



**ROLLING
BEARINGS**
for
**INDUSTRIAL
MACHINERY**

1. TYPES AND FEATURES OF ROLLING BEARINGS

1.1 Design and Classification

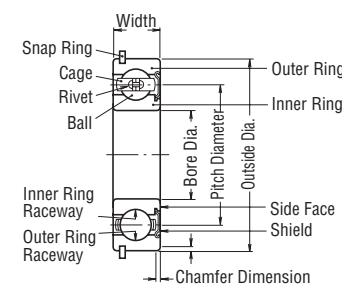
Rolling bearings generally consist of rolling elements, two rings, and a cage. They are classified into radial bearings or thrust bearings depending on the direction of the main load. In addition, depending on the type of rolling elements, they are classified into ball bearings or roller bearings and further divided by differences in their design or specific purpose. The most common bearing types and part names are shown in Fig. 1.1, and a general classification of rolling bearings is shown in Fig. 1.2.

1.2 Characteristics of Rolling Bearings

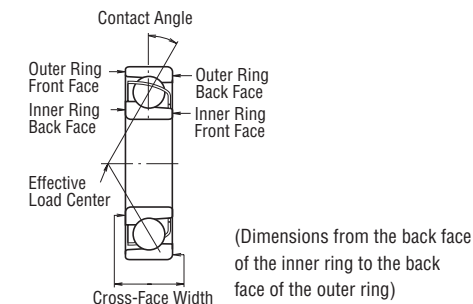
Compared with plain bearings, rolling bearings have the following major advantages:

- (1) Their starting torque or friction is low and the difference between the starting torque and running torque is small.
- (2) With the advancement of worldwide standardization, rolling bearings are internationally available and interchangeable.
- (3) Maintenance, replacement, and inspection are easy because of the simple structure surrounding rolling bearings.
- (4) Many rolling bearings are capable of taking both radial and axial loads simultaneously or independently.
- (5) Rolling bearings can be used under a wide range of temperatures.
- (6) Rolling bearings can be preloaded to produce a negative clearance and achieve greater rigidity.

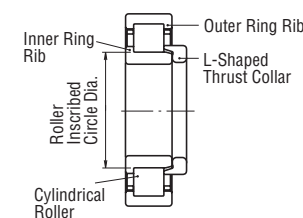
Furthermore, different types of rolling bearings have their own individual advantages. The features of the most common rolling bearings are described on Pages A010 to A013 and in Table 1.1 (Pages A014 and A015).



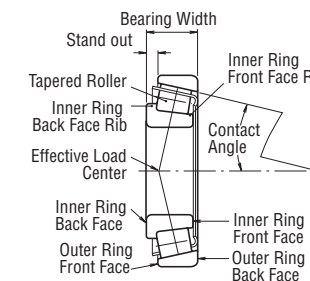
Single-Row Deep Groove Ball Bearing



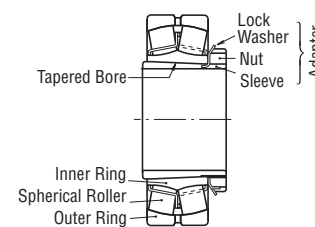
Single-Row Angular Contact Ball Bearing



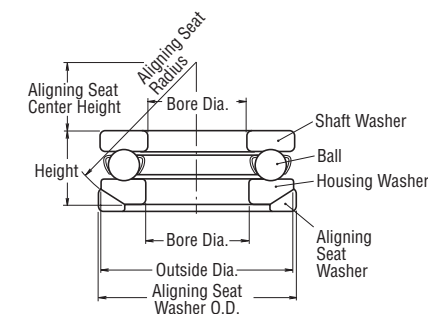
Cylindrical Roller Bearing



Tapered Roller Bearing



Spherical Roller Bearing



Single-Direction Thrust Ball Bearing

Fig. 1.1 Names of Bearing Parts

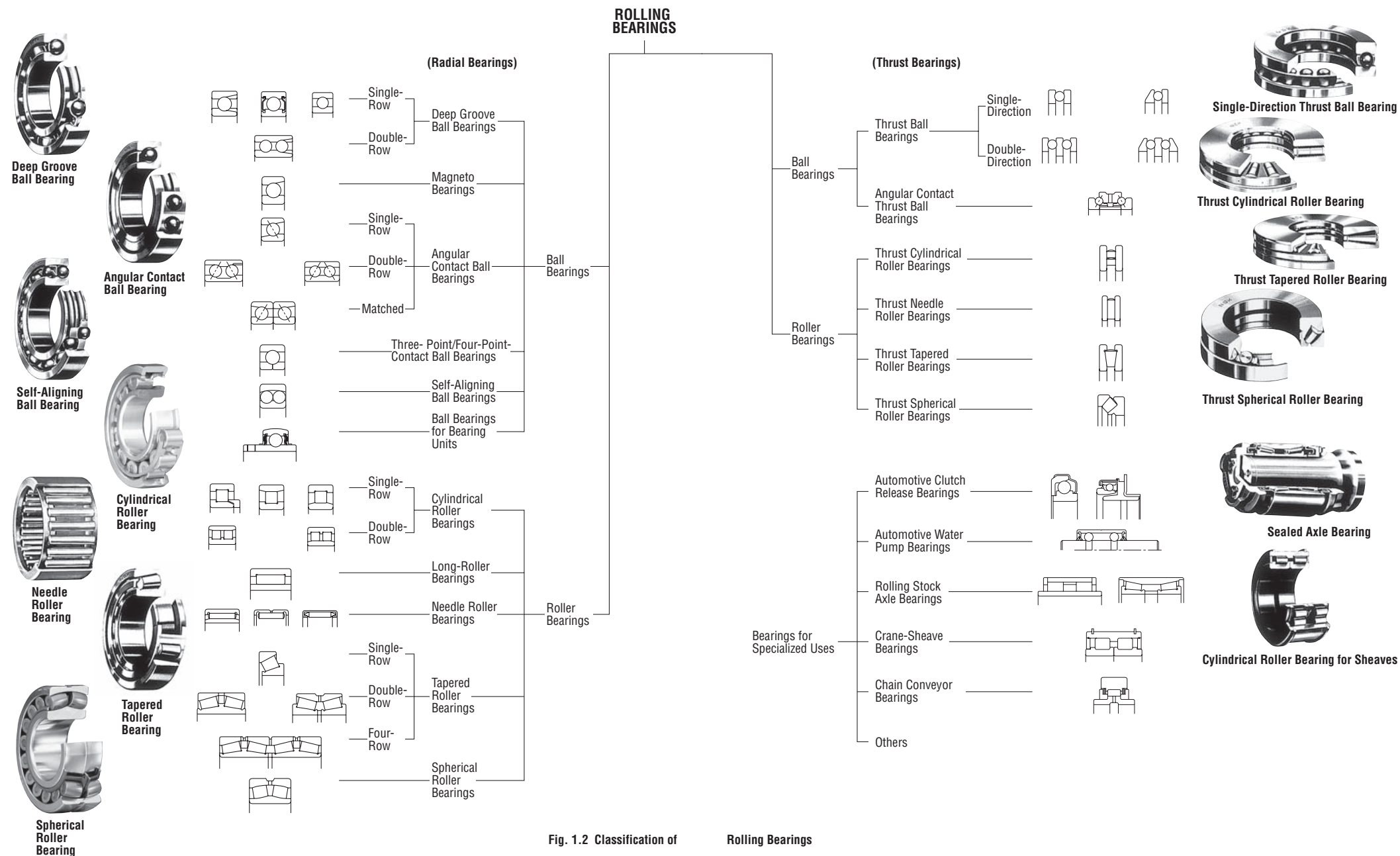
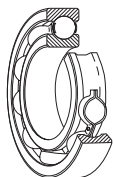


Fig. 1.2 Classification of Rolling Bearings

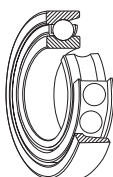
Single-Row Deep Groove Ball Bearings



Single-row deep groove ball bearings are the most common type of rolling bearing and are in widespread use. The raceway grooves on both the inner and outer rings have circular arcs of slightly larger radii than those of the balls. They are capable of taking radial loads. In addition, axial loads can be applied in either direction. Because of their low torque, they are highly suitable for applications where high speeds and low power loss are required.

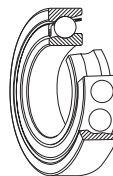
While they can be used as open bearings, single-row deep groove bearings often have steel shields or rubber seals installed on one or both sides and are prelubricated with grease. In addition, snap rings are sometimes used on the periphery. Pressed-steel cages are most commonly used.

Magneto Bearings



The inner groove of magneto bearings is slightly more shallow than that of deep groove bearings. Since the outer ring has a shoulder on only one side, the outer ring may be removed, which is often advantageous for mounting. In general, two such bearings are used in a paired mounting. Magneto bearings are small bearings with a bore diameter of 4 to 20 mm and are mainly used for small magnetos, gyroscopes, instruments, etc. Pressed-brass cages are generally used.

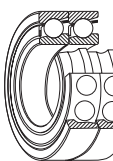
Single-Row Angular Contact Ball Bearings



Individual bearings of this type are capable of taking axial loads in one direction and radial loads. Four contact angles of 15°, 25°, 30°, and 40° are available. The larger the contact angle, the higher the axial load capacity. For high-speed operation however, smaller contact angles are preferred. Usually, two bearings are used in a paired mounting, and the clearance between them must be adjusted properly.

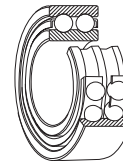
Pressed-steel and machined-brass cages are commonly used; however, for high precision bearings with a contact angle less than 30°, polyamide resin cages are often used.

Paired Mounting



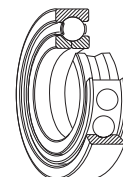
A combination of two radial bearings is called a paired mounting. Usually, they are formed using angular contact ball bearings or tapered roller bearings. Possible arrangements include: face-to-face (type DF), in which the outer ring faces are oriented towards each other; back-to-back (type DB); or same-direction (type DT), in which both front faces are oriented in the same direction. DF and DB arrangements are capable of taking radial loads and axial loads in both directions. Type DT is used when there is a strong axial load in one direction and it is necessary to divide the load equally across each bearing.

Double-Row Angular Contact Ball Bearings



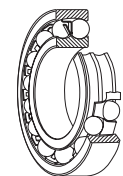
Double-row angular contact ball bearings are like two single-row angular contact ball bearings mounted back-to-back, except that they have only one inner ring and one outer ring. They have a narrower width than two single bearings, and can take thrust loads in both directions.

Four-Point-Contact Ball Bearings



The inner and outer rings of four-point-contact ball bearings are separable because the inner ring is split in a radial plane. They can take axial loads from either direction, and the balls have a contact angle of 35° with each ring. Radial loads are not recommended. Just one bearing of this type can replace a combination of face-to-face or back-to-back angular contact bearings. Machined-brass cages are generally used.

Self-Aligning Ball Bearings



The inner ring of this type of bearing has two raceways, and the outer ring has a single spherical raceway with its center of curvature coincident with the bearing axis. Therefore, the axis of the inner ring, balls, and cage can deflect to some extent around the bearing center. Consequently, minor angular misalignment of the shaft and housing caused by machining or mounting error is automatically corrected.

This type of bearing often has a tapered bore for mounting using an adapter sleeve.

Cylindrical Roller Bearings



In bearings of this type, the cylindrical rollers are in linear contact with the raceways. They have a high radial load capacity and are suitable for high speeds.

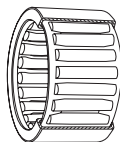
NU, NJ, NUP, N, and NF are single-row bearing types, while NNU and NN are double-row bearing types, with designations depending on the design or absence of side ribs.

The outer and inner rings of all types are separable.

Some cylindrical roller bearings have no ribs on either the inner or outer ring, so that the rings can move axially relative to each other. These can be used as free-end bearings. Cylindrical roller bearings, in which either the inner or outer ring has two ribs and the other ring has one, are capable of taking some axial load in one direction. Double-row cylindrical roller bearings have high radial rigidity and are used primarily for precision machine tools.

Pressed steel or machined brass cages are generally used, but sometimes molded polyamide cages are employed.

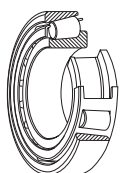
Needle Roller Bearings



Needle roller bearings contain many slender rollers with a length 3 to 10 times their diameter. As a result, the ratio of the bearing outside diameter to the inscribed circle diameter is small, and they have a rather high radial load capacity.

There are numerous types available, and many have no inner ring. The drawn-cup type has a pressed-steel outer ring and the solid type has a machined outer ring. There are also cage and roller assemblies without rings. Most bearings have pressed-steel cages, but some do not use cages.

Tapered Roller Bearings

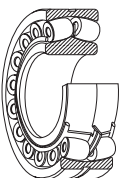


Bearings of this type use conical rollers guided by a back-face rib on the inner ring. These bearings are capable of taking high radial loads and also axial loads in one direction. The HR Series features a greater quantity of larger rollers, allowing for even higher load capacity.

They are generally mounted in pairs in a manner similar to single-row angular contact ball bearings. In this case, the proper internal clearance can be obtained by adjusting the axial distance between the inner or outer rings of the two opposed bearings. Since they are separable, the inner ring assemblies and outer rings can be mounted independently.

Tapered roller bearings are divided into three types depending on contact angle; these are normal angle, medium angle, and steep angle. Double-row and four-row tapered roller bearings are also available. Pressed-steel cages are generally used.

Spherical Roller Bearings



These bearings have barrel-shaped rollers between the inner ring, which has two raceways, and the outer ring, which has one spherical raceway. Since the center of curvature of the outer ring raceway surface coincides with the bearing axis, they are self-aligning in a manner similar to that of self-aligning ball bearings. Therefore, if there is deflection of the shaft or housing or misalignment of their axes, it is automatically corrected so that excessive force is not applied to the bearings.

Spherical roller bearings can take not only heavy radial loads, but also some axial loads in either direction. They have excellent radial load-carrying capacity and are suitable for use where there are heavy or impact loads.

Some bearings have tapered bores and may be mounted directly on tapered shafts or cylindrical shafts using adapters or withdrawal sleeves.

Pressed-steel and machined-brass cages are used.

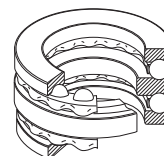
Single-Direction Thrust Ball Bearings



Single-direction thrust ball bearings are composed of washer-like bearing rings with raceway grooves. The ring attached to the shaft is called the shaft washer (or inner ring) while the ring attached to the housing is called the housing washer (or outer ring).

Double-direction thrust ball bearings have three rings with the middle ring (center ring) fixed to the shaft.

Double-Direction Thrust Ball Bearings



As their names imply, single-direction thrust bearings can take axial loads in one direction, while double-direction thrust bearings can take axial loads in both directions.

There are also thrust ball bearings with an aligning seat washer beneath the housing washer in order to compensate for shaft misalignment or mounting error.

Pressed-steel cages are usually used in smaller bearings and machined cages in larger bearings.

Spherical Thrust Roller Bearings



These bearings have a spherical raceway in the housing washer and barrel-shaped rollers obliquely arranged around it. Since the raceway in the housing washer is spherical, these bearings are self-aligning. They have a very high axial load capacity and are capable of taking moderate radial loads when an axial load is applied.

Pressed-steel cages or machined-brass cages are usually used.

Table 1. 1 Types and Characteristics

Bearing Type		Deep Groove Ball Bearings	Magneto Bearings	Angular Contact Ball Bearings	Double-Row Angular Contact Ball Bearings	Duplex Angular Contact Ball Bearings	Four-Point-Contact Ball Bearings	Self-Aligning Ball Bearings	Cylindrical Roller Bearings	Double-Row Cylindrical Roller Bearings	Cylindrical Roller Bearings with Single Rib
Features											
Load Capacity	Radial Loads										
	Axial Loads										
	Combined Loads										
High Speeds											
High Accuracy											
Low Noise and Torque											
Rigidity											
Angular Misalignment											
Self-Aligning Capability											
Ring Separability											
Fixed-End Bearing											
Free-End Bearing											
Inner Ring Tapered Bore											
Remarks		Two bearings are usually mounted in opposition. Contact angles of 15°, 25°, 30° and 40°. Two bearings are usually mounted in opposition. Clearance adjustment is necessary. Combination of DF and DT pairs is possible, but not for use on free-end. Contact angle of 35° Including N type Including MNU type Including NF type									
Page No.		C005 C053	C005 C050	C072	C072 C106	C072	C072 C108	C114	C124	C124 C158	C124

Excellent
 Good
 Fair
 Poor
 Unsuitable
 One direction only
 Two directions

☆ Applicable
 ★ Applicable, allow for shaft contraction/elongation at bearing fitting surfaces.

of Rolling Bearings

Cylindrical Roller Bearings with Thrust Collars	Needle Roller Bearings	Tapered Roller Bearings	Double- and Multi-Row Tapered Roller Bearings	Spherical Roller Bearings	Thrust Ball Bearings	Thrust Ball Bearings with Aligning Seat	Double-Direction Angular Contact Thrust Ball Bearings	Thrust Cylindrical Roller Bearings	Thrust Tapered Roller Bearings	Thrust Spherical Roller Bearings	Page No.
											—
											—
											—
											—
											A022 A098
											A023 A126 A151
											A023
											A023 A192
											A022 Blue pages of each brg. type
											A022
											A023 A024
											A026 to A029
											A026 to A029
											A150 B008 B012
Including NUP type		Two bearings are usually mounted in opposition. Clearance adjustment is necessary.	KH and KV types are also available but not for use on free-end.					Including needle roller thrust bearings		To be used with oil lubrication	
C124	C341	C182	C182 C246	C258	C296	C296	—	C314	C322	C332	

1.3 Contact Angle and Bearing Types

The contact angle (α) refers to the angle between a vertical plane of the rotation axis of the bearing and a straight line between the points where the rolling element comes in contact with the inner ring raceway and outer ring raceway.

Radial bearings and thrust bearings are classified depending on the size of the contact angle.

Figure 1.3 shows the relation between contact angle and loading direction on the bearing.

Radial bearing α : Less than 45°
(A primarily radial load is applied.)

Thrust bearing α : Over 45°
(A primarily axial load is applied.)

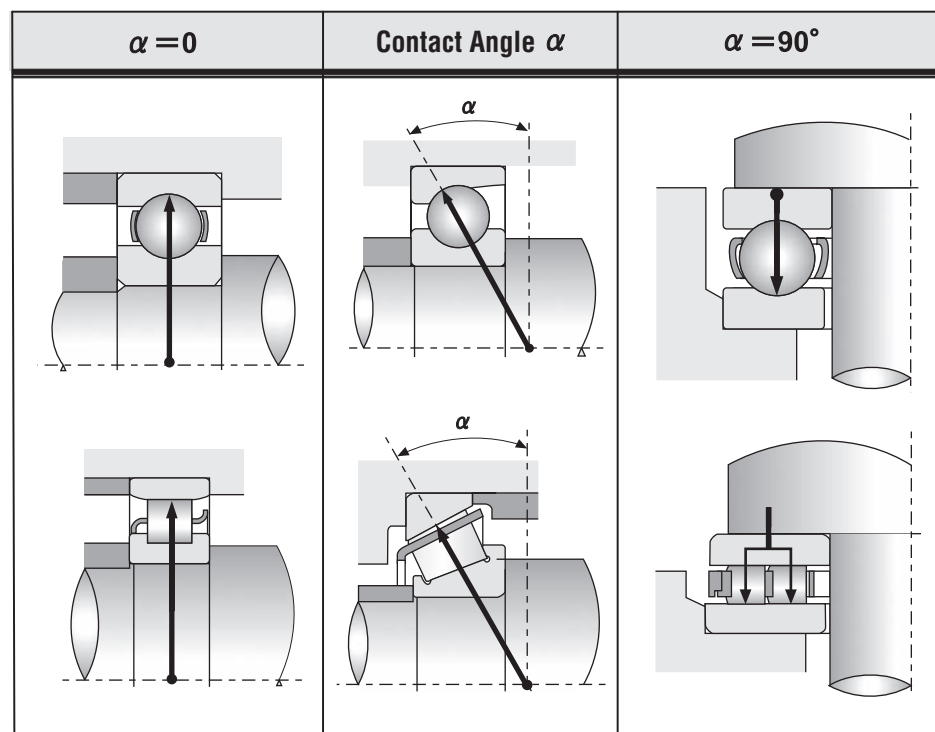


Fig. 1.3 Contact Angle α

1.4 Types of Load on Bearings

An example deep groove ball bearing is shown below in Figure 1.4 along with the types of load applied to a rolling bearing. These are:

- (a) Radial load
- (b) Axial load
- (c) Combined radial and axial load
- (d) Moment load

It is important to select the optimum bearing type according to the type and magnitude of the load.

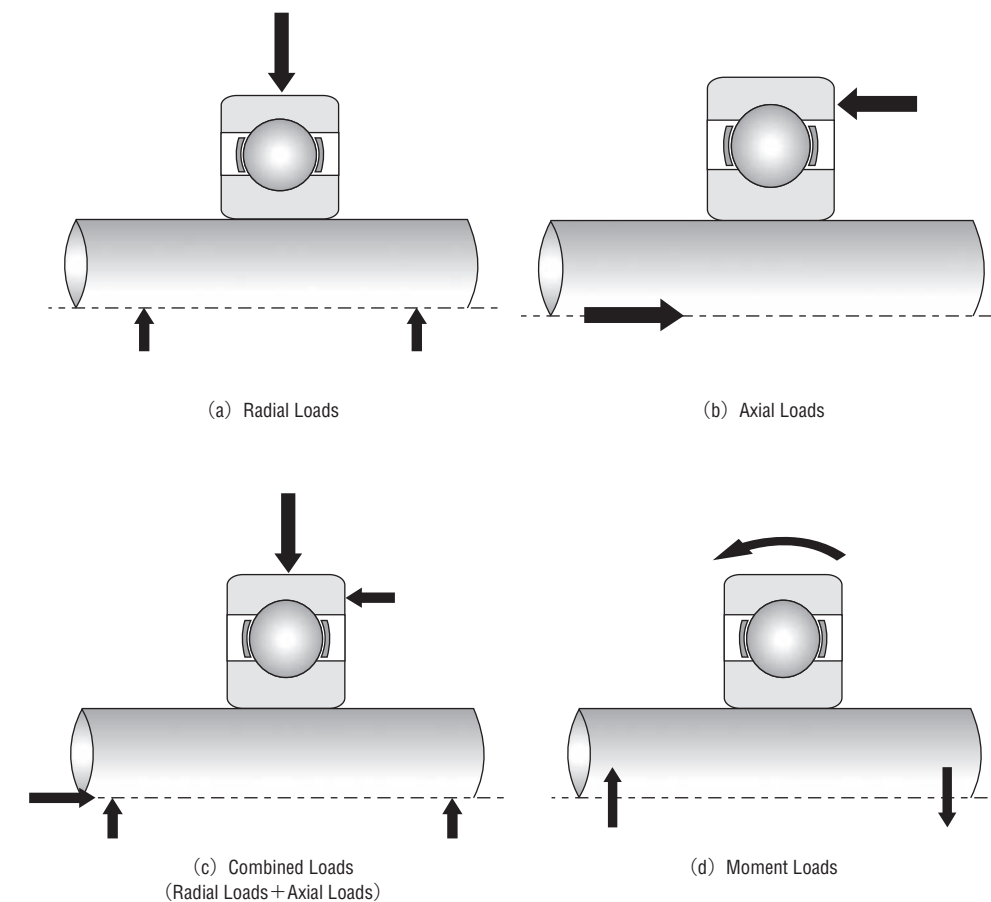
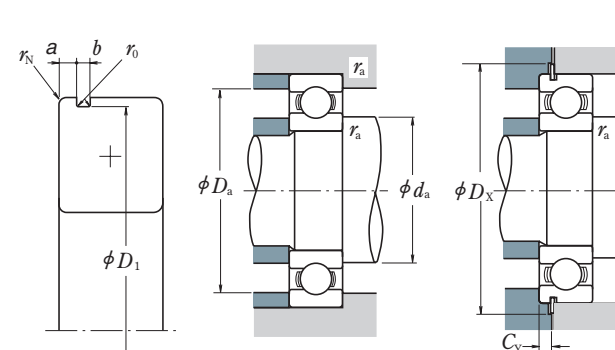
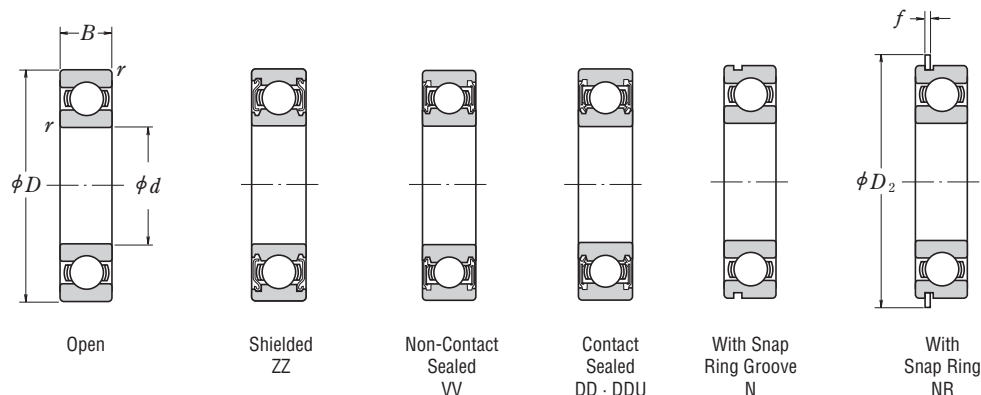


Fig. 1.4 Types of Load

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 50 – 60 mm



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (1) (mm)					Snap Ring (1) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C_r</i>	<i>C_{0r}</i>	<i>f</i> ₀	Grease		Oil	Open	Shielded	Sealed	N	NR	<i>a</i> max.	<i>b</i> min.	<i>D</i> ₁ max.	<i>r</i> ₀ max.	<i>r</i> _N min.	<i>D</i> ₂ max.	<i>f</i> max.	<i>d</i> _a (2) min.	<i>D</i> _a (2) max.	<i>r</i> _a max.	<i>D</i> _x min.	<i>C</i> _Y max.	approx.		
						Open Z - ZZ V - VV	DU DDU	Open Z																					
50	65	7	0.3	6 400	6 200	17.2	9 500	5 300	11 000	6810	ZZ	VV	DDU	N	NR	1.30	0.95	63.7	0.25	0.3	67.8	0.85	52	52.5	63	0.3	68.5	1.8	0.050
	72	12	0.6	14 500	11 700	16.1	9 000	5 300	11 000	6910	ZZ	VV	DDU	N	NR	1.70	0.95	70.7	0.25	0.5	74.8	0.85	54	55	68	0.6	76	2.3	0.135
	80	10	0.6	15 400	12 400	16.1	8 500	—	10 000	16010	—	—	—	—	—	—	—	—	—	—	—	54	—	76	0.6	—	—	0.175	
	80	16	1	22 900	16 600	15.6	9 500	4 800	11 000	* 6010	ZZ	VV	DDU	—	—	—	—	—	—	—	—	55	58.5	75	1	—	—	0.261	
	80	16	1	21 800	16 600	15.6	8 500	4 800	10 000	6010	ZZ	VV	DDU	N	NR	2.49	1.9	76.81	0.6	0.5	86.6	1.7	55	58.5	75	1	88	3.8	0.261
	90	20	1.1	37 000	23 200	14.4	8 000	4 800	10 000	* 6210	ZZ	VV	DDU	—	—	—	—	—	—	—	—	56.5	60	83.5	1	—	—	0.459	
	90	20	1.1	35 000	23 200	14.4	7 100	4 800	8 500	* 6210	ZZ	VV	DDU	N	NR	3.28	2.7	86.79	0.6	0.5	96.5	2.46	56.5	60	83.5	1	98	5.4	0.459
	110	27	2	65 000	38 500	13.2	7 100	4 300	8 500	* 6310	ZZ	VV	DDU	N	NR	—	—	—	—	—	—	59	68	101	2	—	—	1.06	
	110	27	2	62 000	38 500	13.2	6 000	4 300	7 500	6310	ZZ	VV	DDU	N	NR	3.28	2.7	106.81	0.6	0.5	116.6	2.46	59	68	101	2	118	5.4	1.06
	72	9	0.3	8 800	8 500	17.0	8 500	4 800	10 000	6811	ZZ	VV	DDU	N	NR	1.70	0.95	70.7	0.25	0.3	74.8	0.85	57	59	70	0.3	76	2.3	0.081
	80	13	1	16 000	13 300	16.2	8 000	4 500	9 500	6911	ZZ	VV	DDU	N	NR	2.10	1.3	77.9	0.4	0.5	84.4	1.12	60	61.5	75	1	86	2.9	0.189
	90	11	0.6	19 400	16 300	16.2	7 500	—	9 000	16011	—	—	—	—	—	—	—	—	—	—	—	59	—	86	0.6	—	—	0.257	
55	90	18	1.1	29 700	21 200	15.3	8 500	4 500	10 000	* 6011	ZZ	VV	DDU	—	—	—	—	—	—	—	—	61.5	64	83.5	1	—	—	0.381	
	90	18	1.1	28 300	21 200	15.3	7 500	4 500	9 000	6011	ZZ	VV	DDU	N	NR	2.87	2.7	86.79	0.6	0.5	96.5	2.46	61.5	64	83.5	1	98	5	0.381
	100	21	1.5	45 500	29 300	14.3	7 500	4 300	9 000	* 6211	ZZ	VV	DDU	—	—	—	—	—	—	—	—	63	66.5	92	1.5	—	—	0.619	
	100	21	1.5	43 500	29 300	14.3	6 300	4 300	7 500	* 6211	ZZ	VV	DDU	N	NR	3.28	2.7	96.8	0.6	0.5	106.5	2.46	63	66.5	92	1.5	108	5.4	0.619
	120	29	2	75 000	44 500	13.1	6 700	4 000	8 000	* 6311	ZZ	VV	DDU	—	—	—	—	—	—	—	—	64	72.5	111	2	—	—	1.37	
	120	29	2	71 500	44 500	13.1	5 600	4 000	6 700	6311	ZZ	VV	DDU	N	NR	4.06	3.1	115.21	0.6	0.5	129.7	2.82	64	72.5	111	2	131.5	6.5	1.37
	78	10	0.3	11 500	10 900	16.9	8 000	4 500	9 500	6812	ZZ	VV	DD	N	NR	1.70	1.3	76.2	0.4	0.3	82.7	1.12	62	64	76	0.3	84	2.5	0.103
	85	13	1	19 400	16 300	16.2	7 500	4 300	9 000	6912	ZZ	VV	DDU	N	NR	2.10	1.3	82.9	0.4	0.5	89.4	1.12	65	66	80	1	91	2.9	0.192
	95	11	0.6	20 000	17 500	16.3	7 100	—	8 500	16012	—	—	—	—	—	—	—	—	—	—	—	64	—	91	0.6	—	—	0.281	
	95	18	1.1	31 000	23 200	15.6	8 000	4 000	9 500	* 6012	ZZ	VV	DDU	—	—	—	—	—	—	—	—	66.5	69	88.5	1	—	—	0.412	
	95	18	1.1	29 500	23 200	15.6	7 100	4 000	8 500	6012	ZZ	VV	DDU	N	NR	2.87	2.7	91.82	0.6	0.5	101.6	2.46	66.5	69	88.5	1	103	5	0.412
	110	22	1.5	55 000	36 000	14.3	6 700	3 800	8 000	* 6212	ZZ	VV	DDU	—	—	—	—	—	—	—	—	68	74.5	102	1.5	—	—	0.783	
60	110	22	1.5	52 500	36 000	14.3	5 600	3 800	7 100	* 6212	ZZ	VV	DDU	N	NR	3.28	2.7	106.81	0.6	0.5	116.6	2.46	68	74.5	102	1.5	118	5.4	0.783
	130	31	2.1	86 000	52 000	13.1	6 000	3 600	7 100	* 6312	ZZ	VV	DDU	—	—	—	—	—	—	—	—	71	79	119	2	—	—	1.72	
	130	31	2.1	82 000	52 000	13.1	5 300	3 600	6 300	6312	ZZ	VV	DDU	N	NR	4.06	3.1	125.22	0.6	0.5	139.7	2.82	71	79	119	2	141.5	6.5	1.72

Notes (1) For tolerances of snap ring grooves and snap ring dimensions, refer to Pages A116 to A119.

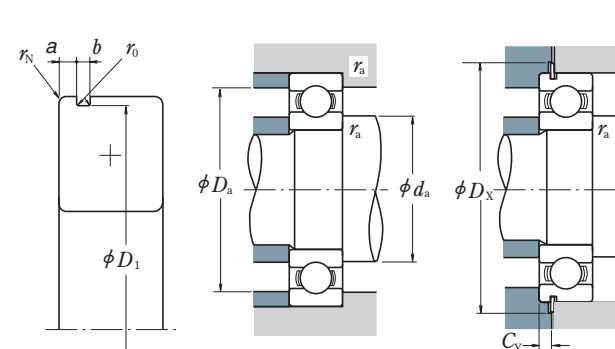
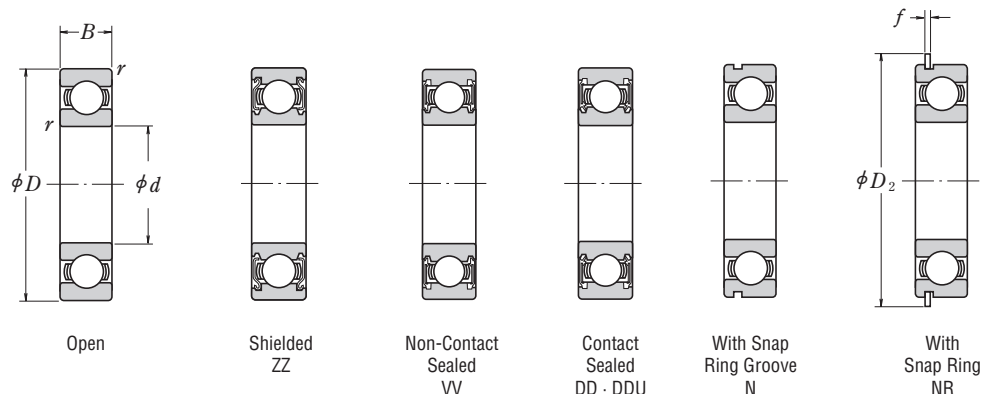
(2) When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.

Remarks

1. Diameter Series 7 (extra-thin wall) bearings are also available; please contact NSK for details.
2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
3. Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.
4. Bearings denoted by an asterisk (*) are NSKHPSTTM deep groove ball bearings.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 65 – 75 mm



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions ⁽¹⁾ (mm)					Snap Ring ⁽¹⁾ Dimensions (mm)		Abutment and Fillet Dimensions (mm)					Mass (kg)		
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C_r</i>	<i>C_{0r}</i>		Grease		Oil	Open	Shielded	Sealed	<i>a</i> max.			<i>b</i> min.	<i>D</i> ₁ max.	<i>r</i> ₀ max.	<i>r</i> _N min.	<i>D</i> ₂ max.	<i>f</i> max.	<i>d</i> _a ⁽²⁾ min.	<i>d</i> _a ⁽²⁾ max.	<i>D</i> _a ⁽²⁾ max.	<i>r</i> _a max.	<i>D</i> _x min.	<i>C</i> _Y max.	approx.		
						Open Z · ZZ V · VV	DU DDU	Open Z																						
65	85	10	0.6	11 900	12 100	17.0	7 500	4 000	8 500	6813	ZZ	VV	DD	N	NR	1.70	1.3	82.9	0.4	0.5	89.4	1.12	69	69	81	0.6	91	2.5	0.128	
	90	13	1	17 400	16 100	16.6	7 100	4 000	8 500	6913	ZZ	VV	DDU	N	NR	2.10	1.3	87.9	0.4	0.5	94.4	1.12	70	71.5	85	1	96	2.9	0.218	
	100	11	0.6	20 500	18 700	16.5	6 700	—	8 000	16013	—	—	—	—	—	—	—	—	—	—	—	69	—	96	0.6	—	—	—	0.30	
	100	18	1.1	32 000	25 200	15.8	7 500	4 000	9 000	* 6013	ZZ	VV	DDU	N	NR	—	—	—	—	—	—	—	—	—	—	—	—	—	0.439	
	100	18	1.1	30 500	25 200	15.8	6 700	4 000	8 000	6013	ZZ	VV	DDU	N	NR	2.87	2.7	96.8	0.6	0.5	106.5	2.46	71.5	73	93.5	1	108	5	0.439	
	120	23	1.5	60 000	40 000	14.4	6 300	3 600	7 500	* 6213	ZZ	VV	DDU	—	—	—	—	—	—	—	—	73	80	112	1.5	—	—	—	1.0	
	120	23	1.5	57 500	40 000	14.4	5 300	3 600	6 300	* 6213	ZZ	VV	DDU	N	NR	4.06	3.1	115.21	0.6	0.5	129.7	2.82	73	80	112	1.5	131.5	6.5	2.11	
	140	33	2.1	97 500	60 000	13.2	5 600	3 400	6 700	* 6313	ZZ	VV	DDU	N	NR	4.90	3.1	135.23	0.6	0.5	149.7	2.82	76	85.5	129	2	—	—	2.11	
	140	33	2.1	92 500	60 000	13.2	4 800	3 400	6 000	6313	ZZ	VV	DDU	N	NR	4.90	3.1	135.23	0.6	0.5	149.7	2.82	76	85.5	129	2	152	7.3	2.11	
	70	90	10	0.6	12 100	12 700	17.2	6 700	3 800	8 000	6814	ZZ	VV	DD	N	NR	1.70	1.3	87.9	0.4	0.5	94.4	1.12	74	74.5	86	0.6	96	2.5	0.134
		100	16	1	23 700	21 200	16.3	6 300	3 600	7 500	6914	ZZ	VV	DDU	N	NR	2.50	1.3	97.9	0.4	0.5	104.4	1.12	75	77.5	95	1	106	3.3	0.349
		110	13	0.6	26 800	23 600	16.3	6 000	—	7 100	16014	—	—	—	—	—	—	—	—	—	—	—	74	—	106	0.6	—	—	—	0.441
110		20	1.1	40 000	31 000	15.6	7 100	3 600	8 500	* 6014	ZZ	VV	DDU	—	—	—	—	—	—	—	—	76.5	80.5	103.5	1	—	—	—	0.608	
110		20	1.1	38 000	31 000	15.6	6 000	3 600	7 100	* 6014	ZZ	VV	DDU	N	NR	2.87	2.7	106.81	0.6	0.5	116.6	2.46	76.5	80.5	103.5	1	118	5	0.608	
125		24	1.5	65 500	44 000	14.5	6 000	3 400	7 100	* 6214	ZZ	VV	DDU	—	—	—	—	—	—	—	—	78	84	117	1.5	—	—	—	1.09	
125		24	1.5	62 000	44 000	14.5	5 000	3 400	6 300	* 6214	ZZ	VV	DDU	N	NR	4.06	3.1	120.22	0.6	0.5	134.7	2.82	78	84	117	1.5	136.5	6.5	1.09	
150		35	2.1	109 000	68 000	13.2	5 300	3 200	6 300	* 6314	ZZ	VV	DDU	—	—	—	—	—	—	—	—	81	92	139	2	—	—	—	2.57	
150		35	2.1	104 000	68 000	13.2	4 500	3 200	5 300	* 6314	ZZ	VV	DDU	N	NR	4.90	3.1	145.24	0.6	0.5	159.7	2.82	81	92	139	2	162	7.3	2.57	
75		95	10	0.6	12 500	13 900	17.3	6 300	3 600	7 500	6815	ZZ	VV	DDU	N	NR	1.70	1.3	92.9	0.4	0.5	99.4	1.12	79	79.5	91	0.6	101	2.5	0.149
		105	16	1	24 400	22 600	16.5	6 000	3 400	7 100	6915	ZZ	VV	DDU	N	NR	2.50	1.3	102.6	0.4	0.5	110.7	1.12	80	82	100	1	112	3.3	0.364
		115	13	0.6	27 600	25 300	16.4	5 600	—	6 700	16015	—	—	—	—	—	—	—	—	—	—	—	79	—	111	0.6	—	—	—	0.463
	115	20	1.1	41 500	33 500	15.8	6 700	3 400	8 000	* 6015	ZZ	VV	DDU	—	—	—	—	—	—	—	—	81.5	85.5	108.5	1	—	—	—	0.649	
	115	20	1.1	39 500	33 500	15.8	5 600	3 400	6 700	6015	ZZ	VV	DDU	N	NR	2.87	2.7	111.81	0.6	0.5	121.6	2.46	81.5	85.5	108.5	1	123	5	0.649	
	130	25	1.5	69 500	49 500	14.7	5 600	3 200	6 700	* 6215	ZZ	VV	DDU	—	—	—	—	—	—	—	—	83	90	122	1.5	—	—	—	1.19	
	130	25	1.5	66 000	49 500	14.7	4 800	3 200	5 600	* 6215	ZZ	VV	DDU	N	NR	4.06	3.1	125.22	0.6	0.5	139.7	2.82	83	90	122	1.5	141.5	6.5	1.19	
	160	37	2.1	119 000	77 000	13.2	4 800	2 800	6 000	* 6315	ZZ	VV	DDU	—	—	—	—	—	—	—	—	86	98.5	149	2	—	—	—	3.08	
	160	37	2.1	113 000	77 000	13.2	4 300	2 800	5 000	6315	ZZ	VV	DDU	N	NR	4.90	3.1	155.22	0.6	0.5	169.7	2.82	86	98.5	149	2	172	7.3	3.08	

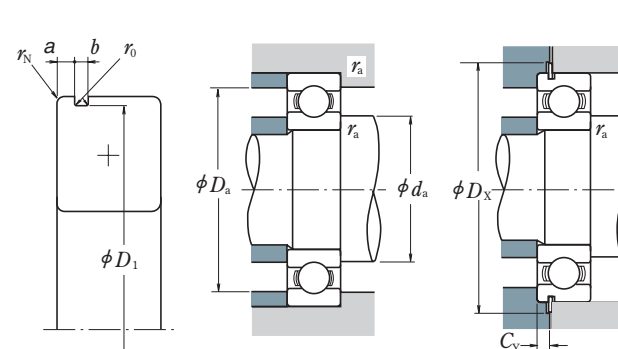
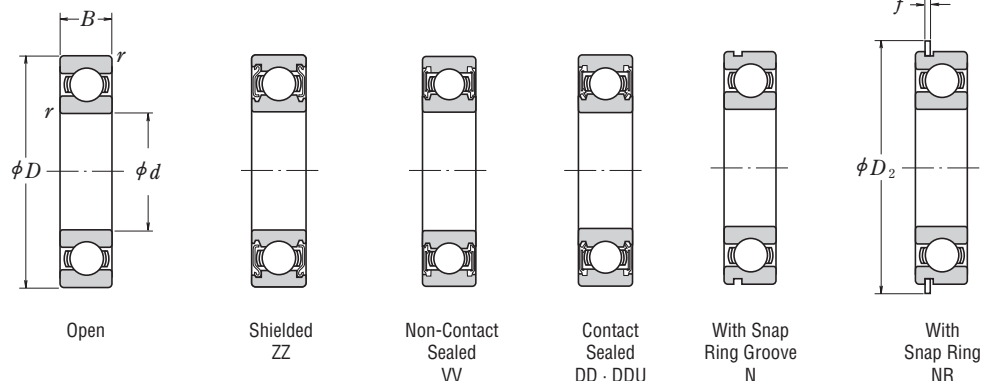
Notes (1) For tolerances of snap ring grooves and snap ring dimensions, refer to Pages A116 to A119.

(2) When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.

Remarks

- Diameter Series 7 (extra-thin wall) bearings are also available; please contact NSK for details.
- When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
- Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.
- Bearings denoted by an asterisk (*) are NSKHPST™ deep groove ball bearings.

Bore Diameter 80 – 90 mm


$$P = XF_{-} + YF_{+}$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.95
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

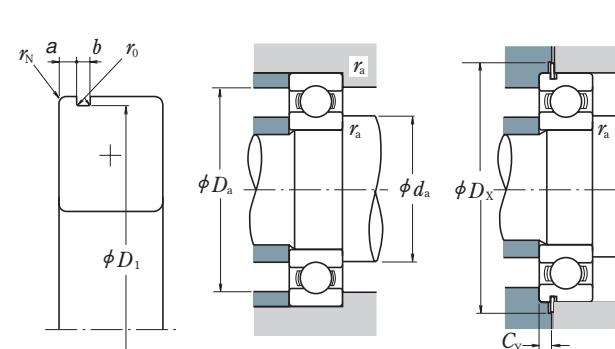
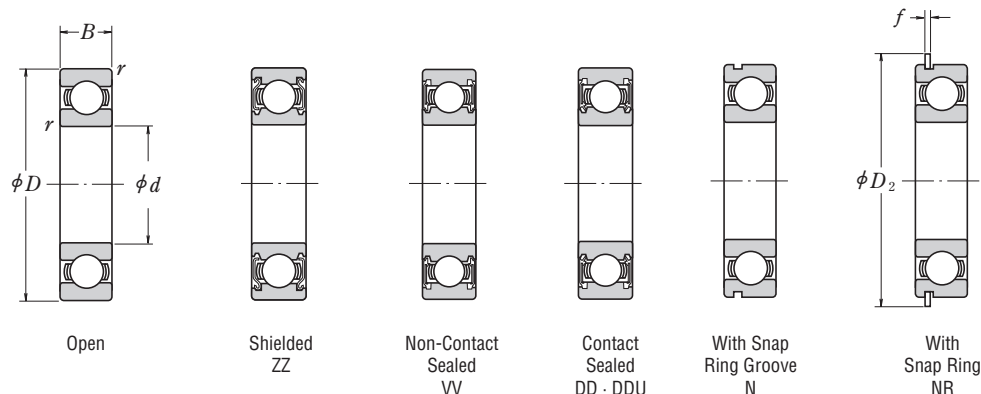
Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions ⁽¹⁾ (mm)					Snap Ring ⁽¹⁾ Dimensions (mm)		Abutment and Fillet Dimensions (mm)					Mass (kg)		
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C_r</i>	<i>C_{0r}</i>	<i>f₀</i>	Grease		Oil	Open	Shielded	Sealed				<i>a</i> max.	<i>b</i> min.	<i>D</i> ₁ max.	<i>r</i> ₀ max.	<i>r_N</i> min.	<i>D</i> ₂ max.	<i>f</i> max.	min.	<i>d_a</i> ⁽²⁾ max.	<i>D_a</i> ⁽²⁾ max.	<i>r_a</i> max.	<i>D_x</i> min.	<i>C_Y</i> max.	approx.	
						Open Z · ZZ V · VV	DU DDU	Open Z																						
80	100	10	0.6	12 700	14 500	17.4	6 000	3 400	7 100	6816	ZZ	VV	DDU	N	NR	1.7	1.3	97.9	0.4	0.5	104.4	1.12	84	84.5	96	0.6	106	2.5	0.151	
	110	16	1	25 000	24 000	16.6	5 600	3 200	6 700	6916	ZZ	VV	DDU	N	NR	2.5	1.3	107.6	0.4	0.5	115.7	1.12	85	87.5	105	1	117	3.3	0.391	
	125	14	0.6	32 000	29 600	16.4	5 300	—	6 300	16016	—	—	—	—	—	—	—	—	—	—	—	—	84	—	121	0.6	—	—	0.621	
	125	22	1.1	50 000	40 000	15.6	6 300	3 200	7 100	* 6016	ZZ	VV	DDU	N	NR	—	—	—	—	—	—	—	86.5	91	118.5	1	—	—	0.872	
	125	22	1.1	47 500	40 000	15.6	5 300	3 200	6 300	6016	ZZ	VV	DDU	N	NR	2.87	3.1	120.22	0.6	0.5	134.7	2.82	86.5	91	118.5	1	136.5	5.3	0.872	
	140	26	2	76 500	53 000	14.6	5 300	3 000	6 300	* 6216	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	89	95.5	131	2	—	—	1.42	
	140	26	2	72 500	53 000	14.6	4 500	3 000	5 300	* 6216	ZZ	VV	DDU	N	NR	4.90	3.1	135.23	0.6	0.5	149.7	2.82	89	95.5	131	2	152	7.3	1.42	
	170	39	2.1	129 000	86 500	13.3	4 500	2 800	5 600	* 6316	ZZ	VV	DDU	N	NR	—	—	—	—	—	—	—	91	104.5	159	2	—	—	3.67	
	170	39	2.1	123 000	86 500	13.3	4 000	2 800	4 800	6316	ZZ	VV	DDU	N	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.1	91	104.5	159	2	185	8.4	3.67	
	85	110	13	1	18 700	20 000	17.1	5 600	3 200	6 700	6817	ZZ	VV	DDU	N	NR	2.10	1.3	107.6	0.4	0.5	115.7	1.12	90	90.5	105	1	117	2.9	0.263
		120	18	1.1	32 000	29 600	16.4	5 300	3 000	6 300	6917	ZZ	VV	DDU	N	NR	3.30	1.3	117.6	0.4	0.5	125.7	1.12	91.5	94.5	113.5	1	127	4.1	0.55
		130	14	0.6	33 000	31 500	16.5	5 000	—	6 000	16017	—	—	—	—	—	—	—	—	—	—	—	—	89	—	126	0.6	—	—	0.652
130		22	1.1	52 000	43 000	15.8	6 000	3 000	7 100	* 6017	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	91.5	96	123.5	1	—	—	0.918	
130		22	1.1	49 500	43 000	15.8	5 000	3 000	6 000	6017	ZZ	VV	DDU	N	NR	2.87	3.1	125.22	0.6	0.5	139.7	2.82	91.5	96	123.5	1	141.5	5.3	0.918	
150		28	2	88 000	62 000	14.5	4 800	2 800	6 000	* 6217	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	94	102	141	2	—	—	1.76	
150		28	2	84 000	62 000	14.5	4 300	2 800	5 000	* 6217	ZZ	VV	DDU	N	NR	4.90	3.1	145.24	0.6	0.5	159.7	2.82	94	102	141	2	162	7.3	1.76	
180		41	3	139 000	97 000	13.3	4 300	2 600	5 000	* 6317	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	98	110.5	167	2.5	—	—	4.28	
180		41	3	133 000	97 000	13.3	3 800	2 600	4 500	6317	ZZ	VV	DDU	N	NR	5.69	3.5	173.66	0.6	0.5	192.9	3.1	98	110.5	167	2.5	195	8.4	4.28	
90		115	13	1	19 000	21 000	17.2	5 300	3 000	6 300	6818	ZZ	VV	DDU	N	NR	2.10	1.3	112.6	0.4	0.5	120.7	1.12	95	95.5	110	1	122	2.9	0.276
		125	18	1.1	33 000	31 500	16.5	5 000	2 800	6 000	6918	ZZ	VV	DDU	N	NR	3.30	1.3	122.6	0.4	0.5	130.7	1.12	96.5	98.5	118.5	1	132	4.1	0.585
		140	16	1	41 500	39 500	16.3	4 800	—	5 600	16018	—	—	—	—	—	—	—	—	—	—	—	—	95	—	135	1	—	—	0.873
	140	24	1.5	61 000	50 000	15.6	5 600	2 800	6 300	* 6018	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	98	103	132	1.5	—	—	1.19	
	140	24	1.5	58 000	50 000	15.6	4 800	2 800	5 600	6018	ZZ	VV	DDU	N	NR	3.71	3.1	135.23	0.6	0.5	149.7	2.82	98	103	132	1.5	152	6.1	1.19	
	160	30	2	101 000	71 500	14.5	4 500	2 600	5 600	* 6218	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	99	107.5	151	2	—	—	2.18	
	160	30	2	96 000	71 500	14.5	4 000	2 600	4 800	* 6218	ZZ	VV	DDU	N	NR	4.90	3.1	155.22	0.6	0.5	169.7	2.82	99	107.5	151	2	172	7.3	2.18	
	190	43	3	150 000	107 000	13.3	4 000	2 400	4 800	* 6318	ZZ	VV	DDU	—	—	—	—	—	—	—	—	—	103	117	177	2.5	—	—	4.98	
	190	43	3	143 000	107 000	13.3	3 600	2 400	4 300	6318	ZZ	VV	DDU	N	NR	5.69	3.5	183.64	0.6	0.5	202.9	3.1	103	117	177	2.5	205	8.4	4.98	

Remarks 1. Diameter Series 7 (extra-thin wall) bearings are also available; please contact NSK for details.

1. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
2. Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.
3. Bearings denoted by an asterisk (*) are NSKHPST™ deep groove ball bearings.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 95 – 105 mm



Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (1) (mm)					Snap Ring (1) Dimensions (mm)		Abutment and Fillet Dimensions (mm)					Mass (kg)	
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C_r</i>	<i>C_{0r}</i>		Grease		Oil	Open	Shielded	Sealed	<i>a</i> max.			<i>b</i> min.	<i>D</i> ₁ max.	<i>r</i> ₀ max.	<i>r</i> _N min.	<i>D</i> ₂ max.	<i>f</i> max.	min.	<i>d</i> _a (2) max.	<i>D</i> _a (2) max.	<i>r</i> _a max.	<i>D</i> _x min.	<i>C</i> _Y max.	approx.	
						Open Z · ZZ V · VV	DU DDU	Open Z																					
95	120	13	1	19 300	22 000	17.2	5 000	2 800	6 000	6819	ZZ	VV	DD	N	NR	2.10	1.3	117.6	0.4	0.5	125.7	1.12	100	101.5	115	1	127	2.9	0.297
	130	18	1.1	33 500	33 500	16.6	4 800	2 800	5 600	6919	ZZ	VV	DDU	N	NR	3.30	1.3	127.6	0.4	0.5	135.7	1.12	101.5	103.5	123.5	1	137	4.1	0.601
	145	16	1	43 000	42 000	16.4	4 500	—	5 300	16019	—	—	—	—	—	—	—	—	—	—	—	100	—	140	1	—	—	0.904	
	145	24	1.5	63 500	54 000	15.8	5 300	2 600	6 000	* 6019	ZZ	VV	DDU	—	—	—	—	—	—	—	—	103	108.5	137	1.5	—	—	1.23	
	145	24	1.5	60 500	54 000	15.8	4 500	2 600	5 300	* 6019	ZZ	VV	DDU	N	NR	3.71	3.1	140.23	0.6	0.5	154.7	2.82	103	108.5	137	1.5	157	6.1	1.23
	170	32	2.1	114 000	82 000	14.4	4 300	2 600	5 000	* 6219	ZZ	VV	DDU	—	—	—	—	—	—	—	—	106	114	159	2	—	—	2.64	
	170	32	2.1	109 000	82 000	14.4	3 800	2 600	4 500	* 6219	ZZ	VV	DDU	N	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.1	106	114	159	2	185	8.4	2.64
	200	45	3	160 000	119 000	13.3	3 400	2 400	4 300	* 6319	ZZ	VV	DDU	N	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.1	108	123.5	187	2.5	—	—	5.76
	200	45	3	153 000	119 000	13.3	3 000	2 400	3 600	* 6319	ZZ	VV	DDU	N	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.1	108	123.5	187	2.5	215	8.4	5.76
	125	13	1	19 600	23 000	17.3	4 800	2 800	5 600	6820	ZZ	VV	DD	N	NR	2.10	1.3	122.6	0.4	0.5	130.7	1.12	105	105.5	120	1	132	2.9	0.31
	140	20	1.1	43 000	42 000	16.4	4 500	2 600	5 300	6920	ZZ	VV	DDU	N	NR	3.30	1.9	137.6	0.6	0.5	145.7	1.7	106.5	111	133.5	1	147	4.7	0.828
	150	16	1	42 500	42 000	16.5	4 300	—	5 300	16020	—	—	—	—	—	—	—	—	—	—	—	105	—	145	1	—	—	0.945	
100	150	24	1.5	63 000	54 000	15.9	5 000	2 600	6 000	* 6020	ZZ	VV	DDU	—	—	—	—	—	—	—	—	108	112.5	142	1.5	—	—	1.29	
	150	24	1.5	60 000	54 000	15.9	4 300	2 600	5 300	* 6020	ZZ	VV	DDU	N	NR	3.71	3.1	145.24	0.6	0.5	159.7	2.82	108	112.5	142	1.5	162	6.1	1.29
	180	34	2.1	128 000	93 000	14.4	4 000	2 400	4 800	* 6220	ZZ	VV	DDU	—	—	—	—	—	—	—	—	111	121.5	169	2	—	—	3.17	
	180	34	2.1	122 000	93 000	14.4	3 600	2 400	4 300	6220	ZZ	VV	DDU	N	NR	5.69	3.5	173.66	0.6	0.5	192.9	3.1	111	121.5	169	2	195	8.4	3.17
	215	47	3	173 000	141 000	13.2	2 800	2 200	3 400	6320	ZZ	VV	DDU	—	—	—	—	—	—	—	—	113	133	202	2.5	—	—	7.04	
	130	13	1	19 800	23 900	17.4	4 800	2 600	5 600	6821	ZZ	VV	DDU	N	NR	2.10	1.3	127.6	0.4	0.5	135.7	1.12	110	110.5	125	1	137	2.9	0.324
105	145	20	1.1	42 500	42 000	16.5	4 300	—	5 300	6921	ZZ	VV	—	N	NR	3.30	1.9	142.6	0.6	0.5	150.7	1.7	111.5	116	138.5	1	152	4.7	0.856
	160	18	1	52 000	50 500	16.3	4 000	—	4 800	16021	—	—	—	—	—	—	—	—	—	—	—	110	—	155	1	—	—	1.24	
	160	26	2	76 000	66 000	15.8	4 500	2 400	5 600	* 6021	ZZ	VV	DDU	—	—	—	—	—	—	—	—	114	120	151	2	—	—	1.58	
	160	26	2	72 500	66 000	15.8	4 000	2 400	4 800	* 6021	ZZ	VV	DDU	N	NR	3.71	3.1	155.22	0.6	0.5	169.7	2.82	114	120	151	2	172	6.1	1.58
	190	36	2.1	140 000	105 000	14.4	3 800	2 200	4 500	* 6221	ZZ	VV	DDU	—	—	—	—	—	—	—	—	116	127.5	179	2	—	—	3.79	
	190	36	2.1	133 000	105 000	14.4	3 400	2 200	4 000	6221	ZZ	VV	DDU	N	NR	5.69	3.5	183.64	0.6	0.5	202.9	3.1	116	127.5	179	2	205	8.4	3.79
225	49	3	184 000	154 000	13.2	2 600	2 000	3 200	6321	ZZ	—	DDU	—	—	—	—	—	—	—	—	118	138	212	2.5	—	—	8.09		

Notes (1) For tolerances of snap ring grooves and snap ring dimensions, refer to Pages A116 to A119.

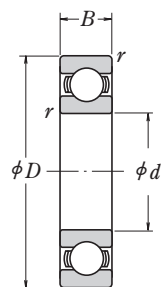
(2) When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.

Remarks

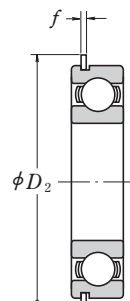
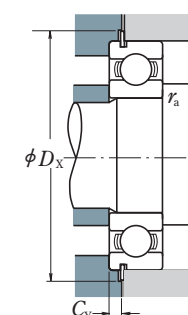
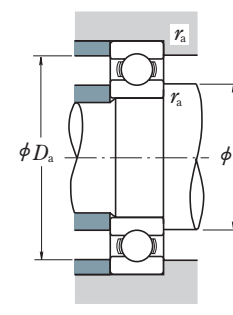
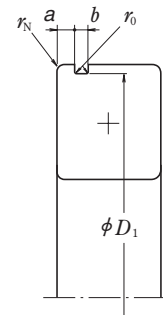
1. Diameter Series 7 (extra-thin wall) bearings are also available; please contact NSK for details.
2. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
3. Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.
4. Bearings denoted by an asterisk (*) are NSKHPSTTM deep groove ball bearings.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 110 – 150 mm



Open

Shielded
ZZ · ZTSNon-Contact
Sealed
VVContact
Sealed
DD · DDUWith Snap
Ring Groove
NWith Snap
Ring
NR

Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

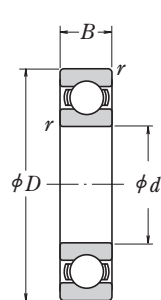
$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor f_0	Limiting Speeds (min ⁻¹)			Bearing Designations				With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions ⁽¹⁾ (mm)					Snap Ring ⁽¹⁾ Dimensions (mm)		Abutment and Fillet Dimensions (mm)					Mass (kg) approx.	
d	D	B	$r_{\min.}$	C_r	C_{0r}		Grease		Oil	Open	Shielded	Sealed	D_2 max.			f max.	a max.	b min.	D_1 max.	r_0 max.	r_N min.	D_2 max.	f max.	d_a ⁽²⁾ min.	d_a ⁽²⁾ max.	D_a ⁽²⁾ max.	r_a max.		D_x min.
						Open Z · ZZ V · VV	DU DDU	Open Z																					
110	140	16	1	28 100	32 500	17.1	4 300	2 400	5 300	6822	ZZ	VV	DDU	N	NR	2.50	1.9	137.6	0.6	0.5	145.7	1.7	115	117	135	1	147	3.9	0.497
	150	20	1.1	43 500	44 500	16.6	4 300	2 400	5 000	6922	ZZ	VV	DDU	N	NR	3.30	1.9	147.6	0.6	0.5	155.7	1.7	116.5	121	143.5	1	157	4.7	0.893
	170	19	1	57 500	56 500	16.3	3 800	—	4 500	16022	—	—	—	—	—	—	—	—	—	—	—	115	—	165	1	—	—	—	1.51
	170	28	2	89 000	73 000	15.5	4 500	2 200	5 300	* 6022	ZZ	VV	DDU	—	—	—	—	—	—	—	—	119	124.5	161	2	—	—	—	1.94
	170	28	2	85 000	73 000	15.5	3 800	2 200	4 500	6022	ZZ	VV	DDU	N	NR	3.71	3.5	163.65	0.6	0.5	182.9	3.1	119	124.5	161	2	185	6.4	1.94
	200	38	2.1	144 000	117 000	14.3	2 800	2 200	3 400	6222	ZZ	VV	DDU	N	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.1	121	134	189	2	215	8.4	4.45
	240	50	3	205 000	179 000	13.2	2 400	—	3 000	6322	ZZ	—	—	—	—	—	—	—	—	—	—	123	147	227	2.5	—	—	—	9.51
120	150	16	1	28 900	35 500	17.3	4 000	2 200	4 800	6824	ZZ	VV	DD	N	NR	2.50	1.9	147.6	0.6	0.5	155.7	1.7	125	127	145	1	157	3.9	0.537
	165	22	1.1	53 000	54 000	16.5	3 800	—	4 500	6924	ZZ	—	—	N	NR	3.70	1.9	161.8	0.6	0.5	171.5	1.7	126.5	132	158.5	1	173	5.1	1.21
	180	19	1	56 500	57 500	16.5	3 600	—	4 300	16024	—	—	—	—	—	—	—	—	—	—	—	125	—	175	1	—	—	—	1.6
	180	28	2	92 500	80 000	15.7	4 000	2 200	4 800	* 6024	ZZ	VV	DDU	—	—	—	—	—	—	—	—	129	134.5	171	2	—	—	—	2.08
	180	28	2	88 000	80 000	15.7	3 600	2 200	4 300	6024	ZZ	VV	DDU	N	NR	3.71	3.5	173.66	0.6	0.5	192.9	3.1	129	134.5	171	2	195	6.4	2.08
	215	40	2.1	155 000	131 000	14.4	2 600	2 000	3 200	6224	ZZ	VV	DDU	—	—	—	—	—	—	—	—	131	146	204	2	—	—	—	5.29
	260	55	3	207 000	185 000	13.5	2 200	1 800	2 800	6324	ZZS	—	—	—	—	—	—	—	—	—	—	133	161	247	2.5	—	—	—	12.5
130	165	18	1.1	37 000	44 000	17.1	3 600	2 000	4 300	6826	ZZS	VV	DD	N	NR	3.30	1.9	161.8	0.6	0.5	171.5	1.7	136.5	138	158.5	1	173	4.7	0.758
	180	24	1.5	65 000	67 500	16.5	3 400	—	4 000	6926	ZZ	—	—	N	NR	3.70	1.9	176.8	0.6	0.5	186.5	1.7	138	144	172	1.5	188	5.1	1.57
	200	22	1.1	75 500	77 500	16.4	3 000	—	3 600	16026	—	—	—	—	—	—	—	—	—	—	—	136.5	—	193.5	1	—	—	—	2.4
	200	33	2	106 000	101 000	15.8	3 000	1 900	3 600	6026	ZZ	—	DDU	N	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.1	139	148.5	191	2	215	8.4	3.26
	230	40	3	167 000	146 000	14.5	2 400	—	3 000	6226	ZZ	—	—	—	—	—	—	—	—	—	—	143	157	217	2.5	—	—	—	5.96
	280	58	4	229 000	214 000	13.6	2 200	—	2 600	6326	ZZS	—	—	—	—	—	—	—	—	—	—	146	175	264	3	—	—	—	15.2
	280	58	4	229 000	214 000	13.6	2 200	—	2 600	6326	ZZS	—	—	—	—	—	—	—	—	—	—	146	175	264	3	—	—	—	15.2
140	175	18	1.1	38 500	48 000	17.3	3 400	1 900	4 000	6828	ZZ	VV	DDU	N	NR	3.30	1.9	171.8	0.6	0.5	181.5	1.7	146.5	148.5	168.5	1	183	4.7	0.832
	190	24	1.5	66 500	72 000	16.6	3 200	—	3 800	6928	ZZS	VV	—	N	NR	3.70	1.9	186.8	0.6	0.5	196.5	1.7	148	153.5	182	1.5	198	5.1	1.67
	210	22	1.1	77 500	82 500	16.5	2 800	—	3 400	16028	—	—	—	—	—	—	—	—	—	—	—	146.5	—	203.5	1	—	—	—	2.84
	210	33	2	110 000	109 000	16.0	2 800	1 800	3 400	6028	ZZ	—	DDU	—	—	—	—	—	—	—	—	149	158.5	201	2	—	—	—	3.48
	250	42	3	166 000	150 000	14.9	2 200	1 700	2 800	6228	ZZS	—	DDU	—	—	—	—	—	—	—	—	153	171.5	237	2.5	—	—	—	7.68
	300	62	4	253 000	246 000	13.6	2 000	—	2 400	6328	ZZS	—	—	—	—	—	—	—	—	—	—	156	187	284	3	—	—	—	18.5
	300	62	4	253 000	246 000	13.6	2 000	—	2 400	6328	ZZS	—	—	—	—	—	—	—	—	—	—	156	187	284	3	—	—	—	18.5
150	190	20	1.1	47 500	58 500	17.1	3 200	1 800	3 800	6830	ZZ	VV	DDU	N	NR	3.30	1.9	186.8	0.6	0.5	196.5	1.7	156.5	160	183.5	1	198	4.7	1.15
	210	28	2	85 000	90 500	16.5	2 600	1 700	3 200	6930	ZZS	—	DDU	—	—	—	—	—	—	—	—	159	166	201	2	—	—	—	3.01
	225	24	1.1	84 000	91 000	16.6	2 600	—	3 000	16030	—	—	—	—	—	—	—	—	—	—	—	156.5	—	218.5	1	—	—	—	3.62
	225	35	2.1	126 000	126 000	15.9	2 600	1 700	3 000	6030	ZZ	VV	DDU	—	—	—	—	—	—	—	—	161	170	214	2	—	—	—	4.24
	270	45	3	176 000	168 000	15.1	2 000	—	2 600	6230	ZZS	—	—	—	—	—	—	—	—	—	—	163	186	257	2.5	—	—	—	10
	320	65	4	274 000	284 000	13.9	1 800	—	2 200	6330	ZZS	—	—	—	—	—	—	—	—	—	—	166	203	304	3	—	—	—	22.7
	320	65	4	274 000	284 000	13.9	1 800	—	2 200	6330	ZZS	—	—	—	—	—	—	—	—	—	—	166	203	304	3	—	—	—	22.7

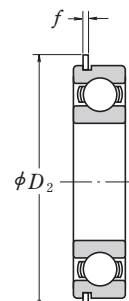
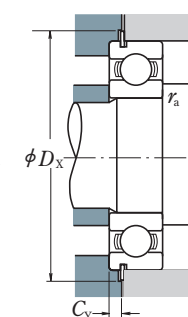
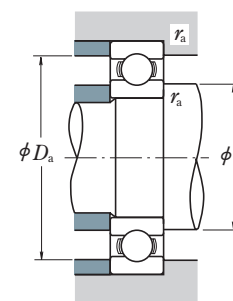
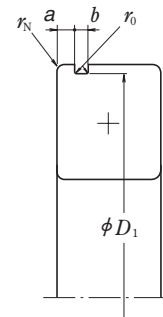
Notes ⁽¹⁾ For tolerances of snap ring grooves and snap ring dimensions, refer to Pages A116 to A119.⁽²⁾ When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.Remarks 1. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
2. Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.
3. Bearings denoted by an asterisk (*) are NSKHP™ deep groove ball bearings.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 160 mm



Open

Shielded
ZZ · ZTSNon-Contact
Sealed
VVContact
Sealed
DD · DDUWith Snap
Ring Groove
NWith Snap
Ring
NR

Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				Snap Ring Groove Dimensions (1) (mm)					Snap Ring (1) Dimensions		Abutment and Fillet Dimensions (mm)					Mass (kg)			
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C</i> _r	<i>C</i> _{0r}	<i>f</i> ₀	Grease		Oil	Open	Shielded	Sealed	With Snap Ring Groove	With Snap Ring	<i>a</i>	<i>b</i>	<i>D</i> ₁	<i>r</i> ₀	<i>r</i> _N	<i>D</i> ₂ (mm)	<i>f</i>	<i>d</i> _a (2)	<i>D</i> _a (2)	<i>r</i> _a	<i>D</i> _x	<i>C</i> _Y	approx.		
						Open Z · ZZ V · VV	DU DDU	Open Z	max.						min.	max.	max.	min.	max.									max.	max.
160	200	20	1.1	48 500	61 000	17.2	2 600	1 700	3 200	6832	ZZS	VV	DDU	N	NR	3.30	1.9	196.8	0.6	0.5	206.5	1.7	166.5	170.5	193.5	1	208	4.7	1.23
	220	28	2	87 000	96 000	16.6	2 600	1 600	3 000	6932	ZZS	—	DDU	—	—	—	—	—	—	—	—	—	169	176	211	2	—	—	2.71
	240	25	1.5	99 000	108 000	16.5	2 400	—	2 800	16032	—	—	—	—	—	—	—	—	—	—	—	—	168	—	232	1.5	—	—	4.2
	240	38	2.1	137 000	135 000	15.9	2 400	1 600	2 800	6032	ZZ	—	DDU	—	—	—	—	—	—	—	—	—	171	181.5	229	2	—	—	5.15
	290	48	3	185 000	186 000	15.4	1 900	—	2 400	6232	ZZS	—	—	—	—	—	—	—	—	—	—	—	173	202	277	2.5	—	—	12.8
	340	68	4	278 000	287 000	13.9	1 700	—	2 000	6332	ZZS	—	—	—	—	—	—	—	—	—	—	—	176	215.5	324	3	—	—	26.2

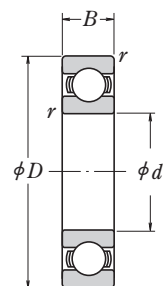
Notes (1) For tolerances of snap ring grooves and snap ring dimensions, refer to Pages A116 to A119.

(2) When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.

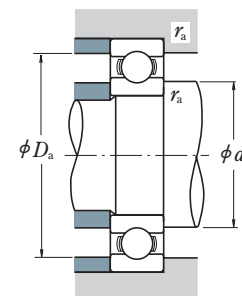
Remarks 1. When using bearings with rotating outer rings, contact NSK if they are sealed, shielded, or have snap rings.
2. Please consult NSK about the snap ring groove dimensions of Dimension Series 18 and 19 sealed and shielded bearings when the diameter is 50 mm or more.

SINGLE-ROW DEEP GROOVE BALL BEARINGS

Bore Diameter 170 – 240 mm



Open

Shielded
ZZSNon-Contact
Sealed
VV

Dynamic Equivalent Load

$$P = XF_r + YF_a$$

$\frac{f_0 F_a}{C_{0r}}$	e	$\frac{F_a}{F_r} \leq e$		$\frac{F_a}{F_r} > e$	
		X	Y	X	Y
0.172	0.19	1	0	0.56	2.30
0.345	0.22	1	0	0.56	1.99
0.689	0.26	1	0	0.56	1.71
1.03	0.28	1	0	0.56	1.55
1.38	0.30	1	0	0.56	1.45
2.07	0.34	1	0	0.56	1.31
3.45	0.38	1	0	0.56	1.15
5.17	0.42	1	0	0.56	1.04
6.89	0.44	1	0	0.56	1.00

Static Equivalent Load

$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

$$\frac{F_a}{F_r} \leq 0.8, P_0 = F_r$$

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Designations				Abutment and Fillet Dimensions (mm)				Mass (kg)
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> min.	<i>C</i> _r	<i>C</i> _{0r}	<i>f</i> ₀	Grease		Oil	Open	Shielded	Sealed	min.	<i>d</i> _a ⁽¹⁾		<i>D</i> _a ⁽¹⁾ max.	<i>r</i> _a max.	approx.
							Open Z : ZZ V : VV	DU DDU	Open Z					max.	max.			
170	215	22	1.1	60 000	75 000	17.1	2 600	1 600	3 000	6834	ZZS	VV DDU	176.5	182	208.5	1	1.86	
	230	28	2	86 000	97 000	16.7	2 400	—	2 800	6934	ZZS	— —	179	186	221	2	3.34	
	260	28	1.5	114 000	126 000	16.5	2 200	—	2 600	16034	— —	—	178	—	252	1.5	5.71	
	260	42	2.1	161 000	161 000	15.8	2 200	—	2 600	6034	ZZS	VV —	181	194.5	249	2	6.89	
	310	52	4	212 000	224 000	15.3	1 800	—	2 200	6234	ZZS	— —	186	215	294	3	15.8	
	360	72	4	325 000	355 000	13.6	1 600	—	2 000	6334	— —	—	186	—	344	3	36.6	
180	225	22	1.1	60 500	78 500	17.2	2 400	—	2 800	6836	—	VV —	186.5	192	218.5	1	1.98	
	250	33	2	119 000	128 000	16.4	2 200	—	2 600	6936	ZZS	— —	189	198.5	241	2	4.16	
	280	31	2	145 000	157 000	16.3	2 000	—	2 400	16036	— —	—	189	—	271	2	7.5	
	280	46	2.1	180 000	185 000	15.6	2 000	—	2 400	6036	ZZS	VV —	191	208	269	2	8.88	
	320	52	4	227 000	241 000	15.1	1 700	—	2 000	6236	ZZS	— —	196	223	304	3	15.9	
	380	75	4	355 000	405 000	13.9	1 500	—	1 800	6336	— —	—	196	—	364	3	43.1	
190	240	24	1.5	73 000	93 500	17.1	2 200	—	2 600	6838	—	VV —	198	202.5	232	1.5	2.53	
	260	33	2	113 000	127 000	16.6	2 200	—	2 600	6938	— —	—	199	—	251	2	5.18	
	290	31	2	149 000	168 000	16.4	2 000	—	2 400	16038	— —	—	199	—	281	2	7.78	
	290	46	2.1	188 000	201 000	15.8	2 000	—	2 400	6038	ZZS	— —	201	218	279	2	9.39	
	340	55	4	255 000	282 000	15.0	1 600	—	2 000	6238	ZZS	— —	206	236	324	3	22.3	
	400	78	5	355 000	415 000	14.1	1 400	—	1 700	6338	— —	—	210	—	380	4	49.7	
200	250	24	1.5	74 000	98 000	17.2	2 200	—	2 600	6840	—	— —	208	—	242	1.5	2.67	
	280	38	2.1	143 000	158 000	16.4	2 000	—	2 400	6940	ZZS	— —	211	222	269	2	7.28	
	310	34	2	161 000	180 000	16.4	1 900	—	2 200	16040	— —	—	209	—	301	2	10	
	310	51	2.1	207 000	226 000	15.6	1 900	—	2 200	6040	ZZS	— —	211	231.5	299	2	12	
	360	58	4	269 000	310 000	15.2	1 500	—	1 800	6240	ZZS	— —	216	252	344	3	26.7	
	420	80	5	380 000	445 000	13.8	1 300	—	1 600	6340	— —	—	220	—	400	4	55.3	
220	270	24	1.5	76 500	107 000	17.4	1 900	—	2 400	6844	ZZS	— —	228	233.5	262	1.5	2.9	
	300	38	2.1	146 000	169 000	16.6	1 800	—	2 200	6944	ZZS	— —	231	242	289	2	7.88	
	340	37	2.1	180 000	217 000	16.5	1 600	—	2 000	16044	— —	—	231	—	329	2	13.1	
	340	56	3	235 000	271 000	15.6	1 700	—	2 000	6044	ZZS	— —	233	254.5	327	2.5	18.6	
	400	65	4	310 000	375 000	15.1	1 300	—	1 600	6244	— —	—	236	—	384	3	37.4	
	460	88	5	410 000	520 000	14.3	1 200	—	1 500	6344	— —	—	240	—	440	4	73.9	
240	300	28	2	98 500	137 000	17.3	1 700	—	2 000	6848	—	— —	249	—	291	2	4.48	
	320	38	2.1	154 000	190 000	16.8	1 700	—	2 000	6948	ZZS	— —	251	262	309	2	8.49	
	360	37	2.1	196 000	243 000	16.5	1 500	—	1 900	16048	— —	—	251	—	349	2	13.9	
	360	56	3	244 000	296 000	15.9	1 500	—	1 900	6048	—	— —	253	—	347	2.5	19.9	
	440	72	4	340 000	430 000	15.2	1 200	—	1 500	6248	—	— —	256	—	424	3	50.5	
	500	95	5	470 000	625 000	14.2	1 100	—	1 300	6348	—	— —	260	—	480	4	94.4	

Note (1) When heavy axial loads are applied, d_a and D_a can be adjusted up to the shoulder diameter of the races. Please consult NSK for details.

Remark When using bearings with rotating outer rings, contact NSK if they are sealed or shielded.

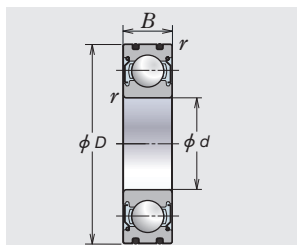
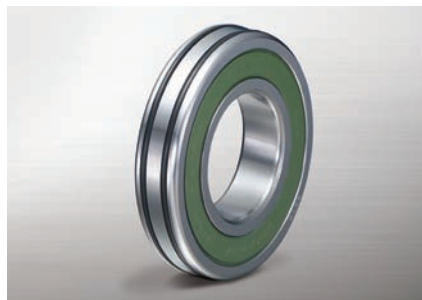
■ Features of Bearings for Pumps

Creep-Free Bearings™

Applications • Water/Sewage and Irrigation, etc.

Outer ring creep prevention is significantly improved by O-ring tension in the housing. Standard principal dimensions are maintained to eliminate the need for re-machining housings, thereby reducing costs.

(Recommended fits: G6 or H7)



Bearing Designation	Boundary Dimensions (mm)				Basic Load Ratings (N)	
	<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (min.)	<i>C</i> _r (dynamic)	<i>C</i> _{0r} (static)
6000	10	26	8	0.3	4 550	1 970
6200	10	30	9	0.6	5 100	2 390
6300	10	35	11	0.6	8 100	3 450
6001	12	28	8	0.3	5 100	2 370
6201	12	32	10	0.6	6 800	3 050
6301	12	37	12	1.0	9 700	4 200
6002	15	32	9	0.3	5 600	2 830
6202	15	35	11	0.6	7 650	3 750
6302	15	42	13	1.0	11 400	5 450
6003	17	35	10	0.3	6 000	3 250
6203	17	40	12	0.6	9 550	4 800
6303	17	47	14	1.0	13 600	6 650
6004	20	42	12	0.6	9 400	5 000
6204	20	47	14	1.0	12 800	6 600
6304	20	52	15	1.1	15 900	7 900
6005	25	47	12	0.6	10 100	5 850
6205	25	52	15	1.0	14 000	7 850
6305	25	62	17	1.1	20 600	11 200
6006	30	55	13	1.0	13 200	8 300
6206	30	62	16	1.0	19 500	11 300
6306	30	72	19	1.1	26 700	15 000
6007	35	62	14	1.0	16 000	10 300
6207	35	72	17	1.1	25 700	15 300
6307	35	80	21	1.5	33 500	19 200
6008	40	68	15	1.0	16 800	11 500
6208	40	80	18	1.1	29 100	17 900
6308	40	90	23	1.5	40 500	24 000
6009	45	75	16	1.0	20 900	15 200
6209	45	85	19	1.1	31 500	20 400
6309	45	100	25	1.5	53 000	32 000