

Deep groove ball bearings Generation C

60..-C, 62..-C, 63..-C

Technical Product Information

We pioneer motion

SCHAEFFLER

Contents

1 Bearing design 5
1.1 Standard bearings 5
1.2 Deep groove ball bearings, Generation C 5
2 Load capacity 8
2.1 Radial load carrying capacity 8
2.2 Axial load carrying capacity 8
3 Compensation of angular misalignments 9
4 Lubrication 10
5 Sealing 11
5.1 Overview 11
5.2 Non-contact seals or sealing shields 12
5.3 Contact seals 12
6 Friction 13
7 Speeds 14
7.1 Speed ratings in product tables 14
7.2 Limiting speeds 14
7.3 Reference speeds 14
8 Noise 15
8.1 Noise RMS value 15
9 Temperature range 16
9.1 Suitability for high temperatures 16
10 Cages 17
11 Internal clearance 18
11.1 Radial internal clearance 18
12 Dimensions, tolerances 19
12.1 Dimension standards 19
12.2 Chamfer dimensions 19
12.3 Tolerances for standard bearings 19
12.4 Tolerances for Generation C bearings 19
13 Suffixes 20
14 Structure of ordering designation 21
15 Dimensioning 22
16 Minimum load 24
17 Design of the bearing arrangement 25
17.1 Radial location of bearings 25
17.2 Axial location of bearings 25

17.3 Noise reduction 25
17.4 Dimensional accuracy, geometric accuracy and running accuracy for cylindrical bearing seats 26
17.5 Roughness of cylindrical bearing seating surfaces 28
17.6 Mounting dimensions for the contact surfaces of bearing rings 29

18 Mounting and dismounting 30

19 Further information 31
19.1 Technical Principles 31
19.2 Product range 31

20 Product tables 32
20.1 Explanations of the product tables 32
20.2 Deep groove ball bearings 34
20.3 Deep groove ball bearings 40

1 Bearing design

Single row deep groove ball bearings are available in the following designs:

- Standard bearings
- Generation C bearings

Single row deep groove ball bearings are also available in many other designs and sizes, as well as for specific applications, by agreement.

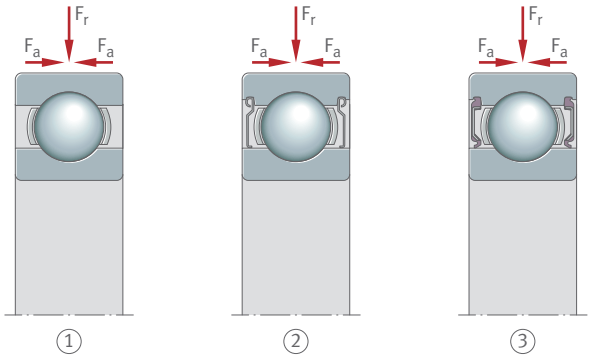
In this description, deep groove ball bearings are also referred to as 'products' or 'bearings'.

1.1 Standard bearings

Single row deep groove ball bearings are self-retaining units, which are part of the product group of radial ball bearings. The solid outer and inner rings have deep raceway grooves, with shoulders which are not generally interrupted by filling slots. Standard cages consist of sheet steel cages or solid polyamide PA66 cages. The bearings are open or sealed. Open bearings may have machining grooves on the outer and inner rings to accommodate sealing washers or sealing shields.

Single row deep groove ball bearings are particularly versatile, robust in operation, easy to maintain, and very economical. Due to their significant advantages, they are the most widely used rolling bearings worldwide. As a result, Schaeffler also manufactures these bearings in a large number of sizes and designs.

1 Single row deep groove ball bearings, open or sealed



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F_r	radial load	F_a	axial load
1	open	2	non-contact sealing shields on both sides
3	contact seal on both sides		

1.2 Deep groove ball bearings, Generation C

The products are similar in design to single row standard bearings, but have been specifically optimised in the following respects:

- low-noise running
- effective sealing
- low frictional torque

Schaeffler has analysed the causes of noise generation in its products using modern methods. Based on these findings, the following characteristics have been optimised:

- surface of the raceways
- ball quality
- osculation
- manufacturing tolerances
- riveted steel cage

The result is a reduction in noise compared with comparable standard bearings.

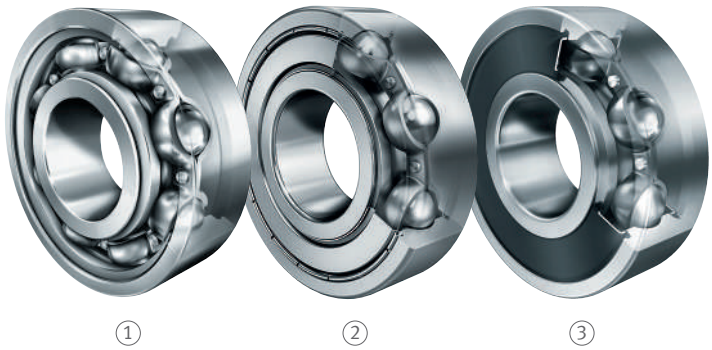
The quality of the seal, together with the rating life, has a considerable influence on the efficiency of a rolling bearing. The seal must reliably protect the bearing system from dirt, moisture ingress and grease loss. At the same time, however, the seal must also ensure that, despite its high sealing effectiveness, the total frictional torque and heat generation within the bearing remain low. With its new sealing shields and non-contact and contact seals (Z, BRS, HRS), Schaeffler has successfully mastered this challenging technical feat.

Electric motors, electrical machinery, washing machines, fans and electric tools are the preferred application areas for single row deep groove ball bearings. However, in order to facilitate further increases in the efficiency of these motors, machines and tools, the power loss occurring in the bearing arrangements must be reduced. The above-mentioned measures for reducing noise also resulted, for example, in a reduction in friction of approx. 35 %. For the designer, this results in the following application-specific benefits:

- lower heat generation
- longer grease operating life
- higher possible speeds
- longer bearing operating life
- reduced energy consumption
- lower energy costs
- lower overall cost of the bearing arrangement

Bearing assemblies using Generation C bearings offer technical advantages and are significantly more cost-effective than those using standard single row bearings. Generation C is available in series 60, 62 and 63.

2 Single row deep groove ball bearings, Generation C, open or with non-contact seals



1	open	2	sealing shields on both sides (2Z)
3	non-contact seal on both sides (2BRS)		

3 Single row deep groove ball bearings, Generation C, contact seals



1	contact seal on both sides (2HRS)	

See also

Sealing [▷ 11]

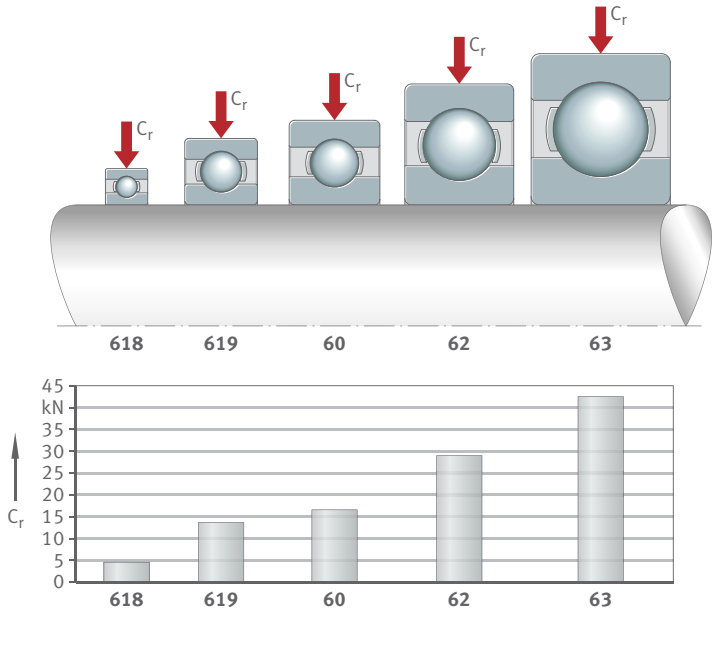
2 Load capacity

2.1 Radial load carrying capacity

The balls are in contact with the raceways at 1 point only. Under purely radial load, the contact points between the rolling elements and raceways lie at the centre of the raceway. As a result, the connection between the contact points passes through the radial plane, i.e. the optimum load direction is a purely radial load.

The load carrying capacity is dependent on the bearing series. Consequently, products in the 618 and 619 series, with their smaller bearing cross-sections, are not capable of withstanding as high a load as the 60, 62 and 63 series – which are dimensionally identical in terms of bore diameter d – with their larger bearing cross-sections.

4 Cross-sectional comparison and load-bearing capacity comparison



C_r	basic dynamic load rating	d	bore diameter d = 40 mm

2.2 Axial load carrying capacity

Due to the deep raceway grooves in the bearing rings and the narrow osculation between the raceway grooves and the balls, the bearings can support axial loads in both directions. The axial load carrying capacity is dependent, for example, on the bearing size, the internal construction and the operating clearance. If the axial load is too high, however, this can increase the running noise and considerably reduce the operating life of the bearings.

If there is any uncertainty regarding the axial load carrying capacity of the bearings, please consult Schaeffler.

3 Compensation of angular misalignments

Single row deep groove ball bearings

Single row deep groove ball bearings are only suitable to a very limited extent for compensating static angular misalignments. As a result, the bearing positions must be well aligned. Misalignments shorten the operating life, as they place an additional strain on the bearing. To keep these stresses low, only small adjustment angles are permitted, depending on the load.

If misalignment cannot be prevented by design measures, please consult Schaeffler.

4 Lubrication

Single row deep groove ball bearings

Bearings sealed on both sides are greased using a lithium soap grease with a mineral oil base. The grease has good anti-corrosion properties. The grease filling is sufficient for the entire operating life of the bearing. These bearings are generally maintenance-free.

Do not wash out greased bearings prior to mounting.

If mounting is carried out using thermal tools, the bearings should not be heated to a temperature in excess of +80 °C to protect the grease filling and the seal material.

If higher heating temperatures are required, the maximum permissible temperatures for the grease and the seal material must not be exceeded.

Schaeffler recommends induction heating units for this purpose.

Oil lubrication or grease lubrication

Open bearings and bearings with seals on one side are not greased as standard. They must be lubricated with oil or grease before use. Lubrication is carried out via the end faces of the bearings.

Compatibility with plastic cages

For bearings with plastic cages, ensure that the lubricant is compatible with the cage material. This applies when using synthetic oils, synthetic oil-based greases, and lubricants with a high proportion of EP additives.

Oil change intervals

Aged oil and additives in the oil can impair the operating life of plastics at high temperatures. As a result, the stipulated oil change intervals must be strictly observed.

See also

Mounting and dismounting [▷ 30]

5 Sealing

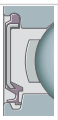
5.1 Overview

The products are available in open versions, as well as with seals on one or both sides. In the case of sealed bearings, either non-contact or contact seals are used.

In the case of unsealed bearings, the surrounding structure must seal the bearing location. The seal must meet the following requirements:

- keep moisture and contaminants away from the bearing
- retain the lubricant within the bearing

1 Seal variants for Generation C

Suffix	Type of seal		low-friction running	high speeds	Sealing against		
					water ingress	dust ingress	loss of grease
–		open (without sealing)	++++	++++	–	–	–
Z, 2Z		non-contact (sheet metal)	+++	++++	o	++	++
BRS, 2BRS		non-contact (elastomer)	+++	++++	o	+++	+++
HRS, 2HRS		contact (elastomer)	++	++	++++	++++	++++

++++ excellent
+++ very good
++ good
o satisfactory
– poor

2 Seal options for standard bearings

Suffix	Type of seal		low-friction running	high speeds	Sealing against		
					water ingress	dust ingress	loss of grease
–		open (without sealing)	+++	++++	–	–	–
Z, 2Z		non-contact (sheet metal)	++	++++	o	o	o
RSR, 2RSR		contact (elastomer)	o	++	++	+++	+++

++++ excellent
+++ very good
++ good

o satisfactory
– poor

5.2 Non-contact seals or sealing shields

Non-contact seals are particularly suitable for applications with high speeds and high requirements for low heat generation. Non-contact seals are friction-free, apart from a small amount of lubricant friction in the sealing gap. Non-contact seals do not wear out and have an unlimited service life. Products with single-sided or double-sided non-contact seals are designated with the suffixes BRS or 2BRS. The suffixes Z and 2Z denote single-sided or double-sided seals with sealing shields.

Z sealing shields are made from sheet steel. Sealing shields sit securely in the outer ring and form a narrow, non-contact seal gap relative to the surface of the inner ring. This sealing arrangement is particularly suitable for applications with a rotating inner ring, high to very high speeds, and low contamination impact.

BRS seals are rubberised sealing washers with a sheet steel reinforcement. The seals sit securely in the outer ring and form a narrow, non-contact seal gap relative to the surface of the inner ring. A groove in the inner ring forms a grease-filled labyrinth together with the sealing lip. The friction behaviour of the seal is comparable to that of sealing shield Z. It offers greater protection against dust ingress and lubricant leakage.

5.3 Contact seals

The seals are in contact with their sliding surface at a defined contact pressure. This gives the seals excellent sealing performance against lubricant leakage and the ingress of moisture and dust.

Take into account the energy loss due to friction at the sealing contact. For bearings with contact seals, the permissible sliding speed at the seal lip limits the bearing's rotational speed. The speed rating of these bearings is lower than that of open bearings or bearings with non-contact seals.

RSR seals are elastomer lip seals with a sheet steel reinforcement. One seal lip is in radial contact with the inner ring.

HRS seals are firmly anchored in a recess in the outer ring. The sealing material is vulcanised onto a sheet steel reinforcement. The sealing washer, together with the inner ring, forms an axial sealing system. In addition, the outer non-contact lip forms a protective labyrinth with the inner ring. The grease layer between the two sealing lips enhances the sealing effect. This seal design allows for higher speeds than with conventional RSR seals. The frictional torque and heat generation in the bearing are lower.

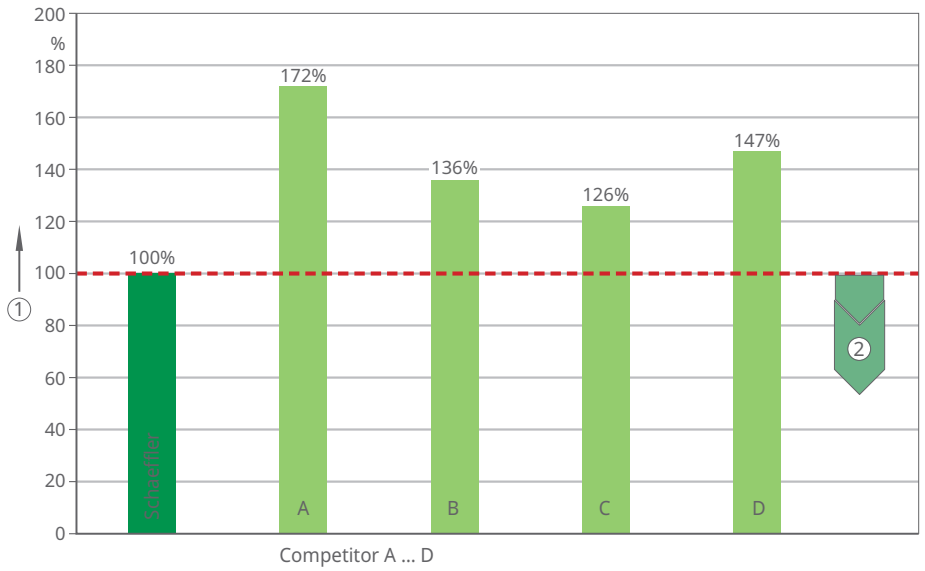
Generation C bearings with contact seals are supplied with HRS seals as standard.

6 Friction

The friction of a rolling bearing is an important criterion and affects its efficiency. Compared with competitors' products, the 6202-C-2Z-C3 bearing, with a sheet steel cage, non-contacting seal shields on both sides and a C3 clearance, has up to 40 % less friction.

A further reduction in friction of up to 25 % is possible by using a plastic cage (TVH).

5 Friction compared to competitors, 6202



1	Friction	2	the less friction, the better

7 Speeds

7.1 Speed ratings in product tables

The product tables generally give two speeds for the bearings:

- limiting speed n_G
- thermal reference speed $n_{\vartheta r}$

7.2 Limiting speeds

The limiting speed n_G is the kinematically permissible speed of the bearing. Even under favourable installation and operating conditions, the maximum speed n_G must not be exceeded without first consulting Schaeffler.

The values given in the product tables are valid for oil lubrication in the case of bearings without seals or shields and for grease lubrication where bearings are supplied greased and with seals or shields.

When using grease lubrication for unsealed bearings or bearings with a cap on one side, 85 % of the value specified in the product tables is permissible in each case.

7.3 Reference speeds

The thermal reference speed $n_{\vartheta r}$ is not an application-specific speed limit, but is a calculated ancillary value for determining the thermally safe operating speed n_ϑ.

No reference speeds are defined in DIN ISO 15312:2004 for bearings with contact seals. As a result, only the limiting speed n_G is given in the product tables.

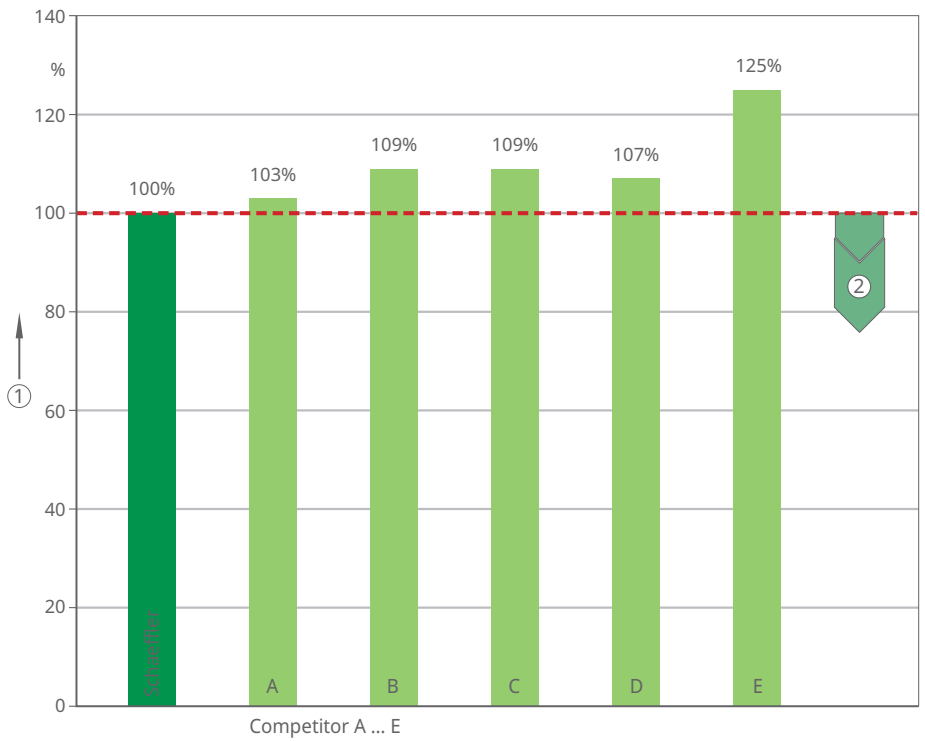
8 Noise

8.1 Noise RMS value

The noise RMS value describes the energy-effective average amplitude of a signal in the frequency range from 50 Hz to 100000 Hz and is based on ISO 15242-2.

Compared with competitor products, series 6202 has an up to 20 % lower noise RMS value.

6 Noise behaviour compared with competitor products



1	Noise RMS value	2	The lower, the better

9 Temperature range

The following factors limit the operating temperature:

- dimensional stabilisation of the bearing rings and rolling elements
- cage
- lubricant
- seal

If temperatures fall outside the specified range, please contact Schaeffler.

3 Permissible operating temperature, open bearings

Version		Value	
		°C	
		>	<
Sheet steel cage [1]	D ≤ 90 mm	–30	+120
	90 mm < D ≤ 240 mm	–30	+150
	D > 240 mm	–30	+200
Polyamide cagePA66		–30	+120

[1] by agreement, dimensionally stabilised for higher temperatures.

4 Permissible operating temperature, sealed bearings

Version	Value for standard greasing	
	°C	
	>	<
NBR seal	–20	+100
	limited by the lubricant and the seal material	
2Z seal	–20	+120
	limited by the lubricant	

9.1 Suitability for high temperatures

To ensure that the bearings operate reliably throughout their service life, all operating requirements – particularly elevated temperatures – must be taken into account.

For rolling bearings with lifetime lubrication, the service life of the grease is of particular importance. The grease operating life describes the period over which the grease is capable, without relubrication, of lubricating the bearing to an adequate extent. In cases where relubrication is not possible, this becomes the decisive factor in the actual service life of the bearings.

Generation C deep groove ball bearings are suitable for use without relubrication; they are fitted with standard, non-contact 2Z seal shields for reliable sealing, have a radial clearance of C3, and a special grease filling L069 or L207 with optimum temperature suitability. Ordering example: 6305-C-2Z-L069-C3

10 Cages

Cages for Generation C bearings

In Generation C bearings, a noise-optimised, riveted sheet steel cage is used as the standard cage. This cage design does not have a suffix in the bearing designation.

By agreement, the bearings are also available as follows:

- Cage made from glass fibre reinforced polyamide

11 Internal clearance

11.1 Radial internal clearance

The basic version of the deep groove ball bearings are manufactured as standard with radial internal clearance CN (normal). CN is not stated in the designation.

Certain sizes are also available by agreement with the smaller internal clearance C2 and with the larger internal clearances C3 and C4.

Bearings with a bore diameter of 10 ≤ d ≤ 50 are available with the tighter tolerance clearance CM. Bearings with this clearance are particularly suitable for use in electric motors.

The values for radial internal clearance correspond to DIN 620-4:2004 (ISO 5753-1:2009). The values are valid for bearings which are free from load and measurement forces, i.e. without elastic deformation.

5 Radial internal clearance

d		C2 (Group 2)		CN (Group N)		C3 (Group 3)		C4 (Group 4)	
mm		µm		µm		µm		µm	
>	≤	min.	max.	min.	max.	min.	max.	min.	max.
1,5	6	0	7	2	13	8	23	–	–
6	10	0	7	2	13	8	23	14	29
10	18	0	9	3	18	11	25	18	33
18	24	0	10	5	20	13	28	20	36
24	30	1	11	5	20	13	28	23	41
30	40	1	11	6	20	15	33	28	46
40	50	1	11	6	23	18	36	30	51
50	65	1	15	8	28	23	43	38	61

d mm Nominal bore diameter

6 Radial internal clearance

d		CM	
mm		µm	
>	≤	min.	Max.
10	18	4	11
18	24	5	12
24	30	5	12
30	40	9	17
40	50	9	17

d mm Nominal bore diameter

12 Dimensions, tolerances

12.1 Dimension standards

The main dimensions of single row bearings correspond to DIN 625-1:2011. Nominal dimensions of the bearings in the product tables (➤32|20).

12.2 Chamfer dimensions

The limiting dimensions for chamfer dimensions correspond to DIN 620-6:2004. Product tables show the nominal dimension of the edge-to-edge distance.

See also

Product tables [▷ 32]

12.3 Tolerances for standard bearings

Tolerances for dimensional accuracy and running accuracy of standard bearings correspond to tolerance class Normal in accordance with ISO 492:2023. Bearings with a higher accuracy are available by agreement. Tolerance values in accordance with ISO 492:2023.

See also

Technical Principles [▷ 31]

12.4 Tolerances for Generation C bearings

The dimensional and geometrical tolerances correspond to tolerance class6 in accordance with ISO 492:2023. Bearings with a higher accuracy are available by agreement. Tolerance values in accordance with ISO 492:2023.

13 Suffixes

Suffixes describe the design and features of a bearing in more detail.

Further special designs are available by agreement.

7 Suffix, single row deep groove ball bearings

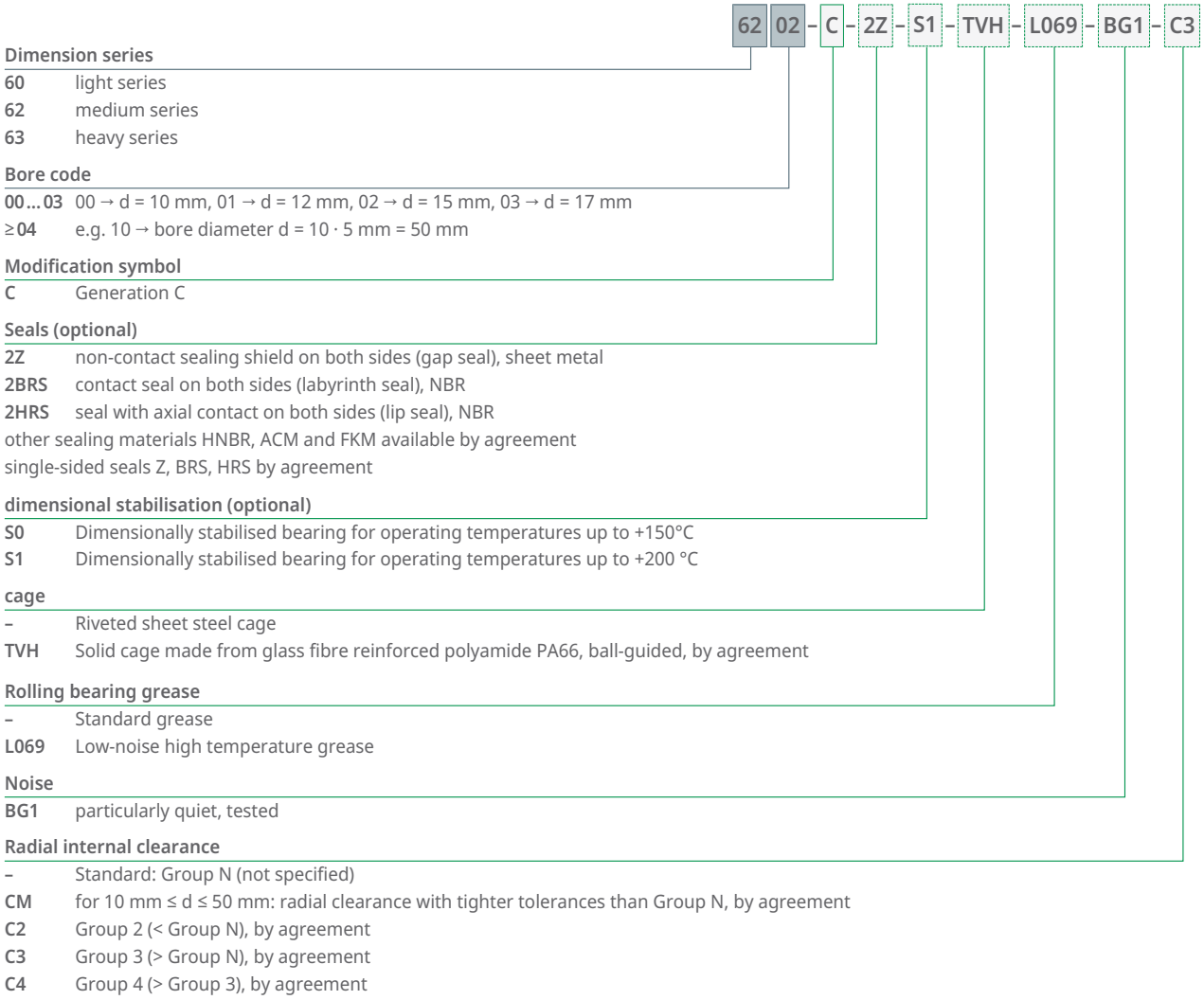
Suffix	Meaning	
C	Deep groove ball bearing, Generation C	Standard
TVH	Solid cage made from glass fibre reinforced polyamide PA66	by agreement
C2	Radial internal clearance C2 (smaller than normal)	by agreement
C3	Radial internal clearance C3 (larger than normal)	
C4	Radial internal clearance C4 (larger than C3)	
CM	Radial internal clearance with narrower tolerance than normal	
2BRS	non-contact seal on both sides (labyrinth seal)	standard for Generation C
BRS	non-contact seal on one side (labyrinth seal)	by agreement
2HRS	contact seal on both sides (lip seal)	standard for Generation C
HRS	contact seal on one side (lip seal)	by agreement
2RSR	contact seal on both sides (lip seal)	standard
RSR	contact seal on one side (lip seal)	by agreement
2Z	non-contact sealing shield on both sides (gap seal made from sheet metal)	standard
Z	non-contact seal on one side (gap seal made from sheet metal)	by agreement
BG1	particularly quiet, tested	by agreement
S0	dimensionally stabilised bearing for operating temperatures up to +150 °C	by agreement
S1	dimensionally stabilised bearing for operating temperatures up to +200 °C	by agreement

14 Structure of ordering designation

medias interchange identifies equivalent Schaeffler bearing designations for the stock designations of other rolling bearing manufacturers: https://www.schaeffler.de/std/1B69.

DIN 623-1 applies to the designation of bearings.

7 Structure of order designation, Generation C



15 Dimensioning

Equivalent dynamic bearing load

The basic rating life equation $L = (C_r/P)^p$ used in the dimensioning of bearings under dynamic load assumes a load of constant magnitude and direction. In radial bearings, this is a purely radial load F_r. If such a load is present, the bearing load F_r is used in the rating life equation for P ($P = F_r$).

If a load of constant magnitude and direction is not present, a constant radial force must first be determined for the rating life calculation that, in relation to the rating life, represents an equivalent load. This force is known as the equivalent dynamic bearing load P.

The calculation of P is dependent on the load ratio F_a/F_r and the calculation factor e:

ƒ1 Equivalent dynamic load

$$\frac{F_a}{F_r} \leq e \quad \Rightarrow \quad P = F_r$$

ƒ2 Equivalent dynamic load

$$\frac{F_a}{F_r} > e \quad \Rightarrow \quad P = X \cdot F_r + Y \cdot F_a$$

e	–	Calculation factor: threshold value for F_a/F_r
F_a	N	Axial load
F_r	N	Radial load
P	N	Equivalent dynamic bearing load
X	–	Radial load factor
Y	–	Axial load factor

The specified values are valid for normal operating clearance. If the operating clearance deviates significantly, Schaeffler recommends calculating the service life using Bearinx. If the calculated values fall between the specified values (such as 0,4), refer to the table values for 0,3 and 0,5 and interpolate the intermediate values linearly.

For normal operating clearance, observe the fit recommendations in Catalogue HR 1, Rolling Bearings.

8 Factors e, X and Y

$\frac{f_0 \cdot F_a}{C_{0r}}$	Factor (for normal operating clearance)		
	e	X	Y
0,3	0,22	0,56	2
0,5	0,24	0,56	1,8
0,9	0,28	0,56	1,58
1,6	0,32	0,56	1,4
3	0,36	0,56	1,2
6	0,43	0,56	1

C_{0r}	N	Basic static load rating, radial
e	–	Calculation factor: threshold value for F_a/F_r
f_0	–	Calculation factor
F_a	N	Axial load
X	–	Radial load factor

Y	–	Axial load factor

Equivalent static bearing load

The calculation of P_0 for deep groove ball bearings under static load is dependent on the load ratio F_{0a}/F_{0r} and the factor 0,8:

ƒ3 Equivalent static load

$$\frac{F_{0a}}{F_{0r}} \leq 0,8 \quad \Rightarrow \quad P_0 = F_{0r}$$

ƒ4 Equivalent static load

$$\frac{F_{0a}}{F_{0r}} > 0,8 \quad \Rightarrow \quad P_0 = 0,6 \cdot F_{0r} + 0,5 \cdot F_{0a}$$

F_{0a}	N	Largest axial load present (maximum load)
F_{0r}	N	Largest radial load present (maximum load)
P_0	N	Equivalent static bearing load

Static load safety factor

In addition to the basic rating life L (L_{10h}), it is also always necessary to check the static load safety factor S_0:

ƒ5 Static load safety factor

$$S_0 = \frac{C_0}{P_0}$$

C_0	N	Basic static load rating
P_0	N	Equivalent static bearing load
S_0	–	Static load safety factor

16 Minimum load

To prevent slippage between the contact faces, the bearings must be constantly subjected to a sufficiently high load. Based on experience, this calls for a minimum radial load of the order of $P > C_{0r}/100$. In most cases, however, the radial load is already higher than the requisite minimum load due to the weight of the supported parts and the external forces.

If the minimum load is lower than specified above, please consult Schaeffler.

17 Design of the bearing arrangement

In order to allow full utilisation of the load carrying capacity of the bearings and thus also achieve the requisite rating life, the bearing rings must be rigidly and uniformly supported by means of contact surfaces over their entire circumference and over the entire width of the raceway. The seating and contact surfaces should not be interrupted by grooves, holes or other recesses. The accuracy of mating parts must meet specific requirements.

17.1 Radial location of bearings

In addition to supporting the rings adequately, the bearings must also be securely located in a radial direction, to prevent creep of the bearing rings on the mating parts under load. This is generally achieved by means of tight fits between the bearing rings and the mating parts. If the rings are secured inadequately or incorrectly, this can cause severe damage to the bearings and adjacent machine parts. Influencing factors, such as the conditions of rotation, magnitude of the load, internal clearance, temperature conditions, design of the mating parts and the mounting and dismounting options must be taken into consideration in the selection of fits.

If shock type loads occur, tight fits in the form of transition fits or interference fits are required to prevent the rings from coming loose at any point.

The following information provided in the Technical Principles must be taken into consideration in the design of bearing arrangements:

- Criteria for selection of fits
- Conditions of rotation
- Tolerance classes for cylindrical shaft seats
- Shaft fits
- Tolerance classes for bearing seats in housings
- Housing fits

See also

Further information [▷ 31]

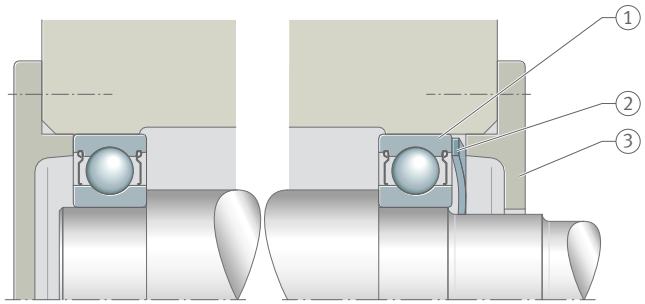
17.2 Axial location of bearings

A tight fit is usually not sufficient to securely fix the bearing rings onto the shaft and in the housing bore in the axial direction as well. Therefore, an additional axial fastening or locking mechanism must generally be used. The axial location of the bearing rings must be matched to the type of bearing arrangement. Suitable options generally include shaft shoulders and housing shoulders, housing covers, nuts, spacer rings and retaining rings.

17.3 Noise reduction

If the bearing arrangement is to run particularly quietly, this can be achieved economically with commonly available spring elements. The bearings in the figure only have to absorb guidance forces in an axial direction. The inner rings have a tight fit on the shaft and are abutted on the shaft shoulders. The outer rings are mounted with a sliding seat. A spring washer is fitted between the outer ring of the right-hand bearing and the cover collar. The tensioned spring adjusts the bearing axially, ensuring that the bearing runs particularly smoothly.

8 Bearing with axially adjusted spring washer



1	Deep groove ball bearings	2	Spring washer
3	Cover		

17.4 Dimensional accuracy, geometric accuracy and running accuracy for cylindrical bearing seats

The accuracy of the cylindrical bearing seat on the shaft and housing should correspond to the accuracy of the bearing used. For cylindrical roller bearings to tolerance class Normal, the shaft seat should correspond to a minimum of the standard tolerance grade IT6 and in the housing seat to a minimum of IT7; in the case of tolerance class 6, the shaft seat should correspond to a minimum of IT5 and the housing seat to a minimum of IT6. Refer to the tables for guide values for the form and position tolerances of the bearing seat surfaces, as well as the corresponding numerical values for IT grades.

For the assignment of tolerances t_1 to t_3, see 'Technical Principles, Bearing Design' ➤28|9.

9 Guide values for the geometrical and positional tolerances of bearing seating surfaces

Bearing tolerance class		Bearing seating surface	Load case	Fundamental tolerance grades to ISO 286-1 (IT grades)			
ISO 492	DIN 620			Diameter tolerance	t_1	t_2	t_3
Normal	PN (P0)	Shaft	Circumferential load	IT6 (IT5)	IT4/2	IT4/2	IT4
			Point load		IT5/2	IT5/2	IT4
		Housing	Circumferential load	IT7 (IT6)	IT5/2	IT5/2	IT5
			Point load		IT6/2	IT6/2	IT5
6	P6	Shaft	Circumferential load	IT5	IT3/2	IT3/2	IT3
			Point load		IT4/2	IT4/2	
		Housing	Circumferential load	IT6	IT4/2	IT4/2	IT4
			Point load		IT5/2	IT5/2	

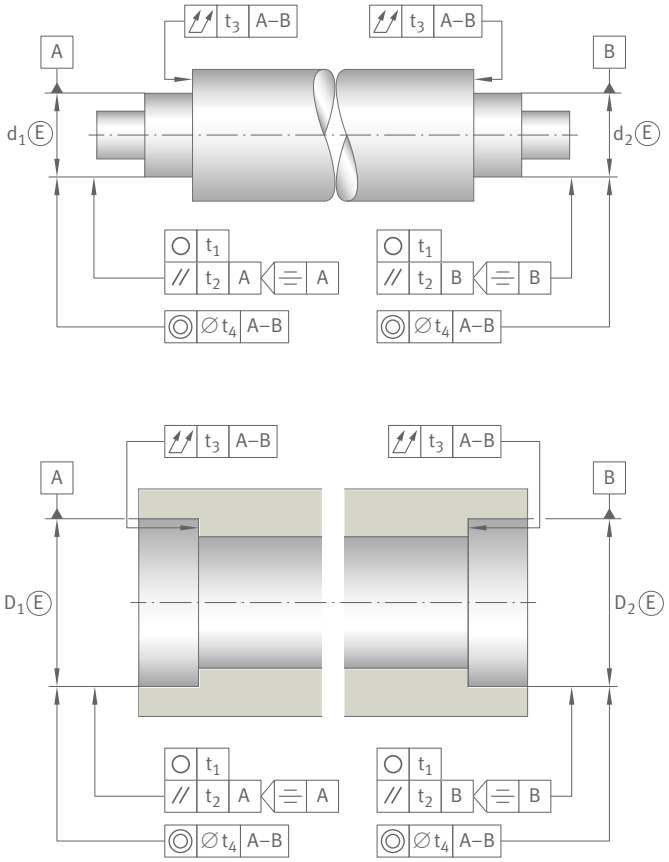
t_1	µm	Roundness tolerance to ISO 286-1
t_2	µm	Parallelism tolerance to ISO 286-1
t_3	µm	Total axial run-out tolerance of abutment shoulder to ISO 286-1

10 Values for the basic tolerance grades (IT grades) according to ISO 286-1:2010

Nominal size		Basic tolerances, values				
mm		µm				
>	≤	IT grade				
		IT3	IT4	IT5	IT6	IT7
–	3	2	3	4	6	10
3	6	2,5	4	5	8	12
6	10	2,5	4	6	9	15
10	18	3	5	8	11	18
18	30	4	6	9	13	21
30	50	4	7	11	16	25
50	80	5	8	13	19	30
80	120	6	10	15	22	35
120	180	8	12	18	25	40
180	250	10	14	20	29	46
250	315	12	16	23	32	52
315	400	13	18	25	36	57
400	500	15	20	27	40	63
500	630	16	22	32	44	70
630	800	18	25	36	50	80
800	1000	21	28	40	56	90

17.4.1 Bearing seating surfaces

9 Guide values for the geometrical and positional tolerances of bearing seating surfaces



00017AEF

d_1, d_2	Nominal diameters of bearing seats on the shaft	D_1, D_2	Nominal diameter of bearing seats in the housing
t_1	Roundness tolerance	t_2	Parallelism tolerance
t_3	Total axial runout tolerance of abutment shoulders	t_4	Coaxiality tolerance

The positional tolerances t_4 for a second bearing seat on the shaft (d_2) or in the housing (D_2) depend on the types of bearings used and the operating conditions. Please consult Schaeffler regarding the required values for the specific application.

17.5 Roughness of cylindrical bearing seating surfaces

The roughness of the bearing seats must be matched to the tolerance class of the bearings. The mean roughness value Ra must not be too high, in order to limit the loss of interference. The shafts must be ground, while the bores must be precision turned. Guide values as a function of the IT grade of bearing seating surfaces can be found in the table.

11 Mean roughness values for cylindrical bearing seating surfaces

Nominal diameter of bearing seat		Recommended mean roughness value for ground bearing seats			
d, D		Ramax			
mm		µm			
>	≤	Diameter tolerance (IT grade)			
		IT4	IT5	IT6	IT7
–	80	0,2	0,4	0,8	1,6
80	500	0,4	0,8	1,6	1,6
500	1250	0,8	1,6	1,6	3,2 [1)]

[1)] For the mounting of bearings using the hydraulic method, a value Ra = 1,6 µm must not be exceeded.

17.6 Mounting dimensions for the contact surfaces of bearing rings

The mounting dimensions of the shaft shoulders and housing shoulders, and spacer rings etc., must ensure that the contact surfaces for the bearing rings are of sufficient height. However, they must also reliably prevent rotating parts of the bearing from grazing stationary parts. Proven mounting dimensions for the radii and diameters of the abutment shoulders are indicated in the product tables. These dimensions are limiting dimensions (maximum or minimum dimensions). These limiting dimensions must be observed.

18 Mounting and dismounting

Deep groove ball bearings are not separable. In the mounting of non-separable bearings, the mounting forces must always be applied to the bearing ring with a tight fit.

The mounting and dismounting options for deep groove ball bearings by thermal, hydraulic or mechanical methods, must also be taken into consideration in the design of the bearing position.

Mounting Handbook

Rolling bearings are well-proven precision machine elements for the design of economical and reliable bearing arrangements, which offer high operational security. In order that these products can function correctly and achieve the envisaged operating life without detrimental effect, they must be handled with care.

Schaeffler assembly manual MH 1 provides extensive information about the correct storage, assembly, removal and maintenance of rotary roller bearings. The assembly manual also provides information for the designer relating to the assembly, removal and maintenance of bearings which is required for designing the bearing.

19 Further information

19.1 Technical Principles

Please note the technical principles relating to rolling bearings:

HR 1 | Rolling Bearings |
https://www.schaeffler.de/std/1D3D

19.2 Product range

The following sources show the rest of the product range:

HR 1 | Rolling Bearings |
https://www.schaeffler.de/std/1D3D

medias | Product Catalogue |
https://medias.schaeffler.com

TPI 64 | Corrosion-resistant products |
https://www.schaeffler.de/std/1F37

GL 1 | Large Size Bearings |
https://www.schaeffler.de/std/22AD

20 Product tables

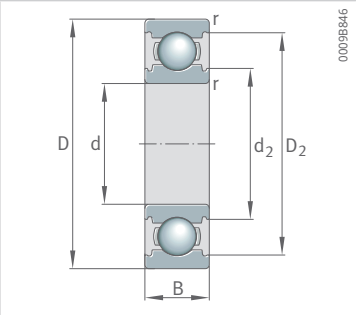
20.1 Explanations of the product tables

B	mm	Width
C_{0r}	N	Basic static load rating, radial
C_r	N	Basic dynamic load rating, radial
C_{ur}	N	Fatigue limit load, radial
d	mm	Bore diameter
D	mm	Outside diameter
d_1	mm	Shoulder diameter of inner ring
d_2	mm	Calibre diameter of inner ring
D_2	mm	Calibre diameter of outer ring
d_a	mm	Mounting dimension
D_a	mm	Mounting dimension
f_0	–	Calculation factor
m	kg	Mass
n_G	min^{-1}	Limiting speed
$n_{\vartheta r}$	min^{-1}	Thermal speed rating
r	mm	Chamfer dimension
r_a	mm	Undercut radius

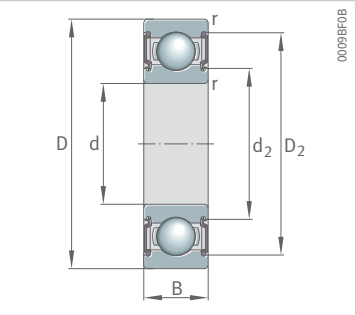
20.2 Deep groove ball bearings

Generation C

Single row

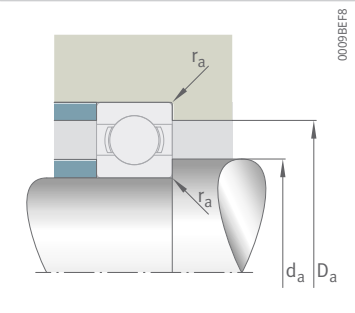


open



with seal 2BRS, 2HRS, 2Z

Designation	d	D	B	r	D_2 ≈	d_2 ≈
–	mm	mm	mm	mm	mm	mm
629-C	9	26	8	0,3	23,09	13,69
629-C-2BRS	9	26	8	0,3	23,09	13,69
629-C-2HRS	9	26	8	0,3	23,09	13,69
629-C-2Z	9	26	8	0,3	23,09	13,69
6000-C	10	26	8	0,3	23,09	13,69
6000-C-2BRS	10	26	8	0,3	23,09	13,69
6000-C-2HRS	10	26	8	0,3	23,09	13,69
6000-C-2Z	10	26	8	0,3	23,09	13,69
6200-C	10	30	9	0,6	25,64	15,14
6200-C-2BRS	10	30	9	0,6	25,64	15,14
6200-C-2HRS	10	30	9	0,6	25,64	15,14
6200-C-2Z	10	30	9	0,6	25,64	15,14
6300-C	10	35	11	0,6	29,41	16,53
6300-C-2HRS	10	35	11	0,6	29,41	16,53
6300-C-2Z	10	35	11	0,6	29,41	16,53
6001-C	12	28	8	0,3	25,1	15,69
6001-C-2BRS	12	28	8	0,3	25,1	15,69
6001-C-2HRS	12	28	8	0,3	25,1	15,69
6001-C-2Z	12	28	8	0,3	25,1	15,69
6201-C	12	32	10	0,6	27,92	17,34
6201-C-2BRS	12	32	10	0,6	27,92	17,34
6201-C-2HRS	12	32	10	0,6	27,92	17,34
6201-C-2Z	12	32	10	0,6	27,92	17,34
6301-C	12	37	12	1	32	17,97
6301-C-2BRS	12	37	12	1	32	17,97
6301-C-2HRS	12	37	12	1	32	17,97
6301-C-2Z	12	37	12	1	32	17,97
6002-C	15	32	9	0,3	28,75	19,18
6002-C-2BRS	15	32	9	0,3	28,75	19,18
6002-C-2HRS	15	32	9	0,3	28,75	19,18
6002-C-2Z	15	32	9	0,3	28,75	19,18
6202-C	15	35	11	0,6	30,92	20,08
6202-C-2BRS	15	35	11	0,6	30,92	20,08
6202-C-2HRS	15	35	11	0,6	30,92	20,08
6202-C-2Z	15	35	11	0,6	30,92	20,08
6302-C	15	42	13	1	36	21,97
6302-C-2BRS	15	42	13	1	36	21,97
6302-C-2HRS	15	42	13	1	36	21,97
6302-C-2Z	15	42	13	1	36	21,97
6203-C	17	40	12	0,6	34,84	22,97



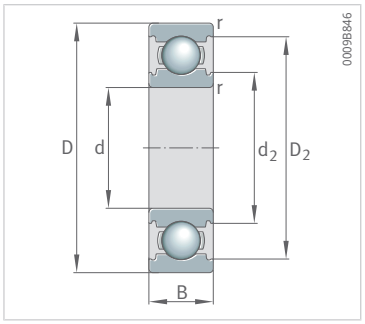
Mounting dimensions

d_a	D_a	r_a	C_r	C_{0r}	C_{ur}	n_G	$n_{\vartheta r}$	f_0	m ≈
mm	mm	mm	N	N	N	min^{-1}	min^{-1}	–	kg
11,4	23,6	0,3	5300	1970	136	44500	27000	12,4	0,018
11,4	23,6	0,3	5300	1970	136	38000	27000	12,4	0,019
11,4	23,6	0,3	5300	1970	136	28500	–	12,4	0,019
11,4	23,6	0,3	5300	1970	136	38000	27000	12,4	0,019
12	24	0,3	5300	1970	136	44500	30000	12,4	0,017
12	24	0,3	5300	1970	136	38000	30000	12,4	0,018
12	24	0,3	5300	1970	136	28500	–	12,4	0,018
12	24	0,3	5300	1970	136	38000	30000	12,4	0,018
14,2	25,8	0,6	7000	2600	181	40500	26000	12	0,028
14,2	25,8	0,6	7000	2600	181	34500	26000	12	0,03
14,2	25,8	0,6	7000	2600	181	26000	–	12	0,029
14,2	25,8	0,6	7000	2600	181	34500	26000	12	0,03
14,2	30,8	0,6	9600	3450	237	34500	23100	11,3	0,05
14,2	30,8	0,6	9600	3450	237	23600	–	11,3	0,052
14,2	30,8	0,6	9600	3450	237	29000	23100	11,3	0,052
14	26	0,3	5900	2370	164	42500	26000	13,1	0,021
14	26	0,3	5900	2370	164	36000	26000	13,1	0,02
14	26	0,3	5900	2370	164	24900	–	13,1	0,02
14	26	0,3	5900	2370	164	36000	26000	13,1	0,021
16,2	27,8	0,6	8000	3100	213	37000	24600	12,3	0,033
16,2	27,8	0,6	8000	3100	213	31500	24600	12,3	0,036
16,2	27,8	0,6	8000	3100	213	22500	–	12,3	0,036
16,2	27,8	0,6	8000	3100	213	31500	24600	12,3	0,036
17,6	31,4	1	11500	4200	290	31000	21900	11,1	0,055
17,6	31,4	1	11500	4200	290	26500	21900	11,1	0,06
17,6	31,4	1	11500	4200	290	21700	–	11,1	0,058
17,6	31,4	1	11500	4200	290	26500	21900	11,1	0,059
17	30	0,3	6300	2850	191	37000	23200	14	0,027
17	30	0,3	6300	2850	191	31500	23200	14	0,029
17	30	0,3	6300	2850	191	20300	–	14	0,029
17	30	0,3	6300	2850	191	31500	23200	14	0,029
19,2	30,8	0,6	8900	3750	260	33000	21900	13	0,041
19,2	30,8	0,6	8900	3750	260	28000	21900	13	0,044
19,2	30,8	0,6	8900	3750	260	19400	–	13	0,044
19,2	30,8	0,6	8900	3750	260	28000	21900	13	0,044
20,6	36,4	1	13300	5300	370	27500	19200	12	0,08
20,6	36,4	1	13300	5300	370	23500	19200	12	0,083
20,6	36,4	1	13300	5300	370	17700	–	12	0,083
20,6	36,4	1	13300	5300	370	23500	19200	12	0,101
21,2	35,8	0,6	11000	4750	330	29000	20100	13	0,061

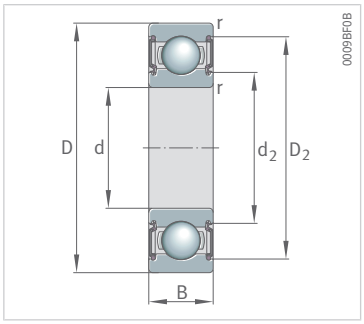
20.2 Deep groove ball bearings

Generation C

Single row

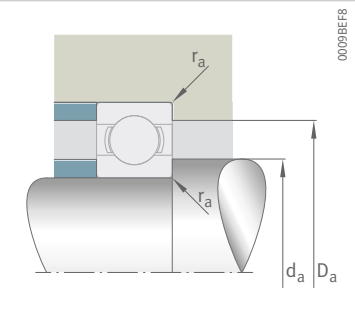


open



with seal 2BRS, 2HRS, 2Z

Designation	d	D	B	r	D_2 ≈	d_2 ≈
–	mm	mm	mm	mm	mm	mm
6203-C-2BRS	17	40	12	0,6	34,84	22,97
6203-C-2HRS	17	40	12	0,6	34,84	22,97
6203-C-2Z	17	40	12	0,6	34,84	22,97
6303-C	17	47	14	1	40,07	24,77
6303-C-2BRS	17	47	14	1	40,07	24,77
6303-C-2HRS	17	47	14	1	40,07	24,77
6303-C-2Z	17	47	14	1	40,07	24,77
6004-C	20	42	12	0,6	37,38	25,38
6004-C-2BRS	20	42	12	0,6	37,38	25,38
6004-C-2HRS	20	42	12	0,6	37,38	25,38
6004-C-2Z	20	42	12	0,6	37,38	25,38
6204-C	20	47	14	1	41	26,77
6204-C-2BRS	20	47	14	1	41	26,77
6204-C-2HRS	20	47	14	1	41	26,77
6204-C-2Z	20	47	14	1	41	26,77
6304-C	20	52	15	1,1	44,12	27,67
6304-C-2BRS	20	52	15	1,1	44,12	27,67
6304-C-2HRS	20	52	15	1,1	44,12	27,67
6304-C-2Z	20	52	15	1,1	44,12	27,67
6005-C	25	47	12	0,6	42,66	29,93
6005-C-2BRS	25	47	12	0,6	42,66	29,93
6005-C-2HRS	25	47	12	0,6	42,66	29,93
6005-C-2Z	25	47	12	0,6	42,66	29,93
6205-C	25	52	15	1	46,01	31,61
6205-C-2BRS	25	52	15	1	46,01	31,61
6205-C-2HRS	25	52	15	1	46,01	31,61
6205-C-2Z	25	52	15	1	46,01	31,61
6305-C	25	62	17	1,1	53,8	34,12
6305-C-2BRS	25	62	17	1,1	53,8	34,12
6305-C-2HRS	25	62	17	1,1	53,8	34,12
6305-C-2Z	25	62	17	1,1	53,8	34,12
6006-C	30	55	13	1	50,22	36,67
6006-C-2BRS	30	55	13	1	50,22	36,67
6006-C-2HRS	30	55	13	1	50,22	36,67
6006-C-2Z	30	55	13	1	50,22	36,67
6206-C	30	62	16	1	54,91	37,72
6206-C-2BRS	30	62	16	1	54,91	37,72
6206-C-2HRS	30	62	16	1	54,91	37,72
6206-C-2Z	30	62	16	1	54,91	37,72
6306-C	30	72	19	1,1	63,28	41,44



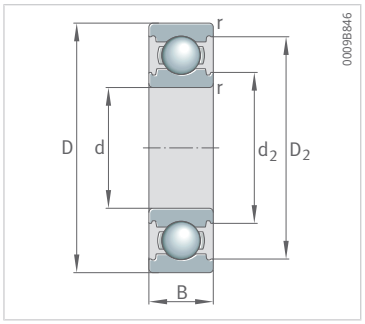
Mounting dimensions

d_a	D_a	r_a	C_r	C_{0r}	C_{ur}	n_G	$n_{\vartheta r}$	f_0	m ≈
mm	mm	mm	N	N	N	min^{-1}	min^{-1}	–	kg
21,2	35,8	0,6	11000	4750	330	24600	20100	13	0,064
21,2	35,8	0,6	11000	4750	330	16900	–	13	0,064
21,2	35,8	0,6	11000	4750	330	24600	20100	13	0,065
22,6	41,4	1	15800	6500	450	24500	17400	12,2	0,105
22,6	41,4	1	15800	6500	450	20800	17400	12,2	0,12
22,6	41,4	1	15800	6500	450	15700	–	12,2	0,12
22,6	41,4	1	15800	6500	450	20800	17400	12,2	0,12
23,2	38,8	0,6	10600	5000	340	27500	19700	13,8	0,061
23,2	38,8	0,6	10600	5000	340	23200	19700	13,8	0,066
23,2	38,8	0,6	10600	5000	340	15300	–	13,8	0,065
23,2	38,8	0,6	10600	5000	340	23200	19700	13,8	0,065
25,6	41,4	1	14700	6600	455	24300	18100	13,1	0,097
25,6	41,4	1	14700	6600	455	20600	18100	13,1	0,101
25,6	41,4	1	14700	6600	455	14500	–	13,1	0,103
25,6	41,4	1	14700	6600	455	20600	18100	13,1	0,103
27	45	1	18500	7800	540	22000	16100	12,3	0,142
27	45	1	18500	7800	540	18700	16100	12,3	0,15
27	45	1	18500	7800	540	14000	–	12,3	0,15
27	45	1	18500	7800	540	18700	16100	12,3	0,151
28,2	43,8	0,6	12600	6500	420	23700	16400	14,3	0,07
28,2	43,8	0,6	12600	6500	420	20200	16400	14,3	0,075
28,2	43,8	0,6	12600	6500	420	12900	–	14,3	0,076
28,2	43,8	0,6	12600	6500	420	20200	16400	14,3	0,074
30,6	46,4	1	15900	7800	530	21600	16000	13,8	0,119
30,6	46,4	1	15900	7800	530	18400	16000	13,8	0,127
30,6	46,4	1	15900	7800	530	12200	–	13,8	0,125
30,6	46,4	1	15900	7800	530	18400	16000	13,8	0,125
32	55	1	26500	11500	790	17800	13500	12,4	0,207
32	55	1	26500	11500	790	15100	13500	12,4	0,226
32	55	1	26500	11500	790	11300	–	12,4	0,218
32	55	1	26500	11500	790	15100	13500	12,4	0,225
34,6	50,4	1	14500	8300	500	20100	13800	14,8	0,108
34,6	50,4	1	14500	8300	500	17100	13800	14,8	0,113
34,6	50,4	1	14500	8300	500	10500	–	14,8	0,113
34,6	50,4	1	14500	8300	500	17100	13800	14,8	0,113
35,6	56,4	1	22000	11300	770	17800	13400	13,8	0,18
35,6	56,4	1	22000	11300	770	15100	13400	13,8	0,195
35,6	56,4	1	22000	11300	770	10200	–	13,8	0,193
35,6	56,4	1	22000	11300	770	15100	13400	13,8	0,192
37	65	1	33500	16200	1120	15100	11500	13	0,323

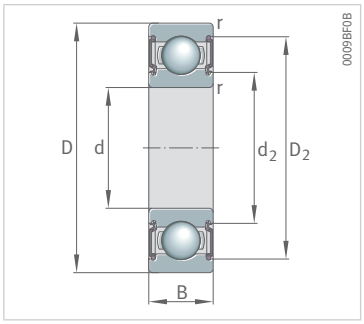
20.2 Deep groove ball bearings

Generation C

Single row

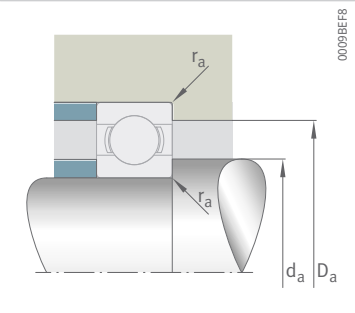


open



with seal 2BRS, 2HRS, 2Z

Designation	d	D	B	r	D_2 ≈	d_2 ≈
–	mm	mm	mm	mm	mm	mm
6306-C-2BRS	30	72	19	1,1	63,28	41,44
6306-C-2HRS	30	72	19	1,1	63,28	41,44
6306-C-2Z	30	72	19	1,1	63,28	41,44
6007-C	35	62	14	1	56,32	41,31
6007-C-2BRS	35	62	14	1	56,32	41,31
6007-C-2HRS	35	62	14	1	56,32	41,31
6007-C-2Z	35	62	14	1	56,32	41,31
6207-C	35	72	17	1,1	64,51	44,61
6207-C-2BRS	35	72	17	1,1	64,51	44,61
6207-C-2HRS	35	72	17	1,1	64,51	44,61
6207-C-2Z	35	72	17	1,1	64,51	44,61
6307-C	35	80	21	1,5	69,68	46,18
6307-C-2BRS	35	80	21	1,5	69,68	46,18
6307-C-2HRS	35	80	21	1,5	69,68	46,18
6307-C-2Z	35	80	21	1,5	69,68	46,18
6208-C	40	80	18	1,1	70,56	49,3
6208-C-2BRS	40	80	18	1,1	70,56	49,3
6208-C-2HRS	40	80	18	1,1	70,56	49,3
6208-C-2Z	40	80	18	1,1	70,56	49,3
6308-C	40	90	23	1,5	78,61	52,28
6308-C-2BRS	40	90	23	1,5	78,61	52,28
6308-C-2HRS	40	90	23	1,5	78,61	52,28
6308-C-2Z	40	90	23	1,5	78,61	52,28
6209-C	45	85	19	1,1	75,34	54,04
6209-C-2BRS	45	85	19	1,1	75,34	54,04
6209-C-2HRS	45	85	19	1,1	75,34	54,04
6209-C-2Z	45	85	19	1,1	75,34	54,04
6309-C	45	100	25	1,5	86,37	60,33
6309-C-2BRS	45	100	25	1,5	86,37	60,33
6309-C-2HRS	45	100	25	1,5	86,37	60,33
6309-C-2Z	45	100	25	1,5	86,37	60,33
6210-C	50	90	20	1,1	81,65	59,23
6210-C-2BRS	50	90	20	1,1	81,65	59,23
6210-C-2HRS	50	90	20	1,1	81,65	59,23
6210-C-2Z	50	90	20	1,1	81,65	59,23
6211-C	55	100	21	1,5	89,72	66,69
6211-C-2BRS	55	100	21	1,5	89,72	66,69
6211-C-2HRS	55	100	21	1,5	89,72	66,69
6211-C-2Z	55	100	21	1,5	89,72	66,69



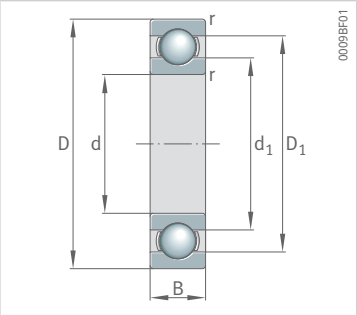
Mounting dimensions

d_a	D_a	r_a	C_r	C_{0r}	C_{ur}	n_G	$n_{\vartheta r}$	f_0	m ≈
mm	mm	mm	N	N	N	min^{-1}	min^{-1}	–	kg
37	65	1	33500	16200	1120	12800	11500	13	0,341
37	65	1	33500	16200	1120	9300	–	13	0,336
37	65	1	33500	16200	1120	12800	11500	13	0,336
39,6	57,4	1	17500	10300	620	17700	12600	14,9	0,14
39,6	57,4	1	17500	10300	620	15000	12600	14,9	0,148
39,6	57,4	1	17500	10300	620	9300	–	14,9	0,148
39,6	57,4	1	17500	10300	620	15000	12600	14,9	0,148
42	65	1	29500	15400	1060	15000	11300	13,9	0,256
42	65	1	29500	15400	1060	12700	11300	13,9	0,276
42	65	1	29500	15400	1060	8600	–	13,9	0,272
42	65	1	29500	15400	1060	12700	11300	13,9	0,27
44	71	1,5	38500	19100	1320	13600	10900	13,1	0,423
44	71	1,5	38500	19100	1320	11500	10900	13,1	0,451
44	71	1,5	38500	19100	1320	8300	–	13,1	0,443
44	71	1,5	38500	19100	1320	11500	10900	13,1	0,439
47	73	1	33500	17800	1230	13600	10500	14	0,337
47	73	1	33500	17800	1230	11600	10500	14	0,36
47	73	1	33500	17800	1230	7800	–	14	0,358
47	73	1	33500	17800	1230	11600	10500	14	0,359
49	81	1,5	50000	25000	1730	11800	9900	13	0,604
49	81	1,5	50000	25000	1730	10100	9900	13	0,621
49	81	1,5	50000	25000	1730	7400	–	13	0,621
49	81	1,5	50000	25000	1730	10100	9900	13	0,621
52	78	1	35500	20300	1400	12700	9900	14,3	0,399
52	78	1	35500	20300	1400	10800	9900	14,3	0,415
52	78	1	35500	20300	1400	7100	–	14,3	0,411
52	78	1	35500	20300	1400	10800	9900	14,3	0,409
54	91	1,5	62000	31500	2190	10500	9100	12,9	0,809
54	91	1,5	62000	31500	2190	8900	9100	12,9	0,85
54	91	1,5	62000	31500	2190	6400	–	12,9	0,84
54	91	1,5	62000	31500	2190	8900	9100	12,9	0,839
57	83	1	40000	23200	1610	11700	9200	14,4	0,421
57	83	1	40000	23200	1610	9900	9200	14,4	0,45
57	83	1	40000	23200	1610	6500	–	14,4	0,447
57	83	1	40000	23200	1610	9900	9200	14,4	0,445
64	91	1,5	50000	29000	2020	10400	8300	14,2	0,58
64	91	1,5	50000	29000	2020	8800	8300	14,2	0,61
64	91	1,5	50000	29000	2020	5800	–	14,2	0,595
64	91	1,5	50000	29000	2020	8800	8300	14,2	0,6

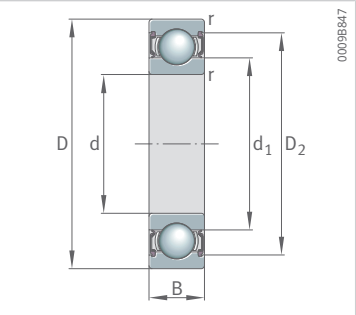
20.3 Deep groove ball bearings

Standard design

Single row

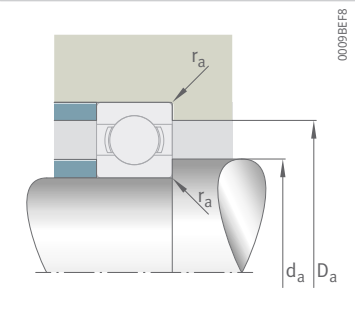


open



with seal 2RSR

Designation	d	D	B	r	D_2 ≈	d_1 ≈
–	mm	mm	mm	mm	mm	mm
6003	17	35	10	0,3	30,81	22,65
6003-2RSR	17	35	10	0,3	30,81	22,65
6003-2Z	17	35	10	0,3	30,81	22,65
6008	40	68	15	1	61,56	49,3
6008-2RSR	40	68	15	1	61,56	49,3
6008-2Z	40	68	15	1	61,56	49,3
6009	45	75	16	1	67,98	54,2
6009-2RSR	45	75	16	1	67,98	54,2
6009-2Z	45	75	16	1	67,98	54,2
6010	50	80	16	1	72,94	59,75
6010-2RSR	50	80	16	1	72,94	59,75
6010-2Z	50	80	16	1	72,94	59,75
6310	50	110	27	2	95,1	68
6310-2RSR	50	110	27	2	95,1	68
6310-2Z	50	110	27	2	95,1	68
6011	55	90	18	1,1	81,54	66,2
6011-2RSR	55	90	18	1,1	81,54	66,2
6011-2Z	55	90	18	1,1	81,54	66,2
6311	55	120	29	2	104,26	75,2
6311-2RSR	55	120	29	2	104,26	75,2
6311-2Z	55	120	29	2	104,26	75,2
6012	60	95	18	1,1	85,98	71,325
6012-2RSR	60	95	18	1,1	85,98	71,325
6012-2Z	60	95	18	1,1	85,98	71,325
6212	60	110	22	1,5	97,68	75,75
6212-2RSR	60	110	22	1,5	97,68	75,75
6212-2Z	60	110	22	1,5	97,68	75,75
6013	65	100	18	1,1	91,52	76,225
6013-2RSR	65	100	18	1,1	91,52	76,225
6013-2Z	65	100	18	1,1	91,52	76,225
6213	65	120	23	1,5	106,34	82,32
6213-2RSR	65	120	23	1,5	106,34	82
6213-2Z	65	120	23	1,5	106,34	82
6014	70	110	20	1,1	100,04	82,75
6014-2RSR	70	110	20	1,1	100,04	82,75
6014-2Z	70	110	20	1,1	100,04	82,75
6015	75	115	20	1,1	105,34	88,05
6015-2RSR	75	115	20	1,1	105,34	88,05
6015-2Z	75	115	20	1,1	105,34	88,05



Mounting dimensions

d_a	D_a	r_a	C_r	C_{0r}	C_{ur}	n_G	$n_{\vartheta r}$	f_0	m ≈
mm	mm	mm	N	N	N	min^{-1}	min^{-1}	–	kg
19	33	0,3	6400	3250	162	31000	20300	14,3	0,037
19	33	0,3	6400	3250	162	11800	–	14,3	0,0395
19	33	0,3	6400	3250	162	26000	20300	14,3	0,0395
44,6	63,4	1	17800	11500	600	14600	10600	15,2	0,181
44,6	63,4	1	17800	11500	600	5400	–	15,2	0,189
44,6	63,4	1	17800	11500	600	12400	10600	15,2	0,189
49,6	70,4	1	21200	14400	750	13100	9700	15,3	0,236
49,6	70,4	1	21200	14400	750	4950	–	15,3	0,24
49,6	70,4	1	21200	14400	750	11200	9700	15,3	0,241
54,6	75,4	1	22000	15800	800	12200	8900	15,6	0,258
54,6	75,4	1	22000	15800	800	4450	–	15,6	0,262
54,6	75,4	1	22000	15800	800	10400	8900	15,6	0,262
61	99	2	68000	38500	2650	9500	7700	13,3	1,049
61	99	2	68000	38500	2650	3950	–	13,3	1,083
61	99	2	68000	38500	2650	8000	7700	13,3	1,083
61	84	1	30000	21200	1150	10700	8300	15,3	0,365
61	84	1	30000	21200	1150	4050	–	15,3	0,389
61	84	1	30000	21200	1150	9100	8300	15,3	0,385
66	109	2	83000	47500	3250	8500	7100	12,9	1,329
66	109	2	83000	47500	3250	3550	–	12,9	1,375
66	109	2	83000	47500	3250	7200	7100	12,9	1,375
66	89	1	31500	23200	1230	10100	7600	15,6	0,402
66	89	1	31500	23200	1230	3750	–	15,6	0,419
66	89	1	31500	23200	1230	8500	7600	15,6	0,42
69	101	1,5	57000	36500	2550	9300	6800	14,5	0,767
69	101	1,5	57000	36500	2550	3550	–	14,5	0,778
69	101	1,5	57000	36500	2550	7900	6800	14,5	0,775
71	94	1	32500	25000	1300	9500	7100	15,7	0,418
71	94	1	32500	25000	1300	3500	–	15,7	0,437
71	94	1	32500	25000	1300	8100	7100	15,7	0,44
74	111	1,5	63000	41500	2850	8600	6300	14,4	0,95
74	111	1,5	63000	41500	2850	3250	–	14,4	0,964
74	111	1,5	63000	41500	2850	7300	6300	14,4	1
76	104	1	40500	31000	1900	8600	6800	15,6	0,606
76	104	1	40500	31000	1900	3250	–	15,6	0,615
76	104	1	40500	31000	1900	7300	6800	15,6	0,596
81	109	1	42000	33500	2020	8100	6300	15,8	0,615
81	109	1	42000	33500	2020	3050	–	15,8	0,678
81	109	1	42000	33500	2020	6900	6300	15,8	0,676

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TPI 165 / 01 / en-GB / 2026-10