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Types of bearings

Definitions

A bearing is a mechanical unit that provides a mobile link between two parts that rotate in relation to one another. Its function is to permit relative rotation of these parts, under load, with accuracy and minimum friction.

A bearing consists of:

- two rings, one associated with a fixed element, the other with the moving element and featuring raceways
- rolling elements allowing relative displacement of the two rings with minimum friction
- a cage separating the rolling elements

There are two large bearing families:

- ball bearings, allowing high speeds of rotation and where the ball-raceway interface is theoretically point contact
- roller bearings, where the ball-raceway interface is theoretically line contact. Roller bearings can withstand higher radial loads than ball bearings

, 6)



Туре	Outer ring	Inner ring	Rolling elements	Synthetic material	Pressed steel	Integrally machined
Ball bearing						
Cylindrical roller bearing						
Tapered roller bearing	(cup)	(cone)				
Double-row spherical roller bearing						0
Needle bearing						
Ball thrust bearing	(housing ring)	(shaft ring)				
Spherical roller thrust bearing	(housing ring)	(shaft ring)				



Types of bearings (continued)

Vocabulary

Standard ISO 5593 has established a vocabulary of standard terms applicable to bearings and bearing technology.

The terms and definitions are given in a multilingual glossary.



Capabilities

General characteristics and capabilities

Ball bearings

Single- or double-row radial ball bearings Popular bearings due to their cost/performance compromise.

Numerous variants (shielded, sealed etc.) and large selection of dimensions.





Electric motor



Reduction gear box Machine-tool spindle



Reducing gear Automobile wheels Agricultural machinery



Reducing gear



For long shaft with deflection



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Roll stand Large reducing gear Large industrial fan Printing machine roller Quarry machine



Single-row angular-contact ball bearings

Always mounted in opposition with another bearing of the same type.

Give great assembly rigidity, especially when preloaded

Double-row angular-contact ball bearings Withstand axial loads in both directions. Can be used alone as a double bearing.

4-point angular contact ball bearings Withstand axial loads in both directions. Often associated with a radial contact bearing.

Double-row self-aligning ball or spherical roller bearings

Double-row self-aligning ball bearings The spherical raceway of the outer ring permits angular displacement.

A variant with a tapered bore simplifies fitting.

Spherical roller bearings

The spherical raceway of the outer ring permits angular displacement

A variant with a tapered bore simplifies fitting.



Types of bearings (continued)

General characteristics and capabilities

Application examples

Roller bearings

Cylindrical roller bearings

Excellent resistance to instantaneous overloads and shocks.

Simplification of installation thanks to their detachable elements.

Certain types allow axial displacement; others allow a low axial load.

Single-row tapered roller bearings

Always mounted in opposition with another bearing of the same type.

Give great assembly rigidity, especially when preloaded.

 Double-row tapered roller bearings (SNR TWINLINE)

Accept axial loads in both directions. Often used alone as a double bearing.

Needle bearings

Accept relatively high radial loads with small space requirement and high radial rigidity.

Thrust bearings

Thrust bearings are often used with other types of bearing.

Ball thrust bearings

Withstand axial loads only. If radial load is applied must be associated with a radial bearing.

Spherical roller thrust bearings

Can withstand a radial and axial load while accepting misalignment.



Heavy-duty electric motor Wagon axle box Pressure roller Rolling machine roll



Reducing gear shaft Truck wheel Bevel gear transfer gearbox



TGV high-speed train axle box Automobile wheel





Vertical shaft Tailstock Plate pump



Heavy-duty vertical shaft Turbo-generator Crane pivot Plastic injection screw

		r	Loa adial	ad cap	pabilities axial			Limiting speed of rotation			Permissible misalignment between shaft and housing	
				Q)•	Q			=0		
Types	Cross-section	low	medium	good	low	medium	good	low	medium	good	low	good
Radial ball bearing											•	
Double-row radial ball bearing											•	
Angular-contact ball bearing											•	
4-point angular-contact ball bearing											•	
Double-row angular contact ball bearing											•	
TWINLINE angular contact ball bearing											•	
Double-row self-aligning ball bearing												•
Cylindrical roller bearing (1)											•	
Tapered roller bearing											•	
TWINLINE tapered roller bearing											•	
Double-row spherical roller bearing												٠
Single-direction ball thrust bearing											•	
Spherical roller thrust bearing												•

(1) Types NJ and NUP accept low axial loads



Seneral Data

Standardization and interchangeability

The standards

The mission of the International Standard Organisation (ISO) is to develop and coordinate standardization to facilitate the trade of products and services between nations. It encompasses the standards committees of 89 countries (AFNOR-France, DIN-Germany, UNI-Italy, BS-Great Britain, ANSI-United States, etc.).

Bearing standardization is the responsibility of the ISO Technical Committee "TC 4" in which SNR plays an active part. The main standards used for bearings and thrust bearings are specified in the appendix page 147.

Interchangeability

- Dimensional interchangeability is guaranteed by the values and tolerances on the bearing dimensions: d, D, B, C, r and T.
- d Bore diameter
- D Outside diameter
- B Width of bearing or width of inner ring (cone)
- C Width of bearing or width of outer ring (cup)
- T Width or total height
- r Corner radius



Strict application of the standards in the manufacture of the bearing enables one to obtain full interchangeability between bearings of the same part number, whoever the manufacturer, place or date of production.

Standardization of the bearing also allows dimensional interchangeability between bearings of different types, either total or partial. It is necessary to ensure the functional interchangeability.

12)

Bearing series codes according to the different outside diameters and widths

For a given bore the standards provide for several diameter series (series 8, 9, 0, 1, 2, 3, 4 in ascending order).

For each diameter series there are several width series (series 0, 1, 2, 3, 4 in ascending order).

Interchangeability of detachable elements of cylindrical or tapered roller bearings

Cylindrical or tapered roller bearings can be separated into two parts: a ring that is joined to the cage and rollers and a bare ring.

Cylindrical roller bearings

Interchangeability is ensured by the dimensions below the rollers ${\sf F}$ and above the rollers ${\sf E}.$





Tapered roller bearings

The interchangeability of the internal sub-assemblies (fitted cones) and outer rings (cups) is ensured by standard ISO 355 which defines the contact angle α and the theoretical inside diameter of the cup E. One must check that the bearings are indeed identical (same suffix).





Caution : There is full interchangeability between SNR elements. ISO has standardized the values of the above dimensions without specifying their tolerances. Consequently, although the assembly of elements from different manufacturers presents no risk, it does not always give optimum performance and should therefore be avoided.



Dimensions and part numbers

General designations

ISO has established standards in the form of a general plan of dimensions corresponding to standards ISO 15, ISO 355 and ISO 104. These standards allow universal use of the different types of bearings.

- The general designation system taken from standards ISO 15 and ISO 104 applies to all types of standardized bearings
- Tapered roller bearings have specific designations taken from standard ISO 355

The special bearings have a specific numbering system.

→ Complete part number

Each bearing part number is comprised of the following components:



The table on the following page specifies the different possibilities for the series codes and bore codes. The main suffixes and prefixes are specified in the chapter corresponding to each family.

Basic part number



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🗪 General Data

Dimensions and part numbers (continued)

Designations of tapered roller bearings

Standard ISO 355 defines the series of dimensions of tapered roller bearings.

The old part numbering system has been maintained in this catalog. The new designation is however mentioned for the bearings of the new series.



Width and diameter series



The part numbers of special bearings is not standard and is specific to each manufacturer. The designation system defined by SNR is given below.

	<u>Y53</u> <u>GB</u>	40256		<u>S01</u>				
Mate or	erial modification heat treatment (optional)	Sequence number in the follow 9000 to 139 40000 to 429	ving number ranges: 099 099	Variant suffix				
	Type of I	bearing	Exam	ples				
AB	Single-row radial contac	t ball bearing						
BB	Single-row angular conta	act ball bearing						
GB	Two-part double-row ang	ular contact ball bearing	$\bigcirc \bigcirc$					
TGB	Single-flange double-row	angular contact ball bearing						
HGB	Two-flange double-row a	angular contact ball bearing						
DB	Double-row radial contac	ct ball bearing						
AP	Ball thrust bearing							
QJ	4-point angular contact l	pearings	Ц.	1				
ТJ	3-point angular contact I	pearings						
N	Cylindrical roller bearing	: N, NU, NUP						
GNU	Cylindrical roller bearing							
EC	Single-row tapered roller	r bearing						
FC	Double-row tapered rolle	er bearing						
TFC	Single-flange double-rov	v tapered roller bearing						
QR	Crossed roller bearing							
Х	Sensor bearings XGB, X	TGB, XHGB, XFC, XTFC	Ó	3				
СН	Ceramic Rolling Element	S		2				



SNR General Data

Bearing manufacturing precision

Standardization

Standard ISO 492 specifies the tolerances applicable to the dimensions and precision of rotation of metric series radial bearings.

The dimensional tolerances defined by this standard bear the following symbols:



- Tolerance classes defined by standard ISO 492:
- The Normal class, which is that of all the standard bearings, and is not usually indicated in the bearing designation
- The High precision classes which are, in ascending order of precision: ISO 6, ISO 5, ISO 4, ISO 2

These classes are indicated in the suffix added to the bearing reference.

Example:

Clearance category 3 _____ ISO precision class 5

Standard ISO 199 sets the tolerances on thrust bearing dimensions.

Standard ISO 582 sets the tolerances on bearing corner radii. The dimensions applicable to fillets and shoulders are indicated in the table of bearing characteristics.

Standard ISO 5753 defines the tolerances on the radial clearance of the bearings.

Tolerance definition

The tolerance classes fix several types of tolerances and characteristics given for a temperature of $20^{\circ}C \pm 1^{\circ}C$ (68°F ±1.8).

Dimensional tolerances

Standard ISO 492 sets the tolerances for the three main dimensions of a bearing:

- the bore diameter d
- the outside diameter D
- the width of each ring B and C with, in addition, for tapered bearings, the total width T

Functional tolerances

The standard also defines the precision of rotation of the bearings:

- the raceway radial runout of each ring. It is measured on the moving ring with respect to the fixed ring
- side face runout with reference to the bore of the inner ring
- outer ring side face runout with respect to the outer diameter
- side face runout with respect to the track



Bearing manufacturing precision (continued)

Dimensional tolerances		Deviations
d: nominal bore diameter	∆dmp Vdp Vdmp	 Deviation of a mean bore diameter in an isolated plane (tolerance on the mean diameter) Variation in the bore diameter in an isolated radial plane (ovality) Variation in the mean bore diameter (applies only to a supposedly cylindrical bore) in different planes
D: nominal outside diameter	∆Dmp VDp VDmp	 Deviation of a mean outside diameter in an isolated plane (tolerance on the mean diameter) Variation in the outside diameter in an isolated radial plane (ovality) Variation in the mean outside diameter in different planes
B: nominal width of ring	∆Bs VBs	 Deviation of an isolated width of the inner ring (width tolerance) Variation in the width of the inner ring (face parallelism)
C: nominal width of ring	∆Cs VCs	 Deviation of an isolated width of the outer ring (width tolerance) Variation in the width of the outer ring (face parallelism)
 T : nominal width of tapered bearing T1: effective nominal width of the internal sub-assembly T2: effective nominal width of the external sub-assembly 	ΔTs ΔT1s Δ T2s	 Deviation in the actual width of the bearing Deviation in the effective actual width of the internal sub-assembly Deviation in the effective actual width of the external sub-assembly

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Functional tolerances	Deviations
radial run-out	 Kia • Radial run-out of the inner ring on the assembled bearing • Radial run-out of the outer ring on the assembled bearing
run-out of the reference face	 Sd • Axial run-out of the reference face (or large face if applicable) of the inner ring with respect to the bore (run-out of the face of the inner ring) SD • Perpendicularity error of the external surface with respect to the reference face (or large face) of the outer ring (external surface run-out)
bearing raceway run-out	 Sea • Axial run-out of the reference face (or large face) of the outer ring with respect to the bearing raceway, on the assembled bearing (run-out of outer ring raceway) Sia • Axial run-out of the reference face (or large face) of the inner ring with respect to the bearing raceway on the assembled bearing (run-out of the inner ring raceway)

Consult SNR for the method of measurement.



Bearing manufacturing precision (continued)

\rightarrow Equivalence of bearing precision standards

	ISO	AFNOR	ABEC	DIN
	tolerance	tolerance	tolerance	tolerance
	class	class	class	class
Standard Precision	Normal	Normal	1	PO
High Precision	6	6	3	P6
	5	5	5	P5
	4	4	7	P4
	2	2	9	P2

The values given by the various standards for certain characteristics are not rigorously identical.

The tolerance class, when indicated on the bearing, imposes compliance with all the tolerances in the said class.

Nevertheless, certain bearing applications require special tolerances on certain dimensions or characteristics.

To avoid using an excessively expensive high-precision bearing, SNR can supply bearings with reduced tolerances on certain dimensions or characteristics. For example, run-out of inner ring of high-speed bearings for wood-working machine spindles.

Consult SNR.

Bearing tolerances

Radial bearings	Standard ISO 492
 Normal tolerance class Tolerance class 6 Tolerance class 5 Tolerance class 4 Tolerance class 2 	page 23 page 24 page 25 page 26 page 27
Tapered roller bearings	Standard ISO 492
 Normal tolerance class Tolerance class 6X Tolerance class 5 	page 28 page 29 page 30
Thrust bearings	Standard ISO 199
Normal tolerance class, 6 and 5	page 31
Tapered boresBore with 1:12 and 1:30 taper	Standard ISO 492 page 32

→ Radial bearings - Normal tolerance classes

With the exception of tapered roller bearings and thrust bearings. Standard ISO 492.

Inner ring

Tolerances in micrometers

d mm				Vdp ⁽¹⁾								
		∆dmp		Diameter series 9 0,1 2,3,4			Vdmp	Kia	all	normal	modified ⁽¹⁾	VBs
		upper	lower		max		max	max	upper	lov	lower	
0,6 ≤d≤ 2 2,5 <d≤ 7<br="">10 <d≤ 7<="" td=""><td>2,5 10 18</td><td>0 0 0</td><td>-8 -8 -8</td><td>10 10 10</td><td>8 8 8</td><td>6 6 6</td><td>6 6 6</td><td>10 10 10</td><td>0 0 0</td><td>-40 -120 -120</td><td>_ -250 -250</td><td>12 15 20</td></d≤></d≤>	2,5 10 18	0 0 0	-8 -8 -8	10 10 10	8 8 8	6 6 6	6 6 6	10 10 10	0 0 0	-40 -120 -120	_ -250 -250	12 15 20
18 <d≤ 3<br="">30 <d≤ 50="" 8<="" <d≤="" td=""><td>30 50 80</td><td>0 0 0</td><td>-10 -12 -15</td><td>13 15 19</td><td>10 12 19</td><td>8 9 11</td><td>8 9 11</td><td>13 15 20</td><td>0 0 0</td><td>-120 -120 -150</td><td>-250 -250 -380</td><td>20 20 25</td></d≤></d≤>	30 50 80	0 0 0	-10 -12 -15	13 15 19	10 12 19	8 9 11	8 9 11	13 15 20	0 0 0	-120 -120 -150	-250 -250 -380	20 20 25
80 <d≤ 12<br="">120<d≤ 18<br="">180<d≤ 25<="" td=""><td>20 80 50</td><td>0 0 0</td><td>-20 -25 -30</td><td>25 31 38</td><td>25 31 38</td><td>15 19 23</td><td>15 19 23</td><td>25 30 40</td><td>0 0 0</td><td>-200 -250 -300</td><td>-380 -500 -500</td><td>25 30 30</td></d≤></d≤></d≤>	20 80 50	0 0 0	-20 -25 -30	25 31 38	25 31 38	15 19 23	15 19 23	25 30 40	0 0 0	-200 -250 -300	-380 -500 -500	25 30 30
250 <d≤ 3<sup="">- 315 <d≤ 40<br="">400 <d≤ 50<="" td=""><td>15 00 00</td><td>0 0 0</td><td>-35 -40 -45</td><td>44 50 56</td><td>44 50 56</td><td>26 30 34</td><td>26 30 34</td><td>50 60 65</td><td>0 0 0</td><td>-350 -400 -450</td><td>-500 -630 –</td><td>35 40 50</td></d≤></d≤></d≤>	15 00 00	0 0 0	-35 -40 -45	44 50 56	44 50 56	26 30 34	26 30 34	50 60 65	0 0 0	-350 -400 -450	-500 -630 –	35 40 50
500 <d≤ 63<br="">630 <d≤ 80<br="">800 <d≤100< td=""><td>30 00 00</td><td>0 0 0</td><td>-50 -75 -100</td><td>63 </td><td>63 </td><td>38 </td><td>38 </td><td>70 80 90</td><td>0 0 0</td><td>-500 -750 -1000</td><td></td><td>60 70 80</td></d≤100<></d≤></d≤>	30 00 00	0 0 0	-50 -75 -100	63 	63 	38 	38 	70 80 90	0 0 0	-500 -750 -1000		60 70 80

(1) Relates to the rings of isolated bearings for installation in pairs or per unit.

Outer ring

Tolerances in micrometers

				VD	p ⁽¹⁾							
D	ADmn		Open bearings			Shielded bearings	VDmn(l)	Kaa	ΔCs ΔC1s ⁽²⁾			
mm		шþ		Diamete	er series			Nea		15	VUIS	
			9	0,1	2,3,4	2,3,4						
	upper	lower		m	ах		max	max	upper	upper lower		
2.5≤D≤ 6	0	-8	10	8	6	10	6	15				
6 <d≤ 18<="" td=""><td>0</td><td>-8</td><td>10</td><td>8</td><td>6</td><td>10</td><td>6</td><td>15</td><td></td><td></td><td></td></d≤>	0	-8	10	8	6	10	6	15				
18 <d≤ 30<="" td=""><td>0</td><td>-9</td><td>12</td><td>9</td><td>7</td><td>12</td><td>7</td><td>15</td><td></td><td></td><td></td></d≤>	0	-9	12	9	7	12	7	15				
30 <d≤ 50<="" td=""><td>0</td><td>-11</td><td>14</td><td>11</td><td>8</td><td>16</td><td>8</td><td>20</td><td colspan="4"></td></d≤>	0	-11	14	11	8	16	8	20				
50 <d≤ 80<="" td=""><td>0</td><td>-13</td><td>16</td><td>13</td><td>10</td><td>20</td><td>10</td><td>25</td><td></td><td></td><td></td></d≤>	0	-13	16	13	10	20	10	25				
80 <d≤120< td=""><td>0</td><td>-15</td><td>19</td><td>19</td><td>11</td><td>26</td><td>11</td><td>35</td><td colspan="3"></td></d≤120<>	0	-15	19	19	11	26	11	35				
120 <d≤ 150<="" td=""><td>0</td><td>-18</td><td>23</td><td>23</td><td>14</td><td>30</td><td>14</td><td>40</td><td></td><td></td><td></td></d≤>	0	-18	23	23	14	30	14	40				
150 <d≤180< td=""><td>0</td><td>-25</td><td>31</td><td>31</td><td>19</td><td>38</td><td>19</td><td>45</td><td>Identio</td><td></td><td></td></d≤180<>	0	-25	31	31	19	38	19	45	Identio			
180 <d≤ 250<="" td=""><td>0</td><td>-30</td><td>38</td><td>38</td><td>23</td><td>- </td><td>23</td><td>50</td><td>of</td><td>the inner ri</td><td>na ves</td></d≤>	0	-30	38	38	23	-	23	50	of	the inner ri	na ves	
250 <d≤ 315<="" td=""><td>0</td><td>-35</td><td>44</td><td>44</td><td>26</td><td>-</td><td>26</td><td>60</td><td>of th</td><td>e same be</td><td>aring</td></d≤>	0	-35	44	44	26	-	26	60	of th	e same be	aring	
315 <d≤ 400<="" td=""><td>0</td><td>-40</td><td>50</td><td>50</td><td>30</td><td>-</td><td>30</td><td>70</td><td></td><td></td><td></td></d≤>	0	-40	50	50	30	-	30	70				
400 <d≤ 500<="" td=""><td>0</td><td>-45</td><td>56</td><td>56</td><td>34</td><td>- </td><td>34</td><td>80</td><td colspan="3"></td></d≤>	0	-45	56	56	34	-	34	80				
500 <d≤ 630<="" td=""><td>0</td><td>-50</td><td>63</td><td>63</td><td>38</td><td>-</td><td>38</td><td>100</td><td></td><td></td><td></td></d≤>	0	-50	63	63	38	-	38	100				
630 <d≤ 800<="" td=""><td>0</td><td>-75</td><td>94</td><td>94</td><td>55</td><td>-</td><td>55</td><td>120</td><td></td><td></td><td></td></d≤>	0	-75	94	94	55	-	55	120				
800 <d≤1000< td=""><td>0</td><td>-100</td><td>125</td><td>125</td><td>75</td><td>-</td><td>75</td><td>140</td><td></td><td></td><td></td></d≤1000<>	0	-100	125	125	75	-	75	140				

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

(1) Taken before fitting and after removal of the inner or outer snap ring.

(2) Only applies to ball and grooved bearings.



Bearing manufacturing precision (continued)

→ High-precision radial bearings – Tolerance class 6

With the exception of tapered roller bearings and thrust bearings. Standard ISO 492.

Inner ring

Tolerances in micrometers

				Vdp					ΔBs		
d mm	∆dmp		Diameter series 9 0,1 2,3,4			Vdmp	Kia	all	normal	modified ⁽¹⁾	VBs
	upper	lower		max		max	max	upper	lov	ver	max
0,6 ≤d≤ 2,5 2,5 <d≤ 10<br="">10 <d≤ 18<="" td=""><td>0 0 0</td><td>-7 -7 -7</td><td>9 9 9</td><td>7 7 7</td><td>5 5 5</td><td>5 5 5</td><td>5 6 7</td><td>0 0 0</td><td>-40 -120 -120</td><td>-250 -250</td><td>12 15 20</td></d≤></d≤>	0 0 0	-7 -7 -7	9 9 9	7 7 7	5 5 5	5 5 5	5 6 7	0 0 0	-40 -120 -120	-250 -250	12 15 20
18 <d≤ 30<br="">30 <d≤ 50<br="">50 <d≤ 80<="" td=""><td>0 0 0</td><td>-8 -10 -12</td><td>10 13 15</td><td>8 10 15</td><td>6 8 9</td><td>6 8 9</td><td>8 10 10</td><td>0 0 0</td><td>-120 -120 -150</td><td>-250 -250 -380</td><td>20 20 25</td></d≤></d≤></d≤>	0 0 0	-8 -10 -12	10 13 15	8 10 15	6 8 9	6 8 9	8 10 10	0 0 0	-120 -120 -150	-250 -250 -380	20 20 25
80 <d≤ 120<br="">120<d≤ 180<br="">180<d≤ 250<="" td=""><td>0 0 0</td><td>-15 -18 -22</td><td>19 23 28</td><td>19 23 28</td><td>11 14 17</td><td>11 14 17</td><td>13 18 20</td><td>0 0 0</td><td>-200 -250 -300</td><td>-380 -500 -500</td><td>25 30 30</td></d≤></d≤></d≤>	0 0 0	-15 -18 -22	19 23 28	19 23 28	11 14 17	11 14 17	13 18 20	0 0 0	-200 -250 -300	-380 -500 -500	25 30 30
250 <d≤ 315<br="">315 <d≤ 400<br="">400 <d≤ 500<br="">500 <d≤ 630<="" td=""><td>0 0 0 0</td><td>-25 -30 -35 -40</td><td>31 38 44 50</td><td>31 38 44 50</td><td>19 23 26 30</td><td>19 23 26 30</td><td>25 30 35 40</td><td>0 0 0 0</td><td>-350 -400 -450 -500</td><td>-500 -630 </td><td>35 40 45 50</td></d≤></d≤></d≤></d≤>	0 0 0 0	-25 -30 -35 -40	31 38 44 50	31 38 44 50	19 23 26 30	19 23 26 30	25 30 35 40	0 0 0 0	-350 -400 -450 -500	-500 -630 	35 40 45 50

(1) Relates to the rings of isolated bearings for installation in pairs or per unit.

Outer ring

Tolerances in micrometers

				VD	p ⁽¹⁾							
D		mn	Ор	en bearir	igs	Shielded bearings		Kea	ΔCs		VCs	
mm		iiih		Diamete	er series		Anuth.,	Nea	<u>Δ</u> C	1s ⁽²⁾	VC1s(2)	
			9	0,1	2,3,4	0,1,2,3,4						
	upper	lower		m	ax		max	max	upper	lower	max	
2.5≤D≤ 6	0	-7	9	7	5	9	5	8				
6 <d≤ 18<="" td=""><td>0</td><td>-7</td><td>9</td><td>7</td><td>5</td><td>9</td><td>5</td><td>8</td><td></td><td></td><td></td></d≤>	0	-7	9	7	5	9	5	8				
18 <d≤ 30<="" td=""><td>0</td><td>-8</td><td>10</td><td>8</td><td>6</td><td>10</td><td>6</td><td>9</td><td></td><td></td><td></td></d≤>	0	-8	10	8	6	10	6	9				
30 <d≤ 50<="" td=""><td>0</td><td>-9</td><td>11</td><td>9</td><td>7</td><td>13</td><td>7</td><td>10</td><td colspan="4"></td></d≤>	0	-9	11	9	7	13	7	10				
50 <d≤ 80<="" td=""><td>0</td><td>-11</td><td>14</td><td>11</td><td>8</td><td>16</td><td>8</td><td>13</td><td></td><td colspan="3"></td></d≤>	0	-11	14	11	8	16	8	13				
80 <d≤ 120<="" td=""><td>0</td><td>-13</td><td>16</td><td>16</td><td>10</td><td>20</td><td>10</td><td>18</td><td colspan="3"></td></d≤>	0	-13	16	16	10	20	10	18				
120 <d≤ 150<="" td=""><td>0</td><td>-15</td><td>19</td><td>19</td><td>11</td><td>25</td><td>11</td><td>20</td><td></td><td></td><td></td></d≤>	0	-15	19	19	11	25	11	20				
150 <d≤ 180<="" td=""><td>0</td><td>-18</td><td>23</td><td>23</td><td>14</td><td>30</td><td>14</td><td>23</td><td></td><td></td><td></td></d≤>	0	-18	23	23	14	30	14	23				
180 <d≤ 250<="" td=""><td>0</td><td>-20</td><td>25</td><td>25</td><td>15</td><td>-</td><td>15</td><td>25</td><td>Identica</td><td>al to ΔBs a</td><td>nd VBs</td></d≤>	0	-20	25	25	15	-	15	25	Identica	al to ΔBs a	nd VBs	
250 <d≤ 315<="" td=""><td>0</td><td>-25</td><td>31</td><td>31</td><td>19</td><td>-</td><td>19</td><td>30</td><td>off</td><td>the inner ri</td><td>ng</td></d≤>	0	-25	31	31	19	-	19	30	off	the inner ri	ng	
315 <d≤ 400<="" td=""><td>0</td><td>-28</td><td>35</td><td>35</td><td>21</td><td>-</td><td>21</td><td>35</td><td></td><td>e same bea</td><td>ung</td></d≤>	0	-28	35	35	21	-	21	35		e same bea	ung	
400 <d≤ 500<="" td=""><td>0</td><td>-33</td><td>41</td><td>41</td><td>25</td><td>-</td><td>25</td><td>40</td><td></td><td></td><td></td></d≤>	0	-33	41	41	25	-	25	40				
500 <d≤ 630<="" td=""><td>0</td><td>-38</td><td>48</td><td>48</td><td>29</td><td>-</td><td>29</td><td>50</td><td></td><td></td><td></td></d≤>	0	-38	48	48	29	-	29	50				
630 <d≤ 800<="" td=""><td>0</td><td>-45</td><td>56</td><td>56</td><td>34</td><td>-</td><td>34</td><td>60</td><td></td><td></td><td></td></d≤>	0	-45	56	56	34	-	34	60				
800 <d≤1000< td=""><td>0</td><td>-60</td><td>75</td><td>75</td><td>45</td><td>-</td><td>45</td><td>75</td><td></td><td></td><td></td></d≤1000<>	0	-60	75	75	45	-	45	75				

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

(1) Taken before fitting and after removal of the inner or outer snap ring.

(2) Only applies to ball and grooved bearings.

→ High-precision radial bearings – Tolerance class 5

With the exception of tapered roller bearings and thrust bearings. Standard ISO 492.

Inner ring

Tolerances in micrometers

Tolerances in micrometers

			V	dp						∆Bs		
d mm	Δdi	mp	Diameto 9	er series 0,1,2,3,4	Vdmp	Kia	Sd	Sia ⁽¹⁾	all	normal	modified ⁽²⁾	VBs
	upper	IUwei		dX	IIIdX	IIIdX	IIIdX	IIIdX	upper	101	vei	IIIdX
0,6 ≤d≤ 2,5	0	-5	5	4	3	4	7	7	0	-40	-250	5
2,5 <d≤ 10<="" td=""><td>0</td><td>-5</td><td>5</td><td>4</td><td>3</td><td>4</td><td>7</td><td>7</td><td>0</td><td>-40</td><td>-250</td><td>5</td></d≤>	0	-5	5	4	3	4	7	7	0	-40	-250	5
10 <d≤ 18<="" td=""><td>0</td><td>-5</td><td>5</td><td>4</td><td>3</td><td>4</td><td>7</td><td>7</td><td>0</td><td>-80</td><td>-250</td><td>5</td></d≤>	0	-5	5	4	3	4	7	7	0	-80	-250	5
18 <d≤ 30<="" td=""><td>0</td><td>-6</td><td>6</td><td>5</td><td>3</td><td>4</td><td>8</td><td>8</td><td>0</td><td>-120</td><td>-250</td><td>5</td></d≤>	0	-6	6	5	3	4	8	8	0	-120	-250	5
30 <d≤ 50<="" td=""><td>0</td><td>-8</td><td>8</td><td>6</td><td>4</td><td>5</td><td>8</td><td>8</td><td>0</td><td>-120</td><td>-250</td><td>5</td></d≤>	0	-8	8	6	4	5	8	8	0	-120	-250	5
50 <d≤ 80<="" td=""><td>0</td><td>-9</td><td>9</td><td>7</td><td>5</td><td>5</td><td>8</td><td>8</td><td>0</td><td>-150</td><td>-250</td><td>6</td></d≤>	0	-9	9	7	5	5	8	8	0	-150	-250	6
80 <d≤ 120<="" td=""><td>0</td><td>-10</td><td>10</td><td>8</td><td>5</td><td>6</td><td>9</td><td>9</td><td>0</td><td>-200</td><td>-380</td><td>7</td></d≤>	0	-10	10	8	5	6	9	9	0	-200	-380	7
120 <d≤ 180<="" td=""><td>0</td><td>-13</td><td>13</td><td>10</td><td>7</td><td>8</td><td>10</td><td>10</td><td>0</td><td>-250</td><td>-380</td><td>8</td></d≤>	0	-13	13	10	7	8	10	10	0	-250	-380	8
180 <d≤ 250<="" td=""><td>0</td><td>-15</td><td>15</td><td>12</td><td>8</td><td>10</td><td>11</td><td>13</td><td>0</td><td>-300</td><td>-500</td><td>10</td></d≤>	0	-15	15	12	8	10	11	13	0	-300	-500	10
250 <d≤ 315<="" td=""><td>0</td><td>-18</td><td>18</td><td>14</td><td>9</td><td>13</td><td>13</td><td>15</td><td>0</td><td>-350</td><td>-500</td><td>13</td></d≤>	0	-18	18	14	9	13	13	15	0	-350	-500	13
315 <d≤ 400<="" td=""><td>0</td><td>-23</td><td>23</td><td>18</td><td>12</td><td>15</td><td>15</td><td>20</td><td>0</td><td>-400</td><td>-630</td><td>15</td></d≤>	0	-23	23	18	12	15	15	20	0	-400	-630	15

(1) Only applies to ball and grooved bearings

(2) Relates to the rings of isolated bearings for installation in pairs or per unit.

Outer ring

			V	Dp			SD ⁽¹⁾	-		٨	Cs	VCs
D mm	ΔD	mp	Diameto 9	er series 0,1,2,3,4	VDmp	Kea	SD1 ⁽²⁾	Sea ⁽¹⁾⁽²⁾	Sea1 ⁽²⁾	ΔC ⁻	1s ⁽²⁾	VC1s ⁽²⁾
	upper	lower	n	iax	max	max	max	max	max	max	lower	max
2,5 ≤D≤ 6 6 <d≤ 18<br="">18 <d≤ 30<="" td=""><td>0 0 0</td><td>-5 -5 -5</td><td>5 5 6</td><td>4 4 5</td><td>3 3 3</td><td>5 5 6</td><td>8 8 8</td><td>8 8 8</td><td>11 11 11</td><td></td><td></td><td>5 5 5</td></d≤></d≤>	0 0 0	-5 -5 -5	5 5 6	4 4 5	3 3 3	5 5 6	8 8 8	8 8 8	11 11 11			5 5 5
30 <d≤ 50<br="">50 <d≤ 80<br="">80 <d≤120< td=""><td>0 0 0</td><td>-7 -9 -10</td><td>7 9 10</td><td>5 7 8</td><td>4 5 5</td><td>7 8 10</td><td>8 8 9</td><td>8 10 11</td><td>11 14 16</td><td colspan="2" rowspan="2">$\begin{array}{c} & \text{Identical} \\ & \text{to } \Delta Bs \\ & \text{of the inner ring} \\ & \text{of the same} \end{array}$</td><td>5 6 8</td></d≤120<></d≤></d≤>	0 0 0	-7 -9 -10	7 9 10	5 7 8	4 5 5	7 8 10	8 8 9	8 10 11	11 14 16	$\begin{array}{c} & \text{Identical} \\ & \text{to } \Delta Bs \\ & \text{of the inner ring} \\ & \text{of the same} \end{array}$		5 6 8
120 <d≤ 150<br="">150 <d≤ 180<br="">180 <d≤ 250<="" td=""><td>0 0 0</td><td>-11 -13 -15</td><td>11 13 15</td><td>8 10 11</td><td>6 7 8</td><td>11 13 15</td><td>10 10 11</td><td>13 14 15</td><td>18 20 21</td><td>8 8 10</td></d≤></d≤></d≤>	0 0 0	-11 -13 -15	11 13 15	8 10 11	6 7 8	11 13 15	10 10 11	13 14 15	18 20 21			8 8 10
250 <d≤ 315<br="">315 <d≤ 400<br="">400 <d≤ 500<="" td=""><td>0 0 0</td><td>-18 -20 -23</td><td>18 20 23</td><td>14 15 17</td><td>9 10 12</td><td>18 20 23</td><td>13 13 15</td><td>18 20 23</td><td>25 28 33</td><td>bearing</td><td>11 13 15</td></d≤></d≤></d≤>	0 0 0	-18 -20 -23	18 20 23	14 15 17	9 10 12	18 20 23	13 13 15	18 20 23	25 28 33	bearing	11 13 15	
500 <d≤ 630<br="">630 <d≤ 800<="" td=""><td>0 0</td><td>-28 -35</td><td>28 35</td><td>21 26</td><td>14 18</td><td>25 30</td><td>18 20</td><td>25 30</td><td>35 42</td><td></td><td></td><td>18 20</td></d≤></d≤>	0 0	-28 -35	28 35	21 26	14 18	25 30	18 20	25 30	35 42			18 20

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

(1) Does not apply to bearings with a flange-type outer ring.

(2) Only applies to ball and grooved bearings.



🗪 General Data

Bearing manufacturing precision (continued)

→ High-precision radial bearings – Tolerance class 4

With the exception of tapered roller bearings and thrust bearings. Standard ISO 492.

Inner ring

Tolerances in micrometers

					Va	ip						∆Bs		
d mm	Δd	mp	Δι	1S ⁽¹⁾	Ø se 9	eries 0,1,2,3,4	Vdmp	Kia	Sd	Sia ⁽²⁾	all	normal	modified ⁽²⁾	VBs
	upper	lower	upper	lower	m	ax	max	max	max	max	upper	lo	ver	max
0,6 ≤d≤ 2,5	0	-4	0	-4	4	3	2	2,5	3	3	0	-40	-250	2,5
2,5 <d≤ 10<="" td=""><td>0</td><td>-4</td><td>0</td><td>-4</td><td>4</td><td>3</td><td>2</td><td>2,5</td><td>3</td><td>3</td><td>0</td><td>-40</td><td>-250</td><td>2,5</td></d≤>	0	-4	0	-4	4	3	2	2,5	3	3	0	-40	-250	2,5
10 <d≤ 18<="" td=""><td>0</td><td>-4</td><td>0</td><td>-4</td><td>4</td><td>3</td><td>2</td><td>2,5</td><td>3</td><td>3</td><td>0</td><td>-80</td><td>-250</td><td>2,5</td></d≤>	0	-4	0	-4	4	3	2	2,5	3	3	0	-80	-250	2,5
18 <d≤ 30<="" td=""><td>0</td><td>-5</td><td>0</td><td>-5</td><td>5</td><td>4</td><td>2,5</td><td>3</td><td>4</td><td>4</td><td>0</td><td>-120</td><td>-250</td><td>2,5</td></d≤>	0	-5	0	-5	5	4	2,5	3	4	4	0	-120	-250	2,5
30 <d≤ 50<="" td=""><td>0</td><td>-6</td><td>0</td><td>-6</td><td>6</td><td>5</td><td>3</td><td>4</td><td>4</td><td>4</td><td>0</td><td>-120</td><td>-250</td><td>3</td></d≤>	0	-6	0	-6	6	5	3	4	4	4	0	-120	-250	3
50 <d≤ 80<="" td=""><td>0</td><td>-7</td><td>0</td><td>-7</td><td>7</td><td>5</td><td>3,5</td><td>4</td><td>5</td><td>5</td><td>0</td><td>-150</td><td>-250</td><td>4</td></d≤>	0	-7	0	-7	7	5	3,5	4	5	5	0	-150	-250	4
80 <d≤ 120<="" td=""><td>0</td><td>-8</td><td>0</td><td>-8</td><td>8</td><td>6</td><td>4</td><td>5</td><td>5</td><td>5</td><td>0</td><td>-200</td><td>-380</td><td>4</td></d≤>	0	-8	0	-8	8	6	4	5	5	5	0	-200	-380	4
120 <d≤ 180<="" td=""><td>0</td><td>-10</td><td>0</td><td>-10</td><td>10</td><td>8</td><td>5</td><td>6</td><td>6</td><td>7</td><td>0</td><td>-250</td><td>-380</td><td>5</td></d≤>	0	-10	0	-10	10	8	5	6	6	7	0	-250	-380	5
180 <d≤ 250<="" td=""><td>0</td><td>-12</td><td>0</td><td>-12</td><td>12</td><td>9</td><td>6</td><td>8</td><td>7</td><td>8</td><td>0</td><td>-300</td><td>-500</td><td>6</td></d≤>	0	-12	0	-12	12	9	6	8	7	8	0	-300	-500	6

(1) These differences apply to diameter series 0, 1, 2, 3 and 4 only.

(2) Only applies to ball and grooved bearings

(3) Relates to the rings of isolated bearings for installation in pairs or per unit.

Outer ring

Tolerances in micrometers

D	ΔD	mp	ΔI)s ⁽¹⁾	VE Ø se)p eries	VDmp	Kea	Sd ⁽²⁾ Sd1 ⁽³⁾	Sea ⁽²⁾⁽³⁾	Sea1 ⁽³⁾	۵۵ ۵۵	Cs 1s ³⁾	VCs VC1s®
mm		louror		lawar	9	0,1,2,3,4							lower	
	upper	lower	upper	lower	m	ax	max	тах	max	max	тах	upper	lower	max
2,5 ≤D≤ 6 6 <d≤ 18<br="">18 <d≤ 30<="" td=""><td>0 0 0</td><td>-4 -4 -5</td><td>0 0 0</td><td>-4 -4 -5</td><td>4 4 5</td><td>3 3 4</td><td>2 2 2,5</td><td>3 3 4</td><td>4 4 4</td><td>5 5 5</td><td>7 7 7</td><td></td><td></td><td>2,5 2,5 2,5</td></d≤></d≤>	0 0 0	-4 -4 -5	0 0 0	-4 -4 -5	4 4 5	3 3 4	2 2 2,5	3 3 4	4 4 4	5 5 5	7 7 7			2,5 2,5 2,5
30 <d≤ 50<br="">50 <d≤ 80<br="">80 <d≤120< td=""><td>0 0 0</td><td>-6 -7 -8</td><td>0 0 0</td><td>-6 -7 -8</td><td>6 7 8</td><td>5 5 6</td><td>3 3,5 4</td><td>5 5 6</td><td>4 4 5</td><td>5 5 6</td><td>7 7 8</td><td>lden to 2 of the</td><td>tical \Bs inner</td><td>2,5 3 4</td></d≤120<></d≤></d≤>	0 0 0	-6 -7 -8	0 0 0	-6 -7 -8	6 7 8	5 5 6	3 3,5 4	5 5 6	4 4 5	5 5 6	7 7 8	lden to 2 of the	tical \Bs inner	2,5 3 4
120 <d≤150 150 <d≤180 180 <d≤250< td=""><td>0 0 0</td><td>-9 -10 -11</td><td>0 0 0</td><td>-9 -10 -11</td><td>9 10 11</td><td>7 8 8</td><td>5 5 6</td><td>7 8 10</td><td>5 5 7</td><td>7 8 10</td><td>10 11 14</td><td>ring c same b</td><td>of the bearing</td><td>5 5 7</td></d≤250<></d≤180 </d≤150 	0 0 0	-9 -10 -11	0 0 0	-9 -10 -11	9 10 11	7 8 8	5 5 6	7 8 10	5 5 7	7 8 10	10 11 14	ring c same b	of the bearing	5 5 7
250 <d≤315 315 <d≤400< td=""><td>0 0</td><td>-13 -15</td><td>0 0</td><td>-13 -15</td><td>13 15</td><td>10 11</td><td>7 8</td><td>11 13</td><td>8 10</td><td>10 13</td><td>14 18</td><td></td><td></td><td>7 8</td></d≤400<></d≤315 	0 0	-13 -15	0 0	-13 -15	13 15	10 11	7 8	11 13	8 10	10 13	14 18			7 8

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

(1) These differences apply to diameter series 0, 1, 2, 3 and 4 only.

(2) Only applies to ball and grooved bearings

(3) Relates to the rings of isolated bearings for installation in pairs or per unit.

→ High-precision radial bearings – Tolerance class 2

With the exception of tapered roller bearings and thrust bearings. Standard ISO 492.

Inner ring

d	hA	mn	٨	de	Vdn ⁽¹⁾	Vdmn	Kia	Sd	Sia ⁽²⁾		ΔBs		VRs
mm		iiib		40	Tup	Vanip	Niu	ou	onu	all	normal	modified ⁽²⁾	103
	upper	lower	upper	lower	max	max	max	max	max	upper	lov	ver	max
$0,6 \le d \le 2,5$ $2,5 < d \le 10$ $10 < d \le 18$ $18 < d \le 30$ $20 < d \le 50$	0 0 0	-2,5 -2,5 -2,5 -2,5	0 0 0	-2,5 -2,5 -2,5 -2,5	2,5 2,5 2,5 2,5	1,5 1,5 1,5 1,5	1,5 1,5 1,5 2,5	1,5 1,5 1,5 1,5	1,5 1,5 1,5 2,5	0 0 0	-40 -40 -80	-250 -250 -250 -250	1,5 1,5 1,5 1,5
$50 < d \le 50$ $50 < d \le 80$	0	-2,5 -4	0	-2,5 -4	2,5 4	2	2,5 2,5	1,5	2,5 2,5	0	-120	-250	1,5 1,5
80 <d≤ 120<br="">120 <d≤ 150<br="">150 <d≤ 180<br="">180 <d≤ 250<="" td=""><td>0 0 0 0</td><td>-5 -7 -7 -8</td><td>0 0 0 0</td><td>-5 -7 -7 -8</td><td>5 7 7 8</td><td>2,5 3,5 3,5 4</td><td>2,5 2,5 5 5</td><td>2,5 2,5 4 5</td><td>2,5 2,5 5 5</td><td>0 0 0 0</td><td>-200 -250 -250 -300</td><td>-380 -380 -380 -380 -500</td><td>2,5 2,5 4 5</td></d≤></d≤></d≤></d≤>	0 0 0 0	-5 -7 -7 -8	0 0 0 0	-5 -7 -7 -8	5 7 7 8	2,5 3,5 3,5 4	2,5 2,5 5 5	2,5 2,5 4 5	2,5 2,5 5 5	0 0 0 0	-200 -250 -250 -300	-380 -380 -380 -380 -500	2,5 2,5 4 5

(1) These differences apply to diameter series 0, 1, 2, 3 and 4 only.

(2) Only applies to ball and grooved bearings

(3) Relates to the rings of isolated bearings for installation in pairs or per unit.

Outer ring

Tolerances in micrometers

Tolerances in micrometers

D mm	ΔD	mp	۵	Ds	VDp ⁽¹⁾	VDp	Кеа	Sd ⁽²⁾ Sd1 ⁽³⁾	Sia ⁽²⁾⁽³⁾	Sia1 ⁽³⁾	∆Cs ∆C1s ⁽³⁾	VCs VC1s ⁽³⁾
	upper	lower	upper	lower	max	max	max	max	max	max	upper lower	max
2,5 ≤D≤ 6	0	-2,5	0	-2,5	2,5	1,5	1,5	1,5	1,5	3		1,5
6 <d≤ 18<="" td=""><td>0</td><td>-2,5</td><td>0</td><td>-2,5</td><td>2,5</td><td>1,5</td><td>1,5</td><td>1,5</td><td>1,5</td><td>3</td><td></td><td>1,5</td></d≤>	0	-2,5	0	-2,5	2,5	1,5	1,5	1,5	1,5	3		1,5
18 <d≤ 30<="" td=""><td>0</td><td>-4</td><td>0</td><td>-4</td><td>4</td><td>2</td><td>2,5</td><td>1,5</td><td>2,5</td><td>4</td><td></td><td>1,5</td></d≤>	0	-4	0	-4	4	2	2,5	1,5	2,5	4		1,5
30 <d≤ 50<="" td=""><td>0</td><td>-4</td><td>0</td><td>-4</td><td>4</td><td>2</td><td>2,5</td><td>1,5</td><td>2,5</td><td>4</td><td>$\begin{array}{c} \text{Identical} \\ \text{to } \Delta \text{Bs} \\ \text{of the inner} \end{array}$</td><td>1,5</td></d≤>	0	-4	0	-4	4	2	2,5	1,5	2,5	4	$\begin{array}{c} \text{Identical} \\ \text{to } \Delta \text{Bs} \\ \text{of the inner} \end{array}$	1,5
50 <d≤ 80<="" td=""><td>0</td><td>-4</td><td>0</td><td>-4</td><td>4</td><td>2</td><td>4</td><td>1,5</td><td>4</td><td>6</td><td></td><td>1,5</td></d≤>	0	-4	0	-4	4	2	4	1,5	4	6		1,5
80 <d≤ 120<="" td=""><td>0</td><td>-5</td><td>0</td><td>-5</td><td>5</td><td>2,5</td><td>5</td><td>2,5</td><td>5</td><td>7</td><td></td><td>2,5</td></d≤>	0	-5	0	-5	5	2,5	5	2,5	5	7		2,5
120 <d≤ 150<="" td=""><td>0</td><td>-5</td><td>0</td><td>-5</td><td>5</td><td>2,5</td><td>5</td><td>2,5</td><td>5</td><td>7</td><td>ring of the same bearing</td><td>2,5</td></d≤>	0	-5	0	-5	5	2,5	5	2,5	5	7	ring of the same bearing	2,5
150 <d≤ 180<="" td=""><td>0</td><td>-7</td><td>0</td><td>-7</td><td>7</td><td>3,5</td><td>5</td><td>2,5</td><td>5</td><td>7</td><td></td><td>2,5</td></d≤>	0	-7	0	-7	7	3,5	5	2,5	5	7		2,5
180 <d≤ 250<="" td=""><td>0</td><td>-8</td><td>0</td><td>-8</td><td>8</td><td>4</td><td>7</td><td>4</td><td>7</td><td>10</td><td></td><td>4</td></d≤>	0	-8	0	-8	8	4	7	4	7	10		4
250 <d≤ 315<="" td=""><td>0</td><td>-8</td><td>0</td><td>-8</td><td>8</td><td>4</td><td>7</td><td>5</td><td>7</td><td>10</td><td></td><td>5</td></d≤>	0	-8	0	-8	8	4	7	5	7	10		5
315 <d≤ 400<="" td=""><td>0</td><td>-10</td><td>0</td><td>-10</td><td>10</td><td>5</td><td>8</td><td>7</td><td>8</td><td>11</td><td></td><td>7</td></d≤>	0	-10	0	-10	10	5	8	7	8	11		7

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

(1) These differences apply to diameter series 0, 1, 2, 3 and 4 only.

(2) Only applies to ball and grooved bearings

(3) Relates to the rings of isolated bearings for installation in pairs or per unit.



SNR General Data

Bearing manufacturing precision (continued)

→ Tapered roller bearings - Normal tolerance class

Diameter and radial run-out - Inner ring

Tolerances in micrometers

d	Δd	mp	Vdp	Vdmp	Kia
mm	upper	lower	max	max	max
10 ≤d≤ 18	0	-12	12	9	15
18 <d≤ 30<="" td=""><td>0</td><td>-12</td><td>12</td><td>9</td><td>18</td></d≤>	0	-12	12	9	18
30 <d≤ 50<="" td=""><td>0</td><td>-12</td><td>12</td><td>9</td><td>20</td></d≤>	0	-12	12	9	20
50 <d≤ 80<="" td=""><td>0</td><td>-15</td><td>15</td><td>11</td><td>25</td></d≤>	0	-15	15	11	25
80 <d≤ 120<="" td=""><td>0</td><td>-20</td><td>20</td><td>15</td><td>30</td></d≤>	0	-20	20	15	30
120 <d≤ 180<="" td=""><td>0</td><td>-25</td><td>25</td><td>19</td><td>35</td></d≤>	0	-25	25	19	35
180 <d≤ 250<="" td=""><td>0</td><td>-30</td><td>30</td><td>23</td><td>50</td></d≤>	0	-30	30	23	50
250 <d≤ 315<="" td=""><td>0</td><td>-35</td><td>35</td><td>26</td><td>60</td></d≤>	0	-35	35	26	60
315 <d≤ 400<="" td=""><td>0</td><td>-40</td><td>40</td><td>30</td><td>70</td></d≤>	0	-40	40	30	70

Diameter and radial run-out - Outer ring

Tolerances in micrometers

D	ΔD	mp	VDp	VDmp	Kea
mm	upper	lower	max	max	max
18 ≤D≤≤ 30	0	-12	12	9	18
30 <d≤ 50<="" td=""><td>0</td><td>-14</td><td>14</td><td>11</td><td>20</td></d≤>	0	-14	14	11	20
50 <d≤ 80<="" td=""><td>0</td><td>-16</td><td>16</td><td>12</td><td>25</td></d≤>	0	-16	16	12	25
80 <d≤ 120<="" td=""><td>0</td><td>-18</td><td>18</td><td>14</td><td>35</td></d≤>	0	-18	18	14	35
120 <d≤ 150<="" td=""><td>0</td><td>-20</td><td>20</td><td>15</td><td>40</td></d≤>	0	-20	20	15	40
150 <d≤ 180<="" td=""><td>0</td><td>-25</td><td>25</td><td>19</td><td>45</td></d≤>	0	-25	25	19	45
180 <d≤ 250<="" td=""><td>0</td><td>-30</td><td>30</td><td>23</td><td>50</td></d≤>	0	-30	30	23	50
250 <d≤ 315<="" td=""><td>0</td><td>-35</td><td>35</td><td>26</td><td>60</td></d≤>	0	-35	35	26	60
315 <d≤ 400<="" td=""><td>0</td><td>-40</td><td>40</td><td>30</td><td>70</td></d≤>	0	-40	40	30	70
400 <d≤ 500<="" td=""><td>0</td><td>-45</td><td>45</td><td>34</td><td>80</td></d≤>	0	-45	45	34	80
500 <d≤ 630<="" td=""><td>0</td><td>-50</td><td>50</td><td>38</td><td>100</td></d≤>	0	-50	50	38	100

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492.

Width - Inner and outer rings, single-row bearings and single-row sub-assemblies

Tolerances in micrometers

d	Δι	Bs	∆Cs		Δ	ſs	ΔT	1s	∆T2s	
mm	upper	lower								
10 ≤d≤ 18	0	-120	0	-120	+200	0	+100	0	+100	0
18 <d≤ 30<="" td=""><td>0</td><td>-120</td><td>0</td><td>-120</td><td>+200</td><td>0</td><td>+100</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-120	0	-120	+200	0	+100	0	+100	0
30 <d≤ 50<="" td=""><td>0</td><td>-120</td><td>0</td><td>-120</td><td>+200</td><td>0</td><td>+100</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-120	0	-120	+200	0	+100	0	+100	0
50 <d≤ 80<="" td=""><td>0</td><td>-150</td><td>0</td><td>-150</td><td>+200</td><td>0</td><td>+100</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-150	0	-150	+200	0	+100	0	+100	0
80 <d≤ 120<="" td=""><td>0</td><td>-200</td><td>0</td><td>-200</td><td>+200</td><td>-200</td><td>+100</td><td>-100</td><td>+100</td><td>-100</td></d≤>	0	-200	0	-200	+200	-200	+100	-100	+100	-100
120 <d≤ 180<="" td=""><td>0</td><td>-250</td><td>0</td><td>-250</td><td>+350</td><td>-250</td><td>+150</td><td>-150</td><td>+200</td><td>-100</td></d≤>	0	-250	0	-250	+350	-250	+150	-150	+200	-100
180 <d≤ 250<="" td=""><td>0</td><td>-300</td><td>0</td><td>-300</td><td>+350</td><td>-250</td><td>+150</td><td>-150</td><td>+200</td><td>-100</td></d≤>	0	-300	0	-300	+350	-250	+150	-150	+200	-100
250 <d≤ 315<="" td=""><td>0</td><td>-350</td><td>0</td><td>-350</td><td>+350</td><td>-250</td><td>+150</td><td>-150</td><td>+200</td><td>-100</td></d≤>	0	-350	0	-350	+350	-250	+150	-150	+200	-100
315 <d≤ 400<="" td=""><td>0</td><td>-400</td><td>0</td><td>-400</td><td>+400</td><td>-400</td><td>+200</td><td>-200</td><td>+200</td><td>-200</td></d≤>	0	-400	0	-400	+400	-400	+200	-200	+200	-200

→ High-precision tapered roller bearings – Tolerance class 6X

The diameter and radial run-out tolerances of inner rings (cones) and outer rings (cups) in this tolerance class are the same as those given in page 28 for the normal class. The width tolerances are given below.

Width - Inner and outer rings, single-row bearings and single-row sub-assemblies

Tolerances in micrometers

d	Δι	ß	۵	Cs	Δ	ſs	ΔT	'1s	Δ	72s
mm	upper	lower								
10 ≤d≤ 18	0	-50	0	-100	+100	0	+50	0	+50	0
18 <d≤ 30<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+100</td><td>0</td><td>+50</td><td>0</td><td>+50</td><td>0</td></d≤>	0	-50	0	-100	+100	0	+50	0	+50	0
30 <d≤ 50<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+100</td><td>0</td><td>+50</td><td>0</td><td>+50</td><td>0</td></d≤>	0	-50	0	-100	+100	0	+50	0	+50	0
50 <d≤ 80<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+100</td><td>0</td><td>+50</td><td>0</td><td>+50</td><td>0</td></d≤>	0	-50	0	-100	+100	0	+50	0	+50	0
80 <d≤ 120<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+100</td><td>0</td><td>+50</td><td>0</td><td>+50</td><td>0</td></d≤>	0	-50	0	-100	+100	0	+50	0	+50	0
120 <d≤ 180<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+150</td><td>0</td><td>+50</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-50	0	-100	+150	0	+50	0	+100	0
180 <d≤ 250<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+150</td><td>0</td><td>+50</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-50	0	-100	+150	0	+50	0	+100	0
250 <d≤ 315<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+200</td><td>0</td><td>+100</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-50	0	-100	+200	0	+100	0	+100	0
315 <d≤ 400<="" td=""><td>0</td><td>-50</td><td>0</td><td>-100</td><td>+200</td><td>0</td><td>+100</td><td>0</td><td>+100</td><td>0</td></d≤>	0	-50	0	-100	+200	0	+100	0	+100	0

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SNR General Data

Bearing manufacturing precision (continued)

→ High-precision tapered roller bearings - Tolerance class 5

Inner ring (cone) and width of single-row bearing

Tolerances in micrometers

d	∆d	mp	Vdp	Vdmp	Kia	Sd	۵	Bs	Δ	Ts
mm	upper	lower	max	max	max	max	upper	lower	upper	lower
10 ≤d≤ 18	0	-7	5	5	5	7	0	-200	+200	-200
18 <d≤ 30<="" td=""><td>0</td><td>-8</td><td>6</td><td>5</td><td>5</td><td>8</td><td>0</td><td>-200</td><td>+200</td><td>-200</td></d≤>	0	-8	6	5	5	8	0	-200	+200	-200
30 <d≤ 50<="" td=""><td>0</td><td>-10</td><td>8</td><td>5</td><td>6</td><td>8</td><td>0</td><td>-240</td><td>+200</td><td>-200</td></d≤>	0	-10	8	5	6	8	0	-240	+200	-200
50 <d≤ 80<="" td=""><td>0</td><td>-12</td><td>9</td><td>6</td><td>7</td><td>8</td><td>0</td><td>-300</td><td>+200</td><td>-200</td></d≤>	0	-12	9	6	7	8	0	-300	+200	-200
80 <d≤ 120<="" td=""><td>0</td><td>-15</td><td>11</td><td>8</td><td>8</td><td>9</td><td>0</td><td>-400</td><td>+200</td><td>-200</td></d≤>	0	-15	11	8	8	9	0	-400	+200	-200
120 <d≤ 180<="" td=""><td>0</td><td>-18</td><td>14</td><td>9</td><td>11</td><td>10</td><td>0</td><td>-500</td><td>+350</td><td>-250</td></d≤>	0	-18	14	9	11	10	0	-500	+350	-250
180 <d≤ 250<="" td=""><td>0</td><td>-22</td><td>17</td><td>11</td><td>13</td><td>11</td><td>0</td><td>-600</td><td>+350</td><td>-250</td></d≤>	0	-22	17	11	13	11	0	-600	+350	-250

Outer ring (cup)

Tolerances in micrometers

D	∆dn	ър	Vdp	Vdmp	Kea	Sd ⁽¹⁾ , SD1	Δ	Ts
mm	upper	lower	max	max	max	max	upper	lower
18 <d≤ 30<br="">30 <d≤ 50<br="">50 <d≤ 80<="" td=""><td>0 0 0</td><td>-8 -9 -11</td><td>6 7 8</td><td>5 5 6</td><td>6 7 8</td><td>8 8 8</td><td></td><td></td></d≤></d≤></d≤>	0 0 0	-8 -9 -11	6 7 8	5 5 6	6 7 8	8 8 8		
80 <d≤ 120<br="">120 <d≤ 150<br="">150 <d≤ 180<="" td=""><td>0 0 0</td><td>-13 -15 -18</td><td>10 11 14</td><td>7 8 9</td><td>10 11 13</td><td>9 10 10</td><td>lder to of the in of the sar</td><td>ntical ∆Bs nner ring ne bearing</td></d≤></d≤></d≤>	0 0 0	-13 -15 -18	10 11 14	7 8 9	10 11 13	9 10 10	lder to of the in of the sar	ntical ∆Bs nner ring ne bearing
180 <d≤ 250<br="">250 <d≤ 315<br="">315 <d≤ 400<="" td=""><td>0 0 0</td><td>-20 -25 -28</td><td>15 19 22</td><td>10 13 14</td><td>15 18 20</td><td>11 13 13</td><td></td><td>-</td></d≤></d≤></d≤>	0 0 0	-20 -25 -28	15 19 22	10 13 14	15 18 20	11 13 13		-

Note: The tolerances on the outside diameter, D1, of the flange on the outer ring are given in standard ISO 492. (1) Does not apply to bearings with a flanged outer ring.

→ Ball thrust bearings - Normal tolerance class

Standard ISO 199

References

dNominal bore diameter of the shaft ring of a single- direction thrust bearingΔdmpDeviation in the mean bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated planeVdpVariation in the bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated planeDNominal outside diameter of the housing ring Deviation in the mean outside diameter of the housing ring in an isolated planeVDpVariation in the outside diameter of the housing ring in an isolated planeVDpVariation in the outside diameter of the housing ring in an isolated planeSiVariation in the contact face of the shaft ring and the contact face of the shaft ringSeVariation in thickness between the bearing raceway and the contact face of the housing ring ATsATsVariation in total height			
ΔdmpDeviation in the mean bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated planeVdpVariation in the bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated radial planeDNominal outside diameter of the housing ring ing in an isolated planeDNominal outside diameter of the housing ring ing in an isolated planeVDpVariation in the mean outside diameter of the housing ring in an isolated planeVDpVariation in the outside diameter of the housing ring in an isolated radial planeSiVariation in thickness between the bearing raceway and the contact face of the housing ring ATsATsVariation in total height	d	Nominal bore diameter of the shaft ring of a single- direction thrust bearing	
 Vdp Variation in the bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated radial plane D Nominal outside diameter of the housing ring ΔDmp Deviation in the mean outside diameter of the housing ring in an isolated plane VDp Variation in the outside diameter of the housing ring in an isolated plane Si Variation in thickness between the bearing raceway and the contact face of the housing ring Se Variation in thickness between the bearing raceway and the contact face of the housing ring ATs Variation in total height 	∆dmp	Deviation in the mean bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated plane	
DNominal outside diameter of the housing ringΔDmpDeviation in the mean outside diameter of the housing ring in an isolated planeVDpVariation in the outside diameter of the housing ring in an isolated radial planeSiVariation in thickness between the bearing raceway and the contact face of the housing ringSeVariation in thickness between the bearing raceway 	Vdp	Variation in the bore diameter of the shaft ring of a single-direction thrust bearing, in an isolated radial plane	
ΔDmpDeviation in the mean outside diameter of the housing ring in an isolated planeDeviation in the mean outside diameter of the housing ring in an isolated radial planeDeviation in the outside diameter of the housing ring in an isolated radial planeSiVariation in thickness between the bearing raceway and the contact face of the shaft ringDeviation in thickness between the bearing raceway and the contact face of the housing ringSeVariation in thickness between the bearing raceway and the contact face of the housing ringATsVariation in total height	D	Nominal outside diameter of the housing ring	
 VDp Variation in the outside diameter of the housing ring in an isolated radial plane Si Variation in thickness between the bearing raceway and the contact face of the shaft ring Se Variation in thickness between the bearing raceway and the contact face of the housing ring ATs Variation in total height 	ΔDmp	Deviation in the mean outside diameter of the housing ring in an isolated plane	D d
SiVariation in thickness between the bearing raceway and the contact face of the shaft ringSeVariation in thickness between the bearing raceway and the contact face of the housing ringΔTsVariation in total height	VDp	Variation in the outside diameter of the housing ring in an isolated radial plane	
Se Variation in thickness between the bearing raceway and the contact face of the housing ring ΔTs Variation in total height	Si	Variation in thickness between the bearing raceway and the contact face of the shaft ring	
ΔTs Variation in total height	Se	Variation in thickness between the bearing raceway and the contact face of the housing ring	
	ΔTs	Variation in total height	

Shaft ring and height of thrust bearing

Tolerances	in	micro	meters	S

d mm		∆d	mp	Vdp	Si	Δ	Ts
>	5	upper	lower	max	max	upper	lower
-	18	0	-8	6	10	+20	-250
18	30	0	-10	8	10	+20	-250
30	50	0	-12	9	10	+20	-250
50	80	0	-15	11	10	+20	-300
80	120	0	-20	15	15	+25	-300
120	180	0	-25	19	15	+25	-400
180	250	0	-30	23	20	+30	-400
250	315	0	-35	26	25	+40	-400
315	400	0	-40	30	30	+40	-500
400	500	0	-45	34	30	+50	-500



Bearing manufacturing precision (continued)

Housing ring

D mi) m	ΔD	mp	VDp	Se
>	≤	upper lower		max	max
10	18	0	-11	8	
18	30	0	-13	10	
30	50	0	-16	12	
50 80 120	80 120 180	0 0 0	-19 -22 -25	14 17 19	Identical to Si of the shaft ring
180	250	0	-30	23	of the same type
250	315	0	-35	26	
315	400	0	-40	30	
400	500	0	-45	34	
500	630	0	-50	38	

Tolerances in micrometers

➔ Tapered bores: 1:12 and 1:30 taper

Standard ISO 492

Nominal half-angle at apex of cone:

1/12 : α = 2° 23' 9.4" = 2.38594° = 0.041643 rad 1/30 : α = 0° 57' 17.4" = 0.95484° = 0.016665 rad

Nominal diameter at the largest theoretical width of the bore:

1/12 : d' = d + B / 12 1/30 : d' = d + B / 30





- The tolerances on a tapered bore comprise:
- a tolerance on the mean diameter, given by the limits of the actual deviation of the mean diameter at the smallest theoretical width of the bore Δmp,
- a taper tolerance, given by the limits of the deviation between the mean diameter deviations at each end of the bore Δ'mp - Δmp,
- a tolerance on the diameter variation Vdp given by a maximum value applicable in any radial plane of the bore

Tapered bore, 1:12 taper

Tolerances in micrometers

d	∆dı	np	∆d'mp - ∆dmp		Vdp ⁽¹⁾⁽²⁾
mm	upper	lower	upper	lower	max
d≤ 10	22	0	15	0	9
10 <d≤ 18<="" td=""><td>27</td><td>0</td><td>18</td><td>0</td><td>11</td></d≤>	27	0	18	0	11
18 <d≤ 30<="" td=""><td>33</td><td>0</td><td>21</td><td>0</td><td>13</td></d≤>	33	0	21	0	13
30 <d≤ 50<="" td=""><td>39</td><td>0</td><td>25</td><td>0</td><td>16</td></d≤>	39	0	25	0	16
50 <d≤ 80<="" td=""><td>46</td><td>0</td><td>30</td><td>0</td><td>19</td></d≤>	46	0	30	0	19
80 <d≤ 120<="" td=""><td>54</td><td>0</td><td>35</td><td>0</td><td>22</td></d≤>	54	0	35	0	22
120 <d≤ 180<="" td=""><td>63</td><td>0</td><td>40</td><td>0</td><td>40</td></d≤>	63	0	40	0	40
180 <d≤ 250<="" td=""><td>72</td><td>0</td><td>46</td><td>0</td><td>46</td></d≤>	72	0	46	0	46
250 <d≤ 315<="" td=""><td>81</td><td>0</td><td>52</td><td>0</td><td>52</td></d≤>	81	0	52	0	52
315 <d≤ 400<="" td=""><td>89</td><td>0</td><td>57</td><td>0</td><td>57</td></d≤>	89	0	57	0	57
400 <d≤ 500<="" td=""><td>97</td><td>0</td><td>63</td><td>0</td><td>63</td></d≤>	97	0	63	0	63
500 <d≤ 630<="" td=""><td>110</td><td>0</td><td>70</td><td>0</td><td>70</td></d≤>	110	0	70	0	70
630 <d≤ 800<="" td=""><td>125</td><td>0</td><td>80</td><td>0</td><td>-</td></d≤>	125	0	80	0	-
800 <d≤1000< td=""><td>140</td><td>0</td><td>90</td><td>0</td><td>-</td></d≤1000<>	140	0	90	0	-

(1) Applies to any isolated radial plane of the bore.

(2) Does not apply to diameter series 7 and 8.

Tapered bore, 1:30 taper

d	∆dı	mp	∆d'mp - ∆dmp		Vdp ⁽¹⁾⁽²⁾
mm	upper	lower	upper	lower	max
50 <d≤ 80<="" td=""><td>15</td><td>0</td><td>30</td><td>0</td><td>19</td></d≤>	15	0	30	0	19
80 <d≤ 120<="" td=""><td>20</td><td>0</td><td>35</td><td>0</td><td>22</td></d≤>	20	0	35	0	22
120 <d≤ 180<="" td=""><td>25</td><td>0</td><td>40</td><td>0</td><td>40</td></d≤>	25	0	40	0	40
180 <d≤ 250<="" td=""><td>30</td><td>0</td><td>46</td><td>0</td><td>46</td></d≤>	30	0	46	0	46
250 <d≤ 315<="" td=""><td>35</td><td>0</td><td>52</td><td>0</td><td>52</td></d≤>	35	0	52	0	52
315 <d≤ 400<="" td=""><td>40</td><td>0</td><td>57</td><td>0</td><td>57</td></d≤>	40	0	57	0	57
400 <d≤ 500<="" td=""><td>45</td><td>0</td><td>63</td><td>0</td><td>63</td></d≤>	45	0	63	0	63
500 <d≤ 630<="" td=""><td>50</td><td>0</td><td>70</td><td>0</td><td>70</td></d≤>	50	0	70	0	70

Tolerances in micrometers

(1) Applies to any isolated radial plane of the bore.

(2) Does not apply to diameter series 7 and 8.



🗪 General Data

Bearings initial radial internal clearance

Radial clearance of radial contact bearings. Definition

The internal radial clearance is the load-free displacement of one ring with respect to the other in the radial direction.

Radial contact bearings to run correctly must have a slight radial clearance.

Radial contact bearings have a built in internal clearance. When the bearing is fitted, a residual clearance must remain.

This radial clearance leads to an axial clearance (except in the case of cylindrical roller bearings).



Internal radial clearance groups

The clearance tolerances of groups are standard (ISO 5753 standard).

The internal clearance group is chosen according to the application specifications and the residual clearance calculation.

Radial clearance		Bearing designation	Other manufacturers
Туре	Group	SNR suffix	
Normal clearance	N		Suitable for low or moderate loads, normal interference fit of only one of the two rings, normal temperatures.
Increased clearance	3	C3	Clearance frequently used in the following cases: - tight interference fit of one ring or slight on both rings - possible misalignment, bending of shaft - to increase the contact angle of highly-loaded radial contact ball bearings - high temperatures
	4	C4 C5	Clearance groups 4 and 5 are used in the above cases when group 3 is insufficient.
Reduced clearance	2	C2	This clearance group is used (rarely) when very good guidance with reduced clearance is required, and in applications with alternating loads and high impact levels. The use of this clearance group is highly particular because its aim is usually to cancel the bearing operating clearance. The study of the assembly (alignment), fits and operating conditions (temperature, speed) must be carried out with particular care. Consult SNR.

Axial clearance of angular contact bearings

Recommended axial clearance

By construction, single-row angular contact ball bearings or tapered roller bearings have no internal clearance.

The bearing clearance is zero when its inner ring, rolling elements and outer ring are in contact without any load applied.



When the bearing is mounted it can be given a clearance or a preload with respect to this reference position.

The figure opposite shows the positions of the components when there is an axial clearance.



Magnitude of the axial clearance of an assembly in operation

The value of the initial clearance on fitting must take into account the operating conditions.

The relation between the axial clearance and radial clearance of a two-bearing assembly is indicated for each type of bearing in chapter corresponding to each family.

d = bearing bore	Ja = axial clearance
d < 20 mm	Ja = 0.03 up to 0.08 mm
20 < d ≤ 80 mm	Ja = 0.05 up to 0.15 mm
80 < d ≤ 120 mm	Ja = 0.05 up to 0.25 mm
d > 120 mm	Ja = 0.10 up to 0.30 mm

