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.

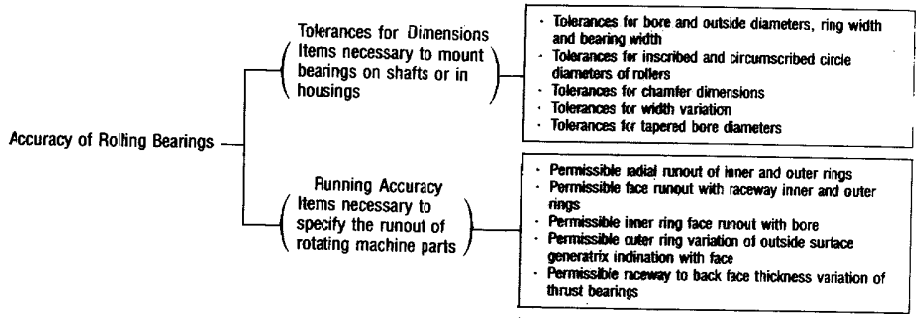


Table 8. 1 Bearing Types and Tolerance Classes

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 ~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 ~A67
	Inch Design	ANSI/ABMA CLASS 4	ANSI/ABMA CLASS 2	ANSI/ABMA CLASS 3	ANSI/ABMA CLASS 1	ANSI/ABMA CLASS 00	Table 8.4	A68 ~A69
Magneto Bearings		Normal	Class 6	Class 5	—	—	Table 8.5	A70 ~A71
Thrust Ball Bearings		Normal	Class 6	Class 5	Class 4	—	Table 8.6	A72 ~A74
Spherical Thrust Roller Bearings		Normal	—	—	—	—	Table 8.7	A75
Equivalent standards (Reference)	JIS(1)	Class 0	Class 6	Class 5	Class 4	Class 2	—	—
	DIN(2)	P 0	P 6	P 5	P 4	P 2	—	—
	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 ~A63 (A76 ~A77)
	ANSI/ABMA(3) Roller Bearings	RBEC 1	RBEC 3	RBEC 5	—	—		
	ANSI/ABMA(3) Tapered Roller Bearings	CLASS 4	CLASS 2	CLASS 3	CLASS 0	CLASS 00	(Table) 8.4	(A68 ~A69)

Note (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).

eference) Rough definitions of the items listed for nning Accuracy and their measuring methods are own in Fig. 8.1, and they are described in detail in O 5593 (Rolling Bearings-Vocabulary) and JIS B 15 (Measuring Methods for Rolling Bearings) and sewhere.

Supplementary Table

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

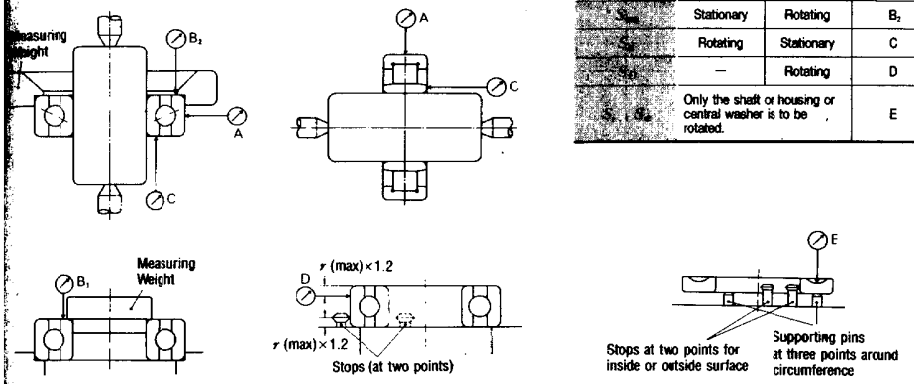


Fig. 8.1 Measuring Methods for Running Accuracy (summarized)

Symbols for Boundary Dimensions and Running Accuracy

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

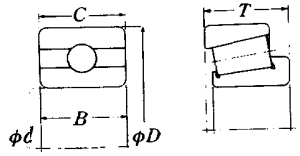


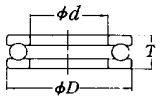
Table 8. 6 Tolerances for Thrust Ball Bearings

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_c (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	6	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_c, applies only to flat-seat thrust bearings.



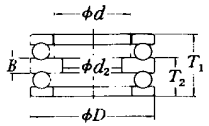


Table 8. 6. 2 Tolerances for Outside Diameter of Housing Washers and Aligning Seat Washers

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 Deviaton Δ_{Dis}	
		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	—	—	—	—	—	—	—	—