



# High Speed Deep Groove Ball Bearings for Electromobility

Technical Product Information



## Foreword

Schaeffler products have proved themselves over many years even under critical and problematic application conditions.

The rotor shaft in an electric motor reaches speeds which are often three times higher than the speed of the crankshaft in an internal combustion engine. The corresponding gearbox input shaft rotates at the same speed as the rotor shaft. As a result of these high speeds, the intrinsic heat generated by the deep groove ball bearings is higher than that encountered in combustion engines. The drives for electric vehicles are designed to be extremely compact. Consequently, the deep groove ball bearings are exposed to additional heat generation in the form of dissipated heat from the electric motor. The heat generated by dissipated heat from the electric motor is significantly higher than the amount of intrinsic heat generated. Suitable deep groove ball bearings are necessary for safe operation at these high speeds and at high ambient temperatures.

High speed deep groove ball bearings (HSBB) from Schaeffler have been specially developed for use at high speeds and high temperatures, with further goals including minimal noise generation and a low frictional torque. Extensive tests on the bearings have shown that all requirements can be met in full, making high speed deep groove ball bearings ideal for supporting the rotor shaft in electric motors and the corresponding gearbox input shaft.

With the deep groove ball bearings covered in this Technical Product Information, we offer a standardised and cost-optimised portfolio of bearings in standard dimensions.

Special designs are also available by agreement for performance requirements that exceed the scope of this portfolio, including special designs for particularly high speeds and designs which prevent the passage of current through the bearing generated by the power electronics.

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# 1 High speed deep groove ball bearings

The dimensions of Schaeffler single row high speed deep groove ball bearings correspond to catalogue series 60, 62 and 63 in accordance with DIN 616 (ISO 15).

General information on deep groove ball bearings can be found in:

HR 1, Rolling Bearings,

<https://www.schaeffler.de/std/1D3D>

1 Open



001A996C

Bearing series:

- F-800000.01.60
- F-800000.01.62
- F-800000.01.63

2 With sealing shields



001A998C

Bearing series:

- F-800000.60
- F-800000.62
- F-800000.63

## 2 Accuracy

The main dimensions of Schaeffler single row high speed deep groove ball bearings correspond to DIN 625-1 (ISO 15).

### 2.1 Dimensional tolerances and running tolerances

The dimensional tolerances and running tolerances of the bearings correspond as a minimum to tolerance class 6 in accordance with ISO 492:2023.

### 2.2 Radial internal clearance

The radial internal clearance of the bearings corresponds to internal clearance group 4 in accordance with DIN 620-4 (ISO 5753-1). Bearings with a different internal clearance are available by agreement.

☐1 Radial internal clearance

<b>d</b>		<b>C4 (Group 4)</b>	
		<b>min.</b>	<b>max.</b>
<b>over</b>	<b>incl.</b>		
<b>mm</b>	<b>mm</b>	<b>µm</b>	<b>µm</b>
30	40	28	46
40	50	30	51
50	65	38	61

## 3 Advantages

### 3.1 High speed

High speed deep groove ball bearings in the standard design are suitable for speeds up to a speed parameter  $n \cdot d_M$  of  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$ . For higher speed requirements, bearings are available in a special design by agreement up to a speed parameter  $n \cdot d_M$  of  $1\,800\,000 \text{ min}^{-1} \cdot \text{mm}$ .

### 3.2 Minimal noise generation

The bearings are quiet in operation. Noise generation is reduced due to the high quality of the balls, an improved surface quality, a stable cage geometry and the optimised internal construction.

### 3.3 Low friction

Friction in the bearing is reduced by raceway osculations which are designed to suit high speeds and by optimised surfaces, waviness and roundness characteristics.

### 3.4 Good sealing effect

The bearings, which are sealed on both sides, are lubricated using a suitable high-quality grease. The innovative design of the sealing shields used with these bearings provides particularly good protection against egress of grease and ingress of dust.

### 3.5 Higher cost-effectiveness

Due to the lower friction, energy costs for operation are reduced. The reduced grease loss, better protection against contamination and reduced strain on the lubricant extend the grease operating life and thus the rating life of the bearing.

## 4 Speed

The bearings listed in the product tables are designed up to a speed parameter  $n \cdot d_M$  of  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$ . The specific speed parameter  $n \cdot d_M$  takes into account the limiting speed  $n_G$  of the bearing multiplied by the pitch circle  $d_M$ .

The limiting speed  $n_G$  limits the speed range in which bearings from the standard portfolio can be used. For higher limiting speeds, special designs are available by agreement with speed parameters  $n \cdot d_M$  up to  $1\,800\,000 \text{ min}^{-1} \cdot \text{mm}$ .

## 5 Temperature range

The bearings are suitable for operation in a temperature range of  $-40 \text{ }^\circ\text{C}$  to  $+150 \text{ }^\circ\text{C}$ . The temperature range applies to open bearings and to greased bearings with sealing shields.

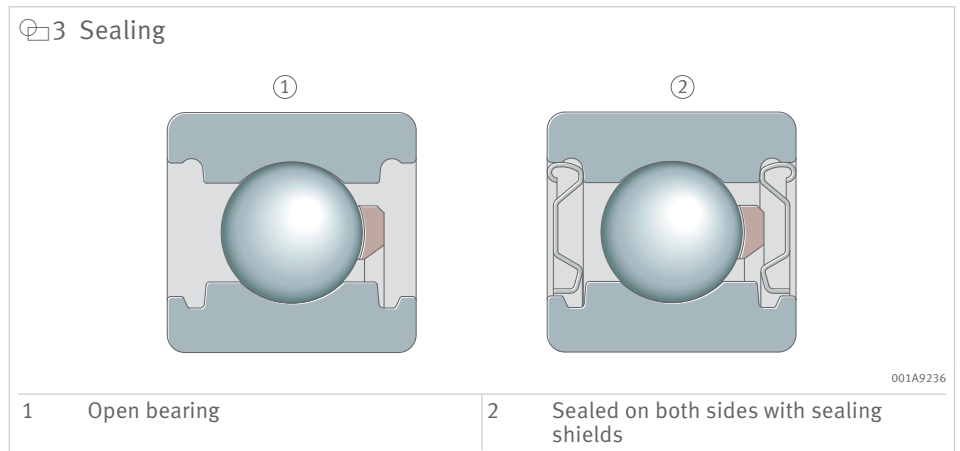
## 6 Cages

Schaeffler single row high speed deep groove ball bearings are fitted with a single-piece polyamide snap cage as standard. These standard bearings are suitable for speeds up to a speed parameter  $n \cdot d_M$  of  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$ . For higher speeds, deep groove ball bearings with cages are available by agreement in a special design for speed parameters  $n \cdot d_M$  up to  $1\,800\,000 \text{ min}^{-1} \cdot \text{mm}$ .



## 7 Sealing

For speeds up to a speed parameter  $n \cdot d_M$  of  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$ , bearings are available in an open design or in a design which is sealed on both sides with sealing shields. The design with sealing shields is lubricated for life with a high-quality grease that is suitable for use at high speeds and high temperatures.



Designs with centrifugal discs are available by agreement for applications in which the bearings run in an oil bath. The centrifugal discs reduce splashing losses in the oil, thus minimising bearing friction and maintaining a low oil temperature.

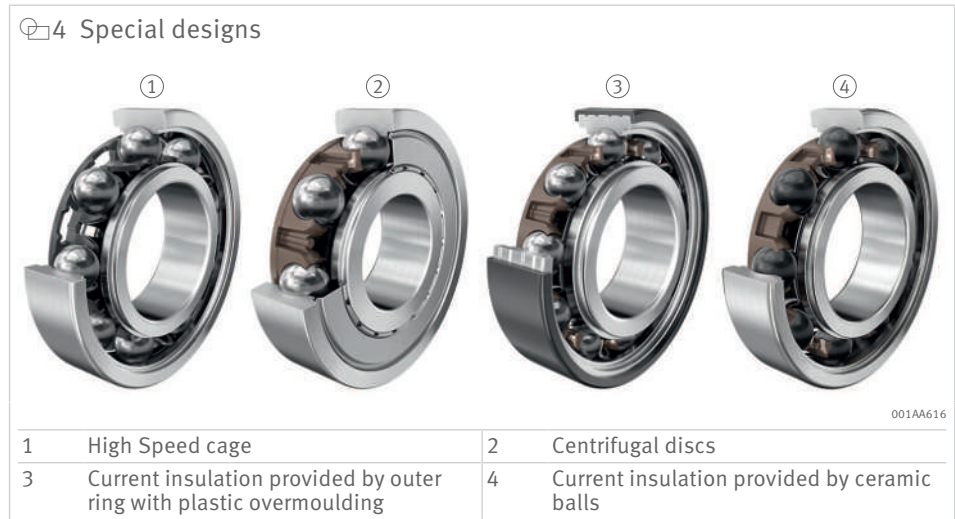
## 8 Bearing design

Standard designs:

- open bearings, speed parameter  $n \cdot d_M$  up to  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$
- with sealing shields, speed parameter  $n \cdot d_M$  up to  $1\,300\,000 \text{ min}^{-1} \cdot \text{mm}$

Special designs:

- high-speed cage reinforced with carbon fibres, speed parameter  $n \cdot d_M$  up to  $1\,800\,000 \text{ min}^{-1} \cdot \text{mm}$
- with centrifugal discs
- current-insulated



Special designs are available by agreement.

## 9 Minimum load

In order that no slippage occurs between the contact partners, the deep groove ball 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 higher than the requisite minimum load due to the weight of the supported parts and the external forces.

If the minimum radial load is lower than stated, please consult Schaeffler.

## 10 Mounting dimensions

The maximum undercut radius  $r_a$ , the diameter of the housing shoulder  $D_a$  and the abutment diameter of the shaft shoulder  $d_a$  are stated in the product tables ►12|11.2.

The guide values in accordance with ISO 286-1 for the diameter tolerance are IT5 for the shaft seat and IT6 for the housing seat.

Further information on the roundness tolerance, parallelism tolerance and the total axial runout tolerance of the abutment shoulder can be found in:

HR 1, Rolling Bearings,  
<https://www.schaeffler.de/std/1D3D>

## 11 Product tables

Other bearing sizes are also available by agreement.

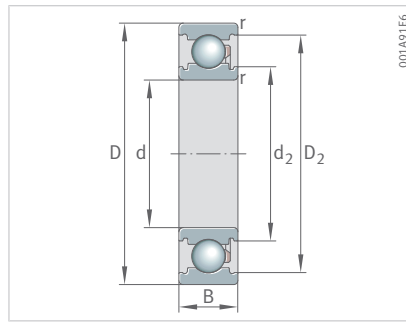
### 11.1 Explanations

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	Bearing bore diameter
D	mm	Bearing outside diameter
$d_2$	mm	Caliber diameter inner ring
$D_2$	mm	Caliber diameter outer ring
$d_a$	mm	Abutment diameter, shaft shoulder
$D_a$	mm	Housing shoulder diameter
m	kg	Mass
$n_G$	$\text{min}^{-1}$	Limiting speed
r	mm	Chamfer dimension
$r_a$	mm	Undercut radius

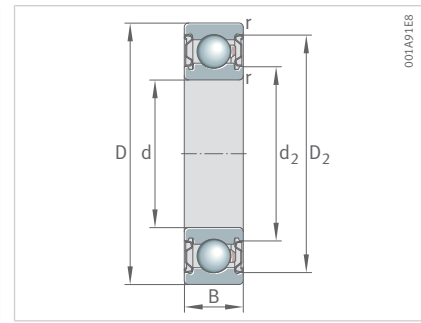
## 11.2 High speed deep groove ball bearings

Single row

Open or sealed

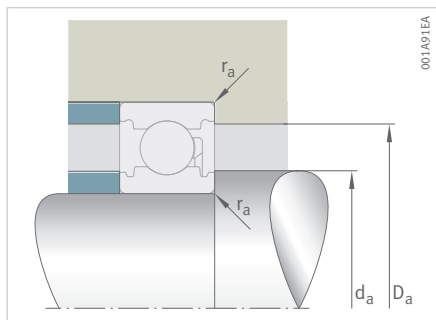


Open  
(F-800000.01.6)

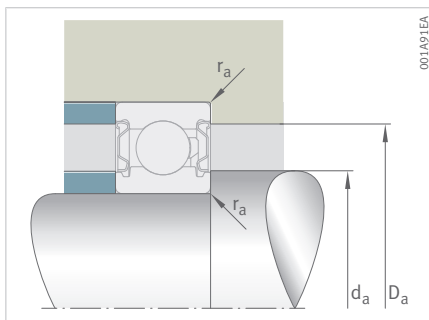


Sealed  
(F-800000.6)

Designation	m	d	D	B	r	D <sub>2</sub>	d <sub>2</sub>
	kg	mm	mm	mm	mm	mm	mm
F-800000.6006	0,107	30	55	13	1	50,22	36,67
F-800000.01.6006	0,101	30	55	13	1	50,22	36,67
F-800000.6206	0,185	30	62	16	1	54,91	37,72
F-800000.01.6206	0,176	30	62	16	1	54,91	37,72
F-800000.6306	0,326	30	72	19	1,1	63,29	41,44
F-800000.01.6306	0,313	30	72	19	1,1	63,29	41,44
F-800000.6007	0,158	35	62	14	1	56,32	41,31
F-800000.01.6007	0,150	35	62	14	1	56,32	41,31
F-800000.6207	0,262	35	72	17	1,1	64,52	44,61
F-800000.01.6207	0,252	35	72	17	1,1	64,52	44,61
F-800000.6307	0,428	35	80	21	1,5	69,69	46,18
F-800000.01.6307	0,417	35	80	21	1,5	69,69	46,18
F-800000.6008	0,180	40	68	15	1	61,81	46,56
F-800000.01.6008	0,172	40	68	15	1	61,81	46,56
F-800000.6208	0,344	40	80	18	1,1	70,57	49,3
F-800000.01.6208	0,330	40	80	18	1,1	70,57	49,3
F-800000.6308	0,588	40	90	23	1,5	78,61	52,28
F-800000.01.6308	0,574	40	90	23	1,5	78,61	52,28
F-800000.6009	0,220	45	75	16	1	68,72	52,14
F-800000.01.6009	0,212	45	75	16	1	68,72	52,14
F-800000.01.6309	0,835	45	100	25	1,5	86,37	60,33
F-800000.6210	0,437	50	90	20	1,1	81,65	59,23
F-800000.01.6210	0,416	50	90	20	1,1	81,65	59,23
F-800000.01.6211	0,593	55	100	21	1,5	89,72	66,69



Mounting dimensions  
Open design



Mounting dimensions  
Sealed design

<b>d<sub>a</sub></b> <b>min.</b>	<b>D<sub>a</sub></b> <b>max.</b>	<b>r<sub>a</sub></b> <b>max.</b>	<b>C<sub>r</sub></b>	<b>C<sub>0r</sub></b>	<b>C<sub>ur</sub></b>	<b>n<sub>G</sub></b>
<b>mm</b>	<b>mm</b>	<b>mm</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>min<sup>-1</sup></b>
34,6	50,4	1	15500	9000	470	30000
34,6	50,4	1	15500	9000	470	30000
35,6	56,4	1	20100	11300	590	27000
35,6	56,4	1	20100	11300	590	27000
37	65	1	30000	16200	850	22800
37	65	1	30000	16200	850	22800
39,6	57,4	1	16200	10300	540	27000
39,6	57,4	1	16200	10300	540	27000
42	65	1	26500	15400	800	22700
42	65	1	26500	15400	800	22700
44	71	1,5	34500	19100	1000	20600
44	71	1,5	34500	19100	1000	20600
44,6	63,4	1	16900	11500	600	24400
44,6	63,4	1	16900	11500	600	24400
47	73	1	30000	17800	930	20600
47	73	1	30000	17800	930	20600
49	81	1,5	44500	25000	1310	17900
49	81	1,5	44500	25000	1310	17900
49,6	70,4	1	20100	14400	750	21900
49,6	70,4	1	20100	14400	750	21900
54	91	1,5	55000	31500	1650	15900
57	83	1	36000	23200	1210	17700
57	83	1	36000	23200	1210	17700
64	91	1,5	44500	29000	1520	15800

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