

TOLERANCE

Bearing tolerances include dimensional tolerance and rotary tolerance or dimensional accuracy and running accuracy, are regulated by ISO or JIS standards (rolling bearing tolerances) etc. For dimensional accuracy, these standards prescribe the tolerances necessary when installing bearings on shafts or in housings. Running accuracy is defined as the allowable limits for bearing run-out during operation.

According to dimension tolerances and runout accuracy, HCH deep groove ball bearings are ranged from ABEC-1 to ABEC-7. ABEC-1 is standard grade, while ABEC-3 is higher, ABEC-5 is much higher and ABEC-7 is the highest.

● Comparison of tolerance classifications of national standards

Standard	Applicable standard	Tolerance class				
		ABEC-1	ABEC-3	ABEC-5	ABEC-7	ABEC-9
ANSI	ANSI/ABMA Std.20	ABEC-1	ABEC-3	ABEC-5	ABEC-7	ABEC-9
JIS	JIS B 1514	Class0,6X	Class 6	Class 5	Class 4	Class 2
ISO	ISO 492	Class0,6X	Class 6	Class 5	Class 4	Class 2
DIN	DIN 620	P0	P6	P5	P4	P2

Symbols: The following symbols are used to identify boundary of dimensions, size and size variations, and runout errors.

● Symbols for bearing dimensions and accuracy

<p>Basic Dimensions</p> <p>d = Basic bore diameter</p> <p>D = Basic outside diameter</p> <p>B = Basic inner ring width</p> <p>C = Basic outer ring width</p> <p>r = Chamfer of inner ring and outer ring</p>	<p>Dimensional Accuracy</p> <p>Δd_{mp} = Single plane mean bore diameter deviation from basic</p> <p>ΔD_{mp} = Single plane mean outside diameter deviation from basic</p> <p>ΔB_s = Single inner ring width deviation from basic</p> <p>ΔC_s = Single outer ring width deviation from basic</p>
<p>Dimensional Varieties</p> <p>Vd_{mp} = Mean bore diameter variation</p> <p>VD_{mp} = Mean outside diameter variation</p> <p>VB_s = Inner ring width variation</p> <p>VC_s = Outer ring width variation</p>	<p>Running Accuracy</p> <p>K_{ia} = Radial runout of assembled bearing inner ring</p> <p>K_{ea} = Radial runout of assembled bearing outer ring</p> <p>S_{ia} = Axial runout of assembled bearing inner ring</p> <p>S_{ea} = Axial runout of assembled bearing outer ring</p> <p>S_d = Inner ring reference face runout with bore</p> <p>SD = Outside cylindrical surface runout with outer ring reference face</p>

DEEP GROOVE BALL BEARING TOLERANCE CLASS ABEC-5 (P5)

INNER RING

Tolerance in μm .

d mm		Δd_{mp}		$V_{dp^{(2)}}$		V_{dmp}	K_{ia}	S_d	$S_{ia^{(3)}}$	ΔB_s		V_{Bs}	
				Diameter Series									
over	incl.	high	low	9 0,1,2,3,4		max.	max.	max.	max.	max.	high	low	max.
¹⁾ 0.6	2.5	0	-5	5	4	3	4	7	7	7	0	-40	5
2.5	10	0	-5	5	4	3	4	7	7	7	0	-40	5
10	18	0	-5	5	4	3	4	7	7	7	0	-80	5
18	30	0	-6	6	5	3	4	8	8	8	0	-120	5
30	50	0	-8	8	6	4	5	8	8	8	0	-120	5
50	80	0	-9	9	7	5	5	8	8	8	0	-150	6
80	120	0	-10	10	8	5	6	9	9	9	0	-200	7
120	180	0	-13	13	10	7	8	10	10	10	0	-250	8

Notes:

- 1) 0.6 is included.
- 2) No values for diameter series 7,8.
- 3) Fit for groove ball bearing only.

OUTER RING

Tolerance in μm .

D mm		ΔD_{mp}		$V_{Dp^{(2,3)}}$		V_{Dmp}	K_{ea}	$SD^{(4)}$	$Sea^{(4,5)}$	ΔC_s		V_{Cs}	
				Diameter Series									
over	incl.	high	low	9 0,1,2,3,4		max.	max.	max.	max.	max.	high	low	max.
¹⁾ 2.5	6	0	-5	5	4	3	5	8	8	8	Identical to ΔB_s of inner ring of same bearing	5	
6	18	0	-5	5	4	3	5	8	8	8		5	
18	30	0	-6	6	5	3	6	8	8	8		5	
30	50	0	-7	7	5	4	7	8	8	8		5	
50	80	0	-9	9	7	5	8	8	10	10		6	
80	120	0	-10	10	8	5	10	9	11	11		8	
120	150	0	-11	11	8	6	11	10	13	13		8	
150	180	0	-13	13	10	7	13	10	14	14		8	
180	250	0	-15	15	11	8	15	11	15	15		10	

Notes:

- 1) 2.5 is included.
- 2) No values for diameter series 7,8.
- 3) No values for shielded and sealed bearings.
- 4) No values for flanged bearings.
- 5) Fit for groove ball bearings.

Inch-dimension equivalent formula

1 inch = 25.4 mm
1 mm = 0.0393700787 inch

DEEP GROOVE BALL BEARING TOLERANCE CLASS ABEC-7 (P4)

INNER RING

Tolerance in μm .

d mm		Δd_{mp}		Δd_s		$V_{dp^{(2)}}$		V_{dmp}	K_{ia}	S_d	S_{ia}	ΔB_s		V_{Bs}
						Diameter Series								
over	incl.	high	low	high	low	7,8,9 1,7,2,3,4		max.	max.	max.	max.	high	low	max.
¹⁾ 0.6	2.5	0	-4	0	-4	4	3	2	2.5	3	3	0	-40	2.5
2.5	10	0	-4	0	-4	4	3	2	2.5	3	3	0	-40	2.5
10	18	0	-4	0	-4	4	3	2	2.5	3	3	0	-80	2.5
18	30	0	-5	0	-5	5	4	2.5	3	4	4	0	-120	2.5
30	50	0	-6	0	-6	6	5	3	4	4	4	0	-120	3
50	80	0	-7	0	-7	7	5	3.5	4	5	5	0	-150	4
80	120	0	-8	0	-8	8	6	4	5	5	5	0	-200	4
120	180	0	-10	0	-10	10	8	5	6	6	7	0	-250	5

Notes:

- 1) 0.6 is included.
- 2) Diameter Series 7 refers to those defined by GB273.3 as the miniature bearing series 7.

OUTER RING

Tolerance in μm .

D mm		ΔD_{mp}		ΔD_s		$V_{Dp^{(2)}}$		V_{Dmp}	K_{Ca}	SD	Sea	ΔC_s		V_{Cs}
						Diameter Series								
over	incl.	high	low	high	low	7,8,9 1,7,2,3,4		max.	max.	max.	high	low	max.	
¹⁾ 2.5	6	0	-4	0	-4	4	3	2	3	4	5	Identical to ΔB_s of inner ring of same bearing	2.5	
6	18	0	-4	0	-4	4	3	2	3	4	5		2.5	
18	30	0	-5	0	-5	5	4	2.5	4	4	5		2.5	
30	50	0	-6	0	-6	6	5	3	5	4	5		2.5	
50	80	0	-7	0	-7	7	5	3.5	5	4	5		3	
80	120	0	-8	0	-8	8	6	4	6	5	6		4	
120	150	0	-9	0	-9	9	7	5	7	5	7		5	
150	180	0	-10	0	-10	10	8	5	8	5	8		5	
180	250	0	-11	0	-11	11	8	6	10	7	10		7	

Notes:

- 1) 2.5 is included.
- 2) These windage is applicable for diameter series 1. 7. 2. 3. and 4.
- 3) Not applicable for closed type bearings.
- 4) Diameter Series 7 refers to those defined by GB273.3 as the miniature bearing series 7.

Inch-dimension equivalent formula

1 inch = 25.4 mm
1 mm = 0.0393700787 inch

METRIC TAPERED ROLLER BEARINGS

TOLERANCE CLASS P0 (Normal)

INNER RING

Tolerance in μm .

d (mm)		Δd_{mp}		V_{dp}	V_{dmp}	S_{ia}	K_{ia}	ΔB_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
10	18	0	-12	12	9	24	15	0	-120
18	30	0	-12	12	9	24	18	0	-120
30	50	0	-12	12	9	24	20	0	-120
50	80	0	-15	15	11	30	25	0	-150
80	120	0	-20	20	15	30	30	0	-200

OUTER RING

Tolerance in μm .

D (mm)		ΔD_{mp}		V_{Dp}	V_{Dmp}	S_{ea}	K_{ea}	ΔC_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
18	30	0	-12	12	9	40	18	Identical to ΔB_s of inner ring of same bearing	
30	50	0	-14	14	11	40	20		
50	80	0	-16	16	12	40	25		
80	120	0	-18	18	14	45	35		
120	150	0	-20	20	15	50	40		
150	180	0	-25	25	19	60	45		
180	250	0	-30	30	23	70	50		

BEARING WIDTHS

d (mm)		ΔT_s		ΔT_{1s}		ΔT_{2s}	
over	incl.	high	low	high	low	high	low
10	18	200	0	100	0	100	0
18	30	200	0	100	0	100	0
30	50	200	0	100	0	100	0
50	80	200	0	100	0	100	0
80	120	200	-200	100	-100	100	-100

METRIC TAPERED ROLLER BEARINGS

TOLERANCE CLASS P6 (CLN)

INNER RING

Tolerance in μm .

d (mm)		Δd_{mp}		V_{dp}	V_{dmp}	S_{ia}	K_{ia}	ΔB_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
10	18	0	-12	12	9	24	7	0	-120
18	30	0	-12	12	9	24	8	0	-120
30	50	0	-12	12	9	24	10	0	-120
50	80	0	-15	15	11	30	13	0	-150
80	120	0	-20	20	15	30	-	0	-200

OUTER RING

Tolerance in μm .

D (mm)		ΔD_{mp}		V_{Dp}	V_{Dmp}	S_{ea}	K_{ea}	ΔC_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
18	30	0	-12	12	9	40	9	Identical to ΔB_s of inner ring of same bearing	
30	50	0	-14	14	11	40	10		
50	80	0	-16	16	12	40	13		
80	120	0	-18	18	14	45	18		
120	150	0	-20	20	15	50	20		
150	180	0	-25	25	19	60	23		
180	250	0	-30	30	23	70	-		

BEARING WIDTHS

d (mm)		ΔT_s		ΔT_{1s}		ΔT_{2s}	
over	incl.	high	low	high	low	high	low
10	18	200	0	100	0	100	0
18	30	200	0	100	0	100	0
30	50	200	0	100	0	100	0
50	80	200	0	100	0	100	0
80	120	200	-200	100	-100	100	-100

METRIC TAPERED ROLLER BEARINGS

TOLERANCE CLASS P6x (CL7C)

INNER RING

Tolerance in μm .

d (mm)		Δd_{mp}		V_{dp}	V_{dmp}	S_{ia}	K_{ia}	ΔB_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
10	18	0	-12	12	9	24	15	0	-50
18	30	0	-12	12	9	24	18	0	-50
30	50	0	-12	12	9	24	20	0	-50
50	80	0	-15	15	11	30	25	0	-50
80	120	0	-20	20	15	30	30	0	-50

OUTER RING

Tolerance in μm .

D (mm)		ΔD_{mp}		V_{Dp}	V_{Dmp}	S_{ea}	K_{ea}	ΔC_s	
over	incl.	high	low	max.	max.	max.	max.	high	low
18	30	0	-12	12	9	40	18	0	-100
30	50	0	-14	14	11	40	20	0	-100
50	80	0	-16	16	12	40	25	0	-100
80	120	0	-18	18	14	45	35	0	-100
120	150	0	-20	20	15	50	40	0	-100
150	180	0	-25	25	19	60	45	0	-100
180	250	0	-30	30	23	70	50	0	-100

BEARING WIDTHS

d (mm)		ΔT_s		ΔT_{1s}		ΔT_{2s}	
over	incl.	high	low	high	low	high	low
10	18	100	0	50	0	50	0
18	30	100	0	50	0	50	0
30	50	100	0	50	0	50	0
50	80	100	0	50	0	50	0
80	120	100	0	50	0	50	0

METRIC TAPERED ROLLER BEARINGS

TOLERANCE CLASS P5

INNER RING

Tolerance in μm .

d (mm)		Δd_{mp}		V_{dp}	V_{dmp}	S_{ia}	K_{ia}	S_d	ΔB_s	
over	incl.	high	low	max.	max.	max.	max.	max.	high	low
10	18	0	-7	5	5	8	7	7	0	-200
18	30	0	-8	6	5	8	8	8	0	-200
30	50	0	-10	8	5	8	10	8	0	-240
50	80	0	-12	9	6	10	10	8	0	-300
80	120	0	-15	11	8	10	13	9	0	-400

OUTER RING

Tolerance in μm .

D (mm)		ΔD_{mp}		V_{Dp}	V_{Dmp}	S_{ea}	K_{ea}	S_D	ΔC_s	
over	incl.	high	low	max.	max.	max.	max.	max.	high	low
18	30	0	-8	6	5	20	6	8	Identical to ΔB_s of inner ring of same bearing	
30	50	0	-9	7	5	20	7	8		
50	80	0	-11	8	6	20	8	8		
80	120	0	-13	10	7	22	10	9		
120	150	0	-15	11	8	25	11	10		
150	180	0	-18	14	9	30	13	10		
180	250	0	-20	15	10	35	15	11		

BEARING WIDTHS

d (mm)		ΔT_s	
over	incl.	high	low
10	18	200	-200
18	30	200	-200
30	50	200	-200
50	80	200	-200
80	120	200	-200

