SKF Energy Efficient deep groove ball bearings

Increased service life for optimized field performance

The Power of Knowledge Engineering

Optimized to increase service life.

SKF Energy Efficient (E2) deep groove ball bearings can provide more than twice the service life while reducing energy use and total cost of ownership. Design improvements reduce frictional losses in the bearing by at least 30% when compared to the same size SKF Explorer bearing. This results in energy savings over the life of the application.

SKF offers an extended catalogue range of shielded and sealed SKF E2 deep groove ball bearings in order to cover a larger range of application requirements, e.g. enabling them to be used on vertical shafts as well as other applications where contamination is a real concern.

Benefits:

- **Longer bearing service life**
- **Longer grease life**
- **Reduced operating temperature**
- **Higher speed capability**
- **Sustained performance**
- **Reduced energy use**
- **Lower cost of ownership**

And reduce energy use.

Reduced friction means increased grease life and service life

Optimized to reduce frictional losses and operating temperature in the bearing, capped SKF Energy Efficient deep groove ball bearings can last at least twice as long as comparable SKF Explorer bearings in many applications. This means that in applications where conventional bearings fail and are replaced, the longer service life of SKF E2 bearings could potentially halve the number of bearings consumed over the machine lifetime or even eliminate the need for replacement altogether. In instances where an application is run-to-failure, SKF E2 bearings could conceivably double the life of the application, consequently reducing the total cost of ownership.

Engineered to promote sustainability

SKF E2 deep groove ball bearings are a part of the SKF BeyondZero portfolio of products, services and solutions designed to help our customers reduce environmental impact.

SKF EnCompass Field Performance Programme: theory meets reality

One might think that two bearings of the same size with the same dynamic load rating should perform equally well in a given application. In reality, they often do not. The reason?

Bearing performance under actual operating conditions is impacted by not only the dynamic load rating (C), but far more by the bearing's inherent design and quality: everything from the surface finish of the raceways to the effectiveness of sealing and lubrication.

The SKF EnCompass Field Performance Programme addresses this issue. By focusing on bearing design optimization and more detailed analysis of the factors influencing bearing service life, the programme will help to meet real-world application conditions.

At the heart of SKF EnCompass are new, more inclusive bearing life models, including the SKF Generalized Bearing Life Model, which separates sub-surface and surface failure modes. By encompassing more of the factors that impact bearing service life, this model and new software tools provide new insight into the calculation of bearing rating life. The result is a significantly improved guide for selecting bearings for optimum reliability and productivity in the field.

As part of the SKF EnCompass programme, SKF Energy Efficient (E2) deep groove ball bearings have been optimized to give you a field advantage.

Lower temperature, longer grease life and superior sealing

For capped deep groove ball bearings in typical applications, fatigue life is rarely an issue. Bearing service life is almost always limited by grease life. Typical applications include:

- electric motors
- pumps
- fans
- conveyors
- textile machines

SKF Energy Efficient deep groove ball bearings are designed specifically for these types of applications.

Reduced operating temperature

The reduction of friction in SKF E2 deep groove ball bearings directly impacts the bearing operating temperature, resulting in a cooler running bearing (→ **diagram 1**). This is true for both shielded and sealed SKF E2 deep groove ball bearings. The reduction of operating temperature leads to increased grease life and bearing service life in greased for life bearings.

As an example, compared to an SKF Explorer 6312-2Z/C3 running in an electric motor at 3 000 r/min under a radial load of 8,2 kN with an operating temperature of 97 °C, SKF E2.6312-2Z/C3 with the same running conditions will have an operating temperature of 92 °C.

Optimized grease for extended grease life

SKF Energy Efficient deep groove ball bearings are filled with a special, low-noise, low-friction SKF grease that offers extended grease life. Additionally, the polymer cage is designed to facilitate grease migration inside the bearing, resulting in a better lubrication of the surface contacts between balls, raceways and cage pockets.

Compared to SKF Explorer deep groove ball bearings, SKF E2 bearings can last more than double the mean time between failure. Due to both specially formulated grease and lower operating temperature, the grease life of a E2.6312-2Z/C3 in the same electric motor operating conditions as described above is increased by 4,5 times (→ **diagram 2**).

Diagram 1

Cooler running

Bearing type 6312 with shields and C3 clearance
Radial load: 8,2 kN

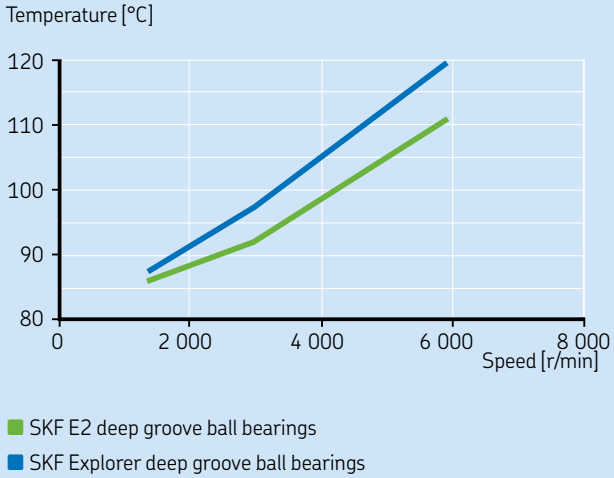
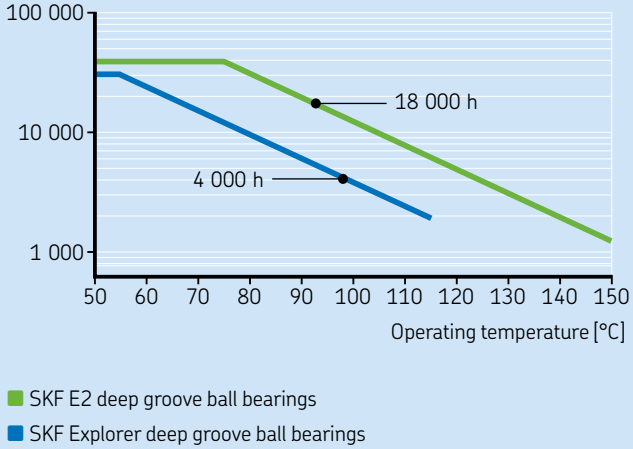


Diagram 2

Longer grease life

Operating conditions: Speed: 3 000 r/min
Radial load: 8,2 kN
Bearing type: 6312 with shields and C3 clearance



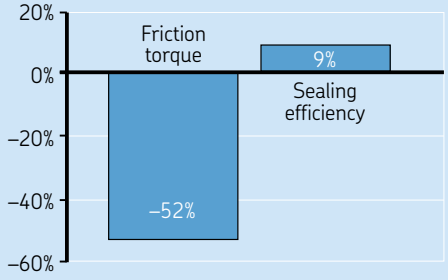
More sealed options for more protection

Sealed versions of SKF E2 deep groove ball bearings help protect the bearing from ingress of contaminants that can shorten bearing service life in contaminated environments, all while maintaining the low-friction features and benefits of the shielded versions.

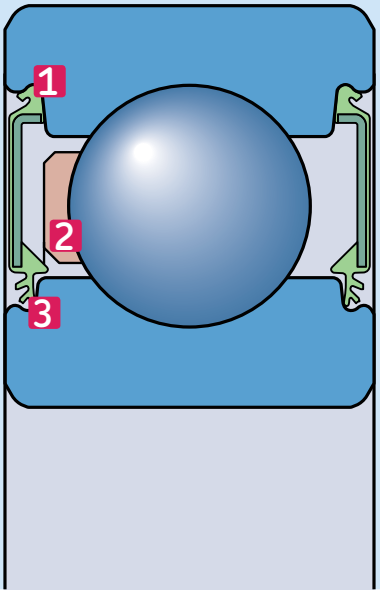
In addition to the existing E2 RSH seal, the low-friction contact seal RST extends the offer of sealed deep groove ball bearings above 70 mm outer diameter. Sealed bearings provide low-friction torque while maintaining high sealing efficiency. Comparison with SKF Explorer seal is illustrated on **diagram 3**.

Diagram 3

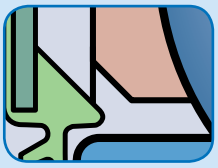
RST seal performances



The low-friction contact seal RST design



1 **Anchorage prevents seal slippage and grease leakage, particularly in outer ring rotation condition.**



2 **Special inner shape optimizes grease circulation inside the bearing, improving the lubricant use.**

3 **Innovative multiple lip design improves protection and allows higher rotational speed while maintaining low-friction performance.**

Designed to deliver optimal field performance

Frictional moment

The frictional moment of an SKF Energy Efficient bearing with shields on both sides was measured under various operating conditions. When compared with the frictional moment of a shielded SKF Explorer deep groove ball bearing, the SKF E2 bearing showed at least 40% friction reduction. This reduction was achieved thanks to several design features: the internal geometry of the raceways, the grease type as well as the polymer material of the cage, which features a lower coefficient of friction than the conventional steel cage. Compared to other manufacturers' bearings, the percentage reduction in the frictional moment can be even greater (**→ diagram 4**).

Calculating the frictional moment for SKF Energy Efficient deep groove ball bearings can be done with the calculation tools provided online at *skf.com/bearingcalculator*.

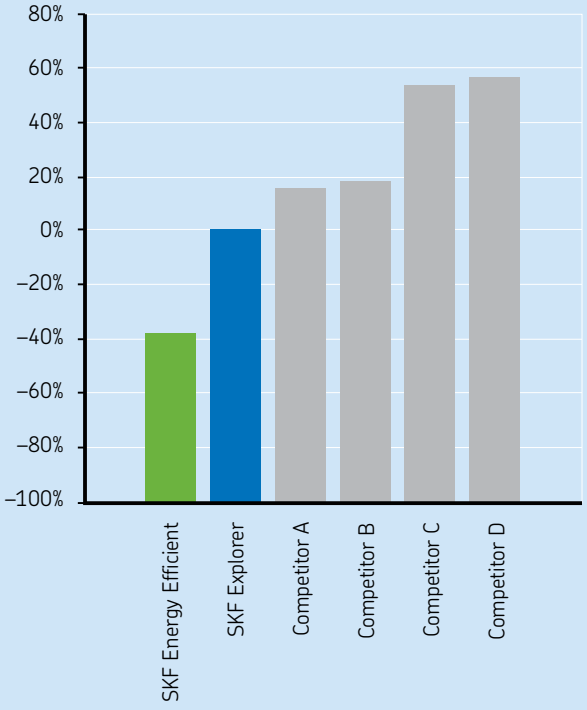
Recommended operating conditions for enhanced performance characteristics:

- Load P ≤ 0,125 C
- Speed n > 1 000 r/min

Diagram 4

Lower friction than competitors

Test conditions: Speed: 5 000 r/min
Bearing type: 6306 with shields and C3 clearance



Speed capability

The operating temperature puts limits on the speed at which rolling bearings can be operated.

Because SKF E2 deep groove ball bearings operate with low-friction and generate low-frictional heat, they are well suited for high-speed operation.

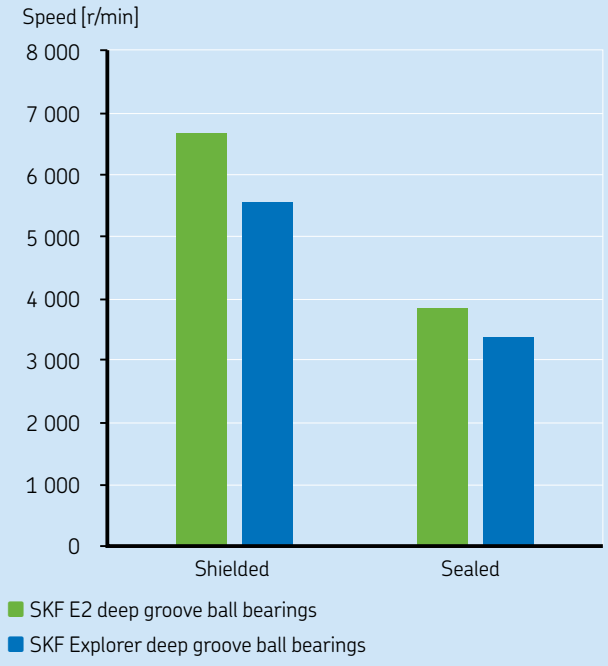
Reference speed relates to the thermal behaviour of the bearing (at which speed a given temperature is reached according to ISO 15312). The reference speed is higher for SKF E2 deep groove ball bearings compared to SKF Explorer bearings due to cooler running temperatures that are a result of reduced friction.

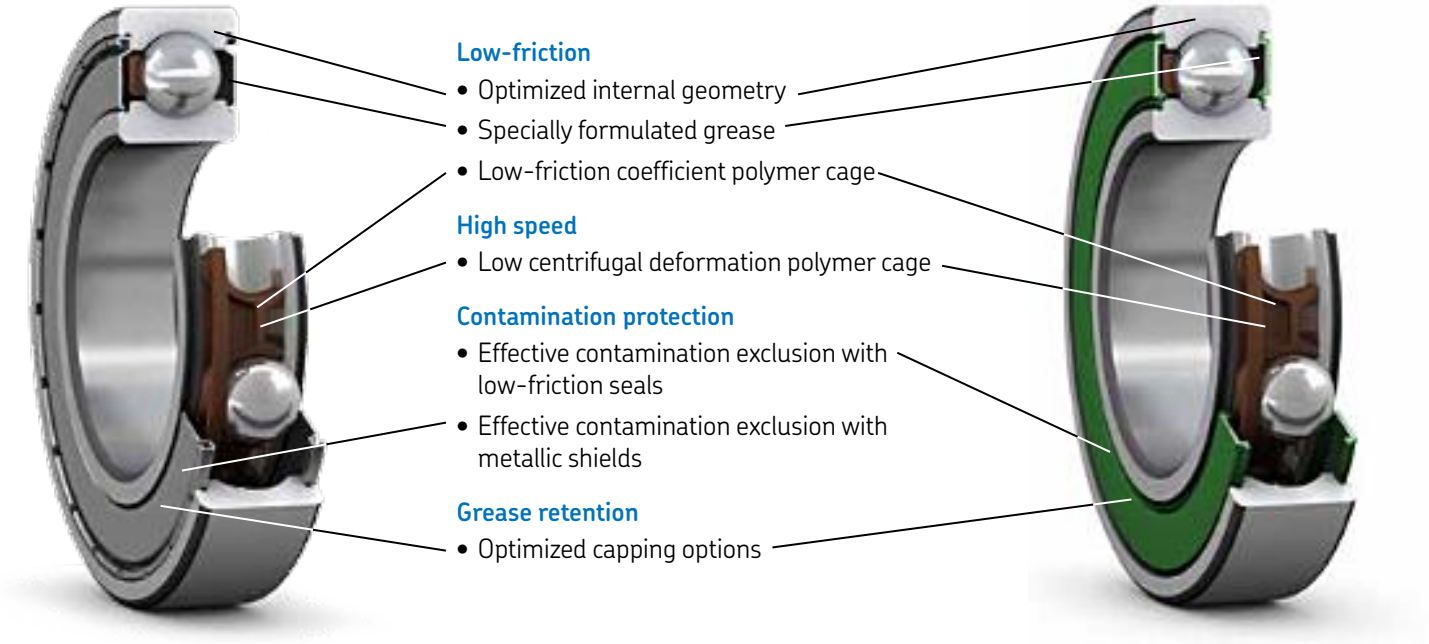
Limiting speed relates to the mechanical stability and strength of the components. The limiting speed is +15% higher compared to SKF Explorer bearings due to a polymer cage shape less sensitive to centrifugal deformation and to new low-friction contact seals (→ **diagram 5**).

Diagram 5

Higher speed capability

Bearing type: 6312





Dimension standards

The boundary dimensions of SKF E2 deep groove ball bearings are in accordance with ISO 15, which makes them dimensionally interchangeable with deep groove ball bearings of the same size in the same dimension series.

Product data

SKF Energy Efficient deep groove ball bearings are available in the 60, 62 and 63 dimension series. The current assortment is listed in the product table (→ **pages 10** and **11**). The assortment will be expanded according to customer demands. For the most up-to-date information, contact your local SKF representative or visit *skf.com/bearings*.

Designs and variants

Cages

SKF Energy Efficient deep groove ball bearings are fitted with a ball centred snap-type cage made of a temperature-resistant glass fibre reinforced composite polymer.

Capped bearings

Depending on series and size, SKF Energy Efficient deep groove ball bearings can be supplied with :

- Z shields on both sides (→ **table 1a**)
- E2 RSH or RST contact seals on both sides (→ **table 1b**, **1c** and **1d**)

The sealed SKF E2 bearings are supplied with a low-friction contact seal. The seal is made from green acrylonitrile-butadiene rubber (NBR) and reinforced with a sheet steel insert. The seal lip, which has a thin and flexible design, minimizes the frictional moment, while effectively protecting the bearing from contaminants. The seal lip and bearing groove contact have been optimized to reduce friction.

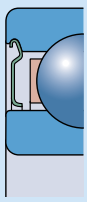
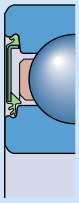
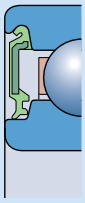
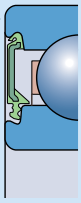
Grease and grease life

The bearings are filled with a special low-noise, low-friction SKF grease (→ **table 2**). The bearings are lubricated for life and are maintenance-free[1)].

Under the recommended operating conditions, the service life of the grease in capped SKF Energy Efficient deep groove ball bearings normally defines the service life of the bearing and can be estimated using **diagram 6**. The estimate is based on an L_{10} grease life. This is defined as the period of time at the end of which 90% of a sufficiently large group of seemingly identical bearings are still reliably lubricated.

Table 1

SKF E2 bearings capping solutions

Requirement	Shields	Contact seals	
	a. 	b. 	c.  d. 
Dimensions	**Z**	**RST** D > 70 mm	**E2 RSH** D < 70 mm
Low-friction	+++	++	+
High speed	+++	+	+
Grease retention	o	+++	+++
Dust exclusion	o	++	++
Water exclusion			
static	–	+++	+++
dynamic	–	+	+

Symbols:
+++ = best ++ = very good + = good o = fair – = not recommended

a. Z shield design
b. RST seal design for D > 70 mm
c. E2 RSH seal design for D < 25 mm
d. E2 RSH seal design for 25 mm < D < 70 mm

Table 2

Grease in SKF Energy Efficient deep groove ball bearings

Thickener	Lithium
Base oil type	Synthetic oil
NLGI consistency class	2

Temperature range

[°C]	–50	55	150	190
[°F]	–60	130	300	375

For more information, see *SKF Rolling bearings catalogue*, **page 245**

1) Maintenance-free, in this case, means that the bearings should not be lubricated prior to or during operation. However, despite the use of this term, the fit and function of this SKF product should still be checked as part of a regularly scheduled maintenance programme.

Grease life depends mainly on the following factors:

- operating temperature
- speed
- load

Diagram 6 provides grease life estimates based on operating temperature and speed. It is valid for light loads (P ≤ 0,05 C) and bearings on a horizontal shaft. For more heavily loaded bearings, the grease life is reduced. Appropriate reduction factors are listed in **table 3**. For bearings on a vertical shaft, the grease life should be halved.

The speed is considered using speed factor A:

$A = n\, d_m$

where

A = speed factor [mm/min]
n = rotational speed [r/min]
d_m = bearing mean diameter [mm]
= 0,5 (d + D)

Table 3

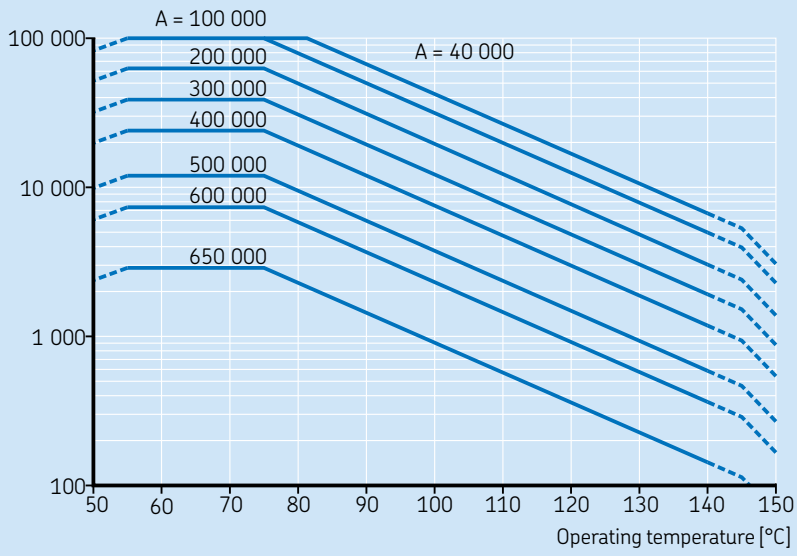
Reduction factors for grease life, depending on load

Load P	Reduction factor
≤ 0,05 C	1
0,1 C	0,7
0,125 C	0,5
0,25 C	0,2

To make adjustments for other operating conditions, refer to the recommendations in the *SKF Rolling bearings catalogue* or contact the SKF application engineering service.

Diagram 6

Grease life for SKF Energy Efficient deep groove ball bearings for load P = 0,05 C



Temperature limits

The permissible operating temperature for SKF E2 deep groove ball bearings is limited by the cage and the seals. When temperatures outside the permissible range are expected, contact SKF application engineering services.

Cages – The permissible operating temperature range for polymer cage is -40 to 120 °C *(-40 to 250 °F)*. This range provides a cage ageing life of 10 000 hours. For more details, refer to the *SKF Rolling bearings catalogue*.

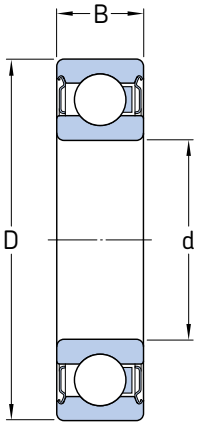
Seals – The permissible operating temperature range for NBR seals is -40 to 100 °C *(-40 to 210 °F)*. Temperatures up to 120 °C *(250 °F)* can be tolerated for brief periods.

Designations and package identification

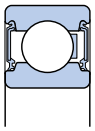
The designations for SKF Energy Efficient deep groove ball bearings follow the basic SKF designation system. SKF Energy Efficient bearings are supplied in a box marked SKF Energy Efficient bearings.

Capped SKF E2 deep groove ball bearings

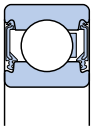
d 5 – 15 mm



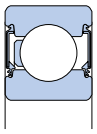
2Z



2RSH for D ≤ 25 mm



2RSH for 25 mm < D ≤ 70 mm



2RST for D > 70 mm

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designations
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
5	16	5	1,14	0,38	0,016	104 000	55 000	0,005	**E2.625-2Z**
	19	6	2,21	0,95	0,040	90 000	47 000	0,009	**E2.635-2Z**
6	19	6	2,21	0,95	0,040	90 000	47 000	0,008	**E2.626-2Z**
	19	6	2,21	0,95	0,040	–	28 000	0,008	**E2.626-2RSH**
7	19	6	2,21	0,95	0,040	90 000	47 000	0,008	**E2.607-2Z**
	19	6	2,21	0,95	0,040	–	28 000	0,008	**E2.607-2RSH**
	22	7	3,32	1,37	0,060	80 000	42 000	0,013	**E2.627-2Z**
	22	7	3,32	1,37	0,060	–	25 000	0,012	**E2.627-2RSH**
8	22	7	3,32	1,37	0,060	80 000	42 000	0,012	**E2.608-2Z**
	22	7	3,32	1,37	0,060	–	24 000	0,012	**E2.608-2RSH**
	24	8	3,71	1,66	0,072	75 000	37 000	0,017	**E2.628-2Z**
9	24	7	3,71	1,66	0,072	75 000	37 000	0,014	**E2.609-2Z**
	24	7	3,71	1,66	0,072	–	21 000	0,014	**E2.609-2RSH**
	26	8	4,62	1,93	0,080	70 000	36 000	0,020	**E2.629-2Z**
	26	8	4,62	1,93	0,080	–	21 000	0,019	**E2.629-2RSH**
10	26	8	4,62	1,93	0,080	70 000	36 000	0,019	**E2.6000-2Z**
	26	8	4,62	1,93	0,080	–	20 000	0,018	**E2.6000-2RSH**
	30	9	5,07	2,32	0,098	61 000	32 000	0,032	**E2.6200-2Z**
	30	9	5,07	2,32	0,098	–	19 000	0,032	**E2.6200-2RSH**
	35	11	8,32	3,4	0,143	55 000	29 000	0,053	**E2.6300-2Z**
	35	11	8,32	3,4	0,143		17 000	0,053	**E2.6300-2RSH**
12	28	8	5,07	2,32	0,098	66 000	33 000	0,022	**E2.6001-2Z**
	28	8	5,07	2,32	0,098	–	19 000	0,021	**E2.6001-2RSH**
	32	10	7,02	3,10	0,132	55 000	29 000	0,037	**E2.6201-2Z**
	32	10	7,02	3,10	0,132	–	17 000	0,036	**E2.6201-2RSH**
	37	12	9,95	4,15	0,176	49 000	25 000	0,060	**E2.6301-2Z**
	37	12	9,95	4,15	0,176	–	16 000	0,059	**E2.6301-2RSH**
15	32	9	5,53	2,75	0,118	55 000	28 000	0,030	**E2.6002-2Z**
	32	9	5,53	2,75	0,118	–	15 000	0,029	**E2.6002-2RSH**
	35	11	7,80	3,75	0,160	47 000	25 000	0,045	**E2.6202-2Z**
	35	11	7,80	3,75	0,160	–	14 000	0,046	**E2.6202-2RSH**
	42	13	11,40	5,30	0,224	41 000	21 000	0,083	**E2.6302-2Z**
	42	13	11,40	5,30	0,224	–	13 000	0,081	**E2.6302-2RSH**

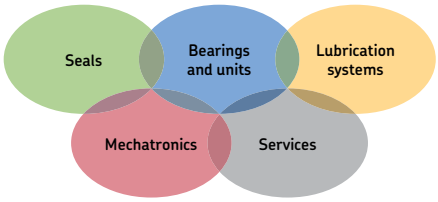
For more information on bearing dimensions and abutment diameters, please refer to product tables for capped single row deep groove ball bearings on *skf.com/bearings*.

Capped SKF E2 deep groove ball bearings

d 17 – 80 mm

Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations
			dynamic	static		Reference speed	Limiting speed		
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
17	35	10	5,85	3	0,127	49 000	25 000	0,039	**E2.6003-2Z**
	35	10	5,85	3	0,127	–	15 000	0,038	**E2.6003-2RSH**
	40	12	9,56	4,75	0,2	41 000	21 000	0,065	**E2.6203-2Z**
	40	12	9,56	4,75	0,2	–	13 000	0,065	**E2.6203-2RSH**
	47	14	13,8	6,55	0,275	37 000	19 000	0,12	**E2.6303-2Z**
	47	14	13,8	6,55	0,275	–	12 000	0,112	**E2.6303-2RSH**
20	42	12	9,36	5	0,212	41 000	21 000	0,069	**E2.6004-2Z**
	42	12	9,36	5	0,212	–	12 000	0,067	**E2.6004-2RSH**
	47	14	12,7	6,55	0,28	35 000	19 000	0,11	**E2.6204-2Z**
	47	14	12,7	6,55	0,28	–	11 000	0,10	**E2.6204-2RSH**
	52	15	16,3	7,8	0,34	34 000	18 000	0,15	**E2.6304-2Z**
	52	15	16,3	7,8	0,34	–	11 000	0,143	**E2.6304-2RSH**
25	47	12	11,1	6,1	0,26	35 000	18 000	0,08	**E2.6005-2Z**
	47	12	11,1	6,1	0,26	–	11 000	0,077	**E2.6005-2RSH**
	52	15	13,8	7,65	0,325	30 000	16 000	0,13	**E2.6205-2Z**
	52	15	13,8	7,65	0,325	–	10 000	0,13	**E2.6205-2RSH**
	62	17	22,9	11,6	0,49	28 000	15 000	0,23	**E2.6305-2Z**
30	55	13	12,7	7,35	0,31	30 000	15 000	0,12	**E2.6006-2Z**
	62	16	19,5	11,2	0,475	26 000	14 000	0,20	**E2.6206-2Z**
	72	19	28,1	15,6	0,67	22 000	12 000	0,36	**E2.6306-2Z**
35	62	14	15,3	9,15	0,39	26 000	13 000	0,15	**E2.6007-2Z**
	72	17	25,5	15,3	0,64	22 000	12 000	0,30	**E2.6207-2Z**
	72	17	25,5	15,3	0,64	–	7 300	0,28	**E2.6207-2RST**
	80	21	33,8	19	0,83	20 000	11 000	0,48	**E2.6307-2Z**
40	68	15	15,9	9,65	0,405	24 000	12 000	0,19	**E2.6008-2Z**
	80	18	30,7	18,6	0,78	20 000	11 000	0,38	**E2.6208-2Z**
	80	18	30,7	18,6	0,78	–	6 500	0,35	**E2.6208-2RST**
	90	23	41	24	1,02	18 000	10 000	0,65	**E2.6308-2Z**
45	85	19	32,5	20,4	0,865	18 000	10 000	0,43	**E2.6209-2Z**
	85	19	32,5	20,4	0,865	–	5 800	0,40	**E2.6209-2RST**
	100	25	52,7	31,5	1,34	16 000	9 000	0,87	**E2.6309-2Z**
50	110	27	62,4	38	1,63	15 000	8 000	1,12	**E2.6310-2Z**
55	100	21	42,3	27,5	1,16	–	5 000	0,58	**E2.6211-2RST**
	120	29	71,5	45	1,9	13 000	7 000	1,41	**E2.6311-2Z**
	120	29	71,5	45	1,9	–	4 400	1,35	**E2.6311-2RST**
60	130	31	81,9	52	2,2	12 000	6 700	1,78	**E2.6312-2Z**
	130	31	81,9	52	2,2	–	3 900	1,70	**E2.6312-2RST**
65	140	33	93,6	60	2,5	11 000	5 300	2,17	**E2.6313-2Z**
70	150	35	104	68	2,75	11 000	5 000	2,63	**E2.6314-2Z**
75	160	37	114	76,5	3,05	10 000	4 500	3,14	**E2.6315-2Z**
80	170	39	124	86,5	3,25	9 500	4 300	3,75	**E2.6316-2Z**

For more information on bearing dimensions and abutment diameters, please refer to product tables for capped single row deep groove ball bearings on *skf.com/bearings*.



The Power of Knowledge Engineering
Combining products, people, and application-specific knowledge, SKF delivers innovative solutions to equipment manufacturers and production facilities in every major industry worldwide. Having expertise in multiple competence areas supports SKF Life Cycle Management, a proven approach to improving equipment reliability, optimizing operational and energy efficiency and reducing total cost of ownership.

These competence areas include bearings and units, seals, lubrication systems, mechatronics, and a wide range of services, from 3-D computer modelling to cloud-based condition monitoring and asset management services.

SKF's global footprint provides SKF customers with uniform quality standards and worldwide product availability. Our local presence provides direct access to the experience, knowledge and ingenuity of SKF people.

SKF BeyondZero is more than our climate strategy for a sustainable environment: it is our mantra; a way of thinking, innovating and acting.

For us, SKF BeyondZero means that we will reduce the negative environmental impact from our own operations and at the same time, increase the positive environmental contribution by offering our customers the SKF BeyondZero portfolio of products and services with enhanced environmental performance characteristics.

For inclusion in the SKF BeyondZero portfolio, a product, service or solution must deliver significant environmental benefits without serious environmental trade-offs.

SKF Energy Efficient (E2) deep groove ball bearings are included in the SKF BeyondZero portfolio because their reduced friction helps reduce energy use and grease usage which, in turn, helps reduce CO_2 emissions compared to conventional bearings.

skf.com | skf.com/dgbb

PUB BU/P2 6692/3 EN · March 2015