered Bore (Class 0)

Unit: μm

Nominal bearing bore dimension d (mm)		Mean bore diameter deviation at theoretical small end of a tapered bore				Bore diameter variation in a single radial plane (1)(2)
		Δ_{dmp}		$\Delta_{d1mp} - \Delta_{dmp}$		V_{dp}
Over	Incl.	High	Low	High	Low	Max
	10	+ 22	0	+ 15	0	9
10	18	+ 27	0	+ 18	0	11
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	1000	+140	0	+ 90	0	–
1000	1250	+165	0	+105	0	–
1250	1600	+195	0	+125	0	–

Note: (1) Applicable to all radial planes of tapered bore.
(2) Not applicable to bearings of diameter series 7 and 8.

Table 6.1 Radial Internal Clearance of Deep-groove Ball Bearings (with Cylindrical Bore) (JIS) (1/2)

Unit: μm

Bearing bore dia. Nominal d (mm)		Radial clearance									
		C2		CN (Normal)		C3		C4		C5	
Over	Incl.	min	max	min	max	min	max	min	max	min	max
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

Table 6.1 Radial Internal Clearance of Deep-groove Ball Bearings (with Cylindrical Bore) (JIS) (2/2)

Unit: μm

Bearing bore dia. Nominal d (mm)		Radial clearance									
		C2		CN (Normal)		C3		C4		C5	
Over	Incl.	min	max	min	max	min	max	min	max	min	max
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
630	710	20	130	110	260	240	400	380	570	540	760
710	800	20	140	120	290	270	450	430	630	600	840
800	900	20	160	140	320	300	500	480	700	670	940
900	1000	20	170	150	350	330	550	530	770	740	1040
1000	1120	20	180	160	380	360	600	580	850	820	1150
1120	1250	20	190	170	410	390	650	630	920	890	1260