

Deep Groove Ball Bearings

DESIGN, TYPES, AND FEATURES

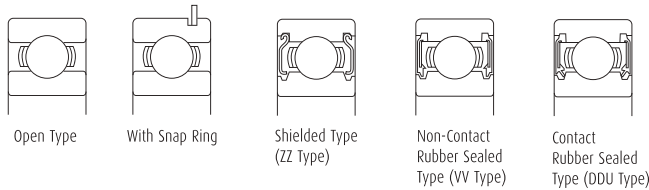
SINGLE-ROW DEEP GROOVE BALL BEARINGS

Single-Row Deep Groove Ball Bearings are classified into the types shown below.
The proper amount of good quality grease is packed in shielded and sealed ball bearings. A comparison of the features of each type is shown in Table 1.

Table 1 Features of Sealed Ball Bearings

Type	Shielded Type (ZZ Type)	Non-Contact Rubber Sealed Type (VV Type)	Contact Rubber Sealed Type (DDU Type)
Torque	Low	Low	Higher than ZZ, VV types due to contact seal
Speed capability	Good	Good	Limited by contact seals
Grease sealing effectiveness	Good	Better than ZZ type	A little better than VV type
Dust resistance	Good	Better than ZZ type (usable in moderately dusty environment)	Best (usable even in very dusty environment)
Water resistance	Not suitable	Not suitable	Good (usable even if fluid is splashed on bearing)
Operating temperature (°)	-10 to +110°C	-10 to +110°C	-10 to +100°C

Note (°) The above temperature range applies to standard bearings. By using cold or heat resistant grease and changing the type of rubber, the operating temperature range can be extended. For such applications, please contact ITJ.



For deep groove ball bearings, pressed cages are usually used. For big bearings, machined brass cages are used. (Refer to Table 2). Machined cages are also used for high speed applications.

Table 2 Standard Cages for Deep Groove Ball Bearings

Series	Pressed Steel Cages	Machined Brass Cages
68	6800 - 6838	6840 - 68/800
69	6900 - 6936	6938 - 69/800
160	16001 - 16026	16028 - 16064
60	6000 - 6040	6044 - 60/670
62	6200 - 6240	6244 - 6272
63	6300 - 6332	6334 - 6356

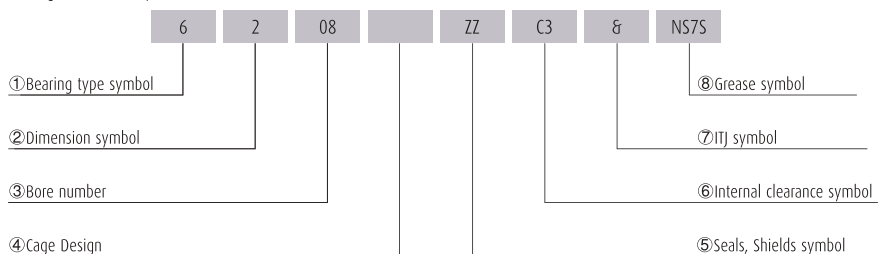
Table 3 Standard Cages for Double Row Deep Groove Ball Bearings

Series	Polyamid Cages
42xxB	4200B - 4218B
43xxB	4302B - 4315B

□ Formulation of Bearing Numbers

Single-Row Deep Groove Ball Bearings

Bearing number example:



- ① Bearing type symbol 6 : Single-Row Deep Groove Ball Bearings ; 4 Double Row Deep Groove Ball Bearing
- ② Dimension symbol 2 : 02 Series, 3 : 03 Series, 9 : 19 Series, 0 : 10 Series
- ③ Bore number Less than 03, Bearing bore 00 : 10mm, 01 : 12mm, 02 : 15mm, 03 : 17mm
Over 04, Bearing bore Bore number X 5 (mm)
- ④ Cage Design Blank: Steel, T/T1X: Plastic, M: Brass
- ⑤ Seals, Shields symbol ZZ : Shield on Both Side , DDU : Contact Rubber Seal on Both Side, VV: Non-Contact Rubber Sealed on Both Side
- ⑥ Internal clearance symbol Omitted : CN clearance^{*1}, C3 : Clearance greater than CN, C4 : Clearance greater than C3, CM : For Electric Motors^{*1}
- ⑦ ITJ symbol ⑧ Grease symbol & : ITJ Bearings
NS7 : NS HI-LUBE

^{*1} The CM clearance can be used in substitute of the CN clearance. (The opposite is not available.)

Deep Groove Ball Bearings

Creep-Free Bearings

Creep-Free Bearings, which come with two O-rings mounted in the outer ring, help to prevent the occurrence of creep by restricting the amount of clearance between the outer ring and housing.

No special machining is required; bearings can be used with the same housing as standard bearings.

In creep limit load tests, the more housing clearance is reduced, the greater the improvement in creep prevention, due to the tension of the O-ring mounted in the outer ring.



Features

› Prevents creep

O-rings help prevent creep.

› Reusable housing

Very little abrasion occurs on the bore surface of the housing, making reuse possible.

› Easy to assemble

Assembly is easy since bearings can be fitted with a loose tolerance.

› No special machining of the housing is required

Bearings can be replaced since boundary dimensions are identical to standard bearings. No reworking of the housing is required.



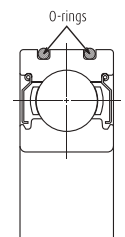


Fig. 1 Structure of Creep-Free Bearings

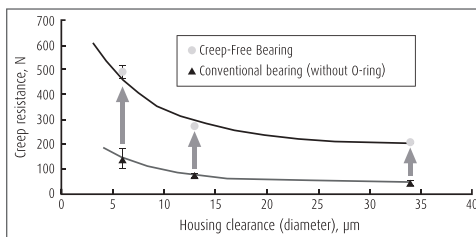


Fig. 2 Creep limit load test (example: 6204)

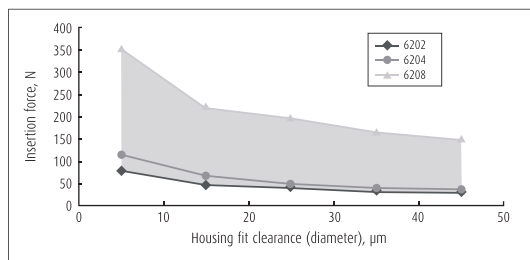


Fig. 3 Fit and insertion force

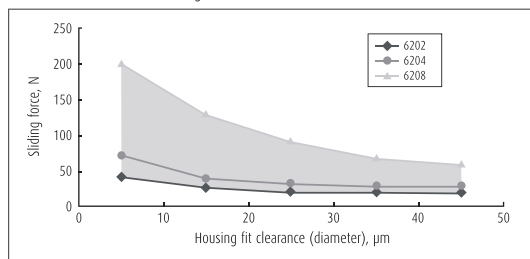


Fig. 4 Fit and sliding force



**Note
on mounting
Creep-Free
Bearings**

- When oil or grease is applied to the outer diameter of the bearing, use a mineral oil or a synthetic hydrocarbon oil (IJT's EA2, etc.).
- O-ring material is nitrile rubber (operating temperature range: -30 to 120°C) as a standard specification. Please contact IJT for use under special environments such as high temperatures.

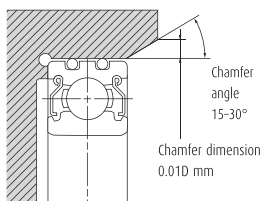
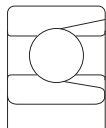


Fig. 5 Housing shape and dimension

Note on the product name "Creep-Free Bearings": The term "free" should not be construed to mean that creep is nonexistent.

Deep Groove Ball Bearings



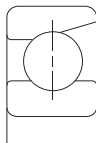
MAXIMUM TYPE BALL BEARINGS

Maximum Type Ball Bearings contain a larger number of balls than normal deep groove ball bearings because of filling slots in the inner and outer rings. Because of their filling slots, they are not suitable for applications with high axial loads.

BL2 and BL3 types of bearings have boundary dimensions equal to those of single-row deep groove ball bearings of Series 62 and 63 respectively. Besides the open type, ZZ type shielded bearings are also available.

When using these bearings, it is important for the filling slot in the outer ring to be outside of the loaded zone as much as possible.

Their cages are pressed steel.



MAGNETO BEARINGS

The groove in the inner ring is a little shallower than that of deep groove ball bearings and one side of the outer ring is relieved. Consequently, the outer ring is separable, which makes it convenient for mounting.

Pressed cages are standard, but for high speed applications, machined synthetic resin cages are used.

PRECAUTIONS FOR USE OF DEEP GROOVE BALL BEARINGS

For deep groove ball bearings, if the bearing load is too small during operation, slippage occurs between the balls and raceways, which may result in smearing. The higher the weight of balls and cage, the higher this tendency becomes, especially for large bearings. If very small bearing loads are expected, please contact ITJ for selection of an appropriate bearing.

Deep Groove Ball Bearings

TECHNICAL DATA

Radial and Axial Internal Clearances and Contact Angles for Single Row Deep Groove Ball Bearings

(1) Radial and Axial Internal Clearances

The internal clearance in single row bearings has been specified as the radial internal clearance. The bearing internal clearance is the amount of relative displacement possible between the bearing rings when one ring is fixed and the other ring does not bear a load. The amount of movement along the direction of the bearing radius is called the radial clearance, and the amount along the direction of the axis is called the axial clearance.

The geometric relation between the radial and axial clearance is shown in Fig. 1.

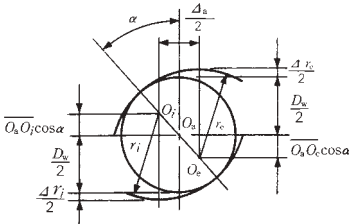


Fig. 1 Relationship Between Δr and Δa

Symbols used in Fig. 1

O_b :	Ball center
O_e :	Center of groove curvature, outer ring
O_i :	Center of groove curvature, inner ring
D_w :	Ball diameter (mm)
r_e :	Radius of outer ring groove (mm)
r_i :	Radius of inner ring groove (mm)
α :	Contact angle ($^\circ$)
Δr_i :	Radial clearance (mm)
Δa_i :	Axial clearance (mm)

It is apparent from Fig. 1 that $\Delta r = \Delta r_e + \Delta r_i$.

From geometric relationships, various equations for clearance, contact angle, etc. can be derived.

$$\Delta r = 2 (1 - \cos \alpha) (r_e + r_i - D_w) \dots \dots \dots (1)$$

$$\Delta a = 2 \sin \alpha (r_e + r_i - D_w) \dots \dots \dots (2)$$

$$\frac{\Delta a}{\Delta r} = \cot \frac{\alpha}{2} \dots \dots \dots (3)$$

$$\Delta \div 2 (r_e + r_i - D_w)^{1/2} \Delta r^{1/2} \dots \dots \dots (4)$$

$$\alpha = \cos^{-1} \left(\frac{r_e + r_i - D_w - \frac{\Delta r}{2}}{r_e + r_i - D_w} \right) \dots \dots \dots (5)$$

$$\alpha = \sin^{-1} \left(\frac{\Delta a / 2}{r_e + r_i - D_w} \right) \dots \dots \dots (6)$$

Because $(r_e + r_i - D_w)$ is a constant, it is apparent why fixed relationships between Δr , Δa and α exist for all the various bearing types.

As was previously mentioned, the clearances for deep groove ball bearings are given as radial clearances, but there are specific applications where it is desirable to have an axial clearance as well. The relationship between deep groove ball bearing radial clearance Δr and axial clearance Δa is given in Equation (4).

To simplify,

$$\Delta a \div K \Delta r^{1/2} \dots \dots \dots (7)$$

where K: Constant depending on bearing design

$$K = 2 (r_e + r_i - D_w)^{1/2}$$

Fig. 2 shows one example. The various values for K are presented by bearing size in Table 1 below.

Example

Assume a 6312 bearing, for a sample calculation, which has a radial clearance of 0.017 mm. From Table 1, $K=2.09$.

Therefore, the axial clearance Δa is:

$$\Delta a = 2.09 \times \sqrt{0.017} = 2.09 \times 0.13 = 0.27 \text{ (mm)}$$

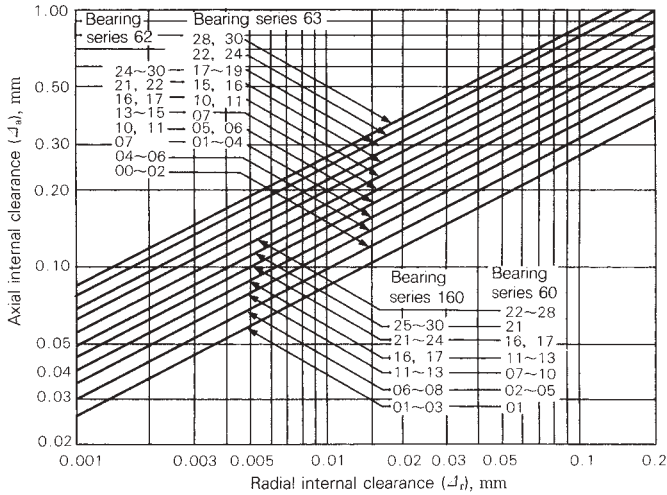


Fig. 2 Radial Clearance, Δ_r and Axial Clearance, Δ_a of Deep Groove Ball Bearings

Table 1 Constant Values of K for Radial and Axial Clearance Conversion

Bearing bore No.	K			
	Series 160	Series 60	Series 62	Series 63
00	-	-	0.93	1.14
01	0.80	0.80	0.93	1.06
02	0.80	0.93	0.93	1.06
03	0.80	0.93	0.99	1.11
04	0.90	0.96	1.06	1.07
05	0.90	0.96	1.06	1.20
06	0.96	1.01	1.07	1.19
07	0.96	1.06	1.25	1.37
08	0.96	1.06	1.29	1.45
09	1.01	1.11	1.29	1.57
10	1.01	1.11	1.33	1.64
11	1.06	1.20	1.40	1.70
12	1.06	1.20	1.50	2.09
13	1.06	1.20	1.54	1.82
14	1.16	1.29	1.57	1.88
15	1.16	1.29	1.57	1.95
16	1.20	1.37	1.64	2.01
17	1.20	1.37	1.70	2.06
18	1.29	1.44	1.76	2.11
19	1.29	1.44	1.82	2.16
20	1.29	1.44	1.88	2.25
21	1.37	1.54	1.95	2.32
22	1.40	1.64	2.01	2.40
24	1.40	1.64	2.06	2.40
26	1.54	1.70	2.11	2.49
28	1.54	1.70	2.11	2.59
30	1.54	1.76	2.11	2.59

Deep Groove Ball Bearings

(2) Relation between Radial Clearance and Contact Angle

Single-row deep groove ball bearings are sometimes used as thrust bearings. In such applications, it is recommended to make the contact angle as large as possible.

The contact angle for ball bearings is determined by the geometric relationship between the radial clearance and the radii of the inner and outer grooves. Using Equations (1) to (6), Fig. 3 shows the particular relationship between the radial clearance and contact angle of 62 and 63 series bearings. The initial contact angle, α_0 , is the initial contact angle when the axial load is zero. Application of any load to the bearing will change this contact angle.

If the initial contact angle α_0 exceeds 20° , it is necessary to check whether or not the contact area of the ball and raceway touch the edge of raceway shoulder. (Refer to Section 8.1.2)

For applications when an axial load alone is applied, the radial clearance for deep groove ball bearings is normally greater than the normal clearance in order to ensure that the contact angle is relatively large. The initial contact angles for C3 and C4 clearances are given for selected bearing sizes in Table 2 below.

Table 2 Initial Contact Angle, α_0 , with C3 and C4 Clearances

Bearing No.	α_0 with C3	α_0 with C4
6205	12.5° to 18°	16.5° to 22°
6210	11.5° to 16.5°	13.5° to 19.5°
6215	11.5° to 16°	15.5° to 19.5°
6220	10.5° to 14.5°	14° to 17.5°
6305	11° to 16°	14.5° to 19.5°
6310	9.5° to 13.5°	12° to 16°
6315	9.5° to 13.5°	12.5° to 15.5°
6320	9° to 12.5°	12° to 15°

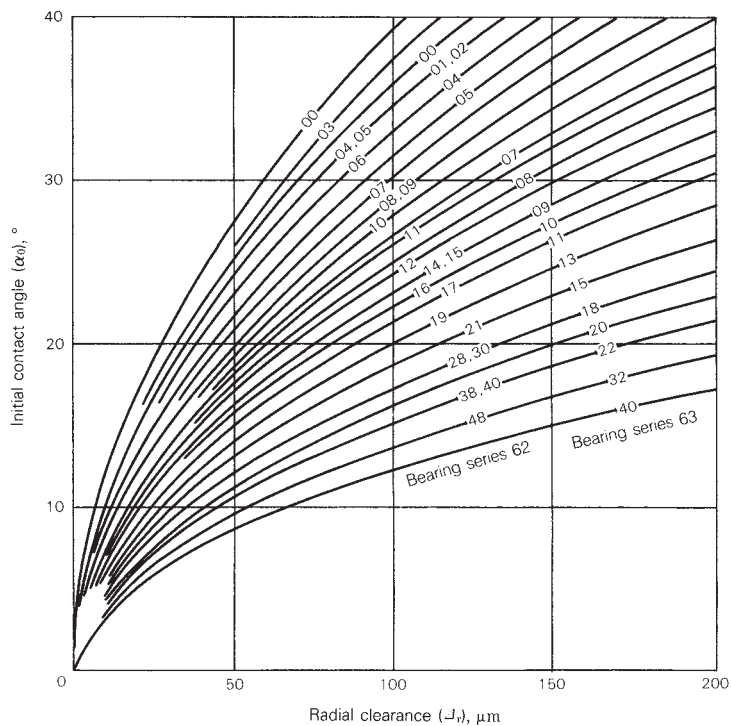


Fig. 3 Radial Clearance and Contact Angle

Deep Groove Ball Bearings

Features and Operating Temperature Range of Ball Bearing Seal Material

The sealed ball bearing is a ball bearing with seals as shown in Figs. 1 and 2. There are two seal types: non-contact seal type and contact seal type. For rubber seal material, nitrile rubber is used for general purpose and poly-acrylic rubber, silicon rubber, and fluoroc rubber are used depending on temperature conditions.

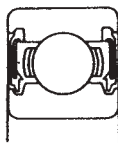
These rubbers have their own unique nature and appropriate rubber must be selected by considering the particular application environment and running conditions.

Table 1 shows principal features of each rubber material and the operating temperature range of the bearing seal. The operating temperature range of Table 1 is a guideline for continuous operation. Thermal aging of rubber is related to the temperature and time. Rubber may be used in a much wider range of operating temperatures depending on the operating time and frequency.

In the non-contact seal, heat generation due to friction on the lip can be ignored. And thermal factors, which cause aging of the rubber, are physical changes due to atmospheric and bearing temperatures. Accordingly, increased hardness or loss of elasticity due to thermal aging exerts only a negligible effect on the seal performance. A rubber non-contact seal can thus be used in an expanded range of operating temperatures greater than that for a contact seal.

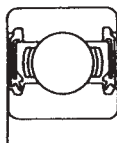
But there are some disadvantages. The contact seal has a problem with wear occurring at the seal lip due to friction, thermal plastic deformation, and hardening. When friction or plastic deformation occurs, the contact pressure between the lip and slide surface decreases, resulting in a clearance. This clearance is minimum and does not cause excessive degradation of sealing performance (for instance, it does not allow dust entry or grease leakage). In most cases, this minor plastic deformation or slightly increased hardness presents no practical problems.

However, in external environments with dust and water in large quantity, the bearing seal is used as an auxiliary seal and a principal seal should be provided separately. As so far described, the operating temperature range of rubber material is only a guideline for selection. Since heat resistant rubber is expensive, it is important to understand the temperature conditions so that an economical selection can be made. Due attention should also be paid not only to heat resistance, but also to the distinctive features of each rubber.



Non-contact
rubber seal (VV)

Fig. 1



Contact
rubber seal (DDU)

Fig. 2

Table 1 Features and Operating Temperature Range of Rubber Materials

Material		Nitrile rubber	Polyacrylic rubber	Silicon rubber	Fluorine rubber
Key features		○Most popular seal material ○Superior in oil and wear resistances and mechanical properties ○Readily ages under direct sunrays ○Less expensive than other rubbers	○Superior in heat and oil resistances ○Large compression causes permanent deformation ○Inferior in cold resistance ○One of the less expensive materials among the high temperature materials ○Attention is necessary because it swells the ester oil based grease	○High heat and cold resistances ○Inferior in mechanical properties other than permanent deformation by compression. Pay attention to tear strength ○Pay attention so as to avoid swell caused by low aniline point mineral oil, silicone grease, and silicone oil	○High heat resistance ○Superior in oil and chemical resistances ○Cold resistance similar to nitrile rubber ○Attention is necessary because it deteriorates the urea grease
Operating temperature range ⁽¹⁾ (°C)	Non-contact seal	-50 to +130	-30 to +170	-100 to +250	-50 to +220
	Contact seal	-30 to +110	-15 to +150	-70 to +200	-30 to +200

Note ⁽¹⁾ This operating temperature is the temperature of seal rubber materials.

Notes ⁽⁴⁾ Snap ring groove dimensions and snap ring dimensions are not conformed to ISO15.

Remarks 1. Diameter Series 7 (extra thin section bearings) are also available, please contact ITJ.

2. When using bearings with rotating outer rings, contact ITJ if they are sealed, shielded, or have snap rings.

Deep Groove Ball Bearings

Free Space and Grease Filling Amount for Deep Groove Ball Bearings

Grease lubrication can simplify the bearing's peripheral construction. In place of oil lubrication, grease lubrication is now employed along with enhancement of the grease quality for applications in many fields. It is important to select a grease appropriate to the operating conditions. Due care is also necessary as to the filling amount, since too much or too little grease greatly affects the temperature rise and torque. The amount of grease needed depends on such factors as housing construction, free space, grease brand, and environment. A general guideline is described next.

First, the bearing is filled with an appropriate amount of grease. In this case, it is essential to push grease onto the cage guide surface. Then, the free space, which excludes the spindle and bearing inside the housing, is filled with an amount of grease as shown next:

1/2 to 2/3..... when the bearing speed is 50% or less of the allowable speed specified in the catalog.

1/3 to 1/2..... when the bearing speed is 50% or more.

Roughly, low speeds require more grease while high speeds require less grease. Depending on the particular application, the filling amount may have to be reduced further to reduce the torque and to prevent heat generation. When the bearing speed is extremely low, on the other hand, grease may be packed almost full to prevent dust and water entry.

Accordingly, it is necessary to know the extent of the housing's free space for the specific bearing to determine the correct filling amount. As a reference, the volume of free space is shown in Table 1 for an open type deep groove ball bearing.

Note that the free space of the open type deep groove ball bearing is the volume obtained by subtracting the volume of the balls and cage from the space formed between inner and outer rings.

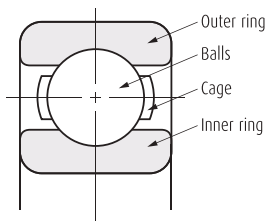


Table 1 Free Space of Open Type Deep Groove Ball Bearing

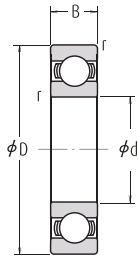
Units : cm³

Bearing bore No.	Bearing free space			Bearing bore No.	Bearing free space		
	Bearing series				Bearing series		
	60	62	63		60	62	63
00	1.2	1.5	2.9	14	34	61	148
01	1.2	2.1	3.5	15	35	67	180
02	1.6	2.7	4.8	16	47	84	213
03	2.0	3.7	6.4	17	48	104	253
04	4.0	6.0	7.9	18	63	127	297
05	4.6	7.7	12	19	66	155	345
06	6.5	11	19	20	68	184	425
07	9.2	15	25	21	88	216	475
08	11	20	35	22	114	224	555
09	14	23	49	24	122	310	675
10	15	28	64	26	172	355	830
11	22	34	79	28	180	415	1 030
12	23	45	98	30	220	485	1 140
13	24	54	122	32	285	545	1 410

Remark The table above shows the free space of a bearing using a pressed steel cage. The free space of a bearing using a high-tension brass machined cage is about 50 to 60% of the value in the table.

Single-Row Deep Groove Ball Bearings

Bore Diameter 10 – 17 mm



Open Type



Shielded Type
ZZ



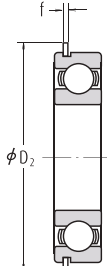
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

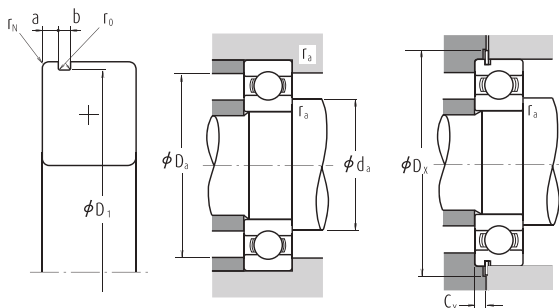


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{or}	f ₀	Grease		Oil				
							Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
10	19	5	0.3	1 720	840	14.8	34 000	24 000	40 000	6800	ZZ	VV	DD
	22	6	0.3	2 700	1 270	14.0	32 000	22 000	38 000	6900	ZZ	VV	DD
	26	8	0.3	4 550	1 970	12.4	30 000	22 000	36 000	6000	ZZ	VV	DDU
	30	9	0.6	5 100	2 390	13.2	24 000	18 000	30 000	6200	ZZ	VV	DDU
	30	9	0.6	5 350	2 390	13.2	28 000	18 000	34 000	6200 ⁺	ZZ	VV	DDU
	35	11	0.6	8 100	3 450	11.2	22 000	17 000	26 000	6300	ZZ	VV	DDU
12	35	11	0.6	8 500	3 450	11.2	26 000	17 000	30 000	6300 ⁺	ZZ	VV	DDU
	21	5	0.3	1 920	1 040	15.3	32 000	20 000	38 000	6801	ZZ	VV	DD
	24	6	0.3	2 890	1 460	14.5	30 000	20 000	36 000	6901	ZZ	VV	DD
	28	7	0.3	5 100	2 370	13.0	28 000	—	32 000	16001	—	—	—
	28	8	0.3	5 100	2 370	13.0	28 000	18 000	32 000	6001	ZZ	VV	DDU
	28	8	0.3	5 350	2 370	13.0	32 000	18 000	38 000	6001 ⁺	ZZ	VV	DDU
15	32	10	0.6	6 800	3 050	12.3	22 000	17 000	28 000	6201	ZZ	VV	DDU
	32	10	0.6	7 150	3 050	12.3	26 000	17 000	32 000	6201 ⁺	ZZ	VV	DDU
	37	12	1	9 700	4 200	11.1	20 000	16 000	24 000	6301	ZZ	VV	DDU
	37	12	1.0	10 200	4 200	11.1	24 000	16 000	28 000	6301 ⁺	ZZ	VV	DDU
	24	5	0.3	2 070	1 260	15.8	28 000	17 000	34 000	6802	ZZ	VV	DD
	28	7	0.3	4 350	2 260	14.3	26 000	17 000	30 000	6902	ZZ	VV	DD
17	32	8	0.3	5 600	2 830	13.9	24 000	—	28 000	16002	—	—	—
	32	9	0.3	5 600	2 830	13.9	24 000	15 000	28 000	6002	ZZ	VV	DDU
	32	9	0.3	5 850	2 830	13.9	26 000	15 000	32 000	6002 ⁺	ZZ	VV	DDU
	35	11	0.6	7 650	3 750	13.2	20 000	14 000	24 000	6202	ZZ	VV	DDU
	35	11	0.6	8 000	3 750	13.2	22 000	14 000	28 000	6202 ⁺	ZZ	VV	DDU
	42	13	1	11 400	5 450	12.3	17 000	13 000	20 000	6302	ZZ	VV	DDU
17	42	13	1.0	12 000	5 450	12.3	19 000	13 000	24 000	6302 ⁺	ZZ	VV	DDU
	26	5	0.3	2 630	1 570	15.7	26 000	15 000	30 000	6803	ZZ	VV	DD
	30	7	0.3	4 600	2 550	14.7	24 000	15 000	28 000	6903	ZZ	VV	DDU
	35	8	0.3	6 000	3 250	14.4	22 000	—	26 000	16003	—	—	—
	35	10	0.3	6 000	3 250	14.4	22 000	13 000	26 000	6003	ZZ	VV	DDU
	35	10	0.3	6 300	3 250	14.4	24 000	13 000	28 000	6003 ⁺	ZZ	VV	DDU
17	40	12	0.6	9 550	4 800	13.2	17 000	12 000	20 000	6203	ZZ	VV	DDU
	40	12	0.6	10 100	4 800	13.2	20 000	12 000	24 000	6203 ⁺	ZZ	VV	DDU
	47	14	1	13 600	6 650	12.4	15 000	11 000	18 000	6303	ZZ	VV	DDU
	47	14	1.0	14 300	6 650	12.4	17 000	11 000	20 000	6303 ⁺	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{F_r}$	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

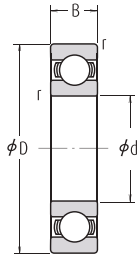
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

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)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d _x (1) min.	D _x (2) max.	r _a max.	D _x min.	C _γ max.	
—	—	—	—	—	—	—	—	—	12	12	17	0.3	—	0.005
N(3)	NR(3)	1.05	0.80	26.80	0.20	0.2	24.8	0.70	12	12.5	20	0.3	25.5	0.009
N(4)	NR(4)	1.35	0.87	24.50	0.20	0.3	28.7	0.84	12	13	24	0.3	29.4	0.018
N	NR	2.06	1.35	28.17	0.40	0.5	34.7	1.12	14	16	26	0.6	35.5	0.032
—	—	—	—	—	—	—	—	—	14	16	26	0.6	—	0.032
N	NR	2.06	1.35	33.17	0.40	0.5	39.7	1.12	14	16.5	31	0.6	40.5	0.052
—	—	—	—	—	—	—	—	—	14	16.5	31	0.6	—	0.052
—	—	—	—	—	—	—	—	—	14	14	19	0.3	—	0.006
N(3)	NR(3)	1.05	0.80	22.80	0.20	0.2	26.8	0.70	14	14.5	22	0.3	27.5	0.010
—	—	—	—	—	—	—	—	—	14	—	26	0.3	—	0.019
N(4)	NR(4)	1.35	0.87	26.50	0.20	0.3	30.7	0.84	14	15.5	26	0.3	31.4	0.022
—	—	—	—	—	—	—	—	—	14	15.5	26	0.3	—	0.022
N	NR	2.06	1.35	30.15	0.40	0.5	36.7	1.12	16	17	28	0.6	37.5	0.037
—	—	—	—	—	—	—	—	—	16	17	28	0.6	—	0.037
N	NR	2.06	1.35	34.77	0.40	0.5	41.3	1.12	17	18	32	1	42	0.060
—	—	—	—	—	—	—	—	—	—	—	—	42	2.9	0.060
—	—	—	—	—	—	—	—	—	17	17	22	0.3	—	0.007
N(3)	NR(3)	1.30	0.95	26.70	0.25	0.3	30.8	0.85	17	17	26	0.3	31.5	0.015
—	—	—	—	—	—	—	—	—	17	—	30	0.3	—	0.027
N	NR	2.06	1.35	30.15	0.40	0.3	36.7	1.12	17	19	30	0.3	37.5	0.031
—	—	—	—	—	—	—	—	—	17	19	30	0.3	—	0.031
N	NR	2.06	1.35	33.17	0.40	0.5	39.7	1.12	19	20.5	31	0.6	40.5	0.045
—	—	—	—	—	—	—	—	—	19	20.5	31	0.6	—	0.045
N	NR	2.06	1.35	39.75	0.40	0.5	46.3	1.12	20	22.5	37	1	47	0.083
—	—	—	—	—	—	—	—	—	20	22.5	37	1	—	0.083
—	—	—	—	—	—	—	—	—	19	19	24	0.3	—	0.007
N(3)	NR(3)	1.30	0.95	28.70	0.25	0.3	32.8	0.85	19	19.5	28	0.3	33.5	0.017
—	—	—	—	—	—	—	—	—	19	—	33	0.3	—	0.033
N	NR	2.06	1.35	33.17	0.40	0.3	39.7	1.12	19	21.5	33	0.3	40.5	0.041
—	—	—	—	—	—	—	—	—	19	21.5	33	0.3	—	0.041
N	NR	2.06	1.35	38.10	0.40	0.5	44.6	1.12	21	23.5	36	0.6	45.5	0.067
—	—	—	—	—	—	—	—	—	21	23.5	36	0.6	—	0.067
N	NR	2.46	1.35	44.60	0.40	0.5	52.7	1.12	22	25.5	42	1	53.5	0.113
—	—	—	—	—	—	—	—	—	22	25.5	42	1	—	0.113

Single-Row Deep Groove Ball Bearings

Bore Diameter 20 – 30 mm



Open Type



Shielded Type
ZZ



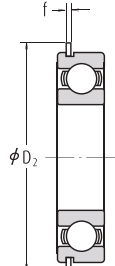
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

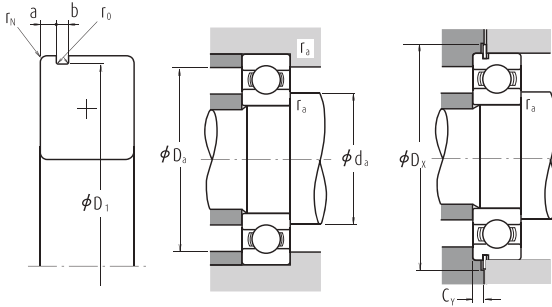


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{or}	f ₀	Grease			Open	Shielded	Sealed	
							Open Z · ZZ V · VV	DU DDU	Oil Open Z				
20	32	7	0.3	4 000	2 470	15.5	22 000	13 000	26 000	6804	ZZ	VV	DD
	37	9	0.3	6 400	3 700	14.7	19 000	12 000	22 000	6904	ZZ	VV	DDU
	42	8	0.3	7 900	4 450	14.5	18 000	—	20 000	16004	—	—	—
	42	12	0.6	9 400	5 000	13.8	18 000	11 000	20 000	6004	ZZ	VV	DDU
	42	12	0.6	9 850	5 000	13.8	20 000	11 000	24 000	6004 ⁺	ZZ	VV	DDU
	47	14	1	12 800	6 600	13.1	15 000	11 000	18 000	6204	ZZ	VV	DDU
	47	14	1.0	13 400	6 600	13.1	17 000	11 000	20 000	6204 ⁺	ZZ	VV	DDU
	52	15	1.1	15 900	7 900	12.4	14 000	10 000	17 000	6304	ZZ	VV	DDU
	52	15	1.1	16 700	7 900	12.4	16 000	10 000	19 000	6304 ⁺	ZZ	VV	DDU
	44	12	0.6	9 400	5 050	14.0	17 000	11 000	20 000	60/22	ZZ	VV	DDU
22	50	14	1	12 900	6 800	13.5	14 000	9 500	16 000	62/22	ZZ	VV	DDU
	56	16	1.1	18 400	9 250	12.4	13 000	9 500	16 000	63/22	ZZ	VV	DDU
	37	7	0.3	4 500	3 150	16.1	18 000	10 000	22 000	6805	ZZ	VV	DD
	42	9	0.3	7 050	4 550	15.4	16 000	10 000	19 000	6905	ZZ	VV	DDU
	47	8	0.3	8 850	5 600	15.1	15 000	—	18 000	16005	—	—	—
	47	12	0.6	10 100	5 850	14.5	15 000	9 500	18 000	6005	ZZ	VV	DDU
	47	12	0.6	10 600	5 850	14.5	18 000	9 500	22 000	6005 ⁺	ZZ	VV	DDU
	52	15	1	14 000	7 850	13.9	13 000	9 000	15 000	6205	ZZ	VV	DDU
	52	15	1.0	14 700	7 850	13.9	15 000	9 000	18 000	6205 ⁺	ZZ	VV	DDU
	62	17	1.1	20 600	11 200	13.2	11 000	8 000	13 000	6305	ZZ	VV	DDU
25	62	17	1.1	21 600	11 200	13.2	13 000	8 000	16 000	6305 ⁺	ZZ	VV	DDU
	52	12	0.6	12 500	7 400	14.5	14 000	8 500	16 000	60/28	ZZ	VV	DDU
	58	16	1	16 600	9 500	13.9	12 000	8 000	14 000	62/28	ZZ	VV	DDU
	68	18	1.1	26 700	14 000	12.4	10 000	7 500	13 000	63/28	ZZ	VV	DDU
	42	7	0.3	4 700	3 650	16.4	15 000	9 000	18 000	6806	ZZ	VV	DD
	47	9	0.3	7 250	5 000	15.8	14 000	8 500	17 000	6906	ZZ	VV	DDU
	55	9	0.3	11 200	7 350	15.2	13 000	—	15 000	16006	—	—	—
	55	13	1	13 200	8 300	14.7	13 000	8 000	15 000	6006	ZZ	VV	DDU
	55	13	1.0	13 900	8 300	14.7	15 000	8 000	18 000	6006 ⁺	ZZ	VV	DDU
	62	16	1	19 500	11 300	13.8	11 000	7 500	13 000	6206	ZZ	VV	DDU
30	62	16	1.0	20 400	11 300	13.8	12 000	7 500	15 000	6206 ⁺	ZZ	VV	DDU
	72	19	1.1	26 700	15 000	13.3	9 500	6 700	12 000	6306	ZZ	VV	DDU
	72	19	1.1	28 000	15 000	13.3	11 000	6 700	13 000	6306 ⁺	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{C_{or}}$	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

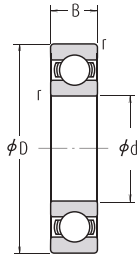
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (°) (mm)					Snap Ring (°) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
		a	b	D ₁	r ₀	r _N	D ₂	f	d _a (°)		D _a (°)	r _a	D _x	C _y	approx.
		max.	min.	max.	max.	min.	max.	max.	min.	max.	max.	max.	min.	max.	
N	NR	1.30	0.95	30.70	0.25	0.3	34.8	0.85	22	22	30	0.3	35.5	1.8	0.017
N	NR	1.70	0.95	35.70	0.25	0.3	39.8	0.85	22	24	35	0.3	40.5	2.3	0.037
—	—	—	—	—	—	—	—	—	22	—	40	0.3	—	—	0.048
N	NR	2.06	1.35	39.75	0.40	0.5	46.3	1.12	24	25.5	38	0.6	47	2.9	0.068
—	—	—	—	—	—	—	—	—	24	25.5	38	0.6	—	—	0.068
N	NR	2.46	1.35	44.60	0.40	0.5	52.7	1.12	25	26.5	42	1	53.5	3.3	0.107
—	—	—	—	—	—	—	—	—	25	26.5	42	1	—	—	0.107
N	NR	2.46	1.35	49.73	0.40	0.5	57.9	1.12	26.5	28	45.5	1	58.5	3.3	0.145
—	—	—	—	—	—	—	—	—	26.5	28	45.5	1	—	—	0.145
N	NR	2.06	1.35	41.75	0.40	0.5	48.3	1.12	26	26.5	40	0.6	49	2.9	0.074
N	NR	2.46	1.35	47.60	0.40	0.5	55.7	1.12	27	29.5	45	1	56.5	3.3	0.119
N	NR	2.46	1.35	53.60	0.40	0.5	61.7	1.12	28.5	30.5	49.5	1	62.5	3.3	0.179
N	NR	1.30	0.95	35.70	0.25	0.3	39.8	0.85	27	27	35	0.3	40.5	1.8	0.021
N(°)	NR(°)	1.70	0.95	40.70	0.25	0.3	44.8	0.85	27	28.5	40	0.3	45.5	2.3	0.042
—	—	—	—	—	—	—	—	—	27	—	45	0.3	—	—	0.059
N	NR	2.06	1.35	44.60	0.40	0.5	52.7	1.12	29	30	43	0.6	53.5	2.9	0.079
—	—	—	—	—	—	—	—	—	29	30	43	0.6	—	—	0.079
N	NR	2.46	1.35	49.73	0.40	0.5	57.9	1.12	30	32	47	1	58.5	3.3	0.129
—	—	—	—	—	—	—	—	—	30	32	47	1	—	—	0.129
N	NR	3.28	1.90	59.61	0.60	0.5	67.7	1.70	31.5	36	55.5	1	68.5	4.6	0.235
—	—	—	—	—	—	—	—	—	31.5	36	55.5	1	—	—	0.235
N	NR	2.06	1.35	49.73	0.40	0.5	57.9	1.12	32	34	48	0.6	58.5	2.9	0.096
N	NR	2.46	1.35	55.60	0.40	0.5	63.7	1.12	33	35.5	53	1	64.5	3.3	0.175
N	NR	3.28	1.90	64.82	0.60	0.5	74.6	1.70	34.5	38	61.5	1	76	4.6	0.287
N	NR	1.30	0.95	40.70	0.25	0.3	44.8	0.85	32	32	40	0.3	45.5	1.8	0.024
N	NR	1.70	0.95	45.70	0.25	0.3	49.8	0.85	32	34	45	0.3	50.5	2.3	0.052
—	—	—	—	—	—	—	—	—	32	—	53	0.3	—	—	0.087
N	NR	2.08	1.35	52.60	0.40	0.5	60.7	1.12	35	36.5	50	1	61.5	2.9	0.116
—	—	—	—	—	—	—	—	—	35	36.5	50	1	—	—	0.116
N	NR	3.28	1.90	59.61	0.60	0.5	67.7	1.70	35	38.5	57	1	68.5	4.6	0.199
—	—	—	—	—	—	—	—	—	35	38.5	57	1	—	—	0.199
N	NR	3.28	1.90	68.81	0.60	0.5	78.6	1.70	36.5	42.5	65.5	1	80	4.6	0.345
—	—	—	—	—	—	—	—	—	36.5	42.5	65.5	1	—	—	0.345

Single-Row Deep Groove Ball Bearings

Bore Diameter 32 – 45 mm



Open Type



Shielded Type
ZZ



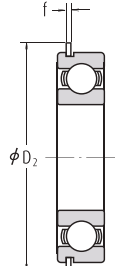
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

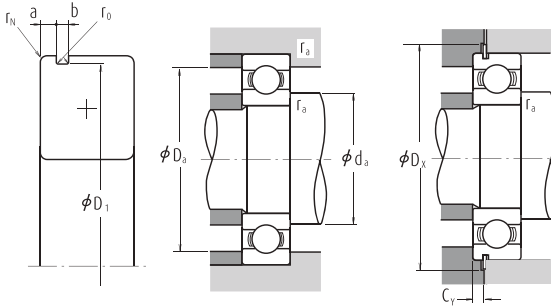


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{or}	f ₀	Grease		Oil				
							Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
32	58	13	1	15 100	9 150	14.5	12 000	7 500	14 000	60/32	ZZ	VV	DDU
	65	17	1	20 700	11 600	13.6	10 000	7 100	12 000	62/32	ZZ	VV	DDU
	75	20	1.1	29 900	17 000	13.2	9 000	6 300	11 000	63/32	ZZ	VV	DDU
	47	7	0.3	4 900	4 100	16.7	14 000	7 500	16 000	6807	ZZ	VV	DD
	55	10	0.6	10 600	7 250	15.5	12 000	7 500	15 000	6907	ZZ	VV	DDU
35	62	9	0.3	11 700	8 200	15.6	11 000	—	13 000	16007	—	—	—
	62	14	1	16 000	10 300	14.8	11 000	6 700	13 000	6007	ZZ	VV	DDU
	62	14	1.0	16 800	10 300	14.8	13 000	6 700	15 000	6007 ⁺	ZZ	VV	DDU
	72	17	1.1	25 700	15 300	13.8	9 500	6 300	11 000	6207	ZZ	VV	DDU
	72	17	1.1	27 000	15 300	13.8	11 000	6 300	13 000	6207 ⁺	ZZ	VV	DDU
	80	21	1.5	33 500	19 200	13.2	8 500	6 000	10 000	6307	ZZ	VV	DDU
	80	21	1.5	35 000	19 200	13.2	10 000	6 000	12 000	6307 ⁺	ZZ	VV	DDU
	52	7	0.3	6 350	5 550	17.0	12 000	6 700	14 000	6808	ZZ	VV	DD
	62	12	0.6	13 700	10 000	15.7	11 000	6 300	13 000	6908	ZZ	VV	DDU
	68	9	0.3	12 600	9 650	16.0	10 000	—	12 000	16008	—	—	—
40	68	15	1	16 800	11 500	15.3	10 000	6 000	12 000	6008	ZZ	VV	DDU
	68	15	1.0	17 600	11 500	15.3	12 000	6 000	14 000	6008 ⁺	ZZ	VV	DDU
	80	18	1.1	29 100	17 900	14.0	8 500	5 600	10 000	6208	ZZ	VV	DDU
	80	18	1.1	30 500	17 900	14.0	9 500	5 600	12 000	6208 ⁺	ZZ	VV	DDU
	90	23	1.5	40 500	24 000	13.2	7 500	5 300	9 000	6308	ZZ	VV	DDU
	90	23	1.5	43 000	24 000	13.2	9 000	5 300	11 000	6308 ⁺	ZZ	VV	DDU
	58	7	0.3	6 600	6 150	17.2	11 000	6 000	13 000	6809	ZZ	VV	DD
	68	12	0.6	14 100	10 900	15.9	9 500	5 600	12 000	6909	ZZ	VV	DDU
	75	10	0.6	14 900	11 400	15.9	9 000	—	11 000	16009	—	—	—
	75	16	1	20 900	15 200	15.3	9 000	5 300	11 000	6009	ZZ	VV	DDU
45	75	16	1.0	22 000	15 200	15.3	10 000	5 300	12 000	6009 ⁺	ZZ	VV	DDU
	85	19	1.1	31 500	20 400	14.4	7 500	5 300	9 000	6209	ZZ	VV	DDU
	85	19	1.1	33 000	20 400	14.4	9 000	5 300	11 000	6209 ⁺	ZZ	VV	DDU
	100	25	1.5	53 000	32 000	13.1	6 700	4 800	8 000	6309	ZZ	VV	DDU
	100	25	1.5	55 500	32 000	13.1	7 500	4 800	9 500	6309 ⁺	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{F_r}$	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

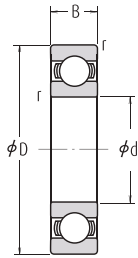
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

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)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d _x (1) min.	d _x (2) max.	r _a max.	D _x min.	C ₁ max.	
N	NR	2.08	1.35	55.60	0.40	0.5	63.7	1.12	37	38.5	53	1	64.5	0.122
N	NR	3.28	1.90	62.60	0.60	0.5	70.7	1.70	37	40	60	1	71.5	0.225
N	NR	3.28	1.90	71.83	0.60	0.5	81.6	1.70	38.5	44.5	68.5	1	83	0.389
N	NR	1.30	0.95	45.70	0.25	0.3	49.8	0.85	37	37	45	0.3	50.5	0.18
N	NR	1.70	0.95	53.70	0.25	0.5	57.8	0.85	39	39	51	0.6	58.5	0.23
—	—	—	—	—	—	—	—	—	37	—	60	0.3	—	0.107
N	NR	2.08	1.90	59.61	0.60	0.5	67.7	1.70	40	41.5	57	1	68.5	0.151
N	—	—	—	—	—	—	—	—	40	41.5	57	1	—	0.151
N	NR	3.28	1.90	68.81	0.60	0.5	78.6	1.70	41.5	44.5	65.5	1	80	0.284
—	—	—	—	—	—	—	—	—	41.5	44.5	65.5	1	—	0.284
N	NR	3.28	1.90	76.81	0.60	0.5	86.6	1.70	43	47	72	1.5	88	0.464
—	—	—	—	—	—	—	—	—	43	47	72	1.5	—	0.464
N	NR	1.30	0.95	50.70	0.25	0.3	54.8	0.85	42	42	50	0.3	55.5	0.18
N	NR	1.70	0.95	60.70	0.25	0.5	64.8	0.85	44	46	58	0.6	65.5	0.23
—	—	—	—	—	—	—	—	—	42	—	66	0.3	—	0.13
N	NR	2.49	1.90	64.82	0.60	0.5	74.6	1.70	45	47.5	63	1	76	0.19
—	—	—	—	—	—	—	—	—	45	47.5	63	1	—	0.19
N	NR	3.28	1.90	76.81	0.60	0.5	86.6	1.70	46.5	50.5	73.5	1	88	0.46
—	—	—	—	—	—	—	—	—	46.5	50.5	73.5	1	—	0.366
N	NR	3.28	2.70	86.79	0.60	0.5	96.5	2.46	48	53	82	1.5	98	0.636
—	—	—	—	—	—	—	—	—	48	53	82	1.5	—	0.636
N	NR	1.30	0.95	56.70	0.25	0.3	60.8	0.85	47	47.5	56	0.3	61.5	0.18
N	NR	1.70	0.95	66.70	0.25	0.3	70.8	0.85	49	50	64	0.6	72	0.23
—	—	—	—	—	—	—	—	—	49	—	71	0.6	—	0.167
N	NR	2.49	1.90	71.83	0.60	0.5	81.6	1.70	50	53.5	70	1	83	0.241
—	—	—	—	—	—	—	—	—	50	53.5	70	1	—	0.241
N	NR	3.28	1.90	81.81	0.60	0.5	91.6	1.70	51.5	55.5	78.5	1	93	0.42
—	—	—	—	—	—	—	—	—	51.5	55.5	78.5	1	—	0.42
N	NR	3.28	2.70	96.80	0.60	0.5	106.50	2.46	53	61.5	92	1.5	108	0.829
—	—	—	—	—	—	—	—	—	53	61.5	92	1.5	—	0.829

Single-Row Deep Groove Ball Bearings

Bore Diameter 50 – 60 mm



Open Type



Shielded Type
ZZ



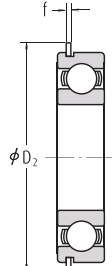
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

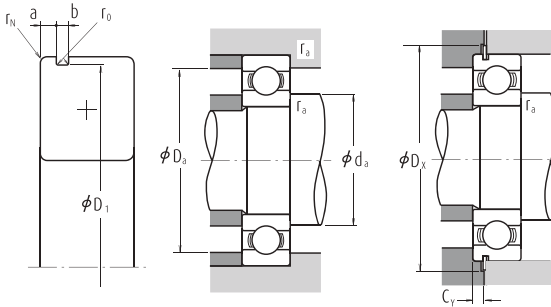


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{or}	f ₀	Grease		Oil				
							Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
50	65	7	0.3	6 400	6 200	17.2	9 500	5 300	11 000	6810	ZZ	VV	DDU
	72	12	0.6	14 500	11 700	16.1	9 000	5 300	11 000	6910	ZZ	VV	DDU
	80	10	0.6	15 400	12 400	16.1	8 500	—	10 000	16010	—	—	—
	80	16	1	21 800	16 600	15.6	8 500	4 800	10 000	6010	ZZ	VV	DDU
	80	16	1.0	22 900	16 600	15.6	9 500	4 800	11 000	6010 ⁺	ZZ	VV	DDU
	90	20	1.1	35 000	23 200	14.4	7 100	4 800	8 500	6210	ZZ	VV	DDU
	90	20	1.1	37 000	23 200	14.4	8 500	4 800	10 000	6210 ⁺	ZZ	VV	DDU
	110	27	2	62 000	38 500	13.2	6 000	4 300	7 500	6310	ZZ	VV	DDU
55	110	27	2.0	65 000	38 500	13.2	7 100	4 300	8 500	6310 ⁺	ZZ	VV	DDU
	72	9	0.3	8 800	8 500	17.0	8 500	4 800	10 000	6811	ZZ	VV	DDU
	80	13	1	16 000	13 300	16.2	8 000	4 500	9 500	6911	ZZ	VV	DDU
	90	11	0.6	19 400	16 300	16.2	7 500	—	9 000	16011	—	—	—
	90	18	1.1	28 300	21 200	15.3	7 500	4 500	9 000	6011	ZZ	VV	DDU
	90	18	1.1	29 700	21 200	15.3	8 500	4 500	10 000	6011 ⁺	ZZ	VV	DDU
	100	21	1.5	43 500	29 300	14.3	6 300	4 300	7 500	6211	ZZ	VV	DDU
	100	21	1.5	45 500	29 300	14.3	7 500	4 300	9 000	6211 ⁺	ZZ	VV	DDU
60	120	29	2	71 500	44 500	13.1	5 600	4 000	6 700	6311	ZZ	VV	DDU
	120	29	2.0	75 000	44 500	13.1	6 700	4 000	8 000	6311 ⁺	ZZ	VV	DDU
	78	10	0.3	11 500	10 900	16.9	8 000	4 500	9 500	6812	ZZ	VV	DD
	85	13	1	19 400	16 300	16.2	7 500	4 300	9 000	6912	ZZ	VV	DDU
	95	11	0.6	20 000	17 500	16.3	7 100	—	8 500	16012	—	—	—
	95	18	1.1	29 500	23 200	15.6	7 100	4 000	8 500	6012	ZZ	VV	DDU
	95	18	1.1	31 000	23 200	15.6	8 000	4 000	9 500	6012 ⁺	ZZ	VV	DDU
	110	22	1.5	52 500	36 000	14.3	5 600	3 800	7 100	6212	ZZ	VV	DDU
	110	22	1.5	55 000	36 000	14.3	6 700	3 800	8 000	6212 ⁺	ZZ	VV	DDU
	130	31	2.1	82 000	52 000	13.1	5 300	3 600	6 300	6312	ZZ	VV	DDU
	130	31	2.1	86 000	52 000	13.1	6 000	3 600	7 100	6312 ⁺	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{C_{or}}$	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

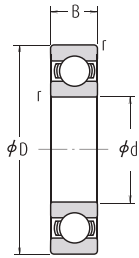
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (°) (mm)					Snap Ring (°) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d _x (°) min.	D _x (°) max.	r _a max.	D _x min.	C _r max.	approx.	
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
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
—	—	—	—	—	—	—	—	—	54	—	76	0.6	—	—	0.175
N	NR	2.49	1.90	76.81	0.60	0.5	86.6	1.70	55	58.5	75	1	88	3.8	0.261
—	—	—	—	—	—	—	—	—	55	58.5	75	1	—	—	0.261
N	NR	3.28	2.70	86.79	0.60	0.5	96.5	2.46	56.5	60	83.5	1	98	5.4	0.459
—	—	—	—	—	—	—	—	—	56.5	60	83.5	1	—	—	0.459
N	NR	3.28	2.70	106.81	0.60	0.5	116.6	2.46	59	68	101	2	118	5.4	1.06
—	—	—	—	—	—	—	—	—	59	68	101	2	—	—	1.06
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
N	NR	2.10	1.30	77.9	0.40	0.5	84.4	1.12	60	61.5	75	1	86	2.9	0.189
—	—	—	—	—	—	—	—	—	59	—	86	0.6	—	—	0.257
N	NR	2.87	2.70	86.79	0.60	0.5	96.5	2.46	61.5	64	83.5	1	98	5.0	0.381
—	—	—	—	—	—	—	—	—	61.5	64	83.5	1	—	—	0.381
N	NR	3.28	2.70	96.8	0.60	0.5	106.5	2.46	63	66.5	92	1.5	108	5.4	0.619
—	—	—	—	—	—	—	—	—	63	66.5	92	1.5	—	—	0.619
N	NR	4.06	3.10	115.21	0.60	0.5	129.7	2.82	64	72.5	111	2	131.5	6.5	1.37
—	—	—	—	—	—	—	—	—	64	72.5	111	2	—	—	1.37
N	NR	1.70	1.30	76.2	0.40	0.3	82.7	1.12	62	64	76	0.3	84	2.5	0.103
N	NR	2.10	1.30	82.9	0.40	0.5	89.4	1.12	65	66	80	1	91	2.9	0.192
—	—	—	—	—	—	—	—	—	64	—	91	0.6	—	—	0.281
N	NR	2.87	2.70	91.82	0.60	0.5	101.6	2.46	66.5	69	88.5	1	103	5.0	0.412
—	—	—	—	—	—	—	—	—	66.5	69	88.5	1	—	—	0.412
N	NR	3.28	2.70	106.81	0.60	0.5	116.6	2.46	68	74.5	102	1.5	118	5.4	0.783
—	—	—	—	—	—	—	—	—	68	74.5	102	1.5	—	—	0.783
N	NR	4.06	3.10	125.22	0.60	0.5	139.7	2.82	71	79	119	2	141.5	6.5	1.72
—	—	—	—	—	—	—	—	—	71	79	119	2	—	—	1.72

Single-Row Deep Groove Ball Bearings

Bore Diameter 65 – 75 mm



Open Type



Shielded Type
ZZ



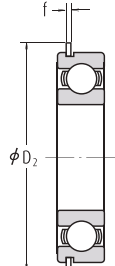
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

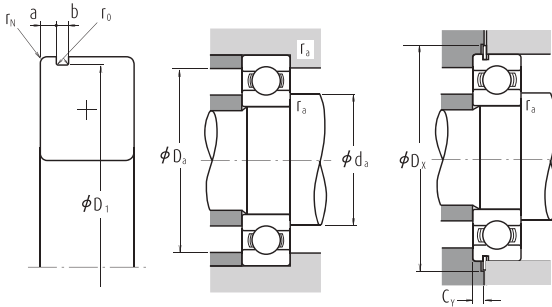


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor f_0	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C_r	C_{or}		Grease		Oil	Open	Shielded	Sealed	
							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
	90	13	1	17 400	16 100	16.6	7 100	4 000	8 500	6913	ZZ	VV	DDU
	100	11	0.6	20 500	18 700	16.5	6 700	—	8 000	16013	—	—	—
	100	18	1.1	30 500	25 200	15.8	6 700	4 000	8 000	6013	ZZ	VV	DDU
	100	18	1.1	32 000	25 200	15.8	7 500	4 000	9 000	6013 ⁺	ZZ	VV	DDU
	120	23	1.5	57 500	40 000	14.4	5 300	3 600	6 300	6213	ZZ	VV	DDU
	120	23	1.5	60 000	40 000	14.4	6 300	3 600	7 500	6213 ⁺	ZZ	VV	DDU
	140	33	2.1	92 500	60 000	13.2	4 800	3 400	6 000	6313	ZZ	VV	DDU
	140	33	2.1	97 500	60 000	13.2	5 600	3 400	6 700	6313 ⁺	ZZ	VV	DDU
	90	10	0.6	12 100	12 700	17.2	6 700	3 800	8 000	6814	ZZ	VV	DD
70	100	16	1	23 700	21 200	16.3	6 300	3 600	7 500	6914	ZZ	VV	DDU
	110	13	0.6	26 800	23 600	16.3	6 000	—	7 100	16014	—	—	—
	110	20	1.1	38 000	31 000	15.6	6 000	3 600	7 100	6014	ZZ	VV	DDU
	110	20	1.1	40 000	31 000	15.6	7 100	3 600	8 500	6014 ⁺	ZZ	VV	DDU
	125	24	1.5	62 000	44 000	14.5	5 000	3 400	6 300	6214	ZZ	VV	DDU
	125	24	1.5	65 500	44 000	14.5	6 000	3 400	7 100	6214 ⁺	ZZ	VV	DDU
	150	35	2.1	104 000	68 000	13.2	4 500	3 200	5 300	6314	ZZ	VV	DDU
	150	35	2.1	109 000	68 000	13.2	5 300	3 200	6 300	6314 ⁺	ZZ	VV	DDU
	95	10	0.6	12 500	13 900	17.3	6 300	3 600	7 500	6815	ZZ	VV	DDU
	105	16	1	24 400	22 600	16.5	6 000	3 400	7 100	6915	ZZ	VV	DDU
75	115	13	0.6	27 600	25 300	16.4	5 600	—	6 700	16015	—	—	—
	115	20	1.1	39 500	33 500	15.8	5 600	3 400	6 700	6015	ZZ	VV	DDU
	115	20	1.1	41 500	33 500	15.8	6 700	3 400	8 000	6015 ⁺	ZZ	VV	DDU
	130	25	1.5	66 000	49 500	14.7	4 800	3 200	5 600	6215	ZZ	VV	DDU
	130	25	1.5	69 500	49 500	14.7	5 600	3 200	6 700	6215 ⁺	ZZ	VV	DDU
	160	37	2.1	113 000	77 000	13.2	4 300	2 800	5 000	6315	ZZ	VV	DDU
	160	37	2.1	119 000	77 000	13.2	4 800	2 800	6 000	6315 ⁺	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{C_{or}}$	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

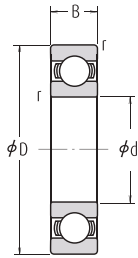
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

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)
		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.	r _a max.	D _t min.	C _y max.	approx.	
N	NR	1.70	1.30	82.9	0.40	0.5	89.4	1.12	69	69	81	0.6	91	2.5	0.128
N	NR	2.10	1.30	87.9	0.40	0.5	94.4	1.12	70	71.5	85	1	96	2.9	0.218
—	—	—	—	—	—	—	—	—	69	—	96	0.6	—	—	0.30
N	NR	2.87	2.70	96.8	0.60	0.5	106.5	2.46	71.5	73	93.5	1	108	5.0	0.439
—	—	—	—	—	—	—	—	—	71.5	73	93.5	1	—	—	0.439
N	NR	4.06	3.10	115.21	0.60	0.5	129.7	2.82	73	80	112	1.5	131.5	6.5	1.0
—	—	—	—	—	—	—	—	—	73	80	112	1.5	—	—	1.0
N	NR	4.90	3.10	135.23	0.60	0.5	149.7	2.82	76	85.5	129	2	152	7.3	2.11
—	—	—	—	—	—	—	—	—	76	85.5	129	2	—	—	2.11
N	NR	1.70	1.30	87.9	0.40	0.5	94.4	1.12	74	74.5	86	0.6	96	2.5	0.134
N	NR	2.50	1.30	97.9	0.40	0.5	104.4	1.12	75	77.5	95	1	106	3.3	0.349
—	—	—	—	—	—	—	—	—	74	—	106	0.6	—	—	0.441
N	NR	2.87	2.70	106.81	0.60	0.5	116.6	2.46	76.5	80.5	103.5	1	118	5.0	0.608
—	—	—	—	—	—	—	—	—	76.5	80.5	103.5	1	—	—	0.608
N	NR	4.06	3.10	120.22	0.60	0.5	134.7	2.82	78	84	117	1.5	136.5	6.5	1.09
—	—	—	—	—	—	—	—	—	78	84	117	1.5	—	—	1.09
N	NR	4.90	3.10	145.24	0.60	0.5	159.7	2.82	81	92	139	2	162	7.3	2.57
—	—	—	—	—	—	—	—	—	81	92	139	2	—	—	2.57
N	NR	1.70	1.30	92.9	0.40	0.5	99.4	1.12	79	79.5	91	0.6	101	2.5	0.149
N	NR	2.50	1.30	102.60	0.40	0.5	110.7	1.12	80	82	100	1	112	3.3	0.364
—	—	—	—	—	—	—	—	—	79	—	111	0.6	—	—	0.463
N	NR	2.87	2.70	111.81	0.60	0.5	121.6	2.46	81.5	85.5	108.5	1	123	5.0	0.649
—	—	—	—	—	—	—	—	—	81.5	85.5	108.5	1	—	—	0.649
N	NR	4.06	3.10	125.22	0.60	0.5	139.7	2.82	83	90	122	1.5	141.5	6.5	1.19
—	—	—	—	—	—	—	—	—	83	90	122	1.5	—	—	1.19
N	NR	4.90	3.10	155.22	0.60	0.5	169.7	2.82	86	98.5	149	2	172	7.3	3.08
—	—	—	—	—	—	—	—	—	86	98.5	149	2	—	—	3.08

Single-Row Deep Groove Ball Bearings

Bore Diameter 80 - 90 mm



Open Type



Shielded Type
ZZ



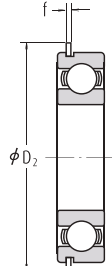
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

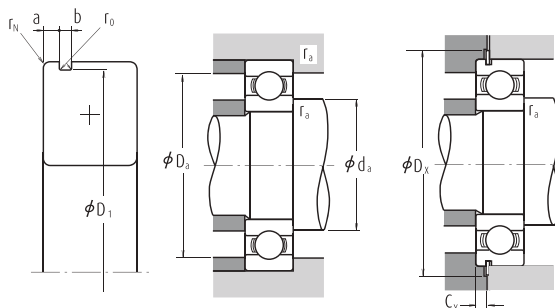


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor f_0	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C_r	C_{or}		Grease		Oil	Open	Shielded	Sealed	
							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
	110	16	1	25 000	24 000	16.6	5 600	3 200	6 700	6916	ZZ	VV	DDU
	125	14	0.6	32 000	29 600	16.4	5 300	—	6 300	16016	—	—	—
	125	22	1.1	47 500	40 000	15.6	5 300	3 200	6 300	6016	ZZ	VV	DDU
	125	22	1.1	50 000	40 000	15.6	6 300	3 200	7 100	6016 ^e	ZZ	VV	DDU
	140	26	2	72 500	53 000	14.6	4 500	3 000	5 300	6216	ZZ	VV	DDU
	140	26	2.0	76 500	53 000	14.6	5 300	3 000	6 300	6216 ^e	ZZ	VV	DDU
	170	39	2.1	123 000	86 500	13.3	4 000	2 800	4 800	6316	ZZ	VV	DDU
	170	39	2.1	129 000	86 500	13.3	4 500	2 800	5 600	6316 ^e	ZZ	VV	DDU
	110	13	1	18 700	20 000	17.1	5 600	3 200	6 700	6817	ZZ	VV	DDU
85	120	18	1.1	32 000	29 600	16.4	5 300	3 000	6 300	6917	ZZ	VV	DDU
	130	14	0.6	33 000	31 500	16.5	5 000	—	6 000	16017	—	—	—
	130	22	1.1	49 500	43 000	15.8	5 000	3 000	6 000	6017	ZZ	VV	DDU
	130	22	1.1	52 000	43 000	15.8	6 000	3 000	7 100	6017 ^e	ZZ	VV	DDU
	150	28	2	84 000	62 000	14.5	4 300	2 800	5 000	6217	ZZ	VV	DDU
	150	28	2.0	88 000	62 000	14.5	4 800	2 800	6 000	6217 ^e	ZZ	VV	DDU
	180	41	3	133 000	97 000	13.3	3 800	2 600	4 500	6317	ZZ	VV	DDU
	180	41	3.0	139 000	97 000	13.3	4 300	2 600	5 000	6317 ^e	ZZ	VV	DDU
	115	13	1	19 000	21 000	17.2	5 300	3 000	6 300	6818	ZZ	VV	DDU
	125	18	1.1	33 000	31 500	16.5	5 000	2 800	6 000	6918	ZZ	VV	DDU
90	140	16	1	41 500	39 500	16.3	4 800	—	5 600	16018	—	—	—
	140	24	1.5	58 000	50 000	15.6	4 800	2 800	5 600	6018	ZZ	VV	DDU
	140	24	1.5	61 000	50 000	15.6	5 600	2 800	6 300	6018 ^e	ZZ	VV	DDU
	160	30	2	96 000	71 500	14.5	4 000	2 600	4 800	6218	ZZ	VV	DDU
	160	30	2.0	101 000	71 500	14.5	4 500	2 600	5 600	6218 ^e	ZZ	VV	DDU
	190	43	3	143 000	107 000	13.3	3 600	2 400	4 300	6318	ZZ	VV	DDU
	190	43	3.0	150 000	107 000	13.3	4 000	2 400	4 800	6318 ^e	ZZ	VV	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{F_r}$	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

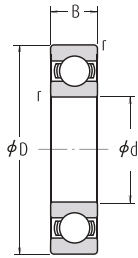
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (°) (mm)					Snap Ring (°) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d ₄ (°) min.	d ₄ (°) max.	D ₄ (°) max.	r _a max.	D _x min.	C _y max.	
N	NR	1.70	1.3	97.9	0.4	0.5	104.4	1.12	84	84.5	96	0.6	106	2.5	0.151
N	NR	2.50	1.3	107.60	0.4	0.5	115.7	1.12	85	87.5	105	1	117	3.3	0.391
—	—	—	—	—	—	—	—	—	84	—	121	0.6	—	—	0.621
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
—	—	—	—	—	—	—	—	—	86.5	91	118.5	1	—	—	0.872
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
—	—	—	—	—	—	—	—	—	89	95.5	131	2	—	—	1.42
N	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.10	91	104.5	159	2	185	8.4	3.67
—	—	—	—	—	—	—	—	—	91	104.5	159	2	—	—	3.67
N	NR	2.10	1.3	107.60	0.4	0.5	115.7	1.12	90	90.5	105	1	117	2.9	0.263
N	NR	3.30	1.3	117.60	0.4	0.5	125.7	1.12	91.5	94.5	113.5	1	127	4.1	0.55
—	—	—	—	—	—	—	—	—	89	—	126	0.6	—	—	0.652
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
—	—	—	—	—	—	—	—	—	91.5	96	123.5	1	—	—	0.918
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
—	—	—	—	—	—	—	—	—	94	102	141	2	—	—	1.76
N	NR	5.69	3.5	173.66	0.6	0.5	192.9	3.10	98	110.5	167	2.5	195	8.4	4.28
—	—	—	—	—	—	—	—	—	98	110.5	167	2.5	—	—	4.28
N	NR	2.10	1.3	112.60	0.4	0.5	120.7	1.12	95	95.5	110	1	122	2.9	0.276
N	NR	3.30	1.3	122.60	0.4	0.5	130.7	1.12	96.5	98.5	118.5	1	132	4.1	0.585
—	—	—	—	—	—	—	—	—	95	—	135	1	—	—	0.873
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
—	—	—	—	—	—	—	—	—	98	103	132	1.5	—	—	1.19
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
—	—	—	—	—	—	—	—	—	99	107.5	151	2	—	—	2.18
N	NR	5.69	3.5	183.64	0.6	0.5	202.9	3.10	103	117	177	2.5	205	8.4	4.98
—	—	—	—	—	—	—	—	—	103	117	177	2.5	—	—	4.98

Single-Row Deep Groove Ball Bearings

Bore Diameter 95 – 105 mm



Open Type



Shielded Type
ZZ · ZZS



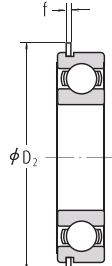
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

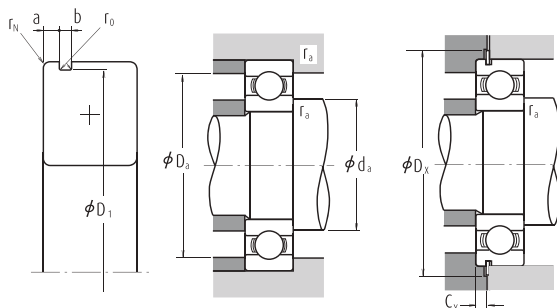


With Snap
Ring Groove
N



With
Snap Ring
NR

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{or}	f ₀	Grease		Oil				
							Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
95	120	13	1	19 300	22 000	17.2	5 000	2 800	6 000	6819	ZZ	VV	DD
	130	18	1.1	33 500	33 500	16.6	4 800	2 800	5 600	6919	ZZ	VV	DDU
	145	16	1	43 000	42 000	16.4	4 500	—	5 300	16019	—	—	—
	145	24	1.5	60 500	54 000	15.8	4 500	2 600	5 300	6019	ZZ	VV	DDU
	145	24	1.5	63 500	54 000	15.8	5 300	2 600	6 000	6019 ⁺	ZZ	VV	DDU
	170	32	2.1	109 000	82 000	14.4	3 800	2 600	4 500	6219	ZZ	VV	DDU
	170	32	2.1	114 000	82 000	14.4	4 300	2 600	5 000	6219 ⁺	ZZ	VV	DDU
	200	45	3	153 000	119 000	13.3	3 000	2 400	3 600	6319	ZZ	VV	DDU
100	200	45	3.0	160 000	119 000	13.3	3 400	2 400	4 300	6319 ⁺	ZZ	VV	DDU
	125	13	1	19 600	23 000	17.3	4 800	2 800	5 600	6820	ZZ	VV	DD
	140	20	1.1	43 000	42 000	16.4	4 500	2 600	5 300	6920	ZZ	VV	DDU
	150	16	1	42 500	42 000	16.5	4 300	—	5 300	16020	—	—	—
	150	24	1.5	60 000	54 000	15.9	4 300	2 600	5 300	6020	ZZ	VV	DDU
	150	24	1.5	63 000	54 000	15.9	5 000	2 600	6 000	6020 ⁺	ZZ	VV	DDU
	180	34	2.1	122 000	93 000	14.4	3 600	2 400	4 300	6220	ZZ	VV	DDU
	180	34	2.1	128 000	93 000	14.4	4 000	2 400	4 800	6220 ⁺	ZZ	VV	DDU
105	215	47	3	173 000	141 000	13.2	2 800	2 200	3 400	6320	ZZ	VV	DDU
	130	13	1	19 800	23 900	17.4	4 800	2 600	5 600	6821	ZZ	VV	DDU
	145	20	1.1	42 500	42 000	16.5	4 300	—	5 300	6921	ZZ	VV	—
	160	18	1	52 000	50 500	16.3	4 000	—	4 800	16021	—	—	—
	160	26	2	72 500	66 000	15.8	4 000	2 400	4 800	6021	ZZ	VV	DDU
	160	26	2.0	76 000	66 000	15.8	4 500	2 400	5 600	6021 ⁺	ZZ	VV	DDU
	190	36	2.1	133 000	105 000	14.4	3 400	2 200	4 000	6221	ZZ	VV	DDU
	190	36	2.1	140 000	105 000	14.4	3 800	2 200	4 500	6221 ⁺	ZZ	VV	DDU
	225	49	3	184 000	154 000	13.2	2 600	2 000	3 200	6321	ZZ	—	DDU



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{C_{or}}$	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

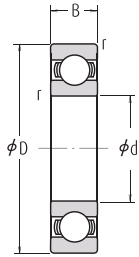
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

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)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d _x (1) min.	d _x (2) max.	r _a max.	D _x min.	C ₁ max.	
N	NR	2.10	1.3	117.60	0.4	0.5	125.7	1.12	100	101.5	115	1	127	2.9
N	NR	3.30	1.3	127.60	0.4	0.5	135.7	1.12	101.5	103.5	123.5	1	137	4.1
—	—	—	—	—	—	—	—	—	100	—	140	1	—	—
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
—	—	—	—	—	—	—	—	—	103	108.5	137	1.5	—	—
N	NR	5.69	3.5	163.65	0.6	0.5	182.9	3.10	106	114	159	2	185	8.4
—	—	—	—	—	—	—	—	—	106	114	159	2	—	—
N	NR	5.69	3.5	193.65	0.6	0.5	212.9	3.10	108	123.5	187	2.5	215	8.4
—	—	—	—	—	—	—	—	—	108	123.5	187	2.5	—	—
N	NR	2.10	1.3	122.60	0.4	0.5	130.7	1.12	105	105.5	120	1	132	2.9
N	NR	3.30	1.9	137.60	0.6	0.5	145.7	1.70	106.5	111	133.5	1	147	4.7
—	—	—	—	—	—	—	—	—	105	—	145	1	—	—
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
—	—	—	—	—	—	—	—	—	108	112.5	142	1.5	—	—
N	NR	5.69	3.5	173.66	0.6	0.5	192.9	3.10	111	121.5	169	2	195	8.4
—	—	—	—	—	—	—	—	—	111	121.5	169	2	—	—
—	—	—	—	—	—	—	—	—	113	133	202	2.5	—	—
N	NR	2.10	1.3	127.60	0.4	0.5	135.7	1.12	110	110.5	125	1	137	2.9
N	NR	3.30	1.9	142.60	0.6	0.5	150.7	1.70	111.5	116	138.5	1	152	4.7
—	—	—	—	—	—	—	—	—	110	—	155	1	—	—
N	NR	3.71	3.1	155.22	0.6	0.5	169.7	2.82	114	120	151	2	172	6.1
—	—	—	—	—	—	—	—	—	114	120	151	2	—	—
N	NR	5.69	3.5	183.64	0.6	0.5	202.9	3.10	116	127.5	179	2	205	8.4
—	—	—	—	—	—	—	—	—	116	127.5	179	2	—	—
—	—	—	—	—	—	—	—	—	118	138	212	2.5	—	—

Single-Row Deep Groove Ball Bearings

Bore Diameter 110 – 150 mm



Open Type



Shielded Type
ZZ · ZTS



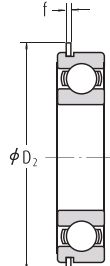
Non-Contact
Sealed Type
VV



Contact
Sealed Type
DD · DDU

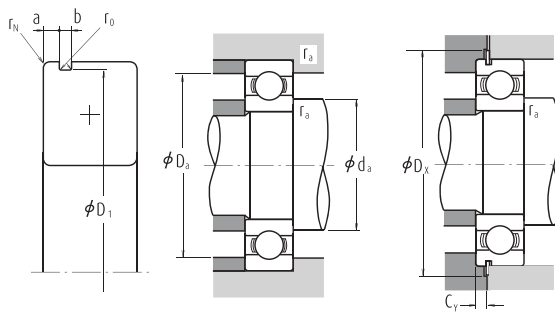


With Snap
Ring Groove
N



With
Snap Ring
NR

	Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor f_0	Limiting Speeds (min ⁻¹)			Bearing Numbers			
	d	D	B	r min.	C_r	C_{or}		Grease			Open	Shielded	Sealed	
								Open Z · ZZ V · VV	DU DDU	Oil Open Z				
110	140	16	1		28 100	32 500	17.1	4 300	2 400	5 300	6822	ZZ	VV	DDU
	150	20	1.1		43 500	44 500	16.6	4 300	2 400	5 000	6922	ZZ	VV	DDU
	170	19	1		57 500	56 500	16.3	3 800	—	4 500	16022	—	—	—
	170	28	2		85 000	73 000	15.5	3 800	2 200	4 500	6022	ZZ	VV	DDU
	170	28	2.0		89 000	73 000	15.5	4 500	2 200	5 300	6022 ⁺	ZZ	VV	DDU
	200	38	2.1		144 000	117 000	14.3	2 800	2 200	3 400	6222	ZZ	VV	DDU
	240	50	3		205 000	179 000	13.2	2 400	—	3 000	6322	ZZ	—	—
	150	16	1		28 900	35 500	17.3	4 000	2 200	4 800	6824	ZZ	VV	DD
120	165	22	1.1		53 000	54 000	16.5	3 800	—	4 500	6924	ZZ	—	—
	180	19	1		56 500	57 500	16.5	3 600	—	4 300	16024	—	—	—
	180	28	2		88 000	80 000	15.7	3 600	2 200	4 300	6024	ZZ	VV	DDU
	180	28	2.0		92 500	80 000	15.7	4 000	2 200	4 800	6024 ⁺	ZZ	VV	DDU
	215	40	2.1		155 000	131 000	14.4	2 600	2 000	3 200	6224	ZZ	VV	DDU
	260	55	3		207 000	185 000	13.5	2 200	1 800	2 800	6324	ZZS	—	DDU
	165	18	1.1		37 000	44 000	17.1	3 600	2 000	4 300	6826	ZZS	VV	DD
	180	24	1.5		65 000	67 500	16.5	3 400	—	4 000	6926	ZZ	—	—
130	200	22	1.1		75 500	77 500	16.4	3 000	—	3 600	16026	—	—	—
	200	33	2		106 000	101 000	15.8	3 000	1 900	3 600	6026	ZZ	—	DDU
	230	40	3		167 000	146 000	14.5	2 400	—	3 000	6226	ZZ	—	—
	280	58	4		229 000	214 000	13.6	2 200	—	2 600	6326	ZZS	—	—
	175	18	1.1		38 500	48 000	17.3	3 400	1 900	4 000	6828	ZZ	VV	DDU
	190	24	1.5		66 500	72 000	16.6	3 200	—	3 800	6928	ZZS	VV	—
	210	22	1.1		77 500	82 500	16.5	2 800	—	3 400	16028	—	—	—
	210	33	2		110 000	109 000	16.0	2 800	1 800	3 400	6028	ZZ	—	DDU
140	250	42	3		166 000	150 000	14.9	2 200	1 700	2 800	6228	ZZS	—	DDU
	300	62	4		253 000	246 000	13.6	2 000	—	2 400	6328	ZZS	—	—
	190	20	1.1		47 500	58 500	17.1	3 200	1 800	3 800	6830	ZZ	VV	DDU
	210	28	2		85 000	90 500	16.5	2 600	1 700	3 200	6930	ZZS	—	DDU
	225	24	1.1		84 000	91 000	16.6	2 600	—	3 000	16030	—	—	—
	225	35	2.1		126 000	126 000	15.9	2 600	1 700	3 000	6030	ZZ	VV	DDU
	270	45	3		176 000	168 000	15.1	2 000	—	2 600	6230	ZZS	—	—
	320	65	4		274 000	284 000	13.9	1 800	—	2 200	6330	ZZS	—	—



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{f_a F_a}{C_r}$	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

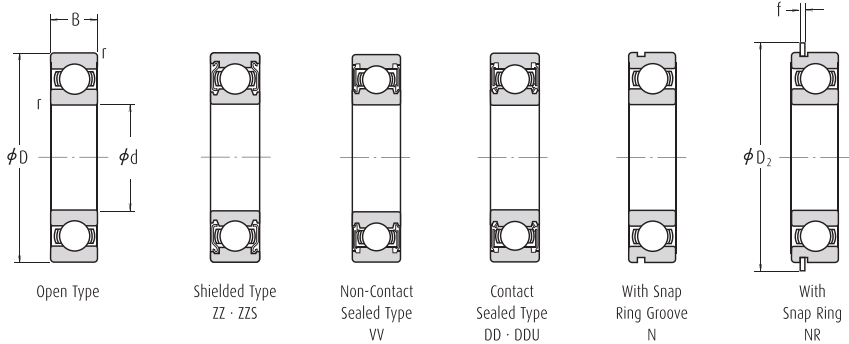
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

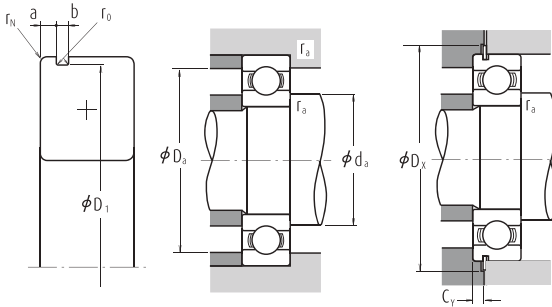
With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (1) (mm)					Snap Ring (1) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
		a max.	b min.	D ₁ max.	r ₀ max.	r _N min.	D ₂ max.	f max.	d _a (2) min.	d _a (2) max.	D ₃ (2) max.	r _a max.	D _x min.	C _y max.	approx.
N	NR	2.50	1.9	137.60	0.6	0.5	145.7	1.7	115	117	135	1	147	3.9	0.497
N	NR	3.30	1.9	147.60	0.6	0.5	155.7	1.7	116.5	121	143.5	1	157	4.7	0.893
—	—	—	—	—	—	—	—	—	115	—	165	1	—	—	1.51
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
—	—	—	—	—	—	—	—	—	119	124.5	161	2	—	—	1.94
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
—	—	—	—	—	—	—	—	—	123	147	227	2.5	—	—	9.51
N	NR	2.50	1.9	147.60	0.6	0.5	155.7	1.7	125	127	145	1	157	3.9	0.537
N	NR	3.70	1.9	161.80	0.6	0.5	171.5	1.7	126.5	132	158.5	1	173	5.1	1.21
—	—	—	—	—	—	—	—	—	125	—	175	1	—	—	1.6
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
—	—	—	—	—	—	—	—	—	129	134.5	171	2	—	—	2.08
—	—	—	—	—	—	—	—	—	131	146	204	2	—	—	5.29
—	—	—	—	—	—	—	—	—	133	161	247	2.5	—	—	12.5
N	NR	3.30	1.9	161.80	0.6	0.5	171.5	1.7	136.5	138	158.5	1	173	4.7	0.758
N	NR	3.70	1.9	176.80	0.6	0.5	186.5	1.7	138	144	172	1.5	188	5.1	1.57
—	—	—	—	—	—	—	—	—	136.5	—	193.5	1	—	—	2.4
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
—	—	—	—	—	—	—	—	—	143	157	217	2.5	—	—	5.96
—	—	—	—	—	—	—	—	—	146	175	264	3	—	—	15.2
N	NR	3.30	1.9	171.80	0.6	0.5	181.5	1.7	146.5	148.5	168.5	1	183	4.7	0.832
N	NR	3.70	1.9	186.80	0.6	0.5	196.5	1.7	148	153.5	182	1.5	198	5.1	1.67
—	—	—	—	—	—	—	—	—	146.5	—	203.5	1	—	—	2.84
—	—	—	—	—	—	—	—	—	149	158.5	201	2	—	—	3.48
—	—	—	—	—	—	—	—	—	153	171.5	237	2.5	—	—	7.68
—	—	—	—	—	—	—	—	—	156	187	284	3	—	—	18.5
N	NR	3.30	1.9	186.80	0.6	0.5	196.5	1.7	156.5	160	183.5	1	198	4.7	1.15
—	—	—	—	—	—	—	—	—	159	166	201	2	—	—	3.01
—	—	—	—	—	—	—	—	—	156.5	—	218.5	1	—	—	3.62
—	—	—	—	—	—	—	—	—	161	170	214	2	—	—	4.24
—	—	—	—	—	—	—	—	—	163	186	257	2.5	—	—	10
—	—	—	—	—	—	—	—	—	166	203	304	3	—	—	22.7

Single-Row Deep Groove Ball Bearings

Bore Diameter 160 mm



Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{0r}	f ₀	Grease		Oil	Open	Shielded	Sealed	
							Open Z · ZZ V · VV	DU DDU	Open Z				
160	200	20	1.1	48 500	61 000	17.2	2 600	1 700	3 200	6832	ZZS	VV	DDU
	220	28	2	87 000	96 000	16.6	2 600	1 600	3 000	6932	ZZS	—	DDU
	240	25	1.5	99 000	108 000	16.5	2 400	—	2 800	16032	—	—	—
	240	38	2.1	137 000	135 000	15.9	2 400	1 600	2 800	6032	ZZ	—	DDU
	290	48	3	185 000	186 000	15.4	1 900	—	2 400	6232	ZZS	—	—
	340	68	4	278 000	287 000	13.9	1 700	—	2 000	6332	ZZS	—	—



Dynamic Equivalent Load $P=XF_r+YF_a$

$\frac{F_a F_a}{C_{or}}$	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

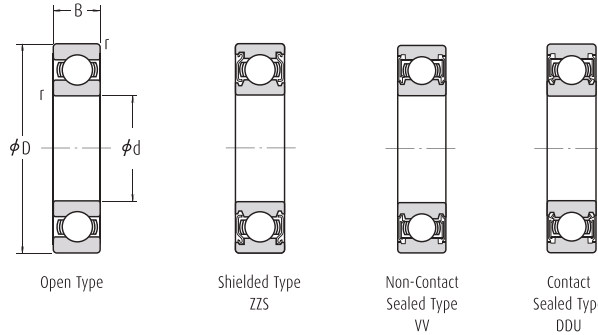
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6F_r + 0.5F_a$$

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

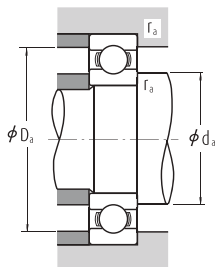
With Snap Ring Groove	With Snap Ring	Snap Ring Groove Dimensions (1) (mm)					Snap Ring (1) Dimensions (mm)		Abutment and Fillet Dimensions (mm)						Mass (kg)
		a max.	b min.	D ₁ max.	r ₀ max.	r ₀ min.	D ₂ max.	f max.	d _a (2)		D _a (2) max.	r _a max.	D _s min.	C _r max.	approx.
									min.	max.					
N	NR	3.30	1.9	196.80	0.6	0.5	206.5	1.7	166.5	170.5	193.5	1	208	4.7	1.23
—	—	—	—	—	—	—	—	—	169	176	211	2	—	—	2.71
—	—	—	—	—	—	—	—	—	168	—	232	1.5	—	—	4.2
—	—	—	—	—	—	—	—	—	171	181.5	229	2	—	—	5.15
—	—	—	—	—	—	—	—	—	173	202	277	2.5	—	—	12.8
—	—	—	—	—	—	—	—	—	176	215.5	324	3	—	—	26.2

Single-Row Deep Groove Ball Bearings

Bore Diameter 170 – 240 mm



Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)			Bearing Numbers			
d	D	B	r min.	C _r	C _{0r}	f ₀	Grease		Oil				
							Open Z · ZZ V · VV	DU DDU	Open Z	Open	Shielded	Sealed	
170	215	22	1.1	60 000	75 000	17.1	2 600	1 600	3 000	6834	ZZS	VV	DDU
	230	28	2	86 000	97 000	16.7	2 400	—	2 800	6934	ZZS	—	—
	260	28	1.5	114 000	126 000	16.5	2 200	—	2 600	16034	—	—	—
	260	42	2.1	161 000	161 000	15.8	2 200	—	2 600	6034	ZZS	VV	—
	310	52	4	212 000	224 000	15.3	1 800	—	2 200	6234	ZZS	—	—
	360	72	4	325 000	355 000	13.6	1 600	—	2 000	6334	—	—	—
180	225	22	1.1	60 500	78 500	17.2	2 400	—	2 800	6836	—	VV	—
	250	33	2	119 000	128 000	16.4	2 200	—	2 600	6936	ZZS	—	—
	280	31	2	145 000	157 000	16.3	2 000	—	2 400	16036	—	—	—
	280	46	2.1	180 000	185 000	15.6	2 000	—	2 400	6036	ZZS	VV	—
	320	52	4	227 000	241 000	15.1	1 700	—	2 000	6236	ZZS	—	—
	380	75	4	355 000	405 000	13.9	1 500	—	1 800	6336	—	—	—
190	240	24	1.5	73 000	93 500	17.1	2 200	—	2 600	6838	—	VV	—
	260	33	2	113 000	127 000	16.6	2 200	—	2 600	6938	—	—	—
	290	31	2	149 000	168 000	16.4	2 000	—	2 400	16038	—	—	—
	290	46	2.1	188 000	201 000	15.8	2 000	—	2 400	6038	ZZS	—	—
	340	55	4	255 000	282 000	15.0	1 600	—	2 000	6238	ZZS	—	—
	400	78	5	355 000	415 000	14.1	1 400	—	1 700	6338	—	—	—
200	250	24	1.5	74 000	98 000	17.2	2 200	—	2 600	6840	—	—	—
	280	38	2.1	143 000	158 000	16.4	2 000	—	2 400	6940	ZZS	—	—
	310	34	2	161 000	180 000	16.4	1 900	—	2 200	16040	—	—	—
	310	51	2.1	207 000	226 000	15.6	1 900	—	2 200	6040	ZZS	—	—
	360	58	4	269 000	310 000	15.2	1 500	—	1 800	6240	ZZS	—	—
	420	80	5	380 000	445 000	13.8	1 300	—	1 600	6340	—	—	—
220	270	24	1.5	76 500	107 000	17.4	1 900	—	2 400	6844	ZZS	—	—
	300	38	2.1	146 000	169 000	16.6	1 800	—	2 200	6944	ZZS	—	—
	340	37	2.1	180 000	217 000	16.5	1 600	—	2 000	16044	—	—	—
	340	56	3	235 000	271 000	15.6	1 700	—	2 000	6044	ZZS	—	—
	400	65	4	310 000	375 000	15.1	1 300	—	1 600	6244	—	—	—
	460	88	5	410 000	520 000	14.3	1 200	—	1 500	6344	—	—	—
240	300	28	2	98 500	137 000	17.3	1 700	—	2 000	6848	—	—	—
	320	38	2.1	154 000	190 000	16.8	1 700	—	2 000	6948	ZZS	—	—
	360	37	2.1	196 000	243 000	16.5	1 500	—	1 900	16048	—	—	—
	360	56	3	244 000	296 000	15.9	1 500	—	1 900	6048	—	—	—
	440	72	4	340 000	430 000	15.2	1 200	—	1 500	6248	—	—	—
	500	95	5	470 000	625 000	14.2	1 100	—	1 300	6348	—	—	—



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{C_{or}}$	e	$\frac{F_a}{F_r} < e$		$\frac{F_a}{F_r} > e$	
		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

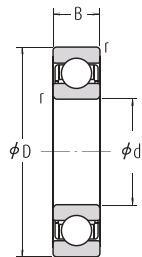
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

Abutment and Fillet Dimensions (mm)				Mass (kg)
min.	$d_a(l)$ max.	$D_a(l)$ max.	r_a max.	approx.
176.5	182.0	208.5	1	1.86
179	186.0	221	2	3.34
178	—	252	1.5	5.71
181	194.5	249	2	6.89
186	215.0	294	3	15.8
186	—	344	3	36.6
186.5	192.0	218.5	1	1.98
189	198.5	241	2	4.16
189	—	271	2	7.5
191	208.0	269	2	8.88
196	223.0	304	3	15.9
196	—	364	3	43.1
198	202.5	232	1.5	2.53
199	—	251	2	5.18
199	—	281	2	7.78
201	218.0	279	2	9.39
206	236.0	324	3	22.3
210	—	380	4	49.7
208	—	242	1.5	2.67
211	222.0	269	2	7.28
209	—	301	2	10
211	231.5	299	2	12
216	252.0	344	3	26.7
220	—	400	4	55.3
228	233.5	262	1.5	2.9
231	242.0	289	2	7.88
231	—	329	2	13.1
233	254.5	327	2.5	18.6
236	—	384	3	37.4
240	—	440	4	73.9
249	—	291	2	4.48
251	262.0	309	2	8.49
251	—	349	2	13.9
253	—	347	2.5	19.9
256	—	424	3	50.5
260	—	480	4	94.4

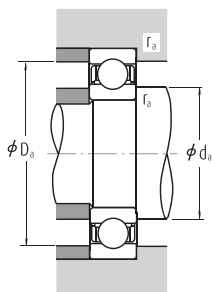
Single-Row Deep Groove Ball Bearings

Bore Diameter 260 – 360 mm



Open Type

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)		Bearing Numbers
d	D	B	r min.	C _r	C _{0r}	f ₀	Grease	Oil	Open
260	320	28	2	101 000	148 000	17.4	1 600	1 900	6852
	360	46	2.1	204 000	255 000	16.5	1 500	1 800	6952
	400	44	3	237 000	310 000	16.4	1 400	1 700	16052
	400	65	4	291 000	375 000	15.8	1 400	1 700	6052
	480	80	5	400 000	540 000	15.1	1 100	1 300	6252
280	540	102	6	505 000	710 000	14.6	1 000	1 200	6352
	350	33	2	133 000	191 000	17.3	1 500	1 700	6856
	380	46	2.1	209 000	272 000	16.6	1 400	1 700	6956
	420	44	3	243 000	330 000	16.5	1 300	1 600	16056
	420	65	4	300 000	410 000	16.0	1 300	1 600	6056
300	500	80	5	400 000	550 000	15.2	1 000	1 300	6256
	580	108	6	570 000	840 000	14.5	900	1 100	6356
	380	38	2.1	166 000	233 000	17.1	1 300	1 600	6860
	420	56	3	269 000	370 000	16.4	1 300	1 500	6960
	460	50	4	285 000	405 000	16.4	1 200	1 400	16060
320	460	74	4	355 000	500 000	15.8	1 200	1 400	6060
	540	85	5	465 000	670 000	15.1	950	1 200	6260
	400	38	2.1	168 000	244 000	17.2	1 300	1 500	6864
	440	56	3	266 000	375 000	16.5	1 200	1 400	6964
	480	50	4	293 000	430 000	16.5	1 100	1 300	16064
340	480	74	4	390 000	570 000	15.7	1 100	1 300	6064
	580	92	5	530 000	805 000	15.0	850	1 100	6264
	420	38	2.1	175 000	265 000	17.3	1 200	1 400	6868
	460	56	3	273 000	400 000	16.6	1 100	1 300	6968
	520	82	5	440 000	660 000	15.6	1 000	1 200	6068
360	620	92	6	530 000	820 000	15.3	800	1 000	6268
	440	38	2.1	192 000	290 000	17.3	1 100	1 300	6872
	480	56	3	280 000	425 000	16.7	1 100	1 300	6972
	540	82	5	460 000	720 000	15.7	950	1 200	6072
	650	95	6	555 000	905 000	15.4	750	950	6272



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{C_{or}}$	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

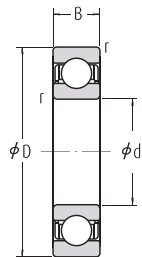
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

Abutment and Fillet Dimensions (mm)			Mass (kg)
d_a (l) min.	D_a (l) max.	r_a max.	approx.
269	311	2	4.84
271	349	2	14
273	387	2.5	21.1
276	384	3	29.4
280	460	4	67
286	514	5	118
289	341	2	7.2
291	369	2	15.1
293	407	2.5	22.7
296	404	3	31.2
300	480	4	70.4
306	554	5	144
311	369	2	10.3
313	407	2.5	23.9
316	444	3	31.5
316	444	3	44.2
320	520	4	87.8
331	389	2	10.8
333	427	2.5	25.3
336	464	3	33.2
336	464	3	46.5
340	560	4	111
351	409	2	11.5
353	447	2.5	26.6
360	500	4	62.3
366	594	5	129
371	429	2	11.8
373	467	2.5	27.9
380	520	4	65.3
386	624	5	145

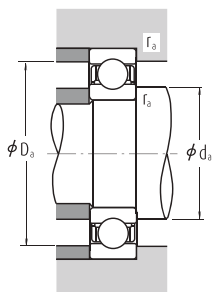
Single-Row Deep Groove Ball Bearings

Bore Diameter 380 – 600 mm



Open Type

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)		Bearing Numbers
d	D	B	r min.	C _r	C _{0r}	f ₀	Grease	Oil	Open
380	480	46	2.1	238 000	375 000	17.1	1 000	1 200	6876
	520	65	4	325 000	510 000	16.6	950	1 200	6976
	560	82	5	455 000	725 000	15.9	900	1 100	6076
400	500	46	2.1	241 000	390 000	17.2	950	1 200	6880
	540	65	4	335 000	540 000	16.7	900	1 100	6980
	600	90	5	510 000	825 000	15.7	850	1 000	6080
420	520	46	2.1	245 000	410 000	17.3	900	1 100	6884
	560	65	4	340 000	570 000	16.8	900	1 100	6984
	620	90	5	530 000	895 000	15.8	800	1 000	6084
440	540	46	2.1	248 000	425 000	17.4	900	1 100	6888
	600	74	4	395 000	680 000	16.6	800	1 000	6988
	650	94	6	550 000	965 000	16.0	750	900	6088
460	580	56	3	310 000	550 000	17.1	800	1 000	6892
	620	74	4	405 000	720 000	16.7	800	950	6992
	680	100	6	605 000	1 080 000	15.8	710	850	6092
480	600	56	3	315 000	575 000	17.2	800	950	6896
	650	78	5	450 000	815 000	16.6	750	900	6996
	700	100	6	605 000	1 090 000	15.9	710	850	6096
500	620	56	3	320 000	600 000	17.3	750	900	68/500
	670	78	5	460 000	865 000	16.7	710	850	69/500
	720	100	6	630 000	1 170 000	16.0	670	800	60/500
530	650	56	3	325 000	625 000	17.4	710	850	68/530
	710	82	5	455 000	870 000	16.8	670	800	69/530
	780	112	6	680 000	1 300 000	16.0	600	750	60/530
560	680	56	3	330 000	650 000	17.4	670	800	68/560
	750	85	5	525 000	1 040 000	16.7	600	750	69/560
	820	115	6	735 000	1 500 000	16.2	560	670	60/560
600	730	60	3	355 000	735 000	17.5	600	710	68/600
	800	90	5	550 000	1 160 000	16.9	560	670	69/600
	870	118	6	790 000	1 640 000	16.1	530	630	60/600



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{C_{or}}$	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

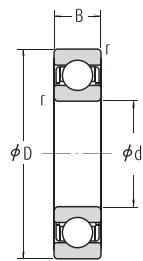
$$\frac{F_a}{F_r} > 0.8, P_0 = 0.6 F_r + 0.5 F_a$$

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

Abutment and Fillet Dimensions (mm)			Mass (kg)
d_a ($\uparrow$) min.	D_a ($\uparrow$) max.	r_a max.	approx.
391	469	2	19.5
396	504	3	40
400	540	4	68
411	489	2	20.5
416	524	3	42
420	580	4	88.4
431	509	2	21.4
436	544	3	43.6
440	600	4	92.2
451	529	2	22.3
456	584	3	60.2
466	624	5	106
473	567	2.5	34.3
476	604	3	62.6
486	654	5	123
493	587	2.5	35.4
500	630	4	73.5
506	674	5	127
513	607	2.5	37.2
520	650	4	82
526	694	5	131
543	637	2.5	39.8
550	690	4	89.8
556	754	5	184
573	667	2.5	41.5
580	730	4	105
586	793.5	5	203
613	717	2.5	50.9
620	780	4	120
626	844	5	236

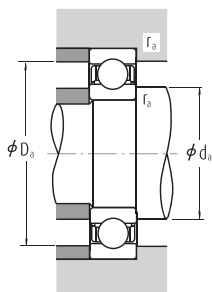
Single-Row Deep Groove Ball Bearings

Bore Diameter 630 – 800 mm



Open Type

Boundary Dimensions (mm)				Basic Load Ratings (N)		Factor	Limiting Speeds (min ⁻¹)		Bearing Numbers
d	D	B	r min.	C _r	C _{0r}	f ₀	Grease	Oil	Open
630	780	69	4	420 000	890 000	17.3	560	670	68/630
	850	100	6	625 000	1 350 000	16.7	530	630	69/630
	920	128	7.5	750 000	1 620 000	16.4	480	600	60/630
670	820	69	4	435 000	965 000	17.4	500	630	68/670
	900	103	6	675 000	1 460 000	16.7	480	560	69/670
	980	136	7.5	765 000	1 730 000	16.6	450	530	60/670
710	870	74	4	480 000	1 100 000	17.4	480	560	68/710
	950	106	6	715 000	1 640 000	16.8	450	530	69/710
750	920	78	5	525 000	1 260 000	17.4	430	530	68/750
	1 000	112	6	785 000	1 840 000	16.7	400	500	69/750
800	980	82	5	530 000	1 310 000	17.5	400	480	68/800
	1 060	115	6	825 000	2 050 000	16.8	380	450	69/800



Dynamic Equivalent Load $P = X F_r + Y F_a$

$\frac{F_a F_a}{C_{or}}$	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

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

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

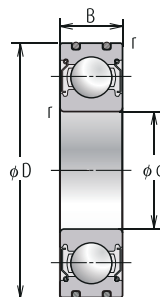
Abutment and Fillet Dimensions (mm)			Mass (kg)
d_a (ϕ) min.	D_a (ϕ) max.	r_a max.	approx.
646	764	3	71.3
656	824	5	163
662	888	6	285
686	804	3	75.4
696	874	5	181
702	948	6	351
726	854	3	92.6
736	924	5	208
770	900	4	110
776	974	5	245
820	960	4	132
826	1034	5	275

Creep-Free Bearings

Bore Diameter 10 – 100 mm

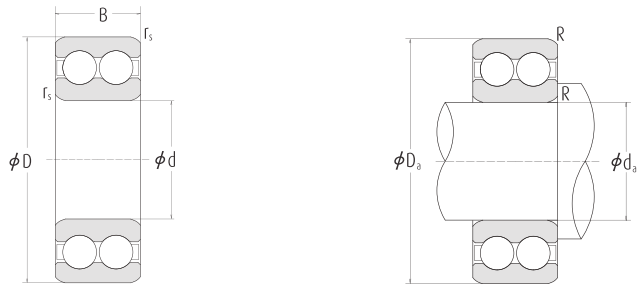
Bearing bore diameter d (mm)	Bearing outer diameter D (mm)	Bearing width B (mm)	Basic load ratings		Recommended fits (1)
			Cr(N)	Ca(N)	
10	26	8	4 550	1 970	H7 or G6
	30	9	5 100	2 390	
	35	11	8 100	3 450	
12	28	8	5 100	2 370	
	32	10	6 800	3 050	
	37	12	9 700	4 200	
15	32	9	5 600	2 830	
	35	11	7 650	3 750	
	42	13	11 400	5 450	
17	35	10	6 000	3 250	
	40	12	9 550	4 800	
	47	14	13 600	6 650	
20	42	12	9 400	5 000	
	47	14	12 800	6 600	
	52	15	15 900	7 900	
25	47	12	10 100	5 850	
	52	15	14 000	7 850	
	62	17	20 600	11 200	
30	55	13	13 200	8 300	
	62	16	19 500	11 300	
	72	19	26 700	15 000	
35	62	14	16 000	10 300	
	72	17	25 700	15 300	
	80	21	33 500	19 200	
40	68	15	16 800	11 500	
	80	18	29 100	17 900	
	90	23	40 500	24 000	
45	75	16	20 900	15 200	
	85	19	31 500	20 400	
	100	25	53 000	32 000	
50	80	16	21 800	16 600	
	90	20	35 000	23 200	
	110	27	62 000	38 500	
55	90	18	28 300	21 200	
	100	21	43 500	29 300	
	120	29	71 500	44 500	
60	95	18	29 500	23 200	
	110	22	52 500	36 000	
	130	31	82 000	52 000	
65	100	18	30 500	25 200	
	120	23	57 500	40 000	
	140	33	92 500	60 000	
70	110	20	38 000	31 000	
	125	24	62 000	44 000	
	150	35	104 000	68 000	
75	115	20	39 500	33 500	
	130	25	66 000	49 500	
80	125	22	47 500	40 000	
	140	26	72 500	53 000	
85	130	22	49 500	43 000	
	150	28	84 000	62 000	
90	140	24	58 000	50 000	
95	145	24	60 500	54 000	
100	150	24	60 000	54 000	

Bearing number			
Basic number(Open type)	Shield type	Contact seal type (2)	Non-contact seal type
6000 6200 6300	ZZ	DDU	VV
6001 6201 6301	ZZ	DDU	VV
6002 6202 6302	ZZ	DDU	VV
6003 6203 6303	ZZ	DDU	VV
6004 6204 6304	ZZ	DDU	VV
6005 6205 6305	ZZ	DDU	VV
6006 6206 6306	ZZ	DDU	VV
6007 6207 6307	ZZ	DDU	VV
6008 6208 6308	ZZ	DDU	VV
6009 6209 6309	ZZ	DDU	VV
6010 6210 6310	ZZ	DDU	VV
6011 6211 6311	ZZ	DDU	VV
6012 6212 6312	ZZ	DDU	VV
6013 6213 6313	ZZ	DDU	VV
6014 6214 6314	ZZ	DDU	VV
6015 6215	ZZ	DDU	VV
6016 6216	ZZ	DDU	VV
6017 6217	ZZ	DDU	VV
6018	ZZ	DDU	VV
6019	ZZ	DDU	VV
6020	ZZ	DDU	VV



Deep Groove Ball Bearings

Double Row | Bore 10 - 90 mm

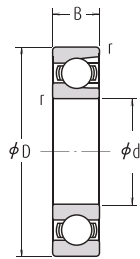


Dimensions				Abbreviation	Load ratings	
d	D	B	r _s min		dyn. C	stat. C ₀
mm					kN	
10	30	14	0.6	42008BTNG	9.15	5.2
12	32	14	0.6	42018BTNG	9.30	5.5
15	35	14	0.6	42028BTNG	10.4	6.7
	42	17	1.0	43028BTNG	14.6	9.2
17	40	16	0.6	42038BTNG	14.6	9.5
	47	19	1.0	43038BTNG	19.6	13.2
20	47	18	1.0	42048BTNG	18.0	12.7
	52	21	1.1	43048BTNG	23.2	16.0
25	52	18	1.0	42058BTNG	19.3	14.6
	62	24	1.1	43058BTNG	31.5	22.4
30	62	20	1.0	42068BTNG	26.0	20.8
	72	27	1.1	43068BTNG	40.0	30.5
35	72	23	1.1	42078BTNG	32.0	26.0
	80	31	1.5	43078BTNG	51.0	38.0
40	80	23	1.1	42088BTNG	34.0	30.0
	90	33	1.5	43088BTNG	63.0	48.0
45	85	23	1.1	42098BTNG	36.0	33.5
	100	36	1.5	43098BTNG	72.0	60.0
50	90	23	1.1	42108BTNG	37.5	36.5
	110	40	2.0	43108BTNG	90.0	75.0
55	100	25	1.5	42118BTNG	43.0	43.0
	120	43	2.0	43118BTNG	104.0	90.0
60	110	28	1.5	42128BTNG	57.0	58.5
	130	46	2.1	43128BTNG	120.0	106.0
65	120	31	1.5	42138BTNG	67.0	67.0
	140	48	2.1	43138BTNG	129.0	98.0
70	125	31	1.5	42148BTNG	69.5	73.5
	150	51	2.1	43148BTNG	146.0	114.0
75	130	31	1.5	42158BTNG	73.5	80.0
	160	55	2.1	43158BTNG	170.0	134.0
80	140	33	2.0	42168BTNG	80.0	90.0
85	150	36	2.0	42178BTNG	93.0	106.0
90	160	40	2.0	42188BTNG	112.0	122.0

Speed limits		Abutment dimensions			Weight
Grease	Oil	d _a min	D _a max	R min	kg
min ⁻¹					
18 000	24 000	14.0	26.0	0.6	0.049
16 000	20 000	16.0	28.0	0.6	0.053
14 000	18 000	19.0	31.0	0.6	0.059
13 000	17 000	20.0	37.0	1.0	0.120
13 000	18 000	21.0	36.0	1.0	0.090
11 000	17 000	22.0	42.0	1.0	0.160
10 000	14 000	25.0	42.0	1.0	0.140
9 500	13 000	26.5	45.5	1.0	0.210
9 000	12 000	30.0	47.0	1.0	0.160
8 000	10 000	31.5	55.5	1.0	0.340
7 500	9 500	35.0	57.0	1.0	0.260
6 700	8 500	36.5	65.5	1.0	0.500
6 700	8 500	41.5	65.5	1.0	0.400
6 300	8 000	43.0	72.0	1.5	0.690
6 000	7 500	46.5	73.5	1.0	0.500
5 600	7 000	48.0	82.0	1.5	0.950
5 600	7 000	51.5	78.5	1.0	0.540
4 800	6 000	53.0	92.0	1.5	1.250
5 000	6 300	56.5	83.5	1.0	0.580
4 300	5 300	59.0	101.0	2.0	1.700
4 500	5 600	63.0	92.0	1.5	0.800
4 000	5 000	64.0	111.0	2.0	2.150
4 000	5 000	68.0	102.0	1.5	1.100
3 600	4 500	71.0	119.0	2.0	2.650
3 800	4 800	73.0	112.0	1.5	1.450
3 600	4 500	76.0	129.0	2.0	3.250
3 600	4 500	78.0	117.0	1.5	1.500
3 200	4 000	81.0	139.0	2.0	3.950
3 400	4 300	83.0	122.0	1.5	1.600
3 000	3 800	86.0	149.0	2.0	5.380
3 200	4 000	89.0	131.0	2.0	2.000
3 000	3 800	94.0	141.0	2.0	2.550
2 800	3 600	99.0	151.0	2.0	3.200

Maximum Type Ball Bearings

Bore Diameter 25 – 110 mm



Open Type

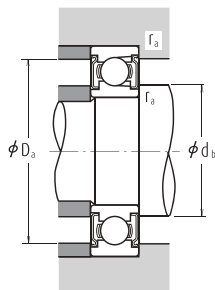
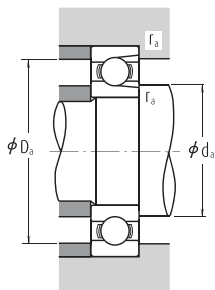


Shielded Type
(One Shield) Z



Shielded Type
(Two Shields) ZZ

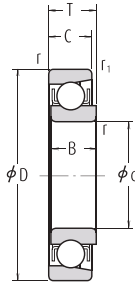
Boundary Dimensions (mm)				Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)		
d	D	B	r min.	C _r	C _{0r}	Grease Open Z · ZZ	Oil Open Z	
25	52	15	1	14 400	10 500	12 000	15 000	BL 205
	62	17	1.1	21 500	15 500	11 000	13 000	BL 305
30	62	16	1	21 000	16 300	10 000	12 000	BL 206
	72	19	1.1	27 900	20 700	9 000	11 000	BL 306
35	72	17	1.1	27 800	22 100	9 000	11 000	BL 207
	80	21	1.5	37 000	29 100	8 000	9 500	BL 307
40	80	18	1.1	35 500	28 800	8 000	9 500	BL 208
	90	23	1.5	46 500	36 000	7 500	9 000	BL 308
45	85	19	1.1	37 000	32 000	7 500	9 000	BL 209
	100	25	1.5	55 500	44 000	6 300	8 000	BL 309
50	90	20	1.1	39 000	35 000	6 700	8 500	BL 210
	110	27	2	65 000	52 500	6 000	7 100	BL 310
55	100	21	1.5	48 000	44 000	6 300	7 500	BL 211
	120	29	2	75 000	61 500	5 600	6 700	BL 311
60	110	22	1.5	58 000	54 000	5 600	6 700	BL 212
	130	31	2.1	85 500	71 500	5 000	6 000	BL 312
65	120	23	1.5	63 500	60 000	5 300	6 300	BL 213
	140	33	2.1	103 000	89 500	4 800	5 600	BL 313
70	125	24	1.5	69 000	66 000	5 000	6 000	BL 214
	150	35	2.1	115 000	102 000	4 300	5 300	BL 314
75	130	25	1.5	72 000	72 000	4 500	5 600	BL 215
	160	37	2.1	126 000	116 000	4 000	5 000	BL 315
80	140	26	2	84 000	85 000	4 300	5 300	BL 216
	170	39	2.1	136 000	130 000	3 800	4 500	BL 316
85	150	28	2	93 000	93 000	4 000	5 000	BL 217
	180	41	3	147 000	145 000	3 600	4 300	BL 317
90	160	30	2	107 000	107 000	3 800	4 500	BL 218
	190	43	3	158 000	161 000	3 400	4 000	BL 318
95	170	32	2.1	121 000	123 000	3 600	4 300	BL 219
	200	45	3	169 000	178 000	2 800	3 600	BL 319
100	180	34	2.1	136 000	140 000	3 400	4 000	BL 220
105	190	36	2.1	148 000	157 000	3 200	3 800	BL 221
110	200	38	2.1	160 000	176 000	2 800	3 400	BL 222



Bearing Numbers		Abutment and Fillet Dimensions (mm)				Mass (kg)
With One Shielded	With Two Shields	d_a min.	d_b max.	D_a max.	r_a max.	approx.
BL 205 Z	BL 205 ZZ	30	32	47	1	0.133
BL 305 Z	BL 305 ZZ	31.5	36	55.5	1	0.246
BL 206 Z	BL 206 ZZ	35	38.5	57	1	0.215
BL 306 Z	BL 306 ZZ	36.5	42	65.5	1	0.364
BL 207 Z	BL 207 ZZ	41.5	44.5	65.5	1	0.307
BL 307 Z	BL 307 ZZ	43	44.5	72	1.5	0.486
BL 208 Z	BL 208 ZZ	46.5	50	73.5	1	0.394
BL 308 Z	BL 308 ZZ	48	52.5	82	1.5	0.685
BL 209 Z	BL 209 ZZ	51.5	55.5	78.5	1	0.449
BL 309 Z	BL 309 ZZ	53	61.5	92	1.5	0.883
BL 210 Z	BL 210 ZZ	56.5	60	83.5	1	0.504
BL 310 Z	BL 310 ZZ	59	68	101	2	1.16
BL 211 Z	BL 211 ZZ	63	66.5	92	1.5	0.667
BL 311 Z	BL 311 ZZ	64	72.5	111	2	1.49
BL 212 Z	BL 212 ZZ	68	74.5	102	1.5	0.856
BL 312 Z	BL 312 ZZ	71	79	119	2	1.88
BL 213 Z	BL 213 ZZ	73	80	112	1.5	1.09
BL 313 Z	BL 313 ZZ	76	85.5	129	2	2.36
BL 214 Z	BL 214 ZZ	78	84	117	1.5	1.19
BL 314 Z	BL 314 ZZ	81	92	139	2	2.87
BL 215 Z	BL 215 ZZ	83	90	122	1.5	1.29
BL 315 Z	BL 315 ZZ	86	98.5	149	2	3.43
BL 216 Z	BL 216 ZZ	89	95.5	131	2	1.61
BL 316 Z	BL 316 ZZ	91	104.5	159	2	4.08
BL 217 Z	BL 217 ZZ	94	102	141	2	1.97
BL 317 Z	BL 317 ZZ	98	110.5	167	2.5	4.77
BL 218 Z	BL 218 ZZ	99	107.5	151	2	2.43
BL 318 Z	BL 318 ZZ	103	117	177	2.5	5.45
BL 219 Z	BL 219 ZZ	106	114	159	2	2.95
BL 319 Z	BL 319 ZZ	108	124	187	2.5	6.4
BL 220 Z	BL 220 ZZ	111	121.5	169	2	3.54
BL 221 Z	BL 221 ZZ	116	127.5	179	2	4.23
—	—	121	—	189	2	4.84

Magneto Bearings

Bore Diameter 4 – 20 mm



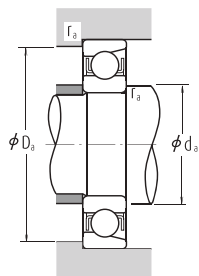
Outside Diameter Tolerance (Class N) Units: µm

Nominal Outside Diameter D (mm)		Single Plane Mean Outside Diameter ΔD_{mp}			
		E Series		EN Series	
Over	Incl.	High	Low	High	Low
—	10	+8	0	0	-8
10	18	+8	0	0	-8
18	30	+9	0	0	-9
30	50	+11	0	0	-11

Boundary Dimensions (mm)					Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)		Bearing Numbers	
d	D	B, C, T	r min.	r ₁ min.	C _r	C _{0r}	Grease	Oil	E Series	EN Series
4	16	5	0.15	0.1	1 650	288	34 000	40 000	E 4	EN 4
5	16	5	0.15	0.1	1 650	288	34 000	40 000	E 5	EN 5
6	21	7	0.3	0.15	2 490	445	30 000	36 000	E 6	EN 6
7	22	7	0.3	0.15	2 490	445	30 000	36 000	E 7	EN 7
8	24	7	0.3	0.15	3 450	650	28 000	34 000	E 8	EN 8
9	28	8	0.3	0.15	4 550	880	24 000	30 000	E 9	EN 9
10	28	8	0.3	0.15	4 550	880	24 000	30 000	E 10	EN 10
11	32	7	0.3	0.15	4 400	845	22 000	26 000	E 11	EN 11
12	32	7	0.3	0.15	4 400	845	22 000	26 000	E 12	EN 12
13	30	7	0.3	0.15	4 400	845	22 000	26 000	E 13	EN 13
14	35	8	0.3	0.15	5 800	1 150	19 000	22 000	—	EN 14
15	35	8	0.3	0.15	5 800	1 150	19 000	22 000	E 15	EN 15
	40	10	0.6	0.3	7 400	1 500	17 000	20 000	BO 15	—
16	38	10	0.6	0.2	6 900	1 380	17 000	22 000	—	EN 16
17	40	10	0.6	0.3	7 400	1 500	17 000	20 000	L 17	—
	44	11	0.6	0.3	7 350	1 500	16 000	19 000	—	EN 17
	44	11	0.6	0.3	7 350	1 500	16 000	19 000	BO 17	—
18	40	9	0.6	0.2	5 050	1 030	17 000	20 000	—	EN 18
19	40	9	0.6	0.2	5 050	1 030	17 000	20 000	E 19	EN 19
20	47	12	1	0.6	11 000	2 380	14 000	17 000	E 20	EN 20
	47	14	1	0.6	11 000	2 380	14 000	17 000	L 20	—

Dynamic Equivalent Load $P = X F_r + Y F_a$

$F_a/F_r \leq e$		$F_a/F_r > e$		e
X	Y	X	Y	
1	0	0.5	2.5	0.2



Abutment and Fillet Dimensions (mm)			Mass (kg)
d_a min.	D_a max.	r_a max.	approx.
5.2	14.8	0.15	0.005
6.2	14.8	0.15	0.004
8	19	0.3	0.011
9	20	0.3	0.013
10	22	0.3	0.014
11	26	0.3	0.022
12	26	0.3	0.021
13	30	0.3	0.029
14	30	0.3	0.028
15	28	0.3	0.021
16	33	0.3	0.035
17	33	0.3	0.034
19	36	0.6	0.055
20	34	0.6	0.049
21	36	0.6	0.051
21	40	0.6	0.080
21	40	0.6	0.080
22	36	0.6	0.051
23	36	0.6	0.049
25	42	1	0.089
25	42	1	0.101

Extra Small Ball Bearings and Miniature Ball Bearings

DESIGN AND TYPES

The size ranges of extra small and miniature ball bearings are shown in Table 1. The design, types, and type symbols are shown in Table 2. Those types among them that are listed in the bearing tables are indicated by the shading in Table 2.

Table 1 Size Ranges of Bearings

Units : mm

Design	Extra Small Ball Bearings	Miniature Ball Bearings
Metric	Outside diameter $D \geq 9$ Bore diameter $d < 10$	Outside diameter $D < 9$
Inch	Outside diameter $D \geq 9.525$ Bore diameter $d < 10$	Outside diameter $D < 9.525$

Please refer to ITJ Miniature Ball Bearings (CAT. No. E126) for details.

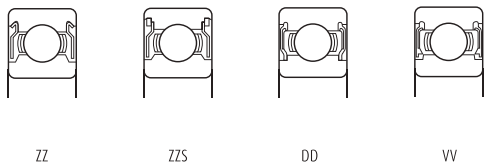


Table 2 Design, Types, and Type Symbols

Design · Types		Type Symbols				Remarks
		Metric	Inch	Special		
				Metric	Inch	
Single-Row Deep Groove Ball Bearings		6 ○ ○	R	MR	—	Shielded · sealed bearings are available.
	 Thin section	—	—	SMT	—	
	 With flange	F6 ○ ○	FR	MF	—	Shielded · sealed bearings are available.
	 Extended inner ring	—	—	—	RW	Shielded bearings are available.
	 With flange and extended inner ring	—	—	—	FRW	Shielded bearings are available.
	 For synchro motors	—	—	—	SR00X00	Shielded bearings are available.
Pivot Ball Bearings		—	—	BCF	—	
Thrust Ball Bearings		—	—	F	—	



Extra Small Ball Bearings and Miniature Ball Bearings

Table 3 Flange Tolerances for Metric Flanged Bearings

(1) Tolerances of Flange Outside Diameter

Units : μm

Nominal Flange Outside Diameter $D_f(\text{mm})$		Deviation of Flange Outside Diameter ΔD_{15}			
		①		②	
over	incl.	high	low	high	low
	10	+220	−36	0	−36
10	18	+270	−43	0	−43
18	30	+330	−52	0	−52

Remark ② is applied when the flange outside diameter is used for positioning.

(2) Flange Width Tolerances and Running Accuracies Related to Flange

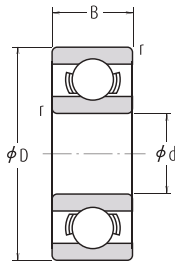
Units : μm

Nominal Bearing Outside Diameter D (mm)		Deviation of Flange Width Δc_{15}		Variation of Flange Width Δc_{15} VC ₁₅				Variation of Bearing Outside Surface Generatrix Inclination with Flange Backface S_{01}			Flange Backface Runout with Raceway S_{01}		
		Normal and Classes 6,5,4,2		Normal and class 6	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2	Class 5	Class 4	Class 2
over	incl.	high	low	max.				max.			max.		
2.5(1)	6	Use the Δ_{gs} tolerance for d of the same bearing of the same class		Use the Δ_{vs} tolerance for d of the same bearing of the same class	5	2.5	1.5	8	4	1.5	11	7	3
6	18				5	2.5	1.5	8	4	1.5	11	7	3
18	30				5	2.5	1.5	8	4	1.5	11	7	3

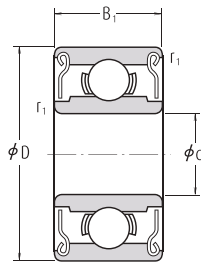


Extra Small Ball Bearings · Miniature Ball Bearings

Metric Design
Bore Diameter 1 – 4 mm



Open Type

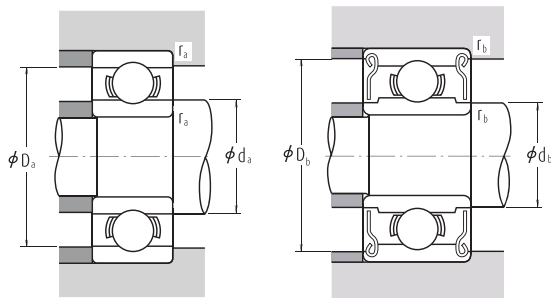


Shielded Type
ZZ · ZZ1

Boundary Dimensions (mm)						Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)		Open
d	D	B	B ₁	r ⁽¹⁾ min.	r ₁ ⁽¹⁾ min.	C _r	C _{0r}	Grease Open Z · ZZ	Oil Open Z	
1	3	1	—	0.05	—	80	23	130 000	150 000	681
	3	1.5	—	0.05	—	80	23	130 000	150 000	MR 31
	4	1.6	—	0.1	—	138	35	100 000	120 000	691
1.2	4	1.8	2.5	0.1	0.1	138	35	110 000	130 000	MR 41 X
1.5	4	1.2	2	0.05	0.05	112	33	100 000	120 000	681 X
	5	2	2.6	0.15	0.15	237	69	85 000	100 000	691 X
	6	2.5	3	0.15	0.15	330	98	75 000	90 000	601 X
2	5	1.5	2.3	0.08	0.08	169	50	85 000	100 000	682
	5	2	2.5	0.1	0.1	187	58	85 000	100 000	MR 52 B
	6	2.3	3	0.15	0.15	330	98	75 000	90 000	692
2.5	6	2.5	2.5	0.15	0.15	330	98	75 000	90 000	MR 62
	7	2.5	3	0.15	0.15	385	127	63 000	75 000	MR 72
	7	2.8	3.5	0.15	0.15	385	127	63 000	75 000	602
	6	1.8	2.6	0.08	0.08	208	74	71 000	80 000	682 X
	7	2.5	3.5	0.15	0.15	385	127	63 000	75 000	692 X
	8	2.5	—	0.2	—	560	179	60 000	67 000	MR 82 X
3	8	2.8	4	0.15	0.15	550	175	60 000	71 000	602 X
	6	2	2.5	0.1	0.1	208	74	71 000	80 000	MR 63
	7	2	3	0.1	0.1	390	130	63 000	75 000	683 A
	8	2.5	—	0.15	—	560	179	60 000	67 000	MR 83
	8	3	4	0.15	0.15	560	179	60 000	67 000	693
	9	2.5	4	0.2	0.15	570	187	56 000	67 000	MR 93
4	9	3	5	0.15	0.15	570	187	56 000	67 000	603
	10	4	4	0.15	0.15	630	218	50 000	60 000	623
	13	5	5	0.2	0.2	1 300	485	40 000	48 000	633
	7	2	—	0.1	—	310	115	60 000	67 000	MR 74
	7	—	2.5	—	0.1	255	107	60 000	71 000	—
	8	2	3	0.15	0.1	395	139	56 000	67 000	MR 84
5	9	2.5	4	(0.15)	(0.15)	640	225	53 000	63 000	684 A
	10	3	4	0.2	0.15	710	270	50 000	60 000	MR 104 B
	11	4	4	0.15	0.15	960	345	48 000	56 000	694
	12	4	4	0.2	0.2	960	345	48 000	56 000	604
	13	5	5	0.2	0.2	1 300	485	40 000	48 000	624
	16	5	5	0.3	0.3	1 730	670	36 000	43 000	634

Radial and axial load factors

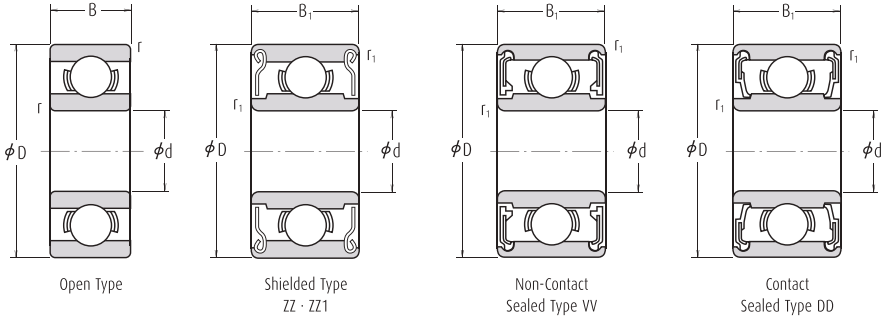
C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Bearing Numbers			Abutment and Fillet Dimensions (mm)						Mass (g)	
Shielded	Sealed		d_a min.	d_b max.	D_a max.	D_b min.	r_a max.	r_b max.	approx.	
									Open	Shielded
—	—	—	1.4	—	2.6	—	0.05	—	0.03	—
—	—	—	1.4	—	2.6	—	0.05	—	0.04	—
—	—	—	1.8	—	3.2	—	0.1	—	0.09	—
MR 41 XZZ	—	—	2.0	1.9	3.2	3.5	0.1	0.1	0.10	0.14
681 XZZ	—	—	1.9	2.1	3.6	3.6	0.05	0.05	0.07	0.11
691 XZZ	—	—	2.7	2.5	3.8	4.3	0.15	0.15	0.17	0.20
601 XZZ	—	—	2.7	3.0	4.8	5.4	0.15	0.15	0.33	0.38
682 ZZ	—	—	2.6	2.7	4.4	4.2	0.08	0.08	0.12	0.17
MR 52 BZZ	—	—	2.8	2.7	4.2	4.4	0.1	0.1	0.16	0.23
692 ZZ	—	—	3.2	3.0	4.8	5.4	0.15	0.15	0.28	0.38
MR 62 ZZ	—	—	3.2	3.0	4.8	5.2	0.15	0.15	0.30	0.29
MR 72 ZZ	—	—	3.2	3.8	5.8	6.2	0.15	0.15	0.45	0.49
602 ZZ	—	—	3.2	3.8	5.8	6.2	0.15	0.15	0.51	0.58
682 XZZ	—	—	3.1	3.7	5.4	5.4	0.08	0.08	0.23	0.29
692 XZZ	—	—	3.7	3.8	5.8	6.2	0.15	0.15	0.41	0.55
—	—	—	4.1	—	6.4	—	0.2	—	0.56	—
602 XZZ	—	—	3.7	4.1	6.8	7.0	0.15	0.15	0.63	0.83
MR 63 ZZ	—	—	3.8	3.7	5.2	5.4	0.1	0.1	0.20	0.27
683 XZZ	—	—	3.8	4.0	6.2	6.4	0.1	0.1	0.32	0.45
—	—	—	4.2	—	6.8	—	0.15	—	0.54	—
693 ZZ	—	—	4.2	4.3	6.8	7.3	0.15	0.15	0.61	0.83
MR 93 ZZ	—	—	4.6	4.3	7.4	7.9	0.2	0.15	0.73	1.18
603 ZZ	—	—	4.2	4.3	7.8	7.9	0.15	0.15	0.87	1.45
623 ZZ	—	—	4.2	4.3	8.8	8.0	0.15	0.15	1.65	1.66
633 ZZ	—	—	4.6	6.0	11.4	11.3	0.2	0.2	3.38	3.33
—	—	—	4.8	—	6.2	—	0.1	—	0.22	—
MR 74 ZZ	—	—	—	4.8	—	6.3	—	0.1	—	0.29
MR 84 ZZ	—	—	5.2	5.0	6.8	7.4	0.15	0.1	0.36	0.56
684 AZZ	—	—	4.8	5.2	8.2	8.1	0.1	0.1	0.63	1.01
MR 104 BZZ	—	—	5.6	5.9	8.4	8.8	0.2	0.15	1.04	1.42
694 ZZ	—	—	5.2	5.6	9.8	9.9	0.15	0.15	1.7	1.75
604 ZZ	—	—	5.6	5.6	10.4	9.9	0.2	0.2	2.25	2.29
624 ZZ	—	—	5.6	6.0	11.4	11.3	0.2	0.2	3.03	3.04
634 ZZ1	—	—	6.0	7.5	14.0	13.8	0.3	0.3	5.24	5.21

Extra Small Ball Bearings · Miniature Ball Bearings

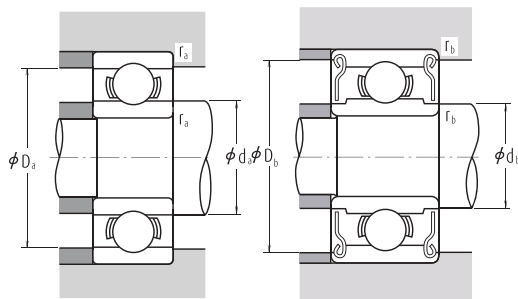
Metric Design Bore Diameter 5 – 9 mm



Boundary Dimensions (mm)						Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)			
d	D	B	B ₁	r ⁽¹⁾ min.	r ₁ ⁽¹⁾ min.	C _r	C _{0r}	Grease		Oil	
								Open Z · ZZ V · VV	D · DD	Open Z	Open
5	8	2	—	0.1	—	310	120	53 000	—	63 000	MR 85
	8	—	2.5	—	0.1	278	131	53 000	—	63 000	—
	9	2.5	3	0.15	0.15	430	168	50 000	—	60 000	MR 95
	10	3	4	0.15	0.15	430	168	50 000	—	60 000	MR 105
	11	—	4	—	0.15	715	276	48 000	—	56 000	—
	11	3	5	0.15	0.15	715	281	45 000	—	53 000	685
	13	4	4	0.2	0.2	1 080	430	43 000	40 000	50 000	695
	14	5	5	0.2	0.2	1 330	505	40 000	38 000	50 000	605
6	16	5	5	0.3	0.3	1 730	670	36 000	32 000	43 000	625
	19	6	6	0.3	0.3	2 340	885	32 000	30 000	40 000	635
	10	2.5	3	0.15	0.1	495	218	45 000	—	53 000	MR 106
	12	3	4	0.2	0.15	715	292	43 000	40 000	50 000	MR 126
	13	3.5	5	0.15	0.15	1 080	440	40 000	38 000	50 000	686 A
	15	5	5	0.2	0.2	1 730	670	40 000	36 000	45 000	696
	17	6	6	0.3	0.3	2 260	835	38 000	34 000	45 000	606
	19	6	6	0.3	0.3	2 340	885	32 000	30 000	40 000	626
7	22	7	7	0.3	0.3	3 300	1 370	30 000	28 000	36 000	636
	11	2.5	3	0.15	0.1	455	201	43 000	—	50 000	MR 117
	13	3	4	0.2	0.15	540	276	40 000	—	48 000	MR 137
	14	3.5	5	0.15	0.15	1 170	510	40 000	34 000	45 000	687
	17	5	5	0.3	0.3	1 610	710	36 000	28 000	43 000	697
	19	6	6	0.3	0.3	2 340	885	36 000	32 000	43 000	607
	22	7	7	0.3	0.3	3 300	1 370	30 000	28 000	36 000	627
	26	9	9	0.3	0.3	4 550	1 970	28 000	22 000	34 000	637
8	12	2.5	3.5	0.15	0.1	545	274	40 000	—	48 000	MR 128
	14	3.5	4	0.2	0.15	820	385	38 000	32 000	45 000	MR 148
	16	4	5	0.2	0.2	1 610	710	36 000	28 000	43 000	688 A
	19	6	6	0.3	0.3	2 240	910	36 000	28 000	43 000	698
	22	7	7	0.3	0.3	3 300	1 370	34 000	28 000	40 000	608
	24	8	8	0.3	0.3	3 350	1 430	28 000	24 000	34 000	628
	28	9	9	0.3	0.3	4 550	1 970	28 000	22 000	34 000	638
	17	4	5	0.2	0.2	1 330	665	36 000	24 000	43 000	689
9	20	6	6	0.3	0.3	1 720	840	34 000	24 000	40 000	699
	24	7	7	0.3	0.3	3 350	1 430	32 000	24 000	38 000	609
	26	8	8	(0.6)	(0.6)	4 550	1 970	28 000	22 000	34 000	629
	30	10	10	0.6	0.6	5 100	2 390	24 000	—	30 000	639

Radial and axial load factors

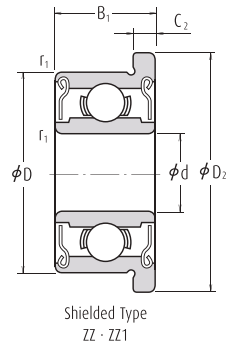
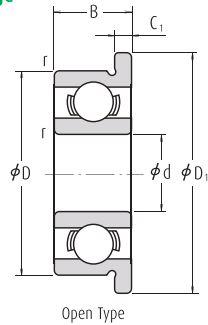
C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Bearing Numbers			Abutment and Fillet Dimensions (mm)						Mass (g)	
Shielded	Sealed		d_a min.	d_b max.	D_a max.	D_b min.	r_a max.	r_b max.	approx. Open	Shielded
—	—	—	5.8	—	7.2	—	0.1	—	0.26	—
MR 85 ZZ	—	—	—	5.8	—	7.4	—	0.1	—	0.34
MR 95 ZZ1	—	—	6.2	6.0	7.8	8.2	0.15	0.15	0.50	0.58
MR 105 ZZ	—	—	6.2	6.0	8.8	8.4	0.15	0.15	0.95	1.29
MR 115 ZZ	VV	—	—	6.3	—	9.8	—	0.15	—	1.49
685 ZZ	—	—	6.2	6.2	9.8	9.9	0.15	0.15	1.2	1.96
695 ZZ	VV	DD	6.6	6.6	11.4	11.2	0.2	0.2	2.45	2.5
605 ZZ	—	DD	6.6	6.9	12.4	12.2	0.2	0.2	3.54	3.48
625 ZZ1	VV	DD	7.0	7.5	14.0	13.8	0.3	0.3	4.95	4.86
635 ZZ1	VV	DD	7.0	8.5	17.0	16.5	0.3	0.3	8.56	8.34
MR 106 ZZ1	—	—	7.2	7.0	8.8	9.3	0.15	0.1	0.56	0.68
MR 126 ZZ	—	DD	7.6	7.2	10.4	10.9	0.2	0.15	1.27	1.74
686 AZZ	VV	DD	7.2	7.4	11.8	11.7	0.15	0.15	1.91	2.69
696 ZZ1	VV	DD	7.6	7.9	13.4	13.3	0.2	0.2	3.88	3.72
606 ZZ	VV	DD	8.0	8.2	15.0	14.8	0.3	0.3	5.97	6.08
626 ZZ1	VV	DD	8.0	8.5	17.0	16.5	0.3	0.3	8.15	7.94
636 ZZ	VV	DD	8.0	10.5	20.0	19.0	0.3	0.3	14	14
MR 117 ZZ	—	—	8.2	8.0	9.8	10.5	0.15	0.1	0.62	0.72
MR 137 ZZ	—	—	8.6	9.0	11.4	11.6	0.2	0.15	1.58	2.02
687 ZZ1	VV	DD	8.2	8.5	12.8	12.7	0.15	0.15	2.13	2.97
697 ZZ1	VV	DD	9.0	10.2	15.0	14.8	0.3	0.3	5.26	5.12
607 ZZ1	VV	DD	9.0	9.1	17.0	16.5	0.3	0.3	7.67	7.51
627 ZZ	VV	DD	9.0	10.5	20.0	19.0	0.3	0.3	12.7	12.9
637 ZZ1	VV	DD	9.0	12.8	24.0	22.8	0.3	0.3	24	25
MR 128 ZZ1	—	—	9.2	9.0	10.8	11.3	0.15	0.1	0.71	0.97
MR 148 ZZ	VV	DD	9.6	9.2	12.4	12.8	0.2	0.15	1.86	2.16
688 AZZ1	VV	DD	9.6	10.2	14.4	14.2	0.2	0.2	3.12	4.02
698 ZZ	VV	DD	10.0	10.0	17.0	16.5	0.3	0.3	7.23	7.18
608 ZZ	VV	DD	10.0	10.5	20.0	19.0	0.3	0.3	12.1	12.2
628 ZZ	VV	DD	10.0	12.0	22.0	20.5	0.3	0.3	17.2	17.4
638 ZZ1	VV	DD	10.0	12.8	26.0	22.8	0.3	0.3	28.3	28.6
689 ZZ1	VV	DD	10.6	11.5	15.4	15.2	0.2	0.2	3.53	4.43
699 ZZ1	VV	DD	11.0	12.0	18.0	17.2	0.3	0.3	8.45	8.33
609 ZZ	VV	DD	11.0	12.0	22.8	20.5	0.3	0.3	14.5	14.7
629 ZZ	VV	DD	11.0	12.8	24.0	22.8	0.3	0.3	19.5	19.3
639 ZZ	VV	—	13.0	16.1	26.0	25.6	0.6	0.6	36.5	36

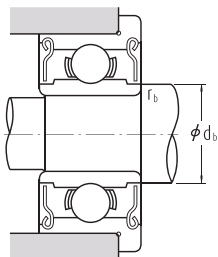
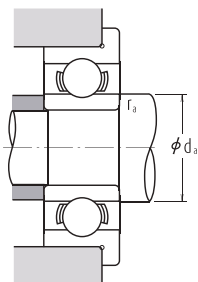
Extra Small Ball Bearings · Miniature Ball Bearings

Metric Design With Flange Bore Diameter 1 – 4 mm



Boundary Dimensions (mm)										Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)	
d	D	D ₁	D ₂	B	B ₁	C ₁	C ₂	r ⁽¹⁾ min.	r ₁ ⁽¹⁾ min.	C _r	C _{or}	Grease Open Z · ZZ	Oil Open Z
1	3	3.8	—	1	—	0.3	—	0.05	—	80	23	130 000	150 000
	4	5	—	1.6	—	0.5	—	0.1	—	140	36	100 000	120 000
1.2	4	4.8	—	1.8	—	0.4	—	0.1	—	138	35	110 000	130 000
1.5	4	5	5	1.2	2	0.4	0.6	0.05	0.05	112	33	100 000	120 000
	5	6.5	6.5	2	2.6	0.6	0.8	0.15	0.15	237	69	85 000	100 000
2	6	7.5	7.5	2.5	3	0.6	0.8	0.15	0.15	330	98	75 000	90 000
	5	6.1	6.1	1.5	2.3	0.5	0.6	0.08	0.08	169	50	85 000	100 000
	5	6.2	6.2	2	2.5	0.6	0.6	0.1	0.1	187	58	85 000	100 000
	6	7.5	7.5	2.3	3	0.6	0.8	0.15	0.15	330	98	75 000	90 000
	6	7.2	—	2.5	—	0.6	—	0.15	—	330	98	75 000	90 000
	7	8.2	8.2	2.5	3	0.6	0.6	0.15	0.15	385	127	63 000	75 000
2.5	7	8.5	8.5	2.8	3.5	0.7	0.9	0.15	0.15	385	127	63 000	75 000
	6	7.1	7.1	1.8	2.6	0.5	0.8	0.08	0.08	208	74	71 000	80 000
	7	8.5	8.5	2.5	3.5	0.7	0.9	0.15	0.15	385	127	63 000	75 000
	8	9.2	—	2.5	—	0.6	—	0.2	—	560	179	60 000	67 000
	8	9.5	9.5	2.8	4	0.7	0.9	0.15	0.15	550	175	60 000	71 000
	6	7.2	7.2	2	2.5	0.6	0.6	0.1	0.1	208	74	71 000	80 000
3	7	8.1	8.1	2	3	0.5	0.8	0.1	0.1	390	130	63 000	75 000
	8	9.2	—	2.5	—	0.6	—	0.15	—	560	179	60 000	67 000
	8	9.5	9.5	3	4	0.7	0.9	0.15	0.15	560	179	60 000	67 000
	9	10.2	10.6	2.5	4	0.6	0.8	0.2	0.15	570	187	56 000	67 000
	9	10.5	10.5	3	5	0.7	1	0.15	0.15	570	187	56 000	67 000
	10	11.5	11.5	4	4	1	1	0.15	0.15	630	218	50 000	60 000
4	13	15	15	5	5	1	1	0.2	0.2	1 300	485	36 000	43 000
	7	8.2	—	2	—	0.6	—	0.1	—	310	115	60 000	67 000
	8	9.2	9.2	2	3	0.6	0.6	0.15	0.1	255	107	60 000	71 000
	9	10.3	10.3	2.5	4	0.6	1	(0.15)	(0.15)	395	139	56 000	67 000
	10	11.2	11.6	3	4	0.6	0.8	0.2	0.15	640	225	53 000	63 000
	11	12.5	12.5	4	4	1	1	0.15	0.15	710	270	50 000	60 000
11	12.5	12.5	4	4	1	1	1	0.2	0.2	960	345	48 000	56 000
	12	13.5	13.5	4	4	1	1	0.2	0.2	960	345	48 000	56 000
	13	15	15	5	5	1	1	0.2	0.2	1 300	485	40 000	48 000
	16	18	18	5	5	1	1	0.3	0.3	1 730	670	36 000	43 000

Radial and axial load factors



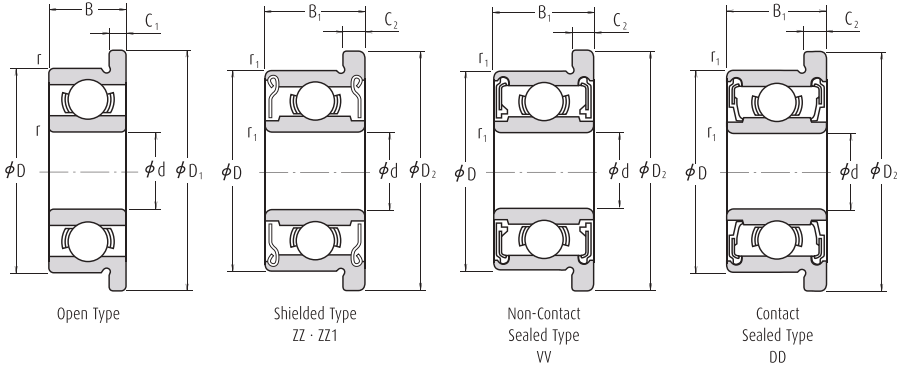
C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Bearing Numbers			Abutment and Fillet Dimensions (mm)				Mass (g)	
Open	Shielded	Sealed	d_a min.	d_b max.	r_a max.	r_b max.	approx.	
							Open	Shielded
F 681	—	—	1.4	—	0.05	—	0.04	—
F 691	—	—	1.8	—	0.1	—	0.14	—
MF 41 X	—	—	2.0	—	0.1	—	0.12	—
F 681 X	F 681 XZZ	—	1.9	2.1	0.05	0.05	0.09	0.14
F 691 X	F 691 XZZ	—	2.7	2.5	0.15	0.15	0.23	0.28
F 601 X	F 601 XZZ	—	2.7	3.0	0.15	0.15	0.42	0.52
F 682	F 682 ZZ	—	2.6	2.7	0.08	0.08	0.16	0.22
MF 52 B	MF 52 BZZ	—	2.8	2.7	0.1	0.1	0.21	0.27
F 692	F 692 ZZ	—	3.2	3.0	0.15	0.15	0.35	0.48
MF 62	—	—	3.2	—	0.15	—	0.36	—
MF 72	MF 72 ZZ	—	3.2	3.8	0.15	0.15	0.52	0.56
F 602	F 602 ZZ	—	3.2	3.1	0.15	0.15	0.60	0.71
F 682 X	F 682 XZZ	—	3.1	3.7	0.08	0.08	0.25	0.36
F 692 X	F 692 XZZ	—	3.7	3.8	0.15	0.15	0.51	0.68
MF 82 X	—	—	4.1	—	0.2	—	0.62	—
F 602 X	F 602 XZZ	—	3.7	3.5	0.15	0.15	0.74	0.98
MF 63	MF 63 ZZ	—	3.8	3.7	0.1	0.1	0.27	0.33
F 683 A	F 683 AZZ	—	3.8	4.0	0.1	0.1	0.37	0.53
MF 83	—	—	4.2	—	0.15	—	0.56	—
F 693	F 693 ZZ	—	4.2	4.3	0.15	0.15	0.70	0.97
MF 93	MF 93 ZZ	—	4.6	4.3	0.2	0.15	0.81	1.34
F 603	F 603 ZZ	—	4.2	4.3	0.15	0.15	1.0	1.63
F 623	F 623 ZZ	—	4.2	4.3	0.15	0.15	1.85	1.86
F 633	F 633 ZZ	—	4.6	6.0	0.2	0.2	3.73	3.59
MF 74	—	—	4.8	—	0.1	—	0.29	—
—	MF 74 ZZ	—	—	4.8	—	0.1	—	0.35
MF 84	MF 84 ZZ	—	5.2	5.0	0.15	0.1	0.44	0.63
F 684	F 684 ZZ	—	4.8	5.2	0.1	0.1	0.70	1.14
MF 104 B	MF 104 BZZ	—	5.6	5.9	0.2	0.15	1.13	1.59
F 694	F 694 ZZ	—	5.2	5.6	0.15	0.15	1.91	1.96
F 604	F 604 ZZ	—	5.6	5.6	0.2	0.2	2.53	2.53
F 624	F 624 ZZ	—	5.6	6.0	0.2	0.2	3.38	3.53
F 634	F 634 ZZ1	—	6.0	7.5	0.3	0.3	5.73	5.62

Extra Small Ball Bearings · Miniature Ball Bearings

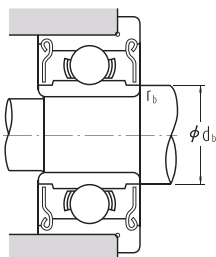
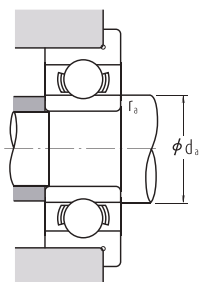
Metric Design With Flange Bore Diameter 5 – 9 mm



Boundary Dimensions (mm)										Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)			
d	D	D ₁	D ₂	B	B ₁	C ₁	C ₂	r min.	r ₁ min.	C _r	C _{0r}	Grease	Oil		
												Open Z · ZZ V · VV	D · DD	Open Z	
5	8	9.2	—	2	—	0.6	—	0.1	—	310	120	53 000	—	63 000	
	8	—	9.2	—	2.5	—	0.6	—	0.1	278	131	53 000	—	63 000	
	9	10.2	10.2	2.5	3	0.6	0.6	0.15	0.15	430	168	50 000	—	60 000	
	10	11.2	11.6	3	4	0.6	0.8	0.15	0.15	430	168	50 000	—	60 000	
	11	12.5	12.5	3	5	0.8	1	0.15	0.15	715	281	45 000	—	53 000	
	13	15	15	4	4	1	1	0.2	0.2	1 080	430	43 000	40 000	50 000	
	14	16	16	5	5	1	1	0.2	0.2	1 330	505	40 000	38 000	50 000	
	16	18	18	5	5	1	1	0.3	0.3	1 730	670	36 000	32 000	43 000	
	19	22	22	6	6	1.5	1.5	0.3	0.3	2 340	885	32 000	30 000	40 000	
	10	11.2	11.2	2.5	3	0.6	0.6	0.15	0.1	495	218	45 000	—	53 000	
6	12	13.2	13.6	3	4	0.6	0.8	0.2	0.15	715	292	43 000	40 000	50 000	
	13	15	15	3.5	5	1	1.1	0.15	0.15	1 080	440	40 000	38 000	50 000	
	15	17	17	5	5	1.2	1.2	0.2	0.2	1 730	670	40 000	36 000	45 000	
	17	19	19	6	6	1.2	1.2	0.3	0.3	2 260	835	38 000	34 000	45 000	
	19	22	22	6	6	1.5	1.5	0.3	0.3	2 340	885	32 000	30 000	40 000	
	22	25	25	7	7	1.5	1.5	0.3	0.3	3 300	1 370	30 000	28 000	36 000	
	7	11	12.2	12.2	2.5	3	0.6	0.6	0.15	0.1	455	201	43 000	—	50 000
		13	14.2	14.6	3	4	0.6	0.8	0.2	0.15	540	276	40 000	—	48 000
		14	16	16	3.5	5	1	1.1	0.15	0.15	1 170	510	40 000	34 000	45 000
		17	19	19	5	5	1.2	1.2	0.3	0.3	1 610	715	36 000	28 000	43 000
19	22	22	6	6	1.5	1.5	0.3	0.3	2 340	885	36 000	32 000	43 000		
22	25	25	7	7	1.5	1.5	0.3	0.3	3 300	1 370	30 000	28 000	36 000		
8	12	13.2	13.6	2.5	3.5	0.6	0.8	0.15	0.1	545	274	40 000	—	48 000	
	14	15.6	15.6	3.5	4	0.8	0.8	0.2	0.15	820	385	38 000	32 000	45 000	
	16	18	18	4	5	1	1.1	0.2	0.2	1 610	710	36 000	30 000	43 000	
	19	22	22	6	6	1.5	1.5	0.3	0.3	2 240	910	36 000	28 000	43 000	
22	25	25	7	7	1.5	1.5	0.3	0.3	3 300	1 370	34 000	28 000	40 000		
9	17	19	19	4	5	1	1.1	0.2	0.2	1 330	665	36 000	24 000	43 000	
	20	23	23	6	6	1.5	1.5	0.3	0.3	1 720	840	34 000	24 000	40 000	

Radial and axial load factors

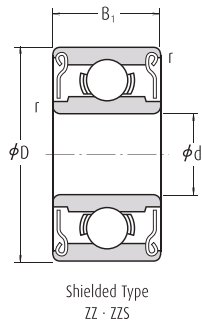
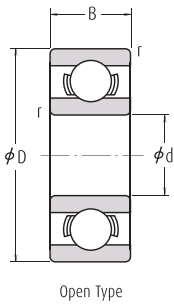
C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Bearing Numbers				Abutment and Fillet Dimensions (mm)				Mass (g) approx.	
Open	Shielded	Sealed		d_a min.	d_b max.	r_a max.	r_b max.	Open	Shielded
MF 85	—	—	—	5.8	—	0.1	—	0.33	—
—	MF 85 ZZ	—	—	—	5.8	—	0.1	—	0.41
MF 95	MF 95 ZZ1	—	—	6.2	6.0	0.15	0.15	0.59	0.66
MF 105	MF 105 ZZ	—	—	6.2	6.0	0.15	0.15	1.05	1.46
F 685	F 685 ZZ	—	—	6.2	6.2	0.15	0.15	1.37	2.18
F 695	F 695 ZZ	VV	DD	6.6	6.6	0.2	0.2	2.79	2.84
F 605	F 605 ZZ	—	DD	6.6	6.9	0.2	0.2	3.9	3.85
F 625	F 625 ZZ1	VV	DD	7.0	7.5	0.3	0.3	5.37	5.27
F 635	F 635 ZZ1	VV	DD	7.0	8.5	0.3	0.3	9.49	9.49
MF 106	MF 106 ZZ1	—	—	7.2	7.0	0.15	0.1	0.65	0.77
MF 126	MF 126 ZZ	—	DD	7.6	7.2	0.2	0.15	1.38	1.94
F 686 A	F 686 AZZ	VV	DD	7.2	7.4	0.15	0.15	2.25	3.04
F 696	F 696 ZZ1	VV	DD	7.6	7.9	0.2	0.2	4.34	4.26
F 606	F 606 ZZ	VV	DD	8.0	8.2	0.3	0.3	6.58	6.61
F 626	F 626 ZZ1	VV	DD	8.0	8.5	0.3	0.3	9.09	9.09
F 636	F 636 ZZ	VV	DD	8.0	10.5	0.3	0.3	14.6	14.7
MF 117	MF 117 ZZ	—	—	8.2	8.0	0.15	0.1	0.72	0.82
MF 137	MF 137 ZZ	—	—	8.6	9.0	0.2	0.15	1.7	2.23
F 687	F 687 ZZ1	VV	DD	8.2	8.5	0.15	0.15	2.48	3.37
F 697	F 697 ZZ1	VV	DD	9.0	10.2	0.3	0.3	5.65	5.65
F 607	F 607 ZZ1	VV	DD	9.0	9.1	0.3	0.3	8.66	8.66
F 627	F 627 ZZ	VV	DD	9.0	10.5	0.3	0.3	14.2	14.2
MF 128	MF 128 ZZ1	—	—	9.2	9.0	0.15	0.1	0.82	1.15
MF 148	MF 148 ZZ	VV	DD	9.6	9.2	0.2	0.15	2.09	2.39
F 688 A	F 688 AZZ	VV	DD	9.6	10.2	0.2	0.2	3.54	4.47
F 698	F 698 ZZ	VV	DD	10.0	10.0	0.3	0.3	8.35	8.3
F 608	F 608 ZZ	VV	DD	10.0	10.5	0.3	0.3	13.4	13.5
F 689	F 689 ZZ1	VV	DD	10.6	11.5	0.2	0.2	3.97	4.91
F 699	F 699 ZZ1	VV	DD	11.0	12.0	0.3	0.3	9.51	9.51

Extra Small Ball Bearings · Miniature Ball Bearings

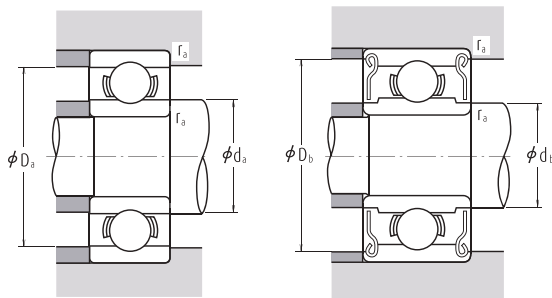
Inch Design
Bore Diameter 1.016 – 9.525 mm



Boundary Dimensions (mm)					Basic Load Ratings (N)		Limiting Speeds (min ⁻¹)		Bearing
d	D	B	B ₁	r min.	C _r	C _{0r}	Grease Open Z · ZZ	Oil Open Z	Open
1.016	3.175	1.191	—	0.1	80	23	130 000	150 000	R 09
1.191	3.967	1.588	2.380	0.1	138	35	110 000	130 000	R 0
1.397	4.762	1.984	2.779	0.1	231	66	90 000	110 000	R 1
1.984	6.350	2.380	3.571	0.1	310	108	67 000	80 000	R 1-4
2.380	4.762	1.588	—	0.1	188	60	80 000	95 000	R 133
	4.762	—	2.380	0.1	143	52	80 000	95 000	—
	7.938	2.779	3.571	0.15	550	175	60 000	71 000	R 1-5
3.175	6.350	2.380	2.779	0.1	283	95	67 000	80 000	R 144
	7.938	2.779	3.571	0.1	560	179	60 000	67 000	R 2-5
	9.525	2.779	3.571	0.15	640	225	53 000	63 000	R 2-6
	9.525	3.967	3.967	0.3	630	218	56 000	67 000	R 2
	12.700	4.366	4.366	0.3	640	225	53 000	63 000	R 2A
3.967	7.938	2.779	3.175	0.1	360	149	53 000	63 000	R 155
4.762	7.938	2.779	3.175	0.1	360	149	53 000	63 000	R 156
	9.525	3.175	3.175	0.1	710	270	50 000	60 000	R 166
	12.700	3.967	4.978	0.3	1 300	485	43 000	53 000	R 3
6.350	9.525	3.175	3.175	0.1	420	204	48 000	56 000	R 168B
	12.700	3.175	4.762	0.15	1 080	440	40 000	50 000	R 188
	15.875	4.978	4.978	0.3	1 610	660	38 000	45 000	R 4B
	19.050	5.558	7.142	0.4	2 620	1 060	36 000	43 000	R 4AA
7.938	12.700	3.967	3.967	0.15	540	276	40 000	48 000	R 1810
9.525	22.225	5.558	7.142	0.4	3 350	1 410	32 000	38 000	R 6

Radial and axial load factors

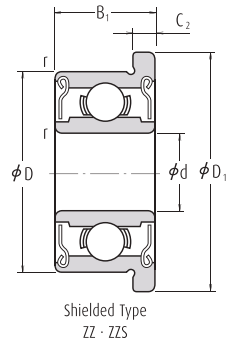
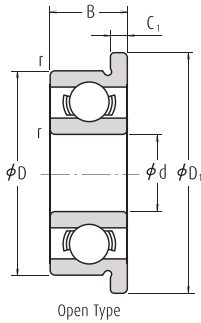
C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Numbers	Abutment and Fillet Dimensions (mm)					Mass (g)	
	d_a min.	d_b max.	D_a max.	D_b min.	r_a max.	Open	Shielded
—	1.9	—	2.3	—	0.1	0.04	—
R 0 ZZ	2.0	1.9	3.1	3.5	0.1	0.09	0.11
R 1 ZZ	2.2	2.3	3.9	4.1	0.1	0.15	0.19
R 1-4 ZZ	2.8	3.9	5.5	5.9	0.1	0.35	0.50
—	3.2	—	3.9	—	0.1	0.10	—
R 133 ZLS	—	3.0	—	4.2	0.1	—	0.13
R 1-5 ZZ	3.6	4.1	6.7	7.0	0.15	0.60	0.72
R 144 ZZ	4.0	3.9	5.5	5.9	0.1	0.25	0.27
R 2-5 ZZ	4.0	4.3	7.1	7.3	0.1	0.55	0.72
R 2-6 ZLS	4.4	4.6	8.3	8.2	0.15	0.96	1.13
R 2 ZZ	5.2	4.8	7.5	8.0	0.3	1.36	1.39
R 2A ZZ	5.2	4.6	10.7	8.2	0.3	3.3	3.23
R 155 ZLS	4.8	5.5	7.1	7.3	0.1	0.51	0.56
R 156 ZLS	5.6	5.5	7.1	7.3	0.1	0.39	0.42
R 166 ZZ	5.6	5.9	8.7	8.8	0.1	0.81	0.85
R 3 ZZ	6.8	6.5	10.7	11.2	0.3	2.21	2.79
R 168 BZZ	7.2	7.0	8.7	8.9	0.1	0.58	0.62
R 188 ZZ	7.6	7.4	11.5	11.6	0.15	1.53	2.21
R 4B ZZ	8.4	8.4	13.8	13.8	0.3	4.5	4.43
R 4AA ZZ	9.4	9.0	16.0	16.6	0.4	7.48	9.17
R 1810 ZZ	9.2	9.0	11.5	11.6	0.15	1.56	1.48
R 6 ZZ	12.6	11.9	19.2	20.0	0.4	9.02	11

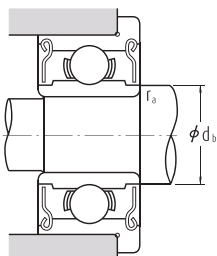
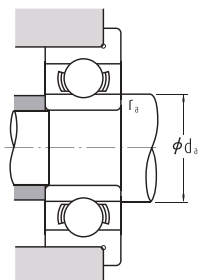
Extra Small Ball Bearings · Miniature Ball Bearings

Inch Design With Flange Bore Diameter 1.191 – 9.525 mm



Boundary Dimensions (mm)								Basic Load Ratings (N)	
d	D	D ₁	B	B ₁	C ₁	C ₂	r min.	C _r	C _{0r}
1.191	3.967	5.156	1.588	2.380	0.330	0.790	0.1	138	35
1.397	4.762	5.944	1.984	2.779	0.580	0.790	0.1	231	66
1.984	6.350	7.518	2.380	3.571	0.580	0.790	0.1	310	108
2.380	4.762	5.944	1.588	—	0.460	—	0.1	188	60
3.175	4.762	5.944	—	2.380	—	0.790	0.1	143	52
	7.938	9.119	2.779	3.571	0.580	0.790	0.15	550	175
	6.350	7.518	2.380	2.779	0.580	0.790	0.1	283	95
3.967	7.938	9.119	2.779	3.571	0.580	0.790	0.1	560	179
	9.525	10.719	2.779	3.571	0.580	0.790	0.15	640	225
	9.525	11.176	3.967	3.967	0.760	0.760	0.3	630	218
4.762	7.938	9.119	2.779	3.175	0.580	0.910	0.1	360	149
	7.938	9.119	2.779	3.175	0.580	0.910	0.1	360	149
	9.525	10.719	3.175	3.175	0.580	0.790	0.1	710	270
6.350	12.700	14.351	4.978	4.978	1.070	1.070	0.3	1 300	485
	9.525	10.719	3.175	3.175	0.580	0.910	0.1	420	204
	12.700	13.894	3.175	4.762	0.580	1.140	0.15	1 080	440
7.938	15.875	17.526	4.978	4.978	1.070	1.070	0.3	1 610	660
	12.700	13.894	3.967	3.967	0.790	0.790	0.15	540	276
9.525	22.225	24.613	7.142	7.142	1.570	1.570	0.4	3 350	1 410

Radial and axial load factors



C_{or}/F_a	$F_a/F_r \leq e$		$F_a/F_r > e$		e
	X	Y	X	Y	
5	1	0	0.56	1.26	0.35
10	1	0	0.56	1.49	0.29
15	1	0	0.56	1.64	0.27
20	1	0	0.56	1.76	0.25
25	1	0	0.56	1.85	0.24
30	1	0	0.56	1.92	0.23
50	1	0	0.56	2.13	0.20



Limiting Speeds (min ⁻¹)		Bearing Numbers		Abutment and Fillet Dimensions (mm)			Mass (g)	
Grease	Oil	Open	Shielded	d_a min.	d_b max.	r_a max.	Open	Shielded
Open Z · ZZ	Open Z							
110 000	130 000	FR 0	FR 0 ZZ	2.0	1.9	0.1	0.11	0.16
90 000	110 000	FR 1	FR 1 ZZ	2.2	2.3	0.1	0.20	0.25
67 000	80 000	FR 1-4	FR 1-4 ZZ	2.8	3.9	0.1	0.41	0.58
80 000	95 000	FR 133	—	3.2	—	0.1	0.13	—
80 000	95 000	—	FR 133 ZZS	—	3.0	0.1	—	0.19
60 000	71 000	FR 1-5	FR 1-5 ZZ	3.6	4.1	0.15	0.68	0.82
67 000	80 000	FR 144	FR 144 ZZ	4.0	3.9	0.1	0.31	0.35
60 000	67 000	FR 2-5	FR 2-5 ZZ	4.0	4.3	0.1	0.62	0.81
53 000	63 000	FR 2-6	FR 2-6 ZZS	4.4	4.6	0.15	1.04	1.25
56 000	67 000	FR 2	FR 2 ZZ	5.2	4.8	0.3	1.51	1.55
53 000	63 000	FR 155	FR 155 ZZS	4.8	5.5	0.1	0.59	0.67
53 000	63 000	FR 156	FR 156 ZZS	5.6	5.5	0.1	0.47	0.53
50 000	60 000	FR 166	FR 166 ZZ	5.6	5.9	0.1	0.90	0.98
43 000	53 000	FR 3	FR 3 ZZ	6.8	6.5	0.3	2.97	3.09
48 000	56 000	FR 168B	FR 168 BZZ	7.2	7.0	0.1	0.66	0.75
40 000	50 000	FR 188	FR 188 ZZ	7.6	7.4	0.15	1.64	2.49
38 000	45 000	FR 4B	FR 4B ZZ	8.4	8.4	0.3	4.78	4.78
40 000	48 000	FR 1810	FR 1810 ZZ	9.2	9.0	0.15	1.71	1.63
32 000	38 000	FR 6	FR 6 ZZ	12.6	11.9	0.4	10.1	12.1