BEARING TOLERANCES
Standard Values

The tolerances for the dimensions and running accuracy of bearings are set out in ISO 492/199/582. This largely corresponds to DIN 620.

Accuracy of rolling bearings

Tolerances for dimensions: items necessary to mount bearings on shafts or in housings
› To ances for bore and outside diameters, ring 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 run-out of rotating machine parts
› Permissible radial run-out of inner and outer rings
› Permissible face run-out with raceway inner and outer rings
› Permissible inner ring face run-out with bore
› Permissible outer ring variation of outside surface generatrix inclination with face
› Permissible raceway-to-back-face thickness variation of thrust bearings

ACCURACY CLASSES

Apart from the standard accuracies defined by DIN/ISO, higher accuracies are specified by 6x, 6, 5, 4 and 2.

Bearing types		Applicable tolerance classes				
Deep-groove ball bearings		Normal	Class 6	Class 5	Class 4	Class 2
Angular-contact ball bearings		Normal	Class 6	Class 5	Class 4	Class 2
Self-aligning ball bearings		Normal	Class 6 equivelant	Class 5 equivelant	–	–
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	–
	Inch design	ANSI/ABMA Class 4	ANSI/ABMA Class 2	ANSI/ABMA Class 3	ANSI/ABMA Class 0	ANSI/ABMA Class 00
Magneto bearings		Normal	Class 6	Class 5	–	–
Thrust ball bearings		Normal	Class 6	Class 5	Class 4	–
Tapered roller thrust bearings		Normal	–	–	–	–
Thrust spherical roller bearings		Normal	–	–	–	–
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 bearing	ABEC 1	ABEC 3	ABEC 5 (Class 5P)	ABEC 7 (Class 7P)	ABEC 9 (Class 9P)
	Roller bearing	RBEC 1	RBEC 3	RBEC 5	–	–
	Tapered roller bearing	Class 4	Class 2	Class 3	Class 0	Class 00

Notes: [1] JIS : Japanese Industrial Standards.
[2] DIN: Deutsche Industrie Norm.
[3] ANSI/ABMA: The American Bearing Manufacturers Association.

The tolerances of the accuracy class "Normal" (P0) are sufficient for general applications in most cases.

TYPICAL TOLERANCE CLASSES FOR SPECIFIC APPLICATIONS (REFERENCE)

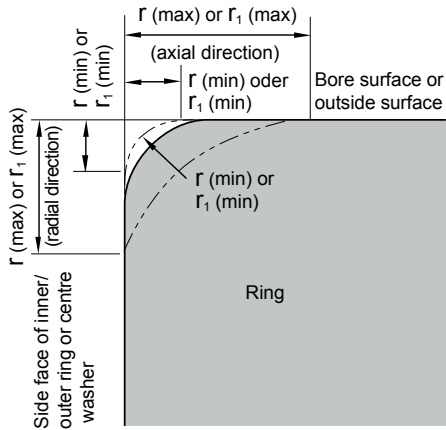| Bearing requirement, operating conditions	Examples of applications	Tolerance classes
High running accuracy is required	VTR drum spindles Magnetic disk spindles for computers Machine tool main spindles Rotary printing presses Rotary tables of vertical presses, etc. Roll necks of cold rolling mill backup rolls Slewing bearings for parabolic antennae	P5 P5, P4, P2 P5, P4, P2 P5 P5, P4 Higher than P4 Higher than P4
Very high speed is required	Dental drills Gyroscopes High-frequency spindles superchargers Compresors Centrifugal separators Main shafts for jet engines	Class 7P, Class 5P Class 7P, P4 Class 7P, P4 P5, P4 P5, P4 Higher than P4
Low torque and low torque variation are required	Gyroscope gimbals Servomechanisms Potentiometric controllers	Class 7P, P4 Class 7P, Class 5P Class 7P

MEASURING METHODS
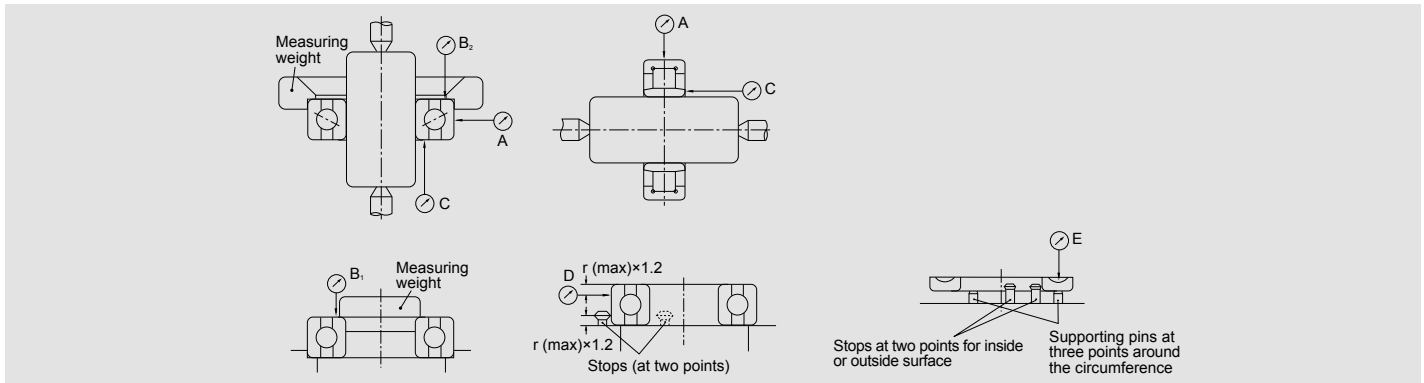
Running accuracy	Inner ring	Outer ring	Measuring point
K_{ia}	rotating	stationary	A
K_{ea}	stationary	rotating	A
S_{ia}	rotating	stationary	B_1
S_{ea}	stationary	rotating	B_2
S_d	rotating	stationary	C
S_D	–	rotating	D
S_i , S_e	Only the shaft or housing or central washer is to be rotated		E

r: Chamfer dimension of inner/outer ring
r₁: Chamfer dimension of inner/outer ring (front side) or the center washer of thrust ball bearings

Remarks: The exact shape of the edge reduction results from the radius that is reduced in the area of the face and rolling surfaces. Make sure that there is no contact between the surrounding structure and the bearing in the area of the edge reduction. The radius here is smaller than the r (min) or r_1 (min) value quoted in the bearing table. (According to DIN 616, ISO 15 and ISO 355.)
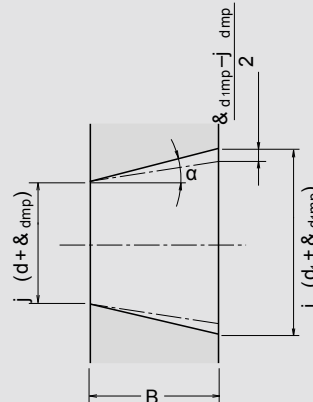
TOLERANCES FOR TAPERED BORES (CLASS NORMAL)

Nominal tapered bore
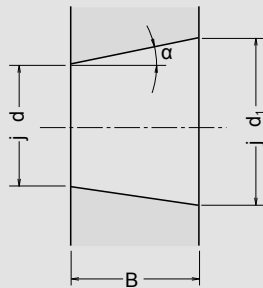
Tapered bore with deviation in single plane mean bore diameter

d : nominal bore diameter
d_1 : heoretical diameter of larger end of tapered bore
taper 1:12 $d_1 = d + 1/12\ B$ taper 1:30 $d_1 = d + 1/30\ B$
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 widths
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 = 0° 57' 17,4"
= 0,95484°
= 0,016665 rad