SKF

SKF spherical roller bearings – setting a new standard for performance and reliability

Made by SKF® stands for excellence. It symbolises our consistent endeavour to achieve total quality in everything we do. For those who use our products. “Made by SKF” implies three main benefits.

Reliability – thanks to modern, efficient products, based on our worldwide application know-how, optimised materials, forward-looking designs and the most advanced production techniques.

Cost effectiveness – resulting from the favourable ratio between our product quality plus service facilities, and the purchase price of the product.

Market lead – which you can achieve by taking advantage of our products and services. Increased operating time and reduced down-time, as well as improved output and product quality are the key to a successful partnership.

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Economical and robust

Why spherical roller bearings?

Spherical roller bearings offer an attractive combination of design features, which are making them irreplaceable in many demanding applications.

- **Self-aligning**
  Spherical roller bearings allow misalignment between shaft and housing without increase of friction and without reduction of bearing life.
- **Very high load carrying capacity**
  Optimum layout inside available cross-section provides maximum radial and axial load carrying capacity.
- **Robust**
  Insensitive to misalignment caused by shaft or housing deflection due to heavy load.
- **Easily fitted for loads in all directions**
  The bearings are non-separable and ready to install using a number of mounting methods.
- **Easy bearing application**
  The favourable design characteristics and mounting enable for a more efficient and compact machine design.

Spherical roller bearings with integral seals offer additional benefits.

- **Protection against contamination**
  Sealed spherical roller bearings are especially suited for bearing positions where, because of limited space or for cost reasons, effective external seals cannot be provided.
- **Grease retention**
  Contact seals on both sides of the bearing retain the factory filled grease where it is required: inside the bearing.
- **Minimum maintenance requirements**
  Under normal operating conditions, sealed spherical roller bearings are maintenance free, keeping service costs and grease consumption low.

Customer benefits

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Why SKF spherical roller bearings?

SKF bearings are developed for customer satisfaction. The best confirmation of the total quality of SKF spherical roller bearings is their success on the market. There are twice as many SKF spherical roller bearings in service as those of any other bearing manufacturer.

This is not just by chance: SKF spherical roller bearings are well-proven in the field and undergo continuous development to provide improved performance. The most recent example has been the introduction of the Explorer bearings, which opened up new application horizons, and the sealed bearings in standard and Explorer versions.

The use of SKF spherical roller bearings implies several benefits.

Application efficiencies
SKF spherical roller bearings have a very high load carrying capacity in the radial and axial directions. Bearing applications become increasingly cost effective due to

- long service life and
- compact arrangements.

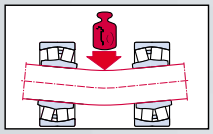
Reduced operating costs
The optimised and robust internal design of the SKF spherical roller bearings minimises friction and heat, and by this, lubricant consumption. In service, this reduces costs due to

- less machine downtime,
- minimised maintenance requirements and
- high reliability.

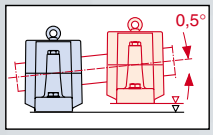
Seals integration
Under normal operating conditions, sealed SKF spherical roller bearings are greased for life and make external seals unnecessary, creating additional benefits:

- simplified bearing arrangements;
- no relubrication.

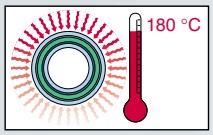
Standard solution
Many bearing applications previously fitted with expensive special bearings can now be equipped with SKF spherical roller bearings. Because of the global availability of SKF spherical roller bearings, spare parts are much easier to get.



Rugged



Tolerant to alignment errors



Resistant to elevated temperatures

Customer benefits

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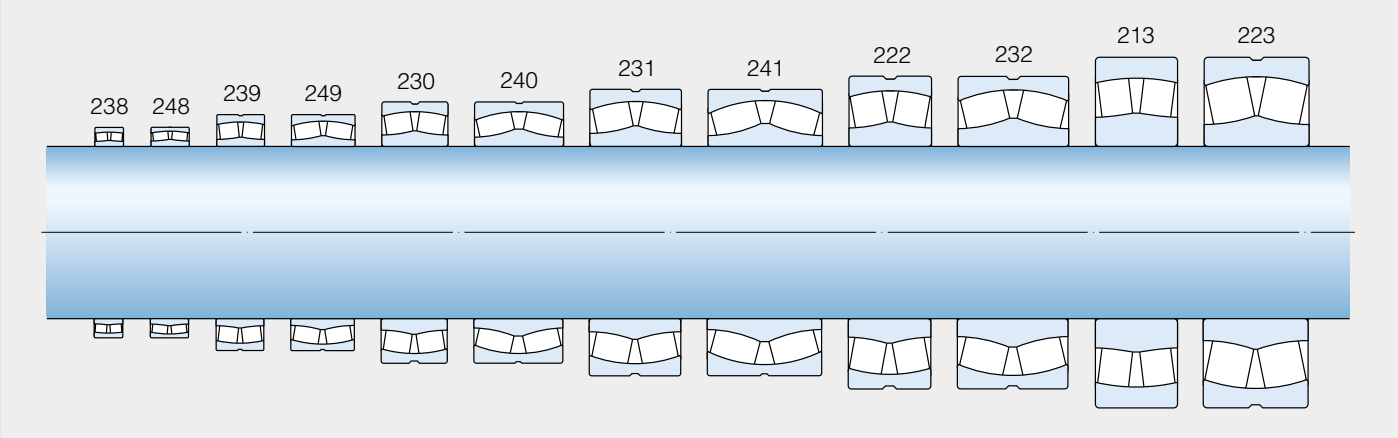
Customer satisfaction
Equipment owners will be impressed by the low operating costs in combination with high reliability contributed by SKF spherical roller bearings. Not only are costs reduced, but with sealed versions environmental resources are spared.

SKF bearings:
always the best choice, when robustness and reliability matter



Bearing series

A complete bearing range

The range of open and sealed SKF spherical roller bearings covers all series currently in demand. Taking availability into account, this constitutes the most complete range on the market.

Narrow low-section bearings have better speed, space and weight characteristics. Wide high-section bearings have higher load carrying capacity.

Product range

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SKF spherical roller bearings without seals

The open bearings are available in sizes from 20 to 1 800 mm bore diameter and with cylindrical or tapered bore to suit all types of mounting methods. To facilitate efficient lubrication, most bearings are provided with an annular groove and three lubrication holes in the outer ring.

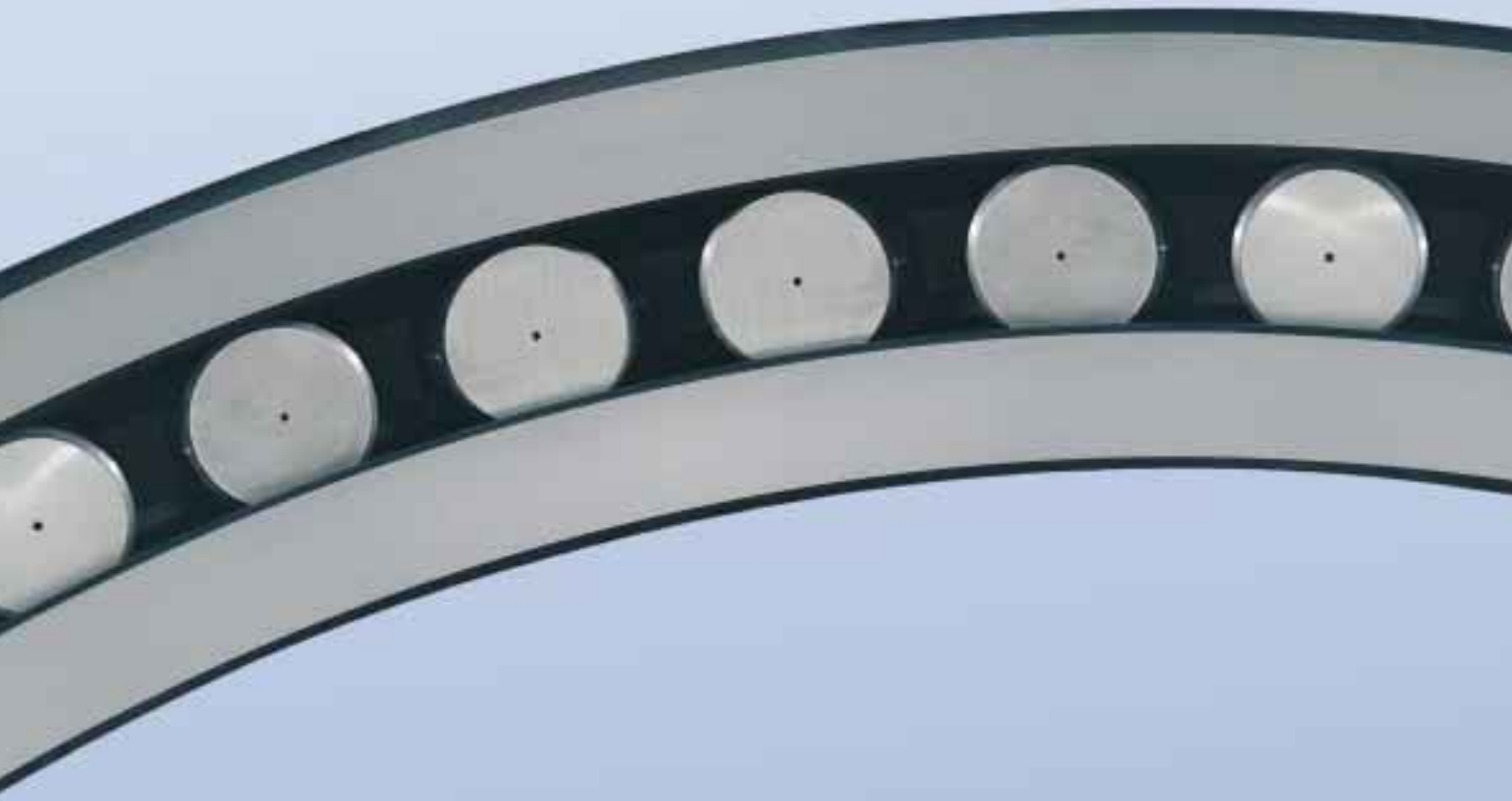
The bearings are available in a wide range of series designed to satisfy the following selection criteria:

- load carrying capacity;
- combination of radial and axial loads;
- rotational speed;
- space in the application.

Sealed SKF spherical roller bearings

The SKF range of sealed spherical roller bearings comprises bearings with cylindrical bore for shaft diameters of 35 to 220 mm and bearings with tapered bore for shaft diameters of 40 to 90 mm in the seven most frequently used bearing series. Further sizes can be produced to special order.

The seals have been specially developed for spherical roller bearings and effectively prevent contamination from entering the rolling contact area. This is not only true in operation, but also during bearing installation, resulting in long service life.



SKF spherical roller bearings – leading in design

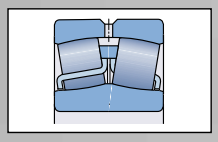
Standard bearings: a unique combination of design features

All SKF spherical roller bearings have features in common which are unique in the market:

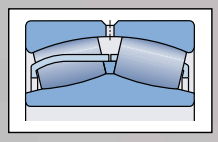
- symmetrical rollers
- special roller profile
- self-guiding rollers – an SKF patent
- floating guide ring between the two rows of rollers
- bearing components dimensionally stabilised for high temperatures
- metallic cages

To facilitate efficient bearing lubrication SKF standard spherical roller bearings are provided with three lubrication holes in the outer ring, mostly in combination with an annular groove. Depending on size and series, standard SKF spherical roller bearings are basically made in three different designs:

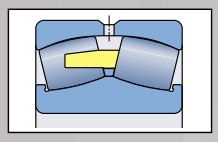
- E design
- CC design
- CA design



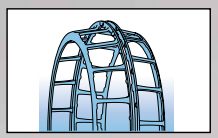
E design
The bearings of this design have symmetrical rollers, two hardened window-type steel cages centred on the inner ring, a flangeless inner ring and a floating guide ring between the two roller rows.



CC design
With symmetrical rollers, two window-type steel cages which are inner ring centred via a floating guide ring between the two roller rows.



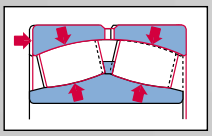
CA design
With symmetrical rollers. The inner ring centred guide ring centres the one piece, double pronged machined cage of brass or steel. The inner ring has retaining flanges.



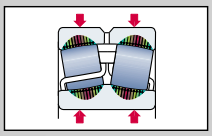
Durable cage design
Steel and brass cages are strong as well as tolerant to high temperatures and all lubricants. Small and medium size bearings have window-type steel cages, larger sizes have machined double pronged brass or steel cages.

E design

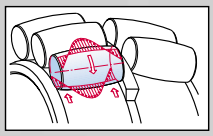
CC design



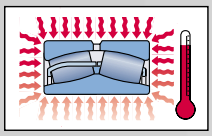
Very high load carrying capacity
The symmetrical rollers self-adjust, providing an even load distribution along the roller length. This gives very high load carrying capacity under all load combinations.



No edge stresses
The special roller profile minimises the risk of edge stresses.



Reduced friction and minimum heat generation
Self-guiding rollers – an SKF patent – mean reduced friction and minimum heat generation.



Excellent performance at high temperatures
High-strength, dimensionally stable bearing rings minimise the risk of ring breakage and also allow good performance at high temperatures.

Setting new standards: the SKF Explorer

The unique SKF spherical roller bearing designs were the starting points for further development of materials and manufacturing processes. The Explorer spherical roller bearings are the result of very skilled and intensive fine tuning processes, which, taken all together constitute a new performance level for spherical roller bearings.

- **Steel**
  New, ultra-clean for longer life at higher loads.
- **Heat treatment**
  New procedures significantly improve wear resistance.
- **Manufacturing**
  Refined processes allow the production of smoother running bearings with improved lubrication.
- **Internal geometry**
  A fine-tuned micro-geometry of the rolling contacts gives better stress distribution.

Explorer bearings give more performance for the same size as explained in more detail from **page 12** onwards.

CA design

Sealed SKF spherical roller bearings – for demanding environments

Sealed SKF spherical roller bearings are designed to fulfil high demands on sealing efficiency and operational reliability under difficult environmental conditions. The seals were developed using computer simulation, making full usage of the vast expertise within the SKF Group. They have been extensively tested both in the laboratory and in the field and have proved their reliable performance and efficiency.

SKF sealed spherical roller bearings include double-lip, sheet steel reinforced seals made of

– nitrile rubber (NBR)
– hydrogenated nitrile rubber (HNBR)
– fluoro rubber (FPM)

and a grease fill which is appropriate to the operating conditions.

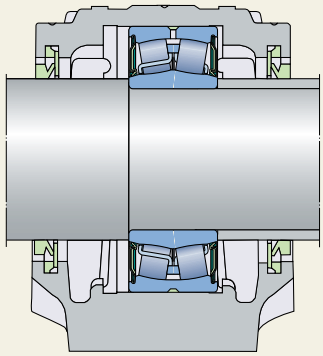
This forms a ready-to-mount and lubricated-for-life bearing with long service life and normally the same space requirements as a standard open bearing. The advantages include a simplification of the bearing arrangement, as well as the option of downsizing. Facilities for relubrication are normally not required, and there are no more costs for purchasing, applying and disposing of bearing greases.

Temperature limits
Sealed SKF spherical roller bearings are suitable for normal operating temperatures up to 110 °C (230 °F). Bearings for higher operating temperatures can be produced upon request. In these cases, the grease and seal material must be chosen accordingly. Other operating conditions such as the speed may need to be considered as well. Please contact the SKF application engineering service for further advice.

Contamination resistance

Due to the efficiency of the integral seals, additional external seals are normally not required. Generally compact bearing arrangements can be produced in most cases. However, if the environmental conditions are harsh, external seals should be employed (➔ **fig 1**).

Fig 1



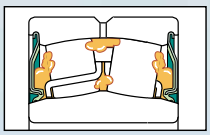
A sealed spherical roller bearing in an SNL plummer block housing

Warning for fluoro rubber (FPM) seals

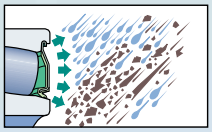
FPM is very stable and harmless in normal operating conditions – up to 200 °C (392 °F). However, if exposed to extreme temperatures above 300 °C (572 °F), e.g. fire or the flame of a cutting torch, fluoro rubber emits dangerous toxic vapours. Once overheated the fluoro rubber will remain dangerous to handle even when cooled. Please contact SKF for complete safety instructions. See also SKF catalog 4006 “CR seals” for further information.

Rule of thumb

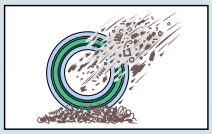
Sealed bearings do not need relubrication when the temperatures do not exceed 70 °C (158 °F) and speed are not more than 50 % of the speed rating listed in the product tables. More precise information is given in the section “Lubrication and maintenance” on **page 28**.



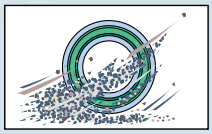
Well lubricated
Bearings for normal operating temperatures and speeds are lubricated with the SKF lithium base grease LGEP 2 with excellent rust inhibiting properties.



Well protected
The bearings have a sheet steel reinforced double-lip seal at each side. Seals can be made of nitrile rubber (NBR), hydrogenated nitrile rubber (HNBR) or fluoro rubber (FPM).



Solid contaminants excluded
Eliminate dirt in the bearing, which creates indentations in both raceways and rollers and causes early failure due to flaking. The best and simplest method to do this is to use SKF sealed spherical roller bearings. The seals offer protection for the bearing interior during handling and mounting.



Always reliable
The bearings are filled with a high-quality grease, which is particularly suitable for SKF spherical roller bearings. Integral seals contribute to the efficient lubrication by keeping the lubricant in position inside the bearing.

Moisture cannot enter
Adequate seals keep water out of the bearing, which otherwise would cause corrosion and considerable damage to the raceways, leading to noise and early failure. The improved seals are endorsed by the rust inhibiting properties of the lubricant.

SKF Explorer – the new performance class for spherical roller bearings

Having invented the spherical roller bearing some eighty years ago, SKF has been the leading manufacturer of these bearings ever since.

Now our specialists in all different disciplines have combined their experience and know-how into one large step forward in bearing technology. And we are proud of having made tomorrow's bearing technology available for our customers today. The Explorer bearings represents a significant breakthrough in performance. By studying the interrelationsship between each bearing component, SKF scientists were able to maximize the effects of lubrication and minimize the effects of friction, wear, and contamination.

The Explorer design is the result of years of intensive research by an international team of SKF scientists and engineers. It incorporates a number of improvements including:

The new material
The new steel used in SKF Explorer bearings is extraordinarily clean and homogeneous. It forms a perfect structure which does not generate stress peaks under load.

The new heat treatment
Together with a refined heat treatment process, the new steel significantly improves the SKF Explorer bearings wear resistance. It does this while retaining the temperature resistance and toughness of the bearings.

The new manufacturing processes
Improved manufacturing processes has enabled the tightening of the tolerances for all essential bearing features. To achieve good bearing performance, the surface texture has been refined to maintain an optimum oil film between the contacting surfaces.

The new bearing knowledge
Sophisticated in-house software has enabled SKF design engineers to study internal bearing dynamics to an extent not possible previously. This led the way to design refinements, which, implemented in the Explorer bearings, allowed further optimisation of the rolling element/raceway contacts.

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New performance class

The result: longer bearing life
All these improvements contribute to a significant increase in bearing service life and reliability. This can best be shown through calculation using the SKF Life Method. The properties of SKF Explorer spherical roller bearings are taken into consideration by

- increased basic dynamic load ratings and
- an increased life adjustment factor a_{SKF}.

Availability
The popular small and medium size spherical roller bearings in the series 213, 222, 223, 230, 231, 240 and 241 are available as Explorer bearings. The range is being extended in these bearings series as well as in other series.

In the product table, the Explorer bearing designations are printed in blue.

Product designations
The Explorer bearings retain the designations of the earlier standard bearings, e.g. 22218 E or BS2-2210 C-2CS. However, each bearing and its box is marked with the name EXPLORER, so that there can be no confusion.

Existing machine

Switching to Explorer bearings give

- several times the service life previously achieved,
- more machine uptime,
- higher safety factor,
- an appreciable reduction of machine cycle cost

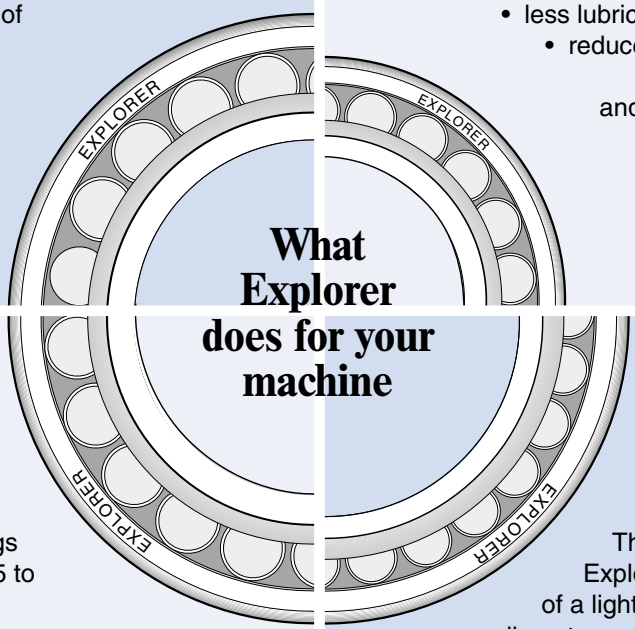
and, therefore, added value.

New machine with same power

Explorer makes it possible to use a smaller bearing size which allows

- more compact machines,
- higher speeds,
- smoother and quieter running,
- less lubricant usage,
- reduced friction,

and will create added value.



What Explorer does for your machine

Existing machine with increased power

Same size Explorer bearings allow power increases of 15 to 25 % with

- same service life,
- same machine uptime,
- same machine design,

and higher added value.

New machine with same or increased power

The higher carrying capacity of Explorer bearings allows the use of a lighter series with same outside diameter and increased bore diameter, so that

- a stronger, or even hollow shaft can be used,
- the total design can be stiffer and also cheaper,
- system life is increased due to higher stiffness,

and machine cycle cost is significantly reduced.

Efficient in all industrial segments

Industrial segments

- Metallurgical
- Mining & construction
- Pulp & paper
- Fluid machinery
- Materials handling
- Industrial gearboxes
- Textile industry
- Railways

Requirements

- Long service life
- High load carrying capacity
- Compact arrangements
- Tolerant of misalignment
- Minimum maintenance
- Reduced operation costs
- No unplanned stoppages
- Environmental welfare
- High availability
- Technical support

Solution

Long service life, high reliability, limited maintenance and the ability to design compact arrangements have made SKF spherical roller bearings indispensable in many industries. In addition to the industries listed above SKF spherical roller bearings are also used in bridges, dam gates, electric motors, generators, plastic calenders, extruders, printing machines, robots and many other applications.

Because end users are recognizing that high quality bearings deliver an excellent return on investment, SKF spherical roller bearings are becoming the preferred choice in new applications.

Where maintenance can be a nightmare

To get to the top is always a challenge, particularly if the goal is the top of ski-lift masts in mid winter when it is 30 degrees below zero and the bearings have to be relubricated. If operational reliability is to be achieved, then it has to be done. Regular relubrication is a must if the bearings are to be kept from rusting because of condensation. In addition safety considerations call for regular inspections – a dangerous job high up in mountainous terrain and under difficult weather conditions.

The introduction of SKF sealed spherical roller bearings has made all the difference. It is now only necessary to perform maintenance once a season – before starting operation. The highly efficient seals reliably exclude condensation so that corrosion is no longer a problem. It has also been possible to simplify the arrangement, saving space and costs – as well as making handling and installation easier.

Downsizing – more than just size

A typical application for spherical roller bearings is the winch of a traversing industrial lift. In this application the load, bending and deformation all call for rugged bearings that can function properly even under misalignment.

Open spherical bearing arrangements provided good service, but were too bulky and complicated to be considered completely satisfactory.

As a result, the open bearings were replaced with SKF sealed spherical roller bearings eliminating the need for the external seals and covers.

This obviously saved space and also meant that the bearings could be positioned 40 % closer to the drum, thus reducing the stress on the journals. In fact, it was possible to reduce the journal diameter by 20 % and use smaller bearings.

The new compact bearing arrangement requires much less maintenance and there is no loss of load lifting capacity. The result has been a 50 % savings of the total cost of the original bearing arrangement.

Trouble-Free Operation – the SKF concept for cost saving

The bearings in a machine can be compared to the heart of a human being. If the bearing comes to a standstill, so does the machine.

Just as a doctor listens to the heart of a patient, so it is possible to listen to the bearings in order to judge the condition of the machine. It is possible to determine whether the bearing is in danger of failing prematurely because of faulty mounting, poor lubrication or other causes.

If the bearings are neglected the result will be higher costs, unnecessary stoppages and, in the worst case, damage to other components of the machine. However, if the bearings are given the attention they deserve, not only will productivity be increased, but costs for maintenance, purchasing and storage will be reduced.

Why is SKF so certain of this? Because, SKF bearings, given ideal operating conditions, can live almost for ever.

The background photo is published by kind permission of British Steel – Sections, Plates & Commercial Steels.

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Trouble-Free Operation

All that is needed is a partnership with SKF for Trouble-Free Operation (TFO™). This includes everything you need to eliminate downtime from one reliable source:

- plant maintenance assessment
- reliability systems – local and via satellite
- predictive and preventive maintenance programs
- root cause failure analysis
- lubrication and filtration management
- equipment maintenance and monitoring – fans, pumps, gear boxes and spindles
- precision balancing
- precision alignment
- productivity management process
- applications-specific training
- technology upgrades
- repair services

There is no single TFO program from SKF, because it is defined in terms of a company's own particular needs and application challenges. Whatever the choice, it will be a win-win situation.

More information can be obtained from the nearest SKF office or authorised dealer.

SKF service engineer on site

Expert advice from the SKF application engineering service

SKF mounting and dismounting tools

Practical SKF seminars cover all there is to know about mounting and maintaining rolling bearings

Selection of bearing size

Bearing life

The life-extending improvements embodied in SKF Explorer spherical roller bearings can best be understood using the SKF Life Method. This calculation method constitutes an extension of the fatigue life theory developed by Lundberg and Palmgren and is better able to predict bearing life. The Life Method was first presented as the SKF New Life Theory in the SKF General Catalogue 4000 in 1989. For roller bearings

$$L_{naa} = a_1 \, a_{SKF} \, L_{10}$$

or

$$L_{naa} = a_1 \, a_{SKF} \left(\frac{C}{P}\right)^{10/3}$$

If the speed is constant, it is often preferable to calculate the life expressed in operating hours using

$$L_{naah} = a_1 \, a_{SKF} \, \frac{1\,000\,000}{60\,n} \left(\frac{C}{P}\right)^{10/3}$$

where
L_{naa} = the adjusted rating life according to the SKF Life Method, million revolutions
L_{naah} = the adjusted rating life according to the SKF Life Method, operating hours
L_{10} = basic rating life, million revolutions
a_1 = life adjustment factor for reliability (➔ **Table** 1)
a_{SKF} = life adjustment factor based on SKF Life Method (➔ **Diagram** 1)
C = basic dynamic load rating, kN
P = equivalent dynamic bearing load, kN
n = rotational speed, r/min

a_{SKF} factor

The a_{SKF} factor represents a very complex relationship between various influencing factors including contamination and lubrication. Lubrication conditions are expressed by the viscosity ratio κ. Values of a_{SKF} can be obtained from **Diagram** 1 for different values of η_c (P_u/P) and κ.

For standard spherical roller bearings, the values in black on the x axis should be used and for Explorer bearings the values in blue on the x axis. In fact, for Explorer spherical roller bearings it has been found appropriate to multiply η_c (P_u/P) by 1,4 as an expression of the life extending refinements of these bearings, and the blue values correspond to this.

Diagram 1 has been drawn up for a safety factor commonly used in fatigue life considerations and is valid for lubricants without EP additives. If a lubricant containing such additives is used, reference should be made to the SKF General Catalogue or the SKF Interactive Engineering Catalogue on CD-ROM or the Internet (www.skf.com).

Equivalent dynamic bearing load

The equivalent dynamic bearing load for spherical roller bearings can be obtained from

$P = F_r + Y_1 F_a$ when $F_a/F_r \leq e$
$P = 0{,}67\, F_r + Y_2 F_a$ when $F_a/F_r > e$

where
P = equivalent dynamic bearing load, kN
F_r = actual radial bearing load, kN
F_a = actual axial bearing load, kN
Y_1, Y_2 = axial load factors for the bearings
e = calculation factor

Appropriate values of the factors e, Y_1 and Y_2 will be found in the bearing tables for each individual bearing.

Life adjustment factor a_1

Table 1

Reliability %	Factor a_1
90	1
95	0,62
96	0,53
97	0,44
98	0,33
99	0,21

Standard and Explorer – a comparison

The performance enhancements incorporated into the SKF Explorer spherical roller bearings can best be demonstrated by a life calculation comparison for the bearing 22218 E in its earlier standard and its new Explorer version.

For the same operating conditions the life of

- the previous standard 22218 E with
  – a basic dynamic load rating
    C = 282 kN, and
  – a fatigue load limit
    P_u = 39 kN, and
- the Explorer bearing 22218 E with
  – a basic dynamic load rating
    C = 325 kN, and
  – a fatigue load limit
    P_u = 39 kN

are calculated.

The operating conditions are:

- equivalent dynamic bearing load
  P = 28,2 kN
- viscosity ratio $\kappa = 2$
- contamination factor $\eta_c = 0,4$.

The lives of the two bearings are then calculated.

Earlier standard bearing

For $\eta_c (P_u/P) = 0,4 \times 39/28,2 = 0,55$ using the black values on the x axis in **Diagram** 1 and $\kappa = 2$

$a_{SKF} = 3,7$

so that the life becomes

$L_{10aa} = a_{SKF} (C/P)^{10/3} = 3,7 \times (282/28,2)^{10/3}$

L_{10aa} = 7 970 million revolutions.

Explorer bearing

For $\eta_c (P_u/P) = 0,4 \times 39/28,2 = 0,55$ using the blue values on the x axis in **Diagram** 1 and $\kappa = 2$

$a_{SKF} = 7,1$

so that the life becomes

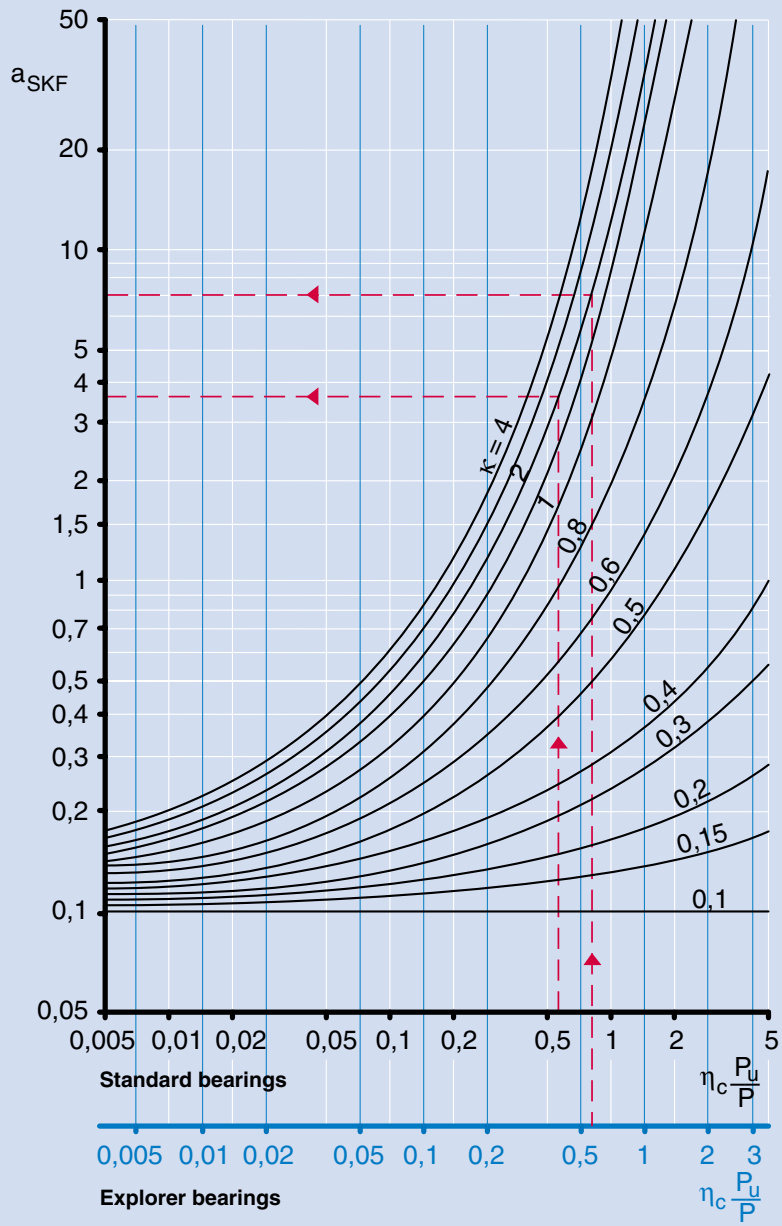
$L_{10aa} = a_{SKF} (C/P)^{10/3} = 7,1 \times (325/28,2)^{10/3}$

L_{10aa} = 24 500 million revolutions.

In this case, the Explorer bearing has a life compared with that of the previous standard bearing, which is 24 500/7 970 = 3,07 or just over three times longer.

Factor a_{SKF} for spherical roller bearings

Diagram 1



Minimum load

In order to provide optimum performance, spherical roller bearings must always be subjected to a given minimum load, especially if they operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on rolling conditions in the bearing and may cause damage due to sliding movements between the rollers and raceways.

The requisite minimum load to be applied to SKF Explorer spherical roller bearings can be estimated from

$$F_{rm} = 0{,}017\ C - Y_0 F_a$$

and for standard spherical roller bearings from

$$F_{rm} = 0{,}02\ C - Y_0 F_a$$

where
F_{rm} = minimum radial load, kN
C = basic dynamic load rating, kN
F_a = actual axial bearing load, kN
Y_0 = axial load factor of the bearing

The values for C and Y_0 will be found in the bearing tables for each individual bearing.

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, often exceed the requisite minimum load. If this is not the case, the bearing must be subjected to an additional radial load. It is advisable to contact SKF when problems with minimum load occur.

Required static load rating

The requisite basic load rating C_0 can be determined from

$$C_0 = s_0 P_0$$

where
C_0 = static load rating, kN
s_0 = static safety factor
P_0 = equivalent static bearing load, kN

Guideline values based on experience are given in **Table 2** for the static safety factor s_0 for various types of operation and requirements regarding smooth running.

The equivalent static bearing load for spherical roller bearings can be obtained from

$$P_0 = F_r + Y_0 F_a$$

where
P_0 = equivalent static bearing load, kN
F_r = actual radial bearing load, kN
F_a = actual axial bearing load, kN
Y_0 = axial load factor of the bearing

The appropriate value of the factor Y_0 will be found in the bearing tables for each individual bearing.

Are you still doing these calculations by hand?
The CD-ROM “SKF Interactive Engineering Catalogue” includes all the equations mentioned in this brochure and the underlying software enables them to be calculated at the click of a mouse. Visit our site on the Internet “www.skf.com”

Guideline values for the static safety factor s_0

Table 2

Type of operation	Rotating bearings Requirements regarding quiet running Unimportant	Normal	High	Non rotating bearings
Smooth, vibration-free	1	1,5	3	0,8
Normal	1	1,5	3,5	1
Pronounced shock loads	≥ 2,5	≥ 3	≥ 4	≥ 2

Application of bearings

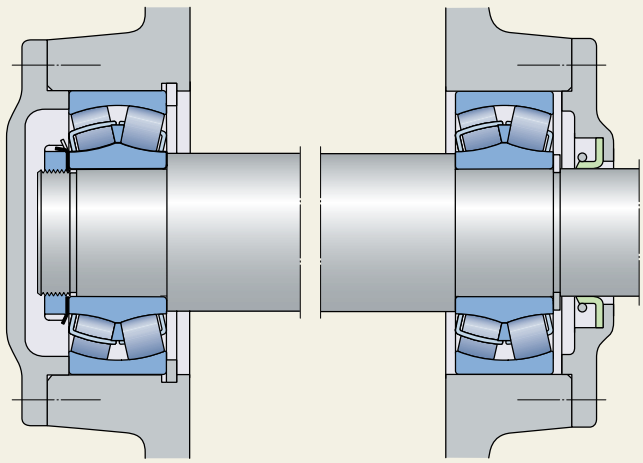
Conventional bearing arrangements

Conventional self-aligning bearing arrangements using two spherical roller bearings (➔ **fig** 1) – one applied as a locating, the other as a non-locating bearing – are the basis of many industrial bearing arrangements. This is a simple robust arrangement capable of withstanding high radial as well as thrust loads, whilst easily accommodating misalignments.

The non-locating bearing must be able to slide axially, usually inside the housing, to accommodate shaft expansion or contraction. To achieve this movement, one of the bearing rings must be mounted with a loose fit and axial space provided for movement.

Under certain loading conditions, however, this bearing arrangement may not be suitable. The ring with a loose fit can creep and damage the housing. It can also result in accelerated wear and increased vibration, additional maintenance and repair costs. It also means that the shaft is supported less rigidly in the radial direction. In these situations, SKF recommends a new self-aligning system.

Fig 1



Conventional spherical roller bearing arrangement with locating (left) and non-locating bearing (right)

The new self-aligning bearing system

The new self-aligning bearing system consists of a spherical roller bearing as the locating and a CARB® toroidal roller bearing as the non-locating bearing (➔ **fig** 2).

This bearing system accommodates misalignment as well as axial movement without generating additional axial forces caused by the friction between the outer ring and housing. Due to the ideal co-operation of both bearings the real load situation is always as predicted.

The advantages of spherical roller bearings and CARB bearings are fully utilised in this bearing system, allowing the performance expected and needed by designers today.

The new self-aligning system enhances reliability and performance. Producers as well as users of machines have clearly reduced costs due to simpler design and increased productivity.

More information will be found in the SKF brochure 4417 “Self-aligning bearing systems” .

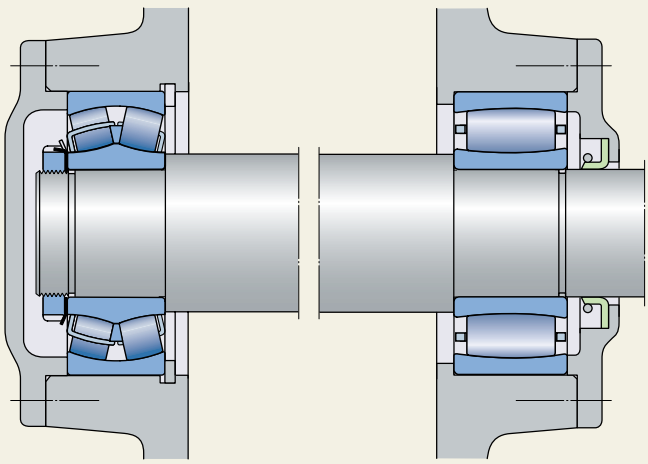
Radial location of bearings

If the load carrying ability of a bearing is to be fully utilised, its rings must be evenly supported around the circumference and across the whole width of the raceway. This support must be firm and even and can be provided by a cylindrical or tapered seating.

Sufficient support, as well as good radial location of the bearing, generally requires a tight fit between the bearing rings and the surrounding components. However, if easy mounting and dismounting is required, or for the one ring of non-locating bearings, a tight fit cannot be applied.

Further information on selection of fits and accuracy of the bearings seatings will be found in the SKF General Catalogue or CD-ROM “SKF Interactive Engineering Catalogue”.

Fig 2



Self-aligning bearing system using a CARB bearing as the non-locating bearing

Axial location of bearings

An interference fit alone is generally inadequate for the axial location of a spherical roller bearing ring. As a rule, some suitable means of axially securing the ring is needed. Both rings of a locating bearing should be axially secured at both sides. For non-locating bearings, on the other hand, it is sufficient if the ring having the tighter fit – usually the inner ring – is axially secured; the other ring must be free to move axially with respect to its seating (➔ **fig** 1 on **page 21**).

Bearing rings having an interference fit are generally mounted so that the ring abuts a shoulder on the shaft or in the housing at one side. At the opposite side, inner rings are normally secured by a snap ring, shaft nut or an end plate attached to the shaft end. Outer rings are usually retained by the housing end cover (➔ **fig** 1 on **page 21**).

The dimensions of the shaft and housing shoulders adjacent to the bearing must provide sufficient support for the bearing rings, without contact between the rotating parts of the bearing and a stationary component. To ensure this, appropriate abutment dimensions are quoted for each individual bearing listed in the product tables.

When using a shaft nut to locate a sealed bearing, insert an intermediate ring between the bearing and the locking washer and, probably, to extend the threaded portion of the shaft accordingly (➔ **fig** 3).

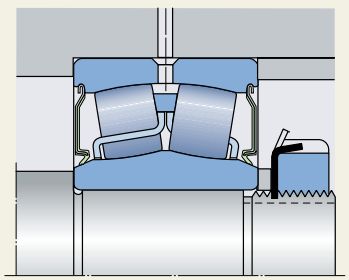
Design of associated components

For arrangements with large spherical roller bearings it is often necessary to make design provisions to enable the bearings to be mounted or dismounted easily. For example, withdrawal tools can be applied to dismount bearings, if appropriate slots are machined in the shaft and housing shoulders, or if threaded holes are provided in the housing shoulders.

If the oil injection method is to be used to mount and dismount bearings on tapered journals (➔ **fig** 4) or to dismount bearings from cylindrical seatings (➔ **fig** 5), it is necessary to provide oil supply ducts in the journal and grooves in the seating. Recommendations are given in the SKF publication 4100 “SKF Bearing Maintenance Handbook” or CD-ROM “SKF Interactive Engineering Catalogue”.

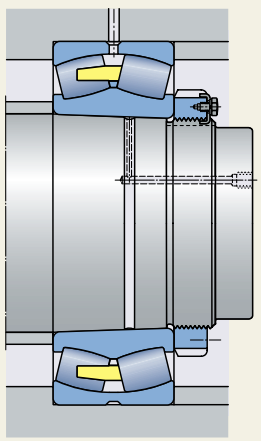
An intermediate ring between the bearing and lock washer (of the nut) protects the seal

Fig 3



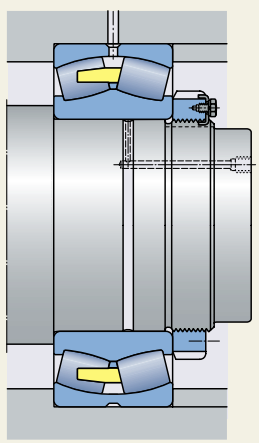
Spherical roller bearing of CAK design on a tapered journal with oil supply ducts and grooves

Fig 4



Spherical roller bearing of CA design on a cylindrical seating with oil supply ducts and grooves

Fig 5



Mounting and dismounting

Bearing storage

Before leaving the factory, SKF spherical roller bearings are treated with a corrosion inhibitor. They can be stored in their unopened original packages for up to five years (three years for sealed bearings), provided the relative humidity in the store does not exceed 60 % (➔ **fig** 1).

To avoid the risk of contamination and corrosion, the original packages should not be opened until immediately before mounting the bearing.

Mounting

Skill and cleanliness are essential when mounting bearings, to make sure that they perform satisfactorily and attain their full potential. Above all, the correct method of mounting should be chosen and suitable tools used. This is particularly important, where sealed SKF spherical roller bearings are concerned, since misalignments of the inner ring relative to the outer ring in excess of 0,5° may damage the seals. For optimum results in mounting and dismounting bearings, SKF offers a full range of tools and equipment. Please refer to the “Related SKF products” section on **page 58**.

Bearings with cylindrical bore

When mounting bearings with cylindrical bore, the ring with the tighter fit is normally mounted first.

The force required to mount a bearing increases according to the bearing size. Therefore, it is not always possible to press large bearings onto a cylindrical shaft or into a housing in the cold state. In this case, either the inner ring or the housing should be expanded by heating before mounting.

To mount with an interference fit on a shaft the bearing should be heated to some 80 to 90 °C (180 to 200 °F) above the temperature of the shaft. Please remember that sealed bearings should never be heated to more than 110 °C (230 °F).

The use of an SKF induction heater has been found very advantageous (➔ **fig** 2). It heats the bearing rapidly, and a bult-in thermostat prevents bearing damage caused by overheating. Non-metallic components such as seals remain cold, as does the heater itself.

Mounting bearings by cooling the shaft or the bearing is not recommended, as the very low temperatures required inevitably cause condensation, thus creating a risk of corrosion.

Correct storage of bearings

Fig 1

SKF induction heater

Fig 2

Bearings with tapered bore

Bearings with tapered bore are always mounted with an interference on the shaft. They can be mounted on adapter or withdrawal sleeves or directly on to tapered journals.

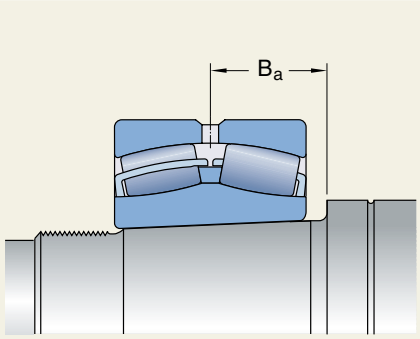
When dimensioning a tapered journal, the distance between the centre of the bearing in its final mounted position and a reference face on the shaft should be used as a basis (➔ **fig** 3). When the dimension B_a has been established, the dimensioning of the journal should be continued as described in SKF catalogue 4003 “Large bearings”.

Spherical roller bearings up to 200 mm bore diameter may be driven up on to a tapered journal or a withdrawal sleeve using a shaft nut and on to an adapter sleeve using the sleeve nut and a spanner (➔ **fig** 4).

The application of the high drive-up forces required by larger bearings can be facilitated using the oil injection method (➔ **fig** 5). This necessitates the provision of oil supply ducts in the journals and oil distribution grooves in the seating. Further reduction of the mounting effort can be achieved by using the oil injection method in combination with an SKF hydraulic nut.

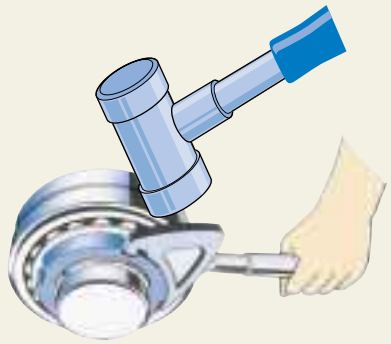
For bearings which are to be hot mounted, the final axial position on the seating has to be predetermined by means of, for instance, a tailor-made spacer ring (➔ **fig** 6). When cold, the bearing will obtain its correct interference fit.

Fig 3



Dimensioning of tapered journals

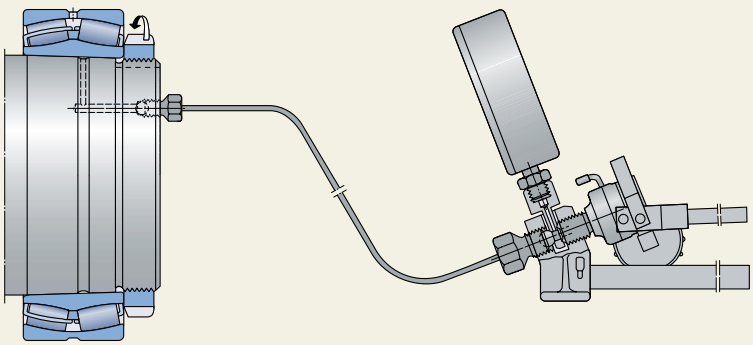
Fig 4



Drive-up of medium size bearing

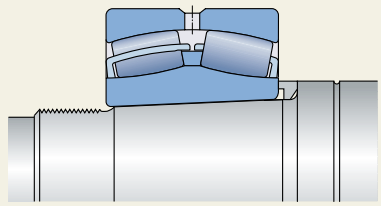
Drive-up of large size bearing

Fig 5



Tailor-made spacer ring used to position the bearing axially

Fig 6

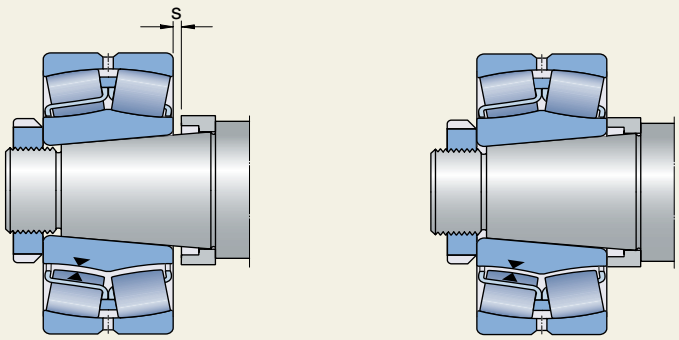


The reduction in radial internal clearance of open bearings or the axial displacement of the inner ring on its tapered seating is used as a measure of the degree of interference (➔ **fig** 7).

To effectively mount sealed bearings with a tapered bore, it is only possible to use the drive-up distance as a measure, and the “SKF drive-up method” is recommended. It allows the starting position of the bearing to be easily and accurately determined by applying a well-defined oil pressure in the hydraulic nut. The correct fit is then achieved by controlling the axial drive-up from this position.

The SKF drive-up method incorporates the use of a new type of hydraulic nut fitted with a dial indicator to control the drive-up and a specially calibrated pressure gauge, mounted on the selected pump (➔ **fig** 8).

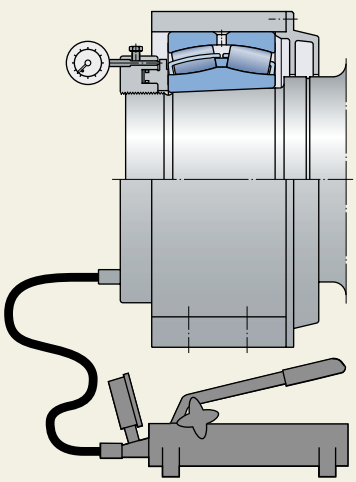
Fig 7



Desired interference obtained by measuring clearance reduction or axial drive-up

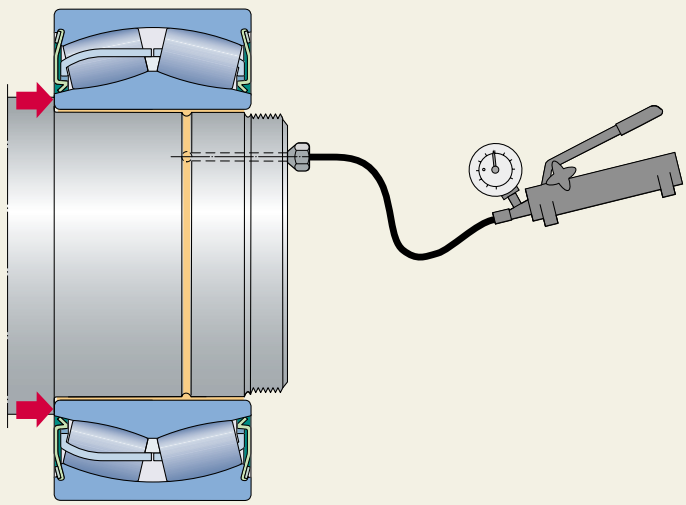
Mounting a bearing using the SKF drive-up method

Fig 8



Dismounting a bearing from a cylindrical seat using the oil injection method

Fig 9



Dismounting

The force required to remove a bearing is generally greater than the mounting force, particularly if, after a long period of service, fretting corrosion is present. If bearings or other associated components are to be reused after inspection, they must be dismounted as carefully as they were mounted, and the dismounting force should never be applied through the rolling elements.

Bearings with cylindrical bore
Small bearings can generally be removed using a mechanical puller. These withdrawal tools should grip over the rings from the inside or outside and contact the side faces.

Dismounting larger bearings with bore diameters of 80 mm and above with an interference fit on the shaft is considerably eased, if the SKF oil injection method is used (➔ **fig** 9).

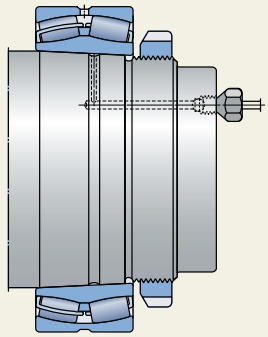
Bearings with tapered bore
To remove spherical roller bearings from tapered journals, the oil injection method is recommended (➔ **fig** 10). The film of pressurised oil separates the two mating surfaces and makes the bearing slide off easily.

Bearings mounted on adapter or withdrawal sleeves are most easily removed using a hydraulic nut (➔ **fig** 11). By using sleeves with oil ducts and oil distribution grooves, the oil injection method easily facilitates the removal of large bearings (➔ **fig** 12).

Safety note
To avoid damage or accidents when dismounting bearings from tapered seatings using the oil injection method, always make sure that the bearing is blocked at the shaft end, e.g. by a lock nut, to prevent it from falling off.

See also SKF publication 4100 "SKF Bearing Maintenance Handbook".

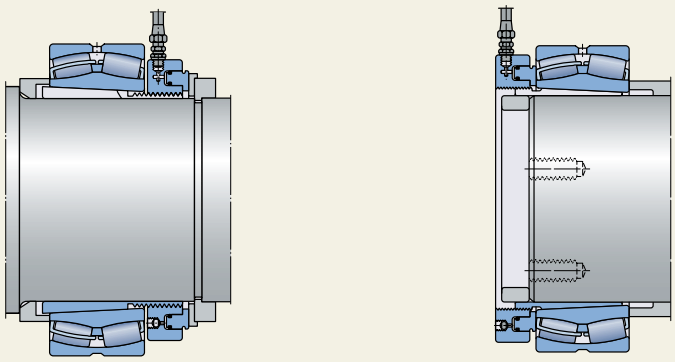
Fig 10



Dismounting a bearing from a tapered journal using the SKF oil injection method

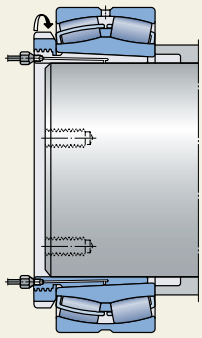
Dismounting bearings on adapter and withdrawal sleeves with hydraulic nuts

Fig 11



Dismounting a large size bearing on withdrawal sleeve with oil ducts and grooves

Fig 12



Lubrication and maintenance

Oil lubrication

For oil lubrication of spherical roller bearings, oil bath and circulating oil lubrication are the two main options.

Oil bath

This is the most simple method of oil lubrication (➔ **fig** 1). The oil, which is picked up by the rotating components of the bearing, is distributed within the bearing and then flows back to the oil bath.

The oil level should be such that it almost reaches the centre of the lowest roller when the bearing is stationary. The speed ratings for oil lubrication given in the product tables apply to this method of lubrication. Even under optimum operating conditions, the oil must be changed at least once a year.

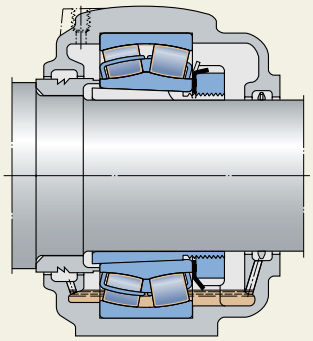
Circulating oil

In the circulating system, the oil can be continuously filtered and/or cooled (➔ **fig** 2). This significantly increases the service life of the oil, helping to avoid frequent oil changes.

The circulation can be produced by a pump. Adequately dimensioned ducts must allow the oil to leave the arrangement after passing through the bearing.

An intermediate form of oil lubrication is one where the oil is splashed up from the oil bath by other components, e.g. gears in a gearbox.

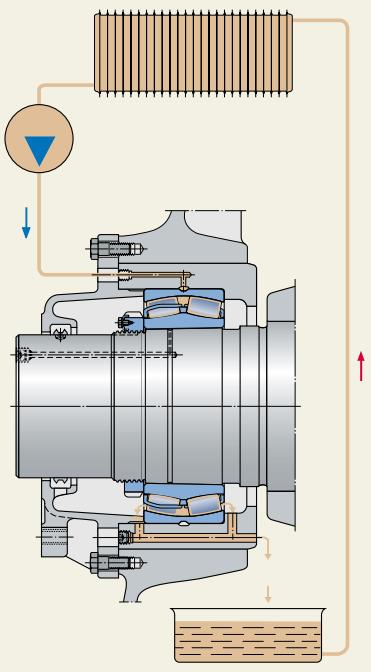
Fig 1



Spherical roller bearing application lubricated by oil bath

Spherical roller bearing application lubricated by circulating oil

Fig 2



Grease lubrication

Today's modern greases allow an increasing number of maintenance-free bearing applications which are lubricated for life. Here, the selection of sealed SKF spherical roller bearings is the optimum choice, both technically and economically. These bearings are filled with the SKF lithium base grease LGEP 2 before leaving the factory (➔ **Table** 1) and are ready to mount and operate.

In cases where the operating conditions are so harsh that very frequent relubrication is needed or where sealed SKF spherical roller bearings are not available, SKF offers a full range of greases and tools to enable proper lubrication of the bearing (➔ section "Lubricants and lubrication equipment" on **page 60**).

Relubrication

It is only possible to determine the time at which relubrication is required based on statistics. The definition used by SKF for the recommendations regarding relubrication intervals relates to a time at which 99 % of the bearings are still reliably lubricated, i.e. they correspond to an L_1 grease life which is the relubrication interval t_f. The L_{10} grease life is approximately twice the L_1 life.

If the L_{10} grease life corresponds to, or exceeds, the L_{10} life of the bearing, the bearing may be considered as being lubricated for life, and relubrication will not be required.

The following recommendations are based on the results of long-term tests in various applications. They do not apply where water and/or particulate contaminants can penetrate the bearing arrangement. In such cases it is advisable to replenish or renew the grease fill in the arrangement more frequently to remove moisture or other contaminants.

Relubrication intervals

Under normal conditions the relubrication interval t_f can be determined from **Diagram 1** based on

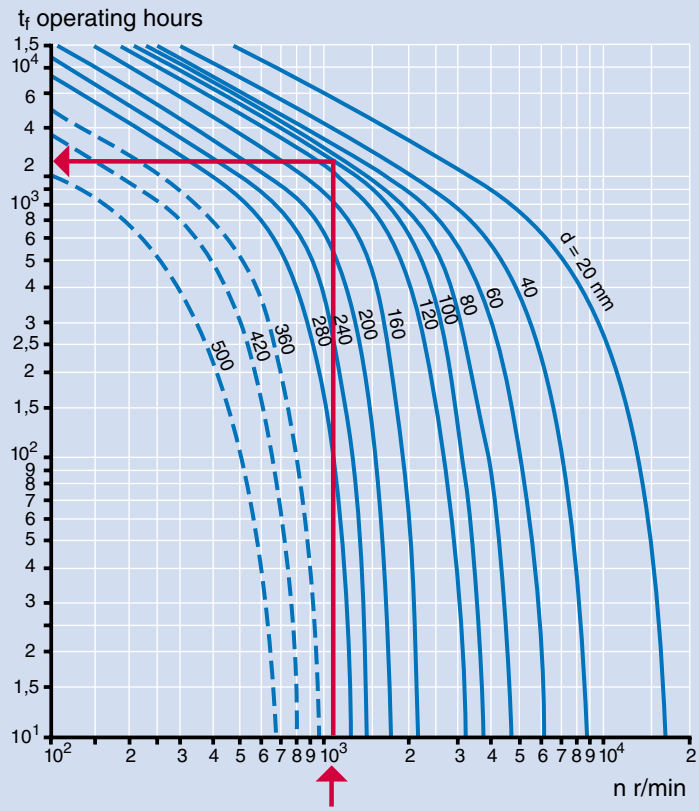
- the rotational speed n and
- the bearing bore diameter d.

The diagram is valid for bearings, which are lubricated with a quality lithium base grease, on horizontal shafts in stationary machines where loads are normal and the operating temperature does not exceed the "reference temperature" for the grease; this is usually 70 °C (158 °F).

Lubricating greases age with time and this process is accelerated at elevated temperatures. Therefore, the relubrication interval obtained from the diagram should be halved for every 15 °C (27 °F) above the reference temperature. At temperatures below 70 °C (158 °F), the relubrication interval may be extended.

Where bearings having bore diameters larger than some 300 mm are concerned, the high specific loads mean that adequate lubricant supply to the rolling contacts can only be secured if relubrication is more frequent than suggested by the diagram. For this reason the relevant curves are shown as dashed lines. In such cases continuous relubrication is recommended.

Diagram 1



Example
A spherical roller bearing with a bore diameter (d) of 100 mm rotates at 1 000 r/min. The operating temperature varies between 60 and 70 °C (140 to 158 °F). What is the correct relubrication interval?
Follow the line from 10^3 on the speed (x) axis to the intersection of the curve for d = 100 mm.
Then follow a line from this intersection horizontally across to the value of t_f which is approximately 2 000. The relubrication interval is therefore 2 000 operating hours.

Relubrication intervals for grease lubricated spherical roller bearings

Technical data for SKF grease LGEP 2

Table 1

Property	SKF grease LGEP 2
Consistency (NLGI Scale)	2
Soap base	lithium
Colour	light brown
Base oil	mineral
Operating temperature range, °C (°F)	–20 to +110 (–4 to +230)
Reference temperature, °C (°F)	60 (140)
Dropping point to ISO 2176, °C (°F)	min. 180 (356)
Kinematic viscosity of base oil at 40 °C, mm^2/s at 100 °C, mm^2/s	 200 16

See also "SKF Interactive Engineering Catalogue" or SKF "General Catalogue".

Grease quantity for periodic relubrication

If the relubrication interval is less than 6 months, it is recommended to replenish the grease fill in the bearing arrangement at intervals corresponding to 0,5 t_f. The complete grease fill should be replaced after three replenishments.

Suitable quantities to be added for open bearings can be obtained from

$$G_p = 0{,}005\ D\ B$$

and for sealed bearings from

$$G_p = 0{,}0015\ D\ B$$

where
G_p = grease quantity to be added when replenishing, g
D = bearing outside diameter, mm
B = total bearing width, mm

The bearing must rotate during relubrication to achieve proper distribution of the grease.

Grease quantity for continuous relubrication

The grease quantity to be continuously supplied can be obtained from

$$G_k = (0{,}3 \ldots 0{,}5)\ D\ B \times 10^{-4}$$

where
G_k = grease quantity to be continuously supplied, g/h
D = bearing outside diameter, mm
B = total bearing width, mm

Continuous relubrication can be efficiently achieved using the SKF SYSTEM 24 lubricator.

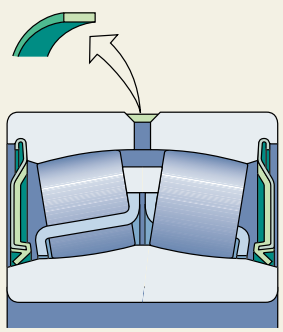
Relubrication of sealed SKF spherical roller bearings

The sealed spherical roller bearings shown in the product tables (**page 54** onwards) have an annular groove and three lubrication holes as standard. To prevent moisture from penetrating and to retain the grease in the bearing a polymer band in the groove covers the lubrication holes (➔ **fig** 3).

If it is anticipated that bearing relubrication will be necessary during operation, the band should be removed before the bearing is mounted. When relubricating, grease should be slowly pressed into the bearing as it rotates until fresh grease emerges from the sealing lips. Excess pressure should be avoided to prevent seal damage.

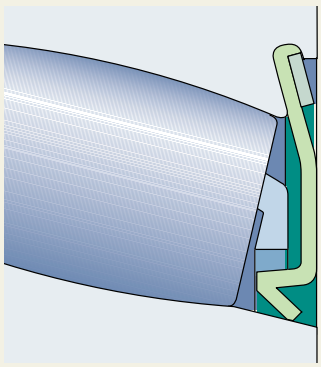
A polymer band in the annular groove covers the lubrication holes in the outer ring of sealed bearings

Fig 3



Retaining rings hold the seals in the outer ring

Fig 4

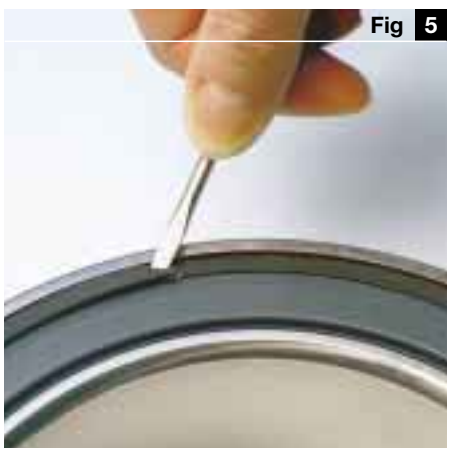


Maintenance

The seals of SKF spherical roller bearings with a bore diameter of 110 mm and above are secured by retaining rings inserted in the outer ring (➔ **fig** 4). The seals can be removed from the bearing so that the bearing can be inspected, washed and regreased, after which the seals can be reinserted and secured. To avoid damage to the seals, this work has to be done with care, using suitable, well rounded tools with no sharp edges.

1. Remove the retaining ring by inserting a tool under the recessed end of the retaining ring (➔ **fig** 5) and pushing it out of the groove.
2. Remove the second retaining ring as above.
3. Swivel out the inner ring, so that the seals are pushed out by the rollers.
4. The bearing, seals and retaining rings can now be washed
5. Inspect the parts for further usability.
6. Regrease the bearing with inner ring swivelled out.
7. Align the bearing and put it on a clean surface for remounting the seals.
8. Insert the seal as far as possible into its groove in the outer ring. Hold down the already inserted part of the seal with one hand, and press in the remainder, stepwise with the thumb of the other hand (➔ **fig** 6).
9. Mount the retaining ring by inserting the rectangular end first. Holding this part down, press in the remainder stepwise with a tool, until the whole retaining ring properly contacts the seal as shown in **fig** 4.
10. Mount the second seal according to steps 7 to 9.
11. If the bearing is not immediately re-used, preserve the bearing surfaces with oil and make sure that the bearing is well packed.

Removing a retaining ring



Inserting the seal in the outer ring

Bearing data – general

Designs
Depending on the size and the series, SKF spherical roller bearings incorporate one of the internal designs shown below. Common features of all designs include symmetrical rollers and a floating guide ring between the roller rows. The arrangement of the guide ring as well as the cage execution are different for the various designs.

E design
$d \leq 65$ mm

Guide ring centred on the inner ring, two window-type steel cages.

E design
$d > 65$ mm

Guide ring centred on the cages, two window-type steel cages.

C, CC, EC and ECC designs

Guide ring centred on the inner ring, two window-type steel cages.

CA, CAC, CAF, ECA and ECAF designs

Guide ring centred on the inner ring, retaining flanges on the inner ring, one-piece machined cage of brass or steel (suffix F).

CAFA and CAMA designs

Guide ring centred on the inner ring, retaining flanges on the inner ring, one-piece machined cage of steel (CAFA) or brass (CAMA).

Explorer
The designations of Explorer bearings are printed in blue in the product tables.

Cylindrical or tapered bore
SKF spherical roller bearings are available with cylindrical bore and tapered bore. The tapered bore of bearings of series 240, 241, 248 and 249 has a taper of 1:30, whereas the bore of the other bearing series have a taper of 1:12.

Annular groove and lubrication holes
Efficient lubrication of the SKF spherical roller bearings is facilitated by either

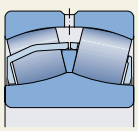
- three lubrication holes and an annular groove (E design or suffix W33) or
- three lubrication holes without annular groove (suffix W20).

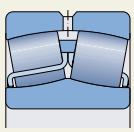
Dimensions
The boundary dimensions of SKF spherical roller bearings with and without seals are in accordance with ISO 15:1998, except for the width of the sealed bearings of series BS2-22. These are basically series 222 E or 222 CC bearings, but are slightly wider to integrate the seals.

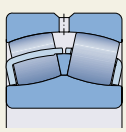
Tolerances
SKF spherical roller bearings with cylindrical and tapered bore are produced as standard with normal tolerances corresponding to ISO 492:1994.

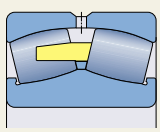
Running accuracy
In high-speed bearing arrangements the demands on running accuracy are often higher than usual. For such bearing arrangements, the C08 execution is recommended which has running accuracy to ISO tolerance class 5 specifications. The values for the running accuracy are in accordance with ISO 492:1994. Check availability of the C08 specification bearing before ordering.

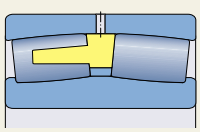
Internal clearance
SKF spherical roller bearings are manufactured as standard with Normal radial internal clearance. Nearly all the bearings are also available with a larger C3 internal clearance and some can be supplied with a even larger C4 clearance. Some sizes can be delivered with C2 internal clearance which is smaller than Normal. Check the availability of bearings with radial

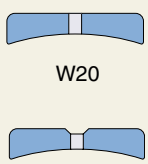

E design
$d \leq 65$ mm


E design
$d > 65$ mm


C, CC, EC and ECC designs


CA, CAC, CAF, ECA and ECAF designs


CAFA and CAMA designs



internal clearances other than Normal before ordering. The various radial internal clearances are in accordance with ISO 5753:1991 and shown in **Tables** 1 and 2. They are valid for zero measuring load and before mounting.

Radial internal clearance of spherical roller bearings with cylindrical bore

Table 1

Bore diameter d		Radial internal clearance C2		Normal		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		µm									
18	**24**	10	20	20	35	35	45	45	60	60	75
24	**30**	15	25	25	40	40	55	55	75	75	95
30	**40**	15	30	30	45	45	60	60	80	80	100
40	**50**	20	35	35	55	55	75	75	100	100	125
50	**65**	20	40	40	65	65	90	90	120	120	150
65	**80**	30	50	50	80	80	110	110	145	145	185
80	**100**	35	60	60	100	100	135	135	180	180	225
100	**120**	40	75	75	120	120	160	160	210	210	260
120	**140**	50	95	95	145	145	190	190	240	240	300
140	**160**	60	110	110	170	170	220	220	280	280	350
160	**180**	65	120	120	180	180	240	240	310	310	390
180	**200**	70	130	130	200	200	260	260	340	340	430
200	**225**	80	140	140	220	220	290	290	380	380	470
225	**250**	90	150	150	240	240	320	320	420	420	520
250	**280**	100	170	170	260	260	350	350	460	460	570
280	**315**	110	190	190	280	280	370	370	500	500	630
315	**355**	120	200	200	310	310	410	410	550	550	690
355	**400**	130	220	220	340	340	450	450	600	600	750
400	**450**	140	240	240	370	370	500	500	660	660	820
450	**500**	140	260	260	410	410	550	550	720	720	900
500	**560**	150	280	280	440	440	600	600	780	780	1 000
560	**630**	170	310	310	480	480	650	650	850	850	1 100
630	**710**	190	350	350	530	530	700	700	920	920	1 190
710	**800**	210	390	390	580	580	770	770	1 010	1 010	1 300
800	**900**	230	430	430	650	650	860	860	1 120	1 120	1 440
900	**1 000**	260	480	480	710	710	930	930	1 220	1 220	1 570
1 000	**1 120**	290	530	530	780	780	1 020	1 020	1 330	1 330	1 720
1 120	**1 250**	320	580	580	860	860	1 120	1 120	1 460	1 460	1 870
1 250	**1 400**	350	640	640	950	950	1 240	1 240	1 620	1 620	2 060
1 400	**1 600**	400	720	720	1 060	1 060	1 380	1 380	1 800	1 800	2 300
1 600	**1 800**	450	810	810	1 180	1 180	1 550	1 550	2 000	2 000	2 550

Radial internal clearance of spherical roller bearings with tapered bore

Table 2

Bore diameter d		Radial internal clearance C2		Normal		C3		C4		C5	
over	incl.	min	max	min	max	min	max	min	max	min	max
mm		µm									
24	**30**	20	30	30	40	40	55	55	75	–	–
30	**40**	25	35	35	50	50	65	65	85	85	105
40	**50**	30	45	45	60	60	80	80	100	100	130
50	**65**	40	55	55	75	75	95	95	120	120	160
65	**80**	50	70	70	95	95	120	120	150	150	200
80	**100**	55	80	80	110	110	140	140	180	180	230
100	**120**	65	100	100	135	135	170	170	220	220	280
120	**140**	80	120	120	160	160	200	200	260	260	330
140	**160**	90	130	130	180	180	230	230	300	300	380
160	**180**	100	140	140	200	200	260	260	340	340	430
180	**200**	110	160	160	220	220	290	290	370	370	470
200	**225**	120	180	180	250	250	320	320	410	410	520
225	**250**	140	200	200	270	270	350	350	450	450	570
250	**280**	150	220	220	300	300	390	390	490	490	620
280	**315**	170	240	240	330	330	430	430	540	540	680
315	**355**	190	270	270	360	360	470	470	590	590	740
355	**400**	210	300	300	400	400	520	520	650	650	820
400	**450**	230	330	330	440	440	570	570	720	720	910
450	**500**	260	370	370	490	490	630	630	790	790	1 000
500	**560**	290	410	410	540	540	680	680	870	870	1 100
560	**630**	320	460	460	600	600	760	760	980	980	1 230
630	**710**	350	510	510	670	670	850	850	1 090	1 090	1 360
710	**800**	390	570	570	750	750	960	960	1 220	1 220	1 500
800	**900**	440	640	640	840	840	1 070	1 070	1 370	1 370	1 690
900	**1 000**	490	710	710	930	930	1 190	1 190	1 520	1 520	1 860
1 000	**1 120**	530	770	770	1 030	1 030	1 300	1 300	1 670	1 670	2 050
1 120	**1 250**	570	830	830	1 120	1 120	1 420	1 420	1 830	1 830	2 250
1 250	**1 400**	620	910	910	1 230	1 230	1 560	1 560	2 000	2 000	2 450
1 400	**1 600**	680	1 000	1 000	1 350	1 350	1 720	1 720	2 200	2 200	2 700
1 600	**1 800**	750	1 110	1 110	1 500	1 500	1 920	1 920	2 400	2 400	2 950

Misalignment

Spherical roller bearings can accommodate misalignment between the outer and inner rings without affecting the bearing. The guideline values of permissible misalignment given in **Table** 3 refer to open bearings and are valid for normal loads (C/P > 10) and operating conditions, and when the inner ring rotates under constant misalignment.

Whether the stated values of misalignment between the outer ring and inner ring can be fully exploited or not depends on the design of the bearing arrangement, the type of seals used etc.

Under the same conditions, sealed SKF spherical roller bearings can accommodate angular misalignments of the shaft with respect to the housing of up to approximately 0,5°.

Influence of operating temperature on the bearing materials

SKF spherical roller bearings rings and rollers are special heat treated so that they can be used at temperatures up to +200 °C (390 °F) for up to 2 500 hours or for brief periods at even higher temperatures without any inadmissible dimensional changes occurring. If provision is made to accommodate slight changes of fits and clearance, even higher temperatures or longer periods can be accommodated.

Sealed SKF spherical roller bearings should not be used at operating temperatures above +110 °C (230 °F) as this would be detrimental to the seals and grease.

Axial load carrying capacity

Because of their special internal design, SKF spherical roller bearings not only have lower friction than other spherical roller bearings, they are also able to accommodate appreciably heavier axial loads. However, if $F_a/F_r > e$ (➔ **product tables**), a more frequent relubrication than usual is recommended.

Speed ratings

Due to the friction generated by contact seals, the speed ratings for sealed bearings for normal temperatures are approximately 40 % of those for the corresponding open bearings.

Table 3

Bearing series	Permissible angular misalignment
–	degrees
213	1
222	1,5
223	2
230	1,5
231	1,5
232	2,5
238	1
239	1,5
240	2
241	2,5
248	1,5
249	1,5

Guideline values for permissible angular misalignment

Supplementary designations

The designation suffixes used to identify certain features of SKF spherical roller bearings are explained below. The suffixes used to identify bearing (and cage) design, e.g. CC or E, are not included here as they are explained under “Designs”.

C2 Radial internal clearance smaller than Normal

C3 Radial internal clearance greater than Normal

C4 Radial internal clearance greater than C3

C08 Increased running accuracy to ISO tolerance class 5

C083 C08 + C3

C084 C08 + C4

2CS Sheet steel reinforced rubbing seals of nitrile rubber (NBR) at both sides of bearing. Grease fill 25 to 35 % with SKF grease LGEP 2. Annular groove and three lubrication holes in outer ring.

2CSW 2CS + W

2CS2 Sheet steel reinforced rubbing seals of fluoro rubber (FPM) at both sides of bearing. Grease fill 70 to 100 % with a polyurea high temperature grease. Annular groove and three lubrication holes in the outer ring.

2CS2W 2CS2 + W

2CS5 Sheet steel reinforced rubbing seals of hydrogenated nitrile rubber (HNBR) at both sides of bearing. Grease fill 70 to 100 % with a polyurea high temperature grease. Annular groove and three lubrication holes in the outer ring.

2CS5W 2CS5 + W

HA3 Case hardened inner ring

K Tapered bore, taper 1:12

K30 Tapered bore, taper 1:30

VA405 Bearing for vibrating applications

VA406 Bearing for vibrating applications with PTFE-coated bore

VE552(E) Outer ring with three equally spaced threaded holes in one side face to take hoisting tackle; the E indicates that appropriate eye bolts are supplied with the bearings

VE553(E) Outer ring with three equally spaced threaded holes in both side faces to take hoisting tackle; the E indicates that appropriate eye bolts are supplied with the bearings

VG186 Hardened cages

VQ424 Running accuracy better than C08

VT143 Grease fill 25 to 35 % with SKF grease LGEP 2

W No relubrication facility in outer ring

W20 Three lubrication holes in outer ring

W26 Six lubrication holes in inner ring

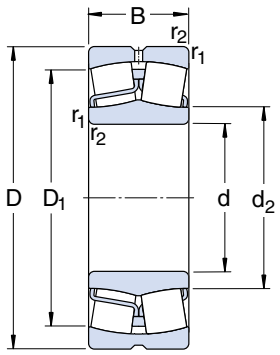
W33 Annular groove and three lubrication holes in outer ring

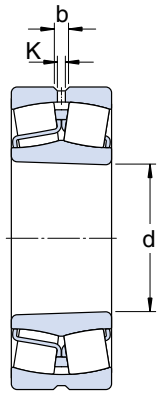
W77 Plugged W33 lubrication holes

W509 W26 + W33

235220 Case hardened inner ring with helical groove in bore

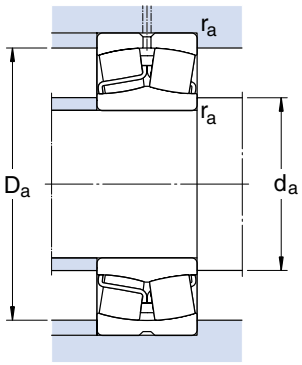
Spherical roller bearings
d **20 – 80** mm

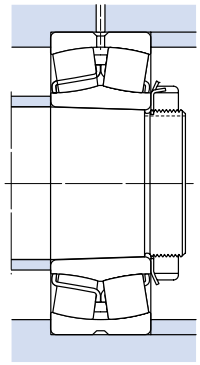




Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
20	52	18	49	44	4,75	8 500	11 000	0,28	**22205/20 E**	–
25	52	18	49	44	4,75	8 500	11 000	0,19	**22205 E**	**22205 EK**
	62	17	41,4	41,5	4,55	6 700	8 500	0,28	**21305 CC**	–
30	62	20	56	52	5,5	7 500	9 500	0,30	**22206 CC/W33**	**22206 CCK/W33**
	72	19	55,2	61	6,8	6 000	7 500	0,41	**21306 CC**	–
35	72	23	76,5	73,5	8	6 300	8 000	0,46	**22207 CC/W33**	**22207 CCK/W33**
	80	21	65,6	72	8,15	5 300	6 700	0,55	**21307 CC**	–
40	80	23	96,5	90	9,8	6 000	7 500	0,53	**22208 E**	**22208 EK**
	90	23	82,8	98	11	4 500	5 600	0,76	**21308 CC**	**21308 CCK**
	90	33	150	140	15	4 500	5 600	1,05	**22308 E**	**22308 EK**
45	85	23	90	88	9,5	5 300	6 700	0,60	**22209 CC/W33**	**22209 CCK/W33**
	100	25	125	127	13,7	4 500	5 600	0,99	**21309 E**	**21309 EK**
	100	36	183	183	19,6	3 800	4 800	1,40	**22309 E**	**22309 EK**
50	90	23	96,5	100	11	5 000	6 300	0,65	**22210 CC/W33**	**22210 CCK/W33**
	110	27	156	166	18,6	4 000	5 000	1,35	**21310 E**	**21310 EK**
	110	40	220	224	24	3 400	4 300	1,90	**22310 E**	**22310 EK**
55	100	25	125	127	13,7	4 500	5 600	0,84	**22211 E**	**22211 EK**
	120	29	156	166	18,6	4 000	5 000	1,70	**21311 E**	**21311 EK**
	120	43	270	280	30	3 200	4 000	2,45	**22311 E**	**22311 EK**
60	110	28	156	166	18,6	4 000	5 000	1,15	**22212 E**	**22212 EK**
	130	31	212	240	26,5	3 400	4 300	2,10	**21312 E**	**21312 EK**
	130	46	310	335	36,5	2 800	3 600	3,10	**22312 E**	**22312 EK**
65	120	31	193	216	24	3 800	4 800	1,55	**22213 E**	**22213 EK**
	140	33	236	270	29	3 200	4 000	2,55	**21313 E**	**21313 EK**
	140	48	340	360	38	2 600	3 400	3,75	**22313 E**	**22313 EK**
70	125	31	208	228	25,5	3 600	4 500	1,55	**22214 E**	**22214 EK**
	150	35	285	325	34,5	2 800	3 600	3,10	**21314 E**	**21314 EK**
	150	51	400	430	45	2 200	3 000	4,55	**22314 E**	**22314 EK**
75	115	40	152	232	28,5	2 600	3 400	1,55	**24015 CC/W33**	–
	130	31	212	240	26,5	3 400	4 300	1,70	**22215 E**	**22215 EK**
	160	37	285	325	34,5	2 800	3 600	3,75	**21315 E**	**21315 EK**
	160	55	440	475	48	2 200	3 000	5,55	**22315 E**	**22315 EK**
80	140	33	236	270	29	3 200	4 000	2,10	**22216 E**	**22216 EK**
	170	39	325	375	39	2 600	3 400	4,45	**21316 E**	**21316 EK**
	170	58	490	540	54	2 000	2 800	6,60	**22316 E**	**22316 EK**

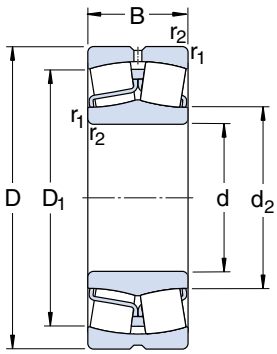
The designations of Explorer bearings are printed in blue

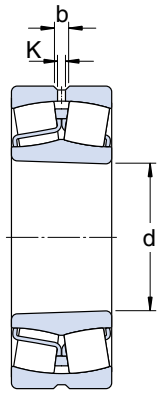




Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
20	31,2	44,2	3,7	2	1	26	46	1	0,35	1,9	2,9	1,8
25	31,2	44,2	3,7	2	1	31	46	1	0,35	1,9	2,9	1,8
	35,7	50,7	–	–	1,1	32	55	1	0,30	2,3	3,4	2,2
30	37,7	52,4	3,7	2	1	36	56	1	0,33	2	3	2
	43,3	58,82	–	–	1,1	37	65	1	0,27	2,5	3,7	2,5
35	44,5	60,9	3,7	2	1,1	42	65	1	0,31	2,2	3,3	2,2
	47,2	65,6	–	–	1,5	44	71	1,5	0,28	2,4	3,6	2,5
40	49,6	69,4	5,5	3	1,1	47	73	1	0,28	2,4	3,6	2,5
	55,6	74,3	–	–	1,5	49	81	1,5	0,26	2,6	3,9	2,5
	49,9	74,3	5,5	3	1,5	49	81	1,5	0,37	1,8	2,7	1,8
45	54,9	73,6	5,5	3	1,1	52	78	1	0,26	2,6	3,9	2,5
	65,3	87,9	5,5	3	1,5	54	91	1,5	0,24	2,8	4,2	2,8
	57,6	83,1	5,5	3	1,5	54	91	1,5	0,37	1,8	2,7	1,8
50	60,1	78,8	5,5	3	1,1	57	83	1	0,24	2,8	4,2	2,8
	72,6	96,5	5,5	3	2	60	100	2	0,24	2,8	4,2	2,8
	63,9	91,9	5,5	3	2	60	100	2	0,37	1,8	2,7	1,8
55	65,3	87,9	5,5	3	1,5	64	91	1,5	0,24	2,8	4,2	2,8
	72,6	96	5,5	3	2	65	110	2	0,24	2,8	4,2	2,8
	70,1	102	5,5	3	2	66	109	2	0,35	1,9	2,9	1,8
60	72,6	96,3	5,5	3	1,5	69	101	1,5	0,24	2,8	4,2	2,8
	87,8	115	5,5	3	2,1	72	118	2	0,22	3	4,6	2,8
	77,9	110	5,5	3	2,1	72	118	2	0,35	1,9	2,9	1,8
65	80	106	5,5	3	1,5	74	111	1,5	0,24	2,8	4,2	2,8
	94,7	124	5,5	3	2,1	77	128	2	0,22	3	4,6	2,8
	81,6	118	8,3	4,5	2,1	77	128	2	0,35	1,9	2,9	1,8
70	83	111	5,5	3	1,5	79	116	1,5	0,22	3	4,6	2,8
	101	133	5,5	3	2,1	82	138	2	0,22	3	4,6	2,8
	90,3	128	8,3	4,5	2,1	82	138	2	0,33	2	3	2
75	84,1	100	5,5	3	1,1	81	109	1	0,28	2,4	3,6	2,5
	87,8	115	5,5	3	1,5	84	121	1,5	0,22	3	4,6	2,8
	101	133	5,5	3	2,1	87	148	2	0,22	3	4,6	2,8
	92,8	135	8,3	4,5	2,1	87	148	2	0,35	1,9	2,9	1,8
80	94,7	127	5,5	3	2	91	129	2	0,22	3	4,6	2,8
	106	141	5,5	3	2,1	92	158	2	0,24	2,8	4,2	2,8
	98,3	143	8,3	4,5	2,1	92	158	2	0,35	1,9	2,9	1,8

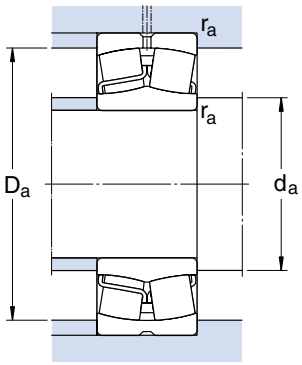
Spherical roller bearings
d **85 – 130** mm

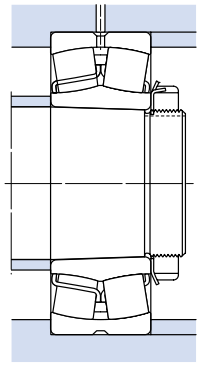




Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
85	150	36	285	325	34,5	2 800	3 600	2,65	**22217 E**	**22217 EK**
	180	41	325	375	39	2 600	3 400	5,20	**21317 E**	**21317 EK**
	180	60	550	620	61	1 900	2 600	7,65	**22317 E**	**22317 EK**
90	160	40	325	375	39	2 600	3 400	3,40	**22218 E**	**22218 EK**
	160	52,4	311	440	48	1 900	2 600	4,65	**23218 CC/W33**	**23218 CCK/W33**
	190	43	380	450	46,5	2 400	3 200	6,10	**21318 E**	**21318 EK**
	190	64	610	695	67	1 800	2 400	9,05	**22318 E**	**22318 EK**
95	170	43	380	450	46,5	2 400	3 200	4,15	**22219 E**	**22219 EK**
	200	45	425	490	49	2 200	3 000	7,05	**21319 E**	**21319 EK**
	200	67	670	765	73,5	1 800	2 400	10,5	**22319 E**	**22319 EK**
100	150	50	248	415	45,5	1 900	2 600	3,15	**24020 CDC/W33**	–
	165	52	322	490	53	2 000	2 800	4,55	**23120 CC/W33**	**23120 CCK/W33**
	165	65	455	640	68	1 700	2 200	5,65	**24120 CC/W33**	–
	180	46	425	490	49	2 200	3 000	4,90	**22220 E**	**22220 EK**
	180	60,3	414	600	63	1 700	2 200	6,85	**23220 CC/W33**	**23220 CCK/W33**
	215	47	425	490	49	2 200	3 000	8,60	**21320 E**	**21320 EK**
	215	73	815	950	88	1 700	2 200	13,5	**22320 E**	**22320 EK**
110	170	45	267	440	46,5	2 200	3 000	3,80	**23022 CC/W33**	**23022 CCK/W33**
	180	56	430	585	61	1 900	2 600	5,75	**23122 CC/W33**	**23122 CCK/W33**
	180	69	460	750	78	1 600	2 000	7,10	**24122 CC/W33**	**24122 CCK30/W33**
	200	53	560	640	63	2 000	2 800	7,00	**22222 E**	**22222 EK**
	200	69,8	518	765	76,5	1 600	2 000	9,85	**23222 CC/W33**	**23222 CCK/W33**
	240	80	950	1 120	100	1 500	1 900	18,4	**22322 E**	**22322 EK**
120	180	46	355	500	52	2 000	2 800	4,20	**23024 CC/W33**	**23024 CCK/W33**
	180	60	430	670	68	1 600	2 000	5,45	**24024 CC/W33**	**24024 CCK30/W33**
	200	62	510	695	71	1 800	2 400	8,00	**23124 CC/W33**	**23124 CCK/W33**
	200	80	575	950	95	1 400	1 800	10,3	**24124 CC/W33**	**24124 CCK30/W33**
	215	58	630	765	73,5	1 900	2 600	8,70	**22224 E**	**22224 EK**
	215	76	610	930	93	1 500	1 900	12,0	**23224 CC/W33**	**23224 CCK/W33**
	260	86	965	1 120	100	1 400	1 800	23,0	**22324 CC/W33**	**22324 CCK/W33**
130	200	52	430	610	62	1 900	2 600	6,00	**23026 CC/W33**	**23026 CCK/W33**
	200	69	540	815	81,5	1 500	1 900	8,05	**24026 CC/W33**	**24026 CCK30/W33**
	210	64	489	780	78	1 700	2 200	8,80	**23126 CC/W33**	**23126 CCK/W33**
	210	80	587	1 000	100	1 300	1 700	11,0	**24126 CC/W33**	**24126 CCK30/W33**
	230	64	735	930	88	1 800	2 400	11,0	**22226 E**	**22226 EK**
	230	80	690	1 060	104	1 300	1 700	14,5	**23226 CC/W33**	**23226 CCK/W33**
	280	93	1 120	1 320	114	1 300	1 700	29,0	**22326 CC/W33**	**22326 CCK/W33**

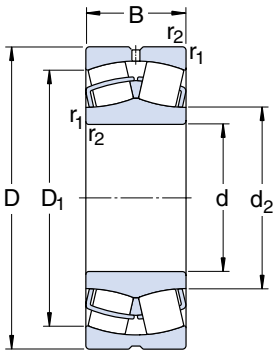
The designations of Explorer bearings are printed in blue

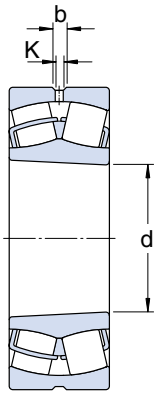




Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
85	101	133	5,5	3	2	96	139	2	0,22	3	4,6	2,8
	106	141	5,5	3	3	99	166	2,5	0,24	2,8	4,2	2,8
	108	154	8,3	4,5	3	99	166	2,5	0,33	2	3	2
90	106	141	5,5	3	2	101	149	2	0,24	2,8	4,2	2,8
	106	137	5,5	3	2	101	149	2	0,31	2,2	3,3	2,2
	112	150	8,3	4,5	3	104	176	2,5	0,24	2,8	4,2	2,8
	113	161	11,1	6	3	104	176	2,5	0,33	2	3	2
95	112	150	8,3	4,5	2,1	107	158	2	0,24	2,8	4,2	2,8
	118	159	8,3	4,5	3	109	186	2,5	0,24	2,8	4,2	2,8
	118	168	11,1	6	3	109	186	2,5	0,33	2	3	2
100	111	132	5,5	3	1,5	107	143	1,5	0,28	2,4	3,6	2,5
	115	144	5,5	3	2	111	154	2	0,30	2,3	3,4	2,2
	113	141	5,5	3	2	111	154	2	0,37	1,8	2,7	1,8
	118	159	8,3	4,5	2,1	112	168	2	0,24	2,8	4,2	2,8
	117	153	8,3	4,5	2,1	112	168	2	0,33	2	3	2
	118	159	8,3	4,5	3	114	201	2,5	0,24	2,8	4,2	2,8
	130	184	11,1	6	3	114	201	2,5	0,33	2	3	2
110	125	151	5,5	3	2	120	160	2	0,23	2,9	4,4	2,8
	126	157	8,3	4,5	2	121	169	2	0,30	2,3	3,4	2,2
	123	153	5,5	3	2	121	169	2	0,37	1,8	2,7	1,8
	130	178	8,3	4,5	2,1	122	188	2	0,25	2,7	4	2,5
	130	169	8,3	4,5	2,1	122	188	2	0,33	2	3	2
	143	204	13,9	7,5	3	124	226	2,5	0,33	2	3	2
120	135	163	5,5	3	2	130	170	2	0,22	3	4,6	2,8
	132	159	5,5	3	2	130	170	2	0,30	2,3	3,4	2,2
	139	174	8,3	4,5	2	131	189	2	0,28	2,4	3,6	2,5
	135	168	5,5	3	2	131	189	2	0,37	1,8	2,7	1,8
	141	189	11,1	6	2,1	132	203	2	0,26	2,6	3,9	2,5
	141	182	8,3	4,5	2,1	132	203	2	0,35	1,9	2,9	1,8
	152	216	13,9	7,5	3	134	246	2,5	0,35	1,9	2,9	1,8
130	148	180	8,3	4,5	2	140	190	2	0,23	2,9	4,4	2,8
	145	175	5,5	3	2	140	190	2	0,31	2,2	3,3	2,2
	148	184	8,3	4,5	2	141	199	2	0,28	2,4	3,6	2,5
	146	180	5,5	3	2	141	199	2	0,35	1,9	2,9	1,8
	152	201	11,1	6	3	144	216	2,5	0,27	2,5	3,7	2,5
	151	196	8,3	4,5	3	144	216	2,5	0,33	2	3	2
	164	233	16,7	9	4	148	262	3	0,35	1,9	2,9	1,8

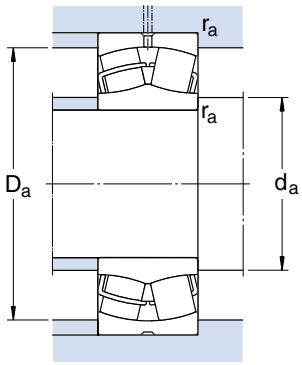
Spherical roller bearings
d **140 – 180** mm

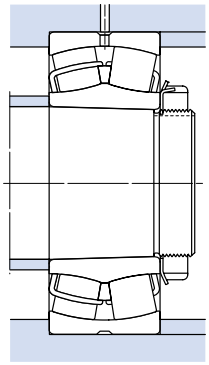




Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
140	210	53	465	680	68	1 800	2 400	6,55	23028 CC/W33	23028 CCK/W33
	210	69	570	900	88	1 400	1 800	8,55	24028 CC/W33	24028 CCK30/W33
	225	68	546	900	88	1 600	2 000	10,5	**23128 CC/W33**	**23128 CCK/W33**
	225	85	673	1 160	112	1 100	1 500	13,5	**24128 CC/W33**	**24128 CCK30/W33**
	250	68	710	900	86,5	1 700	2 200	14,0	22228 CC/W33	22228 CCK/W33
	250	88	915	1 250	120	1 200	1 600	19,0	23228 CC/W33	23228 CCK/W33
	300	102	1 290	1 560	132	1 100	1 500	36,5	22328 CC/W33	22328 CCK/W33
150	225	56	510	750	73,5	1 700	2 200	7,95	23030 CC/W33	23030 CCK/W33
	225	75	655	1 040	100	1 300	1 700	10,5	24030 CC/W33	24030 CCK30/W33
	250	80	725	1 200	114	1 400	1 800	16,0	**23130 CC/W33**	**23130 CCK/W33**
	250	100	1 020	1 530	146	1 000	1 400	20,0	24130 CC/W33	24130 CCK30/W33
	270	73	850	1 080	102	1 600	2 000	18,0	22230 CC/W33	22230 CCK/W33
	270	96	1 080	1 460	137	1 100	1 500	24,5	23230 CC/W33	23230 CCK/W33
	320	108	1 460	1 760	146	1 000	1 400	43,5	22330 CC/W33	22330 CCK/W33
160	240	60	585	880	83	1 700	2 200	9,70	23032 CC/W33	23032 CCK/W33
	240	80	750	1 200	114	1 100	1 500	13,0	24032 CC/W33	24032 CCK30/W33
	270	86	980	1 370	129	1 300	1 700	20,5	23132 CC/W33	23132 CCK/W33
	270	109	1 040	1 760	163	950	1 300	25,0	**24132 CC/W33**	**24132 CCK30/W33**
	290	80	1 000	1 290	118	1 500	1 900	22,5	22232 CC/W33	22232 CCK/W33
	290	104	1 220	1 660	153	1 000	1 400	31,0	23232 CC/W33	23232 CCK/W33
	340	114	1 600	1 960	160	950	1 300	52,0	22332 CC/W33	22332 CCK/W33
170	260	67	710	1 060	100	1 600	2 000	13,0	23034 CC/W33	23034 CCK/W33
	260	90	930	1 460	137	1 000	1 400	17,5	24034 CC/W33	24034 CCK30/W33
	280	88	1 040	1 500	137	1 200	1 600	22,0	23134 CC/W33	23134 CCK/W33
	280	109	1 220	1 860	170	900	1 200	27,5	24134 CC/W33	24134 CCK30/W33
	310	86	1 120	1 460	132	1 300	1 700	28,5	22234 CC/W33	22234 CCK/W33
	310	110	1 400	1 930	173	950	1 300	37,5	23234 CC/W33	23234 CCK/W33
	360	120	1 760	2 160	176	950	1 300	61,0	22334 CC/W33	22334 CCK/W33
180	250	52	490	830	76,5	1 700	2 200	7,90	23936 CC/W33	–
	280	74	830	1 250	114	1 400	1 800	17,0	23036 CC/W33	23036 CCK/W33
	280	100	937	1 730	156	950	1 300	23,0	**24036 CC/W33**	**24036 CCK30/W33**
	300	96	1 200	1 760	160	1 100	1 500	28,0	23136 CC/W33	23136 CCK/W33
	300	118	1 400	2 160	196	900	1 200	34,5	24136 CC/W33	24136 CCK30/W33
	320	86	1 180	1 560	140	1 300	1 700	29,5	22236 CC/W33	22236 CCK/W33
	320	112	1 290	2 120	186	900	1 200	39,5	**23236 CC/W33**	**23236 CCK/W33**
	380	126	2 000	2 450	193	900	1 200	71,5	22336 CC/W33	22336 CCK/W33

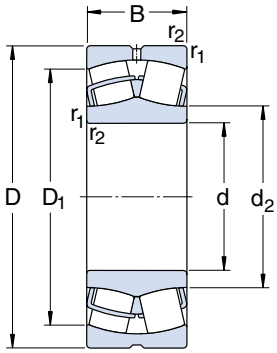
The designations of Explorer bearings are printed in blue

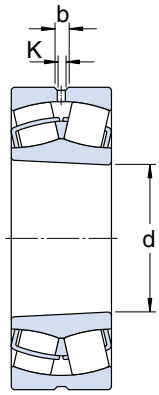




Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
140	158	190	8,3	4,5	2	150	200	2	0,22	3	4,6	2,8
	155	185	5,5	3	2	150	200	2	0,30	2,3	3,4	2,2
	159	197	8,3	4,5	2,1	152	213	2	0,28	2,4	3,6	2,5
	156	193	8,3	4,5	2,1	152	213	2	0,35	1,9	2,9	1,8
	166	216	11,1	6	3	154	236	2,5	0,26	2,6	3,9	2,5
	165	212	11,1	6	3	154	236	2,5	0,33	2	3	2
	175	247	16,7	9	4	157	283	3	0,35	1,9	2,9	1,8
150	169	203	8,3	4,5	2,1	161	214	2	0,22	3	4,6	2,8
	165	197	5,5	3	2,1	161	214	2	0,30	2,3	3,4	2,2
	172	216	11,1	6	2,1	162	238	2	0,30	2,3	3,4	2,2
	169	211	8,3	4,5	2,1	162	238	2	0,37	1,8	2,7	1,8
	178	234	13,9	7,5	3	164	256	2,5	0,26	2,6	3,9	2,5
	175	228	11,1	6	3	164	256	2,5	0,35	1,9	2,9	1,8
	188	266	16,7	9	4	167	303	3	0,35	1,9	2,9	1,8
160	180	217	11,1	6	2,1	171	229	2	0,22	3	4,6	2,8
	176	211	8,3	4,5	2,1	171	229	2	0,30	2,3	3,4	2,2
	184	234	13,9	7,5	2,1	172	258	2	0,30	2,3	3,4	2,2
	181	228	8,3	4,5	2,1	172	258	2	0,40	1,7	2,5	1,6
	191	250	13,9	7,5	3	174	276	2,5	0,26	2,6	3,9	2,5
	188	244	13,9	7,5	3	174	276	2,5	0,35	1,9	2,9	1,8
	200	282	16,7	9	4	177	323	3	0,35	1,9	2,9	1,8
170	191	232	11,1	6	2,1	181	249	2	0,23	2,9	4,4	2,8
	188	226	8,3	4,5	2,1	181	249	2	0,33	2	3	2
	195	244	13,9	7,5	2,1	182	268	2	0,30	2,3	3,4	2,2
	190	237	8,3	4,5	2,1	182	268	2	0,37	1,8	2,7	1,8
	203	267	16,7	9	4	187	293	3	0,27	2,5	3,7	2,5
	200	261	13,9	7,5	4	187	293	3	0,35	1,9	2,9	1,8
	213	300	16,7	9	4	187	343	3	0,33	2	3	2
180	199	231	5,5	3	2	190	240	2	0,18	3,8	5,6	3,6
	204	249	13,9	7,5	2,1	191	269	2	0,24	2,8	4,2	2,8
	201	243	8,3	4,5	2,1	191	269	2	0,33	2	3	2
	207	259	13,9	7,5	3	194	286	2,5	0,30	2,3	3,4	2,2
	203	253	11,1	6	3	194	286	2,5	0,37	1,8	2,7	1,8
	213	278	16,7	9	4	197	303	3	0,26	2,6	3,9	2,5
	211	271	13,9	7,5	4	197	303	3	0,35	1,9	2,9	1,8
	224	317	22,3	12	4	197	363	3	0,35	1,9	2,9	1,8

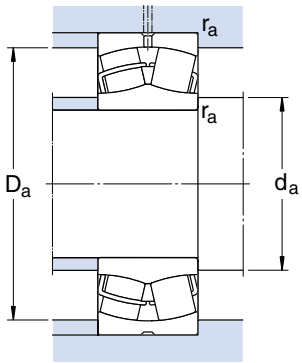
Spherical roller bearings
d **190 – 260** mm

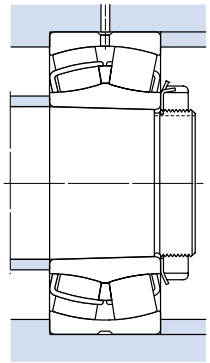




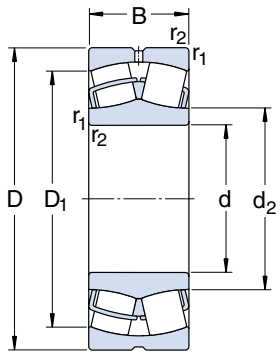
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
190	260	52	475	800	76,5	1 700	2 200	8,30	23938 CC/W33	–
	290	75	865	1 340	122	1 300	1 700	18,0	23038 CC/W33	23038 CCK/W33
	290	100	978	1 800	163	950	1 300	24,5	**24038 CC/W33**	**24038 CCK30/W33**
	320	104	1 370	2 080	183	1 000	1 400	35,0	23138 CC/W33	23138 CCK/W33
	320	128	1 600	2 500	212	850	1 100	43,0	24138 CC/W33	24138 CCK30/W33
	340	92	1 270	1 700	150	1 200	1 600	36,5	22238 CC/W33	22238 CCK/W33
	340	120	1 660	2 400	208	850	1 100	48,0	23238 CC/W33	23238 CCK/W33
	400	132	2 120	2 650	208	850	1 100	82,5	22338 CC/W33	22338 CCK/W33
200	280	60	620	1 040	93	1 600	2 000	11,5	23940 CC/W33	–
	310	82	1 000	1 530	137	1 200	1 600	23,3	23040 CC/W33	23040 CCK/W33
	310	109	1 130	2 120	186	900	1 200	31,0	**24040 CC/W33**	**24040 CCK30/W33**
	340	112	1 600	2 360	204	950	1 300	43,0	23140 CC/W33	23140 CCK/W33
	340	140	1 800	2 800	232	800	1 000	53,5	24140 CC/W33	24140 CCK30/W33
	360	98	1 460	1 930	166	1 100	1 500	43,5	22240 CC/W33	22240 CCK/W33
	360	128	1 860	2 700	228	850	1 100	58,0	23240 CC/W33	23240 CCK/W33
	420	138	2 320	2 900	224	850	1 100	95,0	22340 CC/W33	22340 CCK/W33
220	300	60	630	1 080	93	1 500	1 900	12,5	23944 CC/W33	–
	340	90	1 220	1 860	163	1 100	1 500	30,5	23044 CC/W33	23044 CCK/W33
	340	118	1 360	2 600	212	850	1 100	40,0	**24044 CC/W33**	**24044 CCK30/W33**
	370	120	1 800	2 750	232	900	1 200	53,5	23144 CC/W33	23144 CCK/W33
	370	150	2 120	3 350	285	750	950	67,0	24144 CC/W33	24144 CCK30/W33
	400	108	1 760	2 360	196	950	1 300	60,5	22244 CC/W33	22244 CCK/W33
	400	144	2 360	3 450	285	750	950	81,5	23244 CC/W33	23244 CCK/W33
	460	145	2 700	3 450	260	750	950	120	22344 CC/W33	22344 CCK/W33
240	320	60	655	1 160	98	1 300	1 700	13,5	23948 CC/W33	–
	360	92	1 290	2 080	176	1 000	1 400	33,5	23048 CC/W33	23048 CCK/W33
	360	118	1 380	2 700	228	800	1 000	43,0	**24048 CC/W33**	**24048 CCK30/W33**
	400	128	2 080	3 200	255	850	1 100	66,5	23148 CC/W33	23148 CCK/W33
	400	160	2 400	3 900	320	670	850	83,0	24148 CC/W33	24148 CCK30/W33
	440	120	2 200	3 000	245	900	1 200	83,0	22248 CC/W33	22248 CCK/W33
	440	160	2 900	4 300	345	670	850	110	23248 CC/W33	23248 CCK/W33
	500	155	2 670	4 000	290	670	850	155	**22348 CC/W33**	**22348 CCK/W33**
260	360	75	880	1 800	156	1 100	1 500	23,5	**23952 CC/W33**	–
	400	104	1 600	2 550	212	900	1 200	48,5	23052 CC/W33	23052 CCK/W33
	400	140	2 040	3 450	285	700	900	65,5	24052 CC/W33	24052 CCK30/W33
	440	144	2 550	3 900	290	800	1 000	90,5	23152 CC/W33	23152 CCK/W33
	440	180	3 000	4 800	380	600	750	110	24152 CC/W33	24152 CCK30/W33
	480	130	2 650	3 550	285	850	1 100	110	22252 CC/W33	22252 CCK/W33
	480	174	3 250	4 750	360	630	800	140	23252 CC/W33	23252 CCK/W33
	540	165	3 050	4 550	325	630	800	190	**22352 CC/W33**	**22352 CCK/W33**

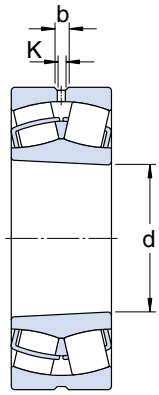
The designations of Explorer bearings are printed in blue





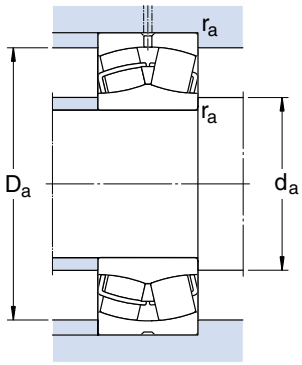
Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
190	209	240	5,5	3	2	200	250	2	0,16	4,2	6,3	4
	216	261	13,9	7,5	2,1	201	279	2	0,23	2,9	4,4	2,8
	210	253	8,3	4,5	2,1	201	279	2	0,31	2,2	3,3	2,2
	220	276	13,9	7,5	3	204	306	2,5	0,31	2,2	3,3	2,2
	215	268	11,1	6	3	204	306	2,5	0,40	1,7	2,5	1,6
	225	294	16,7	9	4	207	323	3	0,26	2,6	3,9	2,5
	222	287	16,7	9	4	207	323	3	0,35	1,9	2,9	1,8
	236	333	22,3	12	5	210	380	4	0,35	1,9	2,9	1,8
200	222	258	8,3	4,5	2,1	211	269	2	0,19	3,6	5,3	3,6
	228	278	13,9	7,5	2,1	211	299	2	0,24	2,8	4,2	2,8
	223	268	11,1	6	2,1	211	299	2	0,33	2	3	2
	231	293	16,7	9	3	214	326	2,5	0,31	2,2	3,3	2,2
	226	284	11,1	6	3	214	326	2,5	0,40	1,7	2,5	1,6
	238	313	16,7	9	4	217	343	3	0,26	2,6	3,9	2,5
	235	304	16,7	9	4	217	343	3	0,35	1,9	2,9	1,8
	249	351	22,3	12	5	220	400	4	0,33	2	3	2
220	241	278	8,3	4,5	2,1	231	289	2	0,16	4,2	6,3	4
	250	306	13,9	7,5	3	233	327	2,5	0,24	2,8	4,2	2,8
	244	295	11,1	6	3	233	327	2,5	0,33	2	3	2
	255	320	16,7	9	4	237	353	3	0,30	2,3	3,4	2,2
	248	310	11,1	6	4	237	353	3	0,40	1,7	2,5	1,6
	263	346	16,7	9	4	237	383	3	0,27	2,5	3,7	2,5
	259	338	16,7	9	4	237	383	3	0,35	1,9	2,9	1,8
	279	389	22,3	12	5	240	440	4	0,31	2,2	3,3	2,2
240	261	298	8,3	4,5	2,1	251	309	2	0,15	4,5	6,7	4,5
	271	326	13,9	7,5	3	253	347	2,5	0,23	2,9	4,4	2,8
	265	316	11,1	6	3	253	347	2,5	0,30	2,3	3,4	2,2
	277	348	16,7	9	4	257	383	3	0,30	2,3	3,4	2,2
	271	336	11,1	6	4	257	383	3	0,40	1,7	2,5	1,6
	290	683	22,3	12	4	257	423	3	0,27	2,5	3,7	2,5
	287	374	22,3	12	4	257	423	3	0,35	1,9	2,9	1,8
	304	422	22,3	12	5	260	480	4	0,31	2,2	3,3	2,2
260	287	331	8,3	4,5	2,1	271	348	2	0,18	3,8	5,6	3,6
	295	360	16,7	9	4	275	385	3	0,23	2,9	4,4	2,8
	289	347	11,1	6	4	275	385	3	0,33	2	3	2
	301	380	16,7	9	4	277	423	3	0,31	2,2	3,3	2,2
	294	368	13,9	7,5	4	277	423	3	0,40	1,7	2,5	1,6
	311	421	22,3	12	5	280	460	4	0,27	2,5	3,7	2,5
	312	408	22,3	12	5	280	460	4	0,35	1,9	2,9	1,8
	329	457	22,3	12	6	286	514	5	0,31	2,2	3,3	2,2

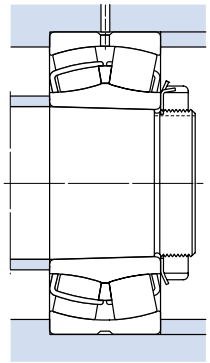




Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings Lubrication		Mass	Designations Bearings with	
			dynamic	static		grease	oil		cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
280	380	75	845	1 760	143	1 000	1 400	25,0	**23956 CC/W33**	**–**
	420	106	1 730	2 850	224	850	1 100	52,5	**23056 CC/W33**	**23056 CCK/W33**
	420	140	2 160	3 800	285	670	850	69,5	**24056 CC/W33**	**24056 CCK30/W33**
	460	146	2 650	4 250	335	750	950	97,0	**23156 CC/W33**	**23156 CCK/W33**
	460	180	3 100	5 100	415	560	700	120	**24156 CC/W33**	**24156 CCK30/W33**
	500	130	2 700	3 750	300	800	1 000	115	**22256 CC/W33**	**22256 CCK/W33**
	500	176	3 250	4 900	365	600	750	150	**23256 CC/W33**	**23256 CCK/W33**
	580	175	3 450	5 200	365	600	750	235	**22356 CC/W33**	**22356 CCK/W33**
300	380	60	656	1 600	137	1 000	1 400	16,5	**23860 CAMA**	**23860 CAKMA**
	420	90	1 200	2 500	200	950	1 300	39,5	**23960 CC/W33**	**23960 CCK/W33**
	460	118	2 120	3 450	265	800	1 000	71,5	**23060 CC/W33**	**23060 CCK/W33**
	460	160	2 700	4 750	355	600	750	97,0	**24060 CC/W33**	**24060 CCK30/W33**
	500	160	3 200	5 100	380	670	850	125	**23160 CC/W33**	**23160 CCK/W33**
	500	200	3 750	6 300	465	530	670	160	**24160 CC/W33**	**24160 CCK30/W33**
	540	140	2 760	4 250	325	750	950	145	**22260 CC/W33**	**22260 CCK/W33**
	540	192	3 900	5 850	425	530	670	190	**23260 CC/W33**	**23260 CCK/W33**
320	440	90	1 430	2 700	212	900	1 200	42,0	**23964 CC/W33**	**23964 CCK/W33**
	480	121	2 240	3 800	285	800	1 000	78,0	**23064 CC/W33**	**23064 CCK/W33**
	480	160	2 850	5 100	400	560	700	100	**24064 CC/W33**	**24064 CCK30/W33**
	540	176	3 750	6 000	440	630	800	165	**23164 CC/W33**	**23164 CCK/W33**
	540	218	3 740	7 100	510	480	600	210	**24164 CC/W33**	**24164 CCK30/W33**
	580	150	3 160	4 900	375	670	850	175	**22264 CC/W33**	**22264 CCK/W33**
	580	208	3 850	6 700	480	500	630	240	**23264 CC/W33**	**23264 CCK/W33**
340	460	90	1 460	2 800	216	900	1 200	45,5	**23968 CC/W33**	**23968 CCK/W33**
	520	133	2 700	4 550	335	700	900	105	**23068 CC/W33**	**23068 CCK/W33**
	520	180	3 450	6 200	475	530	670	140	**24068 CC/W33**	**24068 CCK30/W33**
	580	190	4 250	6 800	480	600	750	210	**23168 CC/W33**	**23168 CCK/W33**
	580	243	4 660	8 650	630	450	560	280	**24168 ECCJ/W33**	**24168 ECCK30J/W33**
	620	224	4 490	7 800	550	430	530	295	**23268 CA/W33**	**23268 CAK/W33**
360	480	90	1 400	2 750	220	850	1 100	43,0	**23972 CC/W33**	**23972 CCK/W33**
	540	134	2 750	4 800	345	670	850	110	**23072 CC/W33**	**23072 CCK/W33**
	540	180	3 550	6 550	490	500	630	145	**24072 CC/W33**	**24072 CCK30/W33**
	600	192	4 300	6 950	490	560	700	220	**23172 CC/W33**	**23172 CCK/W33**
	600	243	4 890	9 300	670	430	530	270	**24172 ECCJ/W33**	**24172 ECCK30J/W33**
	650	170	3 740	6 200	440	480	600	255	**22272 CA/W33**	**22272 CAK/W33**
	650	232	4 660	8 300	570	400	500	335	**23272 CA/W33**	**23272 CAK/W33**

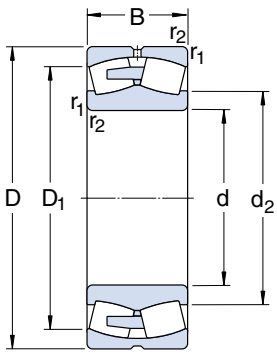
The designations of Explorer bearings are printed in blue

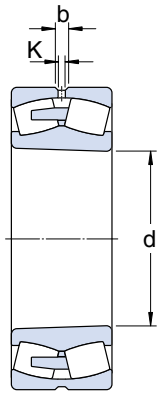




Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
280	308	352	11,1	6	2,1	291	369	2	0,16	4,2	6,3	4
	315	380	16,7	9	4	295	405	3	0,23	2,9	4,4	2,8
	309	368	11,1	6	4	295	405	3	0,31	2,2	3,3	2,2
	321	400	16,7	9	5	300	440	4	0,30	2,3	3,4	2,2
	315	390	13,9	7,5	5	300	440	4	0,40	1,7	2,5	1,6
	333	441	22,3	12	5	300	480	4	0,26	2,6	3,9	2,5
	332	429	22,3	12	5	300	480	4	0,35	1,9	2,9	1,8
	354	492	22,3	12	6	306	554	5	0,30	2,3	3,4	2,2
300	329	358	–	–	2,1	311	369	2	0,13	5,2	7,7	5
	333	385	11,1	6	3	313	407	2,5	0,19	3,6	5,3	3,6
	340	413	16,7	9	4	315	445	3	0,23	2,9	4,4	2,8
	331	400	13,9	7,5	4	315	445	3	0,33	2	3	2
	345	434	16,7	9	5	320	480	4	0,30	2,3	3,4	2,2
	339	422	13,9	7,5	5	320	480	4	0,40	1,7	2,5	1,6
	354	477	22,3	12	5	320	520	4	0,26	2,6	3,9	2,5
	356	461	22,3	12	5	320	520	4	0,35	1,9	2,9	1,8
320	353	405	11,1	6	3	333	427	2,5	0,18	3,8	5,6	3,6
	360	433	16,7	9	4	335	465	3	0,23	2,9	4,4	2,8
	354	423	13,9	7,5	4	335	465	3	0,31	2,2	3,3	2,2
	370	465	22,3	12	5	340	520	4	0,31	2,2	3,3	2,2
	364	455	16,7	9	5	340	520	4	0,40	1,7	2,5	1,6
	379	512	22,3	12	5	340	560	4	0,26	2,6	3,9	2,5
	382	493	22,3	12	5	340	560	4	0,35	1,9	2,9	1,8
340	374	426	11,1	6	3	353	447	2,5	0,17	4	5,9	4
	385	467	22,3	12	5	358	502	4	0,24	2,8	4,2	2,8
	377	453	16,7	9	5	358	502	4	0,33	2	3	2
	394	498	22,3	12	5	360	560	4	0,31	2,2	3,3	2,2
	383	488	16,7	9	5	360	560	4	0,40	1,7	2,5	1,6
	426	528	22,3	12	6	366	594	5	0,35	1,9	2,9	1,8
360	394	447	11,1	6	3	373	467	2,5	0,15	4,5	6,7	4,5
	404	482	22,3	12	5	378	522	4	0,23	2,9	4,4	2,8
	398	474	16,7	9	5	378	522	4	0,31	2,2	3,3	2,2
	418	524	22,3	12	5	380	580	4	0,30	2,3	3,4	2,2
	406	506	16,7	9	5	380	580	4	0,37	1,8	2,7	1,8
	453	566	22,3	12	6	386	624	5	0,26	2,6	3,9	2,5
	447	552	22,3	12	6	386	624	5	0,35	1,9	2,9	1,8

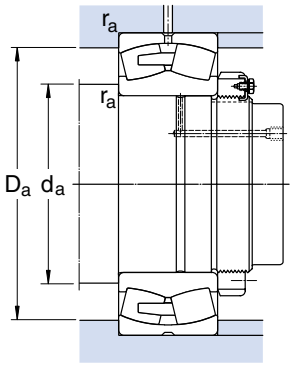
Spherical roller bearings
d **380 – 480** mm

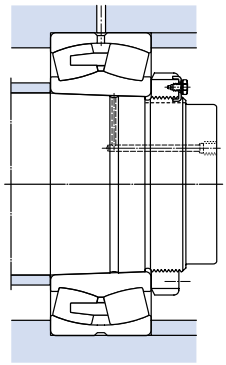




Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
380	520	106	1 960	3 800	285	800	1 000	69,0	**23976 CC/W33**	**23976 CCK/W33**
	560	135	2 900	5 000	360	630	800	115	**23076 CC/W33**	**23076 CCK/W33**
	560	180	3 600	6 800	480	480	600	150	**24076 CC/W33**	**24076 CCK30/W33**
	620	194	3 740	7 100	500	400	500	230	**23176 CA/W33**	**23176 CAK/W33**
	620	243	5 060	9 800	710	340	430	300	**24176 ECA/W33**	**24176 ECAK30/W33**
	680	240	5 060	9 150	620	380	480	375	**23276 CA/W33**	**23276 CAK/W33**
400	540	106	2 000	3 900	290	750	950	71,0	**23980 CC/W33**	**23980 CCK/W33**
	600	148	3 250	5 700	400	600	750	150	**23080 CC/W33**	**23080 CCK/W33**
	600	200	4 300	8 000	560	450	560	205	**24080 ECCJ/W33**	**24080 ECCK30J/W33**
	650	200	4 080	7 650	530	380	480	265	**23180 CA/W33**	**23180 CAK/W33**
	650	250	5 350	10 600	735	320	400	340	**24180 ECA/W33**	**24180 ECAK30/W33**
	720	256	5 750	10 400	680	340	430	450	**23280 CA/W33**	**23280 CAK/W33**
	820	243	6 560	10 400	670	360	450	650	**22380 CA/W33**	**22380 CAK/W33**
420	560	106	2 040	4 150	300	700	900	74,5	**23984 CC/W33**	**23984 CCK/W33**
	620	150	2 990	6 000	415	450	560	155	**23084 CA/W33**	**23084 CAK/W33**
	620	200	3 850	8 300	585	380	480	210	**24084 ECA/W33**	**24084 ECAK30/W33**
	700	224	4 890	9 300	620	360	450	350	**23184 CJ/W33**	**23184 CKJ/W33**
	700	280	6 330	12 600	850	300	380	445	**24184 ECA/W33**	**24184 ECAK30/W33**
	760	272	6 330	11 600	765	320	400	535	**23284 CA/W33**	**23284 CAK/W33**
440	600	118	2 450	4 900	345	670	850	99,5	**23988 CC/W33**	**23988 CCK/W33**
	650	157	3 220	6 550	450	430	530	180	**23088 CA/W33**	**23088 CAK/W33**
	650	212	4 140	9 150	630	360	450	245	**24088 ECA/W33**	**24088 ECAK30/W33**
	720	226	5 180	10 000	670	340	430	360	**23188 CA/W33**	**23188 CAK/W33**
	720	280	6 560	13 200	900	280	360	460	**24188 ECA/W33**	**24188 ECAK30/W33**
	790	280	6 730	12 500	800	320	400	590	**23288 CA/W33**	**23288 CAK/W33**
460	580	118	1 790	4 900	345	450	560	75,5	**24892 CAMA/W20**	**24892 CAK30MA/W20**
	620	118	2 190	5 000	355	430	530	105	**23992 CA/W33**	**23992 CAK/W33**
	680	163	3 450	6 950	465	400	500	205	**23092 CA/W33**	**23092 CAK/W33**
	680	218	4 490	10 000	670	340	430	275	**24092 ECA/W33**	**24092 ECAK30/W33**
	760	240	5 640	10 800	680	320	400	440	**23192 CA/W33**	**23192 CAK/W33**
	760	300	7 250	14 600	1 000	260	340	560	**24192 ECA/W33**	**24192 ECAK30/W33**
	830	296	7 360	13 700	880	300	380	695	**23292 CA/W33**	**23292 CAK/W33**
480	600	90	1 440	3 750	280	430	530	61,0	**23896 CAMA/W20**	**23896 CAKMA/W20**
	650	128	2 530	5 700	405	400	500	125	**23996 CA/W33**	**23996 CAK/W33**
	700	165	3 340	6 800	450	380	480	215	**23096 CA/W33**	**23096 CAK/W33**
	700	218	4 600	10 400	695	340	430	285	**24096 ECA/W33**	**24096 ECAK30/W33**
	790	248	6 100	12 000	780	300	380	485	**23196 CA/W33**	**23196 CAK/W33**
	790	308	7 710	15 600	1 040	240	320	605	**24196 ECA/W33**	**24196 ECAK30/W33**
	870	310	8 170	15 000	950	260	340	800	**23296 CA/W33**	**23296 CAK/W33**

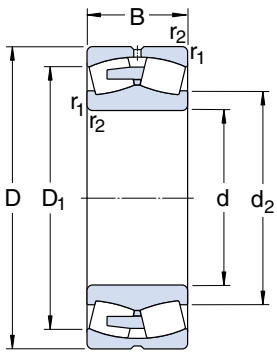
The designations of Explorer bearings are printed in blue

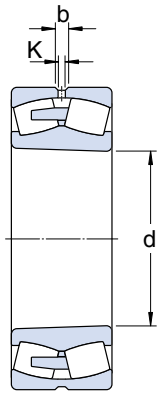




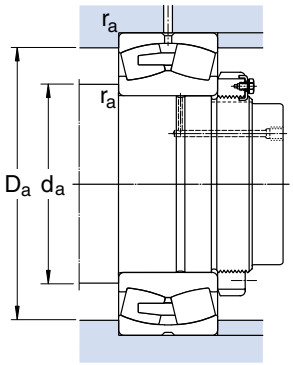
Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
380	420	481	13,9	7,5	4	395	505	3	0,17	4	5,9	4
	425	508	22,3	12	5	398	542	4	0,22	3	4,6	2,8
	420	496	16,7	9	5	398	542	4	0,30	2,3	3,4	2,2
	452	541	22,3	12	5	400	600	4	0,30	2,3	3,4	2,2
	446	529	16,7	9	5	400	600	4	0,37	1,8	2,7	1,8
	471	581	22,3	12	6	406	654	5	0,35	1,9	2,9	1,8
400	438	500	13,9	7,5	4	415	525	3	0,17	4	5,9	4
	450	543	22,3	12	5	418	582	4	0,23	2,9	4,4	2,8
	442	527	22,3	12	5	418	582	4	0,30	2,3	3,4	2,2
	474	566	22,3	12	6	426	624	5	0,28	2,4	3,6	2,5
	468	554	22,3	12	6	426	624	5	0,37	1,8	2,7	1,8
	499	615	22,3	12	6	426	694	5	0,35	1,9	2,9	1,8
	534	697	22,3	12	7,5	432	788	6	0,30	2,3	3,4	2,2
420	459	519	16,7	9	4	435	545	3	0,16	4,2	6,3	4
	485	562	22,3	12	5	438	602	4	0,22	3	4,6	2,8
	476	547	22,3	12	5	438	602	4	0,30	2,3	3,4	2,2
	483	607	22,3	12	6	446	674	5	0,30	2,3	3,4	2,2
	496	590	22,3	12	6	446	674	5	0,37	1,8	2,7	1,8
	525	649	22,3	12	7,5	452	728	6	0,35	1,9	2,9	1,8
440	484	552	16,7	9	4	455	585	3	0,17	4	5,9	4
	509	589	22,3	12	6	463	627	5	0,22	3	4,6	2,8
	498	572	22,3	12	6	463	627	5	0,30	2,3	3,4	2,2
	528	632	22,3	12	6	466	694	5	0,30	2,3	3,4	2,2
	516	610	22,3	12	6	466	694	5	0,37	1,8	2,7	1,8
	547	676	22,3	12	7,5	472	758	6	0,35	1,9	2,9	1,8
460	505	541	–	6	3	473	567	2,5	0,17	4	5,9	3,7
	512	573	16,7	9	4	475	605	3	0,16	4,2	6,3	4
	531	616	22,3	12	6	483	657	5	0,22	3	4,6	2,8
	523	601	22,3	12	6	483	657	5	0,28	2,4	3,6	2,5
	553	665	22,3	12	7,5	492	728	6	0,30	2,3	3,4	2,2
	544	649	22,3	12	7,5	492	728	6	0,37	1,8	2,7	1,8
	572	706	22,3	12	7,5	492	798	6	0,35	1,9	2,9	1,8
480	521	566	–	7,5	3	493	587	2,5	0,13	5,2	7,7	5
	532	601	16,7	9	5	498	632	4	0,18	3,8	5,6	3,6
	547	632	22,3	12	6	503	677	5	0,21	3,2	4,8	3,2
	541	619	22,3	12	6	503	677	5	0,28	2,4	3,6	2,5
	577	692	22,3	12	7,5	512	758	6	0,30	2,3	3,4	2,2
	564	678	22,3	12	7,5	512	758	6	0,37	1,8	2,7	1,8
	600	741	22,3	12	7,5	512	838	6	0,35	1,9	2,9	1,8

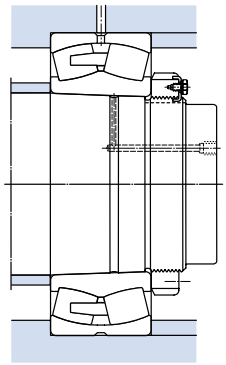
Spherical roller bearings
d **500 – 670** mm





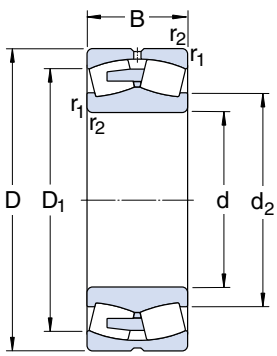
Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings Lubrication		Mass	Designations Bearings with	
			dynamic	static		grease	oil		cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
500	620	90	1 480	4 000	290	430	530	62,0	**238/500 CAMA/W20**	**238/500 CAKMA/W20**
	670	128	2 530	6 000	415	400	500	130	**239/500 CA/W33**	**239/500 CAK/W33**
	720	167	3 680	7 800	510	380	480	225	**230/500 CA/W33**	**230/500 CAK/W33**
	720	218	4 770	11 000	735	320	400	295	**240/500 ECA/W33**	**240/500 ECAK30/W33**
	830	264	6 730	12 900	830	280	360	580	**231/500 CA/W33**	**231/500 CAK/W33**
	830	325	8 630	17 000	1 120	220	300	745	**241/500 ECA/W33**	**241/500 ECAK30/W33**
	920	336	9 370	17 300	1 120	240	320	985	**232/500 CA/W33**	**232/500 CAK/W33**
530	650	118	1 840	5 300	380	380	480	86,0	**248/530 CAMA/W20**	**248/530 CAK30MA/W20**
	710	136	2 820	6 700	480	360	450	155	**239/530 CA/W33**	**239/530 CAK/W33**
	780	185	4 370	9 300	630	340	430	310	**230/530 CA/W33**	**230/530 CAK/W33**
	780	250	5 750	13 200	830	280	360	410	**240/530 ECA/W33**	**240/530 ECAK30/W33**
	870	272	7 130	14 000	915	260	340	645	**231/530 CA/W33**	**231/530 CAK/W33**
	870	335	9 200	19 000	1 220	200	280	830	**241/530 ECA/W33**	**241/530 ECAK30/W33**
	980	355	11 100	20 400	1 220	220	300	1 200	**232/530 CA/W33**	**232/530 CAK/W33**
560	750	140	3 050	7 200	510	340	430	175	**239/560 CA/W33**	**239/560 CAK/W33**
	820	195	4 890	10 200	680	320	400	355	**230/560 CA/W33**	**230/560 CAK/W33**
	820	258	6 330	14 600	960	260	340	465	**240/560 ECA/W33**	**240/560 ECAK30/W33**
	920	280	7 990	16 000	980	240	320	740	**231/560 CA/W33**	**231/560 CAK/W33**
	920	355	10 500	21 600	1 340	190	260	985	**241/560 ECJ/W33**	**241/560 ECK30J/W33**
	1 030	365	11 500	22 000	1 400	200	280	1 350	**232/560 CA/W33**	**232/560 CAK/W33**
600	800	150	3 450	8 300	585	320	400	220	**239/600 CA/W33**	**239/600 CAK/W33**
	870	200	5 230	11 400	750	300	380	405	**230/600 CA/W33**	**230/600 CAK/W33**
	870	272	7 130	17 000	1 100	240	320	520	**240/600 ECAF/W33**	**240/600 ECAK30F/W33**
	980	300	8 970	18 000	1 140	200	280	895	**231/600 CA/W33**	**231/600 CAK/W33**
	980	375	11 500	23 600	1 460	180	240	1 200	**241/600 ECA/W33**	**241/600 ECAK30/W33**
	1 090	388	13 100	25 500	1 560	190	260	1 600	**232/600 CA/W33**	**232/600 CAK/W33**
630	780	112	2 190	6 100	415	320	400	120	**238/630 CAMA/W20**	**238/630 CAKMA/W20**
	850	165	3 970	9 800	640	280	360	280	**239/630 CA/W33**	**239/630 CAK/W33**
	920	212	5 750	12 500	800	260	340	485	**230/630 CA/W33**	**230/630 CAK/W33**
	920	290	7 710	18 000	1 140	220	300	645	**240/630 ECJ/W33**	**240/630 ECK30J/W33**
	1 030	315	10 500	20 800	1 220	190	260	1 050	**231/630 CA/W33**	**231/630 CAK/W33**
	1 030	400	12 700	27 000	1 630	170	220	1 400	**241/630 ECA/W33**	**241/630 ECAK30/W33**
670	820	112	2 250	6 400	440	280	360	130	**238/670 CAMA/W20**	**238/670/ CAKMA/W20**
	820	150	3 110	9 500	655	280	360	172	**248/670 CAMA/W20**	**–**
	900	170	4 370	10 800	695	260	340	315	**239/670 CA/W33**	**239/670 CAK/W33**
	980	230	6 560	14 600	915	240	320	600	**230/670 CA/W33**	**230/670 CAK/W33**
	980	308	8 630	20 400	1 320	200	280	790	**240/670 ECA/W33**	**240/670 ECAK30/W33**
	1 090	336	10 900	22 400	1 370	180	240	1 250	**231/670 CA/W33**	**231/670 CAK/W33**
	1 090	412	13 800	29 000	1 760	160	200	1 600	**241/670 ECA/W33**	**241/670 ECAK30/W33**
	1 220	438	15 400	30 500	1 700	170	220	2 270	**232/670 CA/W33**	**232/670 CAK/W33**

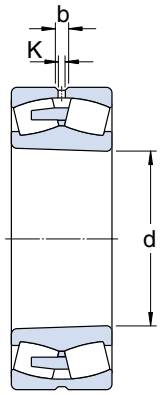




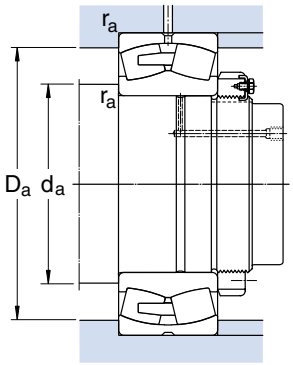
Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
500	543	587	–	7,5	3	513	607	2,5	0,12	5,6	8,4	5,6
	557	621	22,3	12	5	518	652	4	0,17	4	5,9	4
	571	656	22,3	12	6	523	697	5	0,21	3,2	4,8	3,2
	565	643	22,3	12	6	523	697	5	0,26	2,6	3,9	2,5
	603	726	22,3	12	7,5	532	798	6	0,30	2,3	3,4	2,2
	589	713	22,3	12	7,5	532	798	6	0,37	1,8	2,7	1,8
	631	779	22,3	12	7,5	532	888	6	0,35	1,9	2,9	1,8
530	573	612	–	7,5	3	543	637	2,5	0,15	4,5	6,7	4,5
	589	659	22,3	12	5	548	692	4	0,17	4	5,9	4
	611	708	22,3	12	6	553	757	5	0,22	3	4,6	2,8
	600	687	22,3	12	6	553	757	5	0,28	2,4	3,6	2,5
	636	763	22,3	12	7,5	562	838	6	0,30	2,3	3,4	2,2
	623	748	22,3	12	7,5	562	838	6	0,37	1,8	2,7	1,8
	668	836	22,3	12	9,5	570	940	8	0,35	1,9	2,9	1,8
560	625	695	22,3	12	5	578	732	4	0,16	4,2	6,3	4
	644	745	22,3	12	6	583	797	5	0,22	3	4,6	2,8
	635	728	22,3	12	6	583	797	5	0,28	2,4	3,6	2,5
	673	808	22,3	12	7,5	592	888	6	0,30	2,3	3,4	2,2
	634	796	22,3	12	7,5	592	888	6	0,37	1,8	2,7	1,8
	704	877	22,3	12	9,5	600	990	8	0,35	1,9	2,9	1,8
600	668	742	22,3	12	5	618	782	4	0,17	4	5,9	4
	683	786	22,3	12	6	623	847	5	0,22	3	4,6	2,8
	675	774	22,3	12	6	623	847	5	0,30	2,3	3,4	2,2
	720	862	22,3	12	7,5	632	948	6	0,30	2,3	3,4	2,2
	702	845	22,3	12	7,5	632	948	6	0,35	1,9	2,9	1,8
	752	928	22,3	12	9,5	640	1 050	8	0,37	1,8	2,7	1,8
630	681	738	–	9	4	645	765	3	0,12	5,6	8,4	5,6
	705	786	22,3	12	6	653	827	5	0,17	4	5,9	4
	725	837	22,3	12	7,5	658	892	6	0,21	3,2	4,8	3,2
	697	823	22,3	12	7,5	658	892	6	0,28	2,4	3,6	2,5
	757	908	22,3	12	7,5	662	998	6	0,30	2,3	3,4	2,2
	738	885	22,3	12	7,5	662	998	6	0,37	1,8	2,7	1,8
670	720	778	–	9	4	685	805	3	0,11	6,1	9,1	6,3
	718	786	–	9	4	685	805	3	0,16	4,2	6,3	4
	749	834	22,3	12	6	693	877	5	0,17	4	5,9	4
	770	890	22,3	12	7,5	698	952	6	0,21	3,2	4,8	3,2
	756	866	22,3	12	7,5	698	952	6	0,28	2,4	3,6	2,5
	802	958	22,3	12	7,5	702	1 058	6	0,30	2,3	3,4	2,2
	782	942	22,3	12	7,5	702	1 058	6	0,37	1,8	2,7	1,8
	830	1 027	22,3	12	12	718	1 172	10	0,35	1,9	2,9	1,8

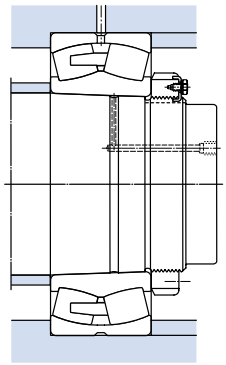
Spherical roller bearings
d **710 – 950** mm





Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings Lubrication		Mass	Designations Bearings with	
			dynamic	static		grease	oil		cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
710	870	118	2 580	7 500	500	260	340	153	**238/710 CAMA/W20**	**–**
	950	180	4 770	12 000	765	240	320	365	**239/710 CA/W33**	**239/710 CAK/W33**
	950	243	5 870	15 600	930	200	280	495	**249/710 CA/W33**	**249/710 CAK30/W33**
	1 030	236	7 250	16 300	1 000	220	300	670	**230/710 CA/W33**	**230/710 CAK/W33**
	1 030	315	9 370	22 800	1 370	190	260	895	**240/710 ECA/W33**	**240/710 ECAK30/W33**
	1 150	345	12 200	26 000	1 530	180	240	1 450	**231/710 CA/W33**	**231/710 CAK/W33**
	1 150	438	15 200	32 500	1 900	150	190	1 900	**241/710 ECA/W33**	**241/710 ECAK30/W33**
	1 280	450	17 600	34 500	2 000	160	200	1 450	**232/710 CA/W33**	**232/710 CAK/W33**
750	920	128	2 930	8 500	550	240	320	135	**238/750 CAMA/W20**	**238/750 CAKMA/W20**
	1 000	185	5 180	13 200	815	220	300	420	**239/750 CA/W33**	**239/750 CAK/W33**
	1 000	250	6 560	18 000	1 100	190	260	560	**249/750 CA/W33**	**249/750 CAK30/W33**
	1 090	250	8 450	18 600	1 100	200	280	795	**230/750 CA/W33**	**230/750 CAK/W33**
	1 090	335	10 100	25 000	1 460	180	240	1 065	**240/750 ECA/W33**	**240/750 ECAK30/W33**
	1 220	365	13 800	29 000	1 700	170	220	1 700	**231/750 CA/W33**	**231/750 CAK/W33**
	1 220	475	17 300	37 500	2 160	140	180	2 100	**241/750 ECA/W33**	**241/750 ECAK30/W33**
	1 360	475	18 700	36 500	2 120	150	190	3 050	**232/750 CAF/W33**	**232/750 CAKF/W33**
800	980	180	4 140	12 900	830	180	240	300	**248/800 CAMA/W20**	**248/800 CAK30MA/W20**
	1 060	195	5 640	14 300	880	200	280	470	**239/800 CA/W33**	**239/800 CAK/W33**
	1 060	258	7 020	19 300	1 060	180	240	640	**249/800 CA/W33**	**249/800 CAK30/W33**
	1 150	258	8 630	20 000	1 160	190	260	895	**230/800 CA/W33**	**230/800 CAK/W33**
	1 150	345	11 100	28 500	1 730	170	220	1 200	**240/800 ECA/W33**	**240/800 ECAK30/W33**
	1 280	375	14 800	31 500	1 800	160	200	1 920	**231/800 CA/W33**	**231/800 CAK/W33**
	1 280	475	18 400	40 500	2 320	130	170	2 300	**241/800 ECA/W33**	**241/800 ECAK30/W33**
850	1 030	136	3 340	10 000	640	190	260	240	**238/850 CAMA/W20**	**238/850 CAKMA/W20**
	1 120	200	5 980	15 600	930	190	260	560	**239/850 CA/W33**	**239/850 CAK/W33**
	1 120	272	8 170	22 800	1 370	170	220	740	**249/850 CA/W33**	**249/850 CAK30/W33**
	1 220	272	9 370	21 600	1 270	180	240	1 050	**230/850 CA/W33**	**230/850 CAK/W33**
	1 220	365	12 700	31 500	1 900	160	200	1 410	**240/850 ECA/W33**	**240/850 ECAK30/W33**
	1 360	400	16 100	34 500	2 000	140	180	2 200	**231/850 CA/W33**	**231/850 CAK/W33**
	1 360	500	20 200	45 000	2 550	110	150	2 710	**241/850 ECAF/W33**	**241/850 ECAK30F/W33**
900	1 090	190	4 660	15 300	950	170	220	370	**248/900 CAMA/W20**	**248/900 CAK30MA/W20**
	1 180	206	6 440	17 000	1 020	180	240	605	**239/900 CA/W33**	**239/900 CAK/W33**
	1 280	280	10 100	23 200	1 340	170	220	1 200	**230/900 CA/W33**	**230/900 CAK/W33**
	1 280	375	13 600	34 500	2 040	150	190	1 570	**240/900 ECA/W33**	**240/900 ECAK30/W33**
	1 420	515	21 400	49 000	2 700	100	140	3 350	**241/900 ECAF/W33**	**241/900 ECAK30F/W33**
950	1 250	224	7 250	19 600	1 120	170	220	755	**239/950 CA/W33**	**239/950 CAK/W33**
	1 250	300	9 200	26 000	1 500	140	180	1 015	**249/950 CA/W33**	**249/950 CAK30/W33**
	1 360	300	12 000	28 500	1 600	160	200	1 450	**230/950 CA/W33**	**230/950 CAK/W33**
	1 360	412	14 800	39 000	2 320	130	170	1 990	**240/950 CAF/W33**	**240/950 CAK30F/W33**
	1 500	545	23 900	55 000	3 000	95	130	3 535	**241/950 ECAF/W33**	**241/950 ECAK30F/W33**





Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
710	762	834	–	12	4	725	855	3	0,11	6,1	9,1	6,3
	788	881	22,3	12	6	732	927	5	0,17	4	5,9	4
	792	868	22,3	12	6	732	927	5	0,22	3	4,6	2,8
	814	939	22,3	12	7,5	738	1 002	6	0,21	3,2	4,8	3,2
	807	917	22,3	12	7,5	738	1 002	6	0,27	2,5	3,7	2,5
	850	1 017	22,3	12	9,5	750	1 110	8	0,28	2,4	3,6	2,5
	838	982	22,3	12	9,5	750	1 110	8	0,37	1,8	2,7	1,8
	851	1 017	22,3	12	12	758	1 232	10	0,35	1,9	2,9	1,8
750	807	873	–	12	5	768	902	4	0,11	6,1	9,1	6,3
	832	929	22,3	12	6	773	977	5	0,16	4,2	6,3	4
	830	916	22,3	12	6	773	977	5	0,22	3	4,6	3,2
	860	996	22,3	12	7,5	778	1 062	6	0,21	3,2	4,8	3,2
	853	969	22,3	12	7,5	778	1 062	6	0,28	2,4	3,6	2,5
	900	1 080	22,3	12	9,5	790	1 180	8	0,28	2,4	3,6	2,5
	875	1 050	22,3	12	9,5	790	1 180	8	0,37	1,8	2,7	1,8
	938	1 163	22,3	12	15	808	1 302	12	0,35	1,9	2,9	1,8
800	865	921	–	12	5	818	962	4	0,15	4,5	6,7	4,5
	885	984	22,3	12	6	823	1 037	5	0,16	4,2	6,3	4
	883	973	22,3	12	6	823	1 037	5	0,21	3,2	4,8	3,2
	915	1 051	22,3	12	7,5	828	1 122	6	0,20	3,4	5	3,2
	908	1 027	22,3	12	7,5	828	1 122	6	0,27	2,5	3,7	2,5
	950	1 141	22,3	12	9,5	840	1 240	8	0,28	2,4	3,6	2,5
	930	1 111	22,3	12	9,5	840	1 240	8	0,35	1,9	2,9	1,8
850	910	981	–	12	5	868	1 012	4	0,11	6,1	9,1	6,3
	940	1 043	22,3	12	6	873	1 097	5	0,16	4,2	6,3	4
	948	1 028	22,3	12	6	873	1 097	5	0,22	3	4,6	2,8
	969	1 114	22,3	12	7,5	878	1 192	6	0,20	3,4	5	3,2
	954	1 087	22,3	12	7,5	878	1 192	6	0,27	2,5	3,7	2,5
	1 010	1 203	22,3	12	12	898	1 312	10	0,28	2,4	3,6	2,5
	988	1 182	22,3	12	12	898	1 312	10	0,35	1,9	2,9	1,8
900	969	1 029	–	12	5	918	1 072	4	0,14	4,8	7,2	4,5
	989	1 100	22,3	12	6	923	1 157	5	0,15	4,5	6,7	4,5
	1 023	1 177	22,3	12	7,5	928	1 252	6	0,20	3,4	5	3,2
	1 012	1 147	22,3	12	7,5	928	1 252	6	0,26	2,6	3,9	2,5
	1 043	1 235	22,3	12	12	948	1 372	10	0,35	1,9	2,9	1,8
950	1 049	1 161	22,3	12	7,5	978	1 222	6	0,15	4,5	6,7	4,5
	1 051	1 150	22,3	12	7,5	978	1 222	6	0,21	3,2	4,8	3,2
	1 083	1 242	22,3	12	7,5	978	1 332	6	0,20	3,4	5	3,2
	1 074	1 212	22,3	12	7,5	978	1 332	6	0,27	2,5	3,7	2,5
	1 102	1 305	22,3	12	12	998	1 452	10	0,35	1,9	2,9	1,8

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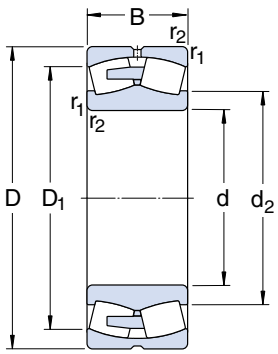
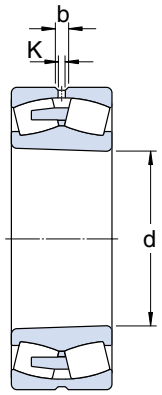
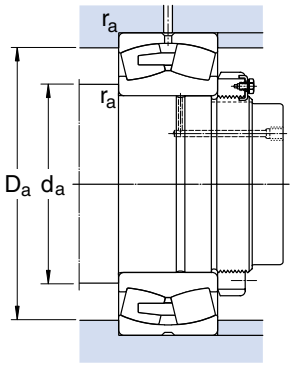
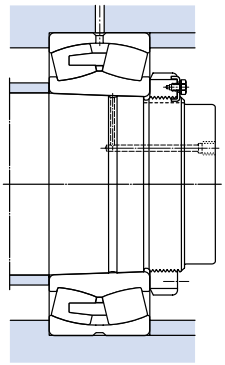
Spherical roller bearings
d **1 000 – 1 800** mm





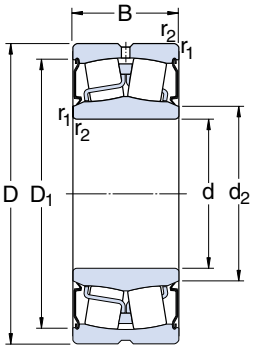
Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designations** Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
1 000	1 220	165	4 660	14 300	865	170	220	410	**238/1000 CAMA/W20**	**238/1000 CAKMA/W20**
	1 320	315	10 400	29 000	1 500	130	170	1 200	**249/1000 CA/W33**	**249/1000 CAK30/W33**
	1 420	308	12 700	30 500	1 700	140	180	1 600	**230/1000 CAF/W33**	**230/1000 CAKF/W33**
	1 420	412	15 400	40 500	2 240	120	160	2 140	**240/1000 CAF/W33**	**240/1000 CAK30F/W33**
	1 580	462	21 400	48 000	2 550	100	140	3 500	**231/1000 CAF/W33**	**231/1000 CAKF/W33**
	1 580	580	26 700	62 000	3 350	90	120	4 300	**241/1000 ECAF/W33**	**241/1000 ECAK30F/W33**
1 060	1 280	165	4 770	15 000	800	160	200	435	**238/1060 CAMA/W20**	**238/1060 CAKMA/W20**
	1 280	218	6 100	20 000	1 200	130	170	570	**248/1060 CAMA/W20**	**248/1060 CAK30MA/W20**
	1 400	250	9 550	26 000	1 460	140	180	1 100	**239/1060 CAF/W33**	**239/1060 CAKF/W33**
	1 400	335	11 500	32 500	1 860	120	160	1 400	**249/1060 CAF/W33**	**249/1060 CAK30F/W33**
	1 500	325	13 800	34 000	1 830	130	170	2 250	**230/1060 CAF/W33**	**230/1060 CAKF/W33**
	1 500	438	17 300	45 500	2 500	110	150	2 515	**240/1060 CAF/W33**	**240/1060 CAK30F/W33**
1 120	1 360	243	7 250	24 000	1 400	110	150	735	**248/1120 CAFA/W20**	**248/1120 CAK30FA/W20**
	1 460	335	11 700	34 500	1 830	100	140	1 500	**249/1120 CAF/W33**	**249/1120 CAK30F/W33**
	1 580	462	18 700	50 000	2 850	95	130	2 925	**240/1120 CAF/W33**	**240/1120 CAK30F/W33**
1 180	1 420	180	5 870	18 600	1 080	130	170	575	**238/1180 CAFA/W20**	**238/1180 CAKFA/W20**
	1 420	243	7 710	27 000	1 560	130	170	770	**248/1180 CAFA/W20**	**248/1180 CAK30FA/W20**
	1 540	272	11 100	31 000	1 660	110	150	1 400	**239/1180 CAF/W33**	**239/1180 CAKF/W33**
	1 540	355	13 600	40 500	2 160	95	130	1 800	**249/1180 CAF/W33**	**249/1180 CAK30F/W33**
1 250	1 750	375	17 900	45 000	2 400	95	130	2 840	**230/1250 CAF/W33**	**230/1250 CAKF/W33**
1 320	1 600	280	9 780	33 500	1 860	90	120	1 160	**248/1320 CAFA/W20**	**248/1320 CAK30FA/W20**
	1 720	400	16 100	49 000	2 550	85	110	2 500	**249/1320 CAF/W33**	**249/1320 CAK30F/W33**
1 500	1 820	315	12 700	45 000	2 400	85	110	1 710	**248/1500 CAFA/W20**	**248/1500 CAK30FA/W20**
	1 950	450	20 700	63 000	3 150	67	85	3 550	**249/1500 CAFB/W33**	**249/1500 CAK30FB/W33**
1 800	2 180	375	17 600	63 000	3 050	60	75	2 900	**248/1800 CAFA/W20**	**248/1800 CAK30FA/W20**



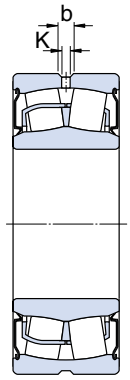


Dimensions						Abutment and fillet dimensions			Calculation factors			
d	d_2	D_1	b	K	$r_{1,2}$ min	d_a min	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm			–			
1 000	1 077	1 161	–	12	6	1 023	1 197	5	0,12	5,6	8,4	5,6
	1 106	1 209	22,3	12	7,5	1 028	1 292	6	0,21	3,2	4,8	3,2
	1 139	1 305	22,3	12	7,5	1 028	1 392	6	0,19	3,6	5,3	3,6
	1 133	1 275	22,3	12	7,5	1 028	1 392	6	0,26	2,6	3,9	2,5
	1 182	1 399	22,3	12	12	1 048	1 532	10	0,28	2,4	3,6	2,5
	1 159	1 373	22,3	12	12	1 048	1 532	10	0,35	1,9	2,9	1,8
1 060	1 135	1 219	–	12	6	1 083	1 257	5	0,11	6,1	9,1	6,3
	1 159	1 210	–	12	6	1 083	1 257	5	0,14	4,8	7,2	4,5
	1 171	1 303	22,3	12	7,5	1 088	1 392	6	0,16	4,2	6,3	4
	1 165	1 282	22,3	12	7,5	1 088	1 392	6	0,21	3,2	4,8	3,2
	1 202	1 373	22,3	12	9,5	1 094	1 466	8	0,19	3,6	5,3	3,6
	1 196	1 347	22,3	12	9,5	1 094	1 466	8	0,26	2,6	3,9	2,5
1 120	1 207	1 282	–	12	6	1 143	1 337	5	0,15	4,5	6,7	4,5
	1 230	1 349	22,3	12	7,5	1 148	1 432	6	0,20	3,4	5	3,2
	1 266	1 422	22,3	12	9,5	1 154	1 546	8	0,26	2,6	3,9	2,5
1 180	1 261	1 355	–	12	6	1 203	1 397	5	0,11	6,1	9,1	6,3
	1 280	1 343	–	12	6	1 203	1 397	5	0,14	4,8	7,2	4,5
	1 298	1 435	22,3	12	7,5	1 208	1 512	6	0,16	4,2	6,3	4
	1 293	1 417	22,3	12	7,5	1 208	1 512	6	0,20	3,4	5	3,2
1 250	1 411	1 607	22,3	12	9,5	1 284	1 716	8	0,19	3,6	5,3	3,6
1 320	1 422	1 511	–	12	6	1 343	1 577	5	0,15	4,5	6,7	4,5
	1 445	1 584	22,3	12	7,5	1 348	1 692	6	0,21	3,2	4,8	3,2
1 500	1 612	1 719	–	12	7,5	1 528	1 792	6	0,15	4,5	6,7	4,5
	1 644	1 794	22,3	12	9,5	1 534	1 916	8	0,20	3,4	5	3,2
1 800	1 932	2 060	–	12	9,5	1 834	2 146	8	0,15	4,5	6,7	4,5

Sealed spherical roller bearings
d **30 – 130** mm



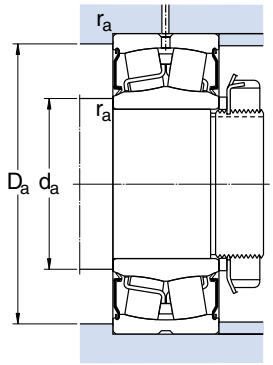
BS2-22-2CS(2)



BS2-22 C-2CS(2)

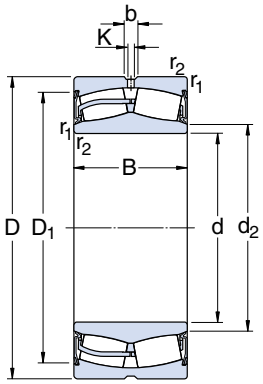
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed rating	Mass	Designations Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min	kg	–	
30	62	25	56	52	5,5	2 800	0,34	BS2-2206 C-2CS	–
35	72	28	76,5	73,5	8	2 400	0,52	BS2-2207 C-2CS	–
40	80	28	96,5	90	9,8	2 200	0,57	BS2-2208-2CS	BS2-2208-2CSK
45	85	28	90	88	9,5	2 000	0,63	BS2-2209 C-2CS	BS2-2209 C-2CSK
50	90	28	96,5	100	11	1 900	0,68	BS2-2210 C-2CS	BS2-2210 C-2CSK
55	100	31	125	127	13,7	1 700	1,00	BS2-2211-2CS	BS2-2211-2CSK
60	110	34	156	166	18,6	1 600	1,30	BS2-2212-2CS	BS2-2212-2CSK
65	100	35	115	173	20,4	1000	0,95	24013-2CS5/VT143	–
	120	38	170	183	21,2	1 500	1,60	BS2-2213 C-2CS	BS2-2213 C-2CSK
70	125	38	208	228	25,5	1 400	1,80	BS2-2214-2CS	BS2-2214-2CSK
75	115	40	152	232	28,5	950	1,55	24015-2CS2/VT143	–
	130	38	212	240	26,5	1 300	2,10	BS2-2215-2CS	BS2-2215-2CSK
80	140	40	236	270	29	1 200	2,40	BS2-2216-2CS	BS2-2216-2CSK
85	150	44	285	325	34,5	1 100	3,00	BS2-2217-2CS	BS2-2217-2CSK
90	160	48	325	375	39	1 000	3,70	BS2-2218-2CS	BS2-2218-2CSK
100	150	50	248	415	45,5	800	3,20	24020-2CS2/VT143	–
	165	52	322	490	53	850	4,40	23120-2CS2/VT143	–
	180	55	425	490	49	900	5,50	BS2-2220-2CS	–
	180	60,3	414	600	63	700	6,70	23220-2CS	–
110	170	45	267	440	46,5	900	3,75	23022-2CS	–
	180	56	430	585	61	800	5,55	23122-2CS2/VT143	–
	180	69	460	750	78	630	6,85	24122-2CS2/VT143	–
	200	63	560	640	63	800	7,60	BS2-2222-2CS5/VT143	–
120	180	46	355	500	52	850	4,20	23024-2CS2/VT143	–
	180	60	430	670	68	670	5,40	24024-2CS2/VT143	–
	200	80	575	950	95	560	10,0	24124-2CS2/VT143	–
	215	69	630	765	73,5	750	9,75	BS2-2224-2CS	–
130	200	52	430	610	61	800	6,10	23026-2CS2/VT143	–
	200	69	540	815	81,5	600	7,95	24026-2CS2/VT143	–
	210	80	587	1 000	100	530	11,0	24126-2CS2/VT143	–

The designations of Explorer bearings are printed in blue



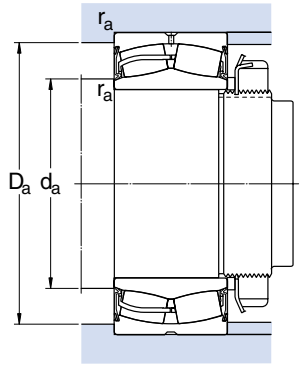
Dimensions						Abutment and fillet dimensions				Calculation factors			
d	d_2 ≈	D_1 ≈	b	K	$r_{1,2}$ min	d_a min	d_a max	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm				–			
30	36	55,7	3,7	2	1	36	36	56	1	0,33	2	3	2
35	43	63,7	3,7	2	1,1	42	43	65	1	0,31	2,2	3,3	3,2
40	47	73	5,5	3	1,1	47	47	73	1	0,28	2,4	3,6	2,5
45	53	77,1	5,5	3	1,1	52	53	78	1	0,26	2,6	3,9	2,5
50	58,1	82,1	5,5	3	1,1	57	58	83	1	0,24	2,8	4,2	2,8
55	64	91,9	5,5	3	1,5	64	64	91	1,5	0,24	2,8	4,2	2,8
60	69,3	100	5,5	3	1,5	69	69,3	101	1,5	0,24	2,8	4,2	2,8
65	71,9	92,8	5,5	3	1,1	71,6	71,6	93	1	0,27	2,5	3,7	2,5
	74	111	5,5	3	1,5	74	74	111	1,5	0,24	2,8	4,2	2,8
70	80,1	115	5,5	3	1,5	79	79	116	1,5	0,23	2,9	4,4	2,8
75	81,8	105	5,5	3	1,1	81	81,8	109	1	0,28	2,4	3,6	2,5
	84,5	119	5,5	3	1,5	84	84,5	121	1,5	0,22	3	4,6	2,8
80	92	128	5,5	3	2	91	92	129	2	0,22	3	4,6	2,8
85	98,2	138	5,5	3	2	96	98	139	2	0,22	3	4,6	2,8
90	103	148	5,5	3	2	101	103	149	2	0,24	2,8	4,2	2,8
100	108	139	5,5	3	1,5	107	108	143	1,5	0,28	2,4	3,6	2,5
	113	152	5,5	3	2	111	113	154	2	0,27	2,5	3,7	2,5
	114	160	8,3	4,5	2,1	112	114	168	2	0,24	2,8	4,2	2,8
	114	160	8,3	4,5	2,1	112	114	169	2	0,30	2,3	3,4	2,2
110	122	157	8,3	4,5	2	120	122	160	2	0,22	3	4,6	2,8
	123	166	8,3	4,5	2	121	123	169	2	0,27	2,5	3,7	2,5
	121	163	5,5	3	2	121	121	169	2	0,35	1,9	2,9	1,8
	126	182	8,3	4,5	2,1	122	126	188	2	0,25	2,7	4	2,5
120	133	168	5,5	3	2	130	133	170	2	0,20	3,4	5	3,2
	130	166	5,5	3	2	130	130	170	2	0,28	2,4	3,6	2,5
	132	179	5,5	3	2	131	132	189	2	0,37	1,8	2,7	1,8
	136	193	11,1	6	2,1	132	136	203	2	0,26	2,6	3,9	2,5
130	145	186	8,3	4,5	2	140	145	190	2	0,21	3,2	4,8	3,2
	141	183	5,5	3	2	140	141	190	2	0,30	2,3	3,4	2,2
	142	190	5,5	3	2	141	142	199	2	0,33	2	3	2

Sealed spherical roller bearings
d **140 – 220** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed rating	Mass	Designation Bearings with cylindrical bore
d	D	B	C	C_0	P_u			
mm			kN		kN	r/min	kg	–
140	210	69	570	900	68	560	8,45	24028-2CS2/VT143
	225	85	673	1 160	112	450	12,7	**24128-2CS2/VT143**
150	225	75	655	1 040	100	530	10,5	24030-2CS2/VT143
	250	100	1020	1 530	146	400	19,5	24130-2CS2/VT143
160	240	80	750	1 200	114	450	13,0	24032-2CS2/VT143
	270	86	980	1 370	129	530	26,5	23132-2CS2/VT143
170	260	90	930	1 460	137	400	17,5	24034-2CS2/VT143
	280	109	1 280	1 860	170	360	26,5	24134-2CS2/VT143
180	280	100	937	1 730	156	380	23,0	**24036-2CS2/VT143**
190	320	128	1 600	2 500	212	340	42,0	24138-2CS2/VT143
200	340	140	1 800	2 800	232	320	52,0	24140-2CS
	360	128	1 860	2 700	228	430	58,0	23240-2CS2/VT143
220	300	60	630	1 080	93	600	13,0	23944-2CS

The designations of Explorer bearings are printed in blue



Dimensions						Abutment and fillet dimensions				Calculation factors			
d	d_2 ≈	D_1 ≈	b	K	$r_{1,2}$ min	d_a min	d_a max	D_a max	r_a max	e	Y_1	Y_2	Y_0
mm						mm				–			
140	152	194	5,5	3	2	150	152	200	2	0,28	2,4	3,6	2,5
	153	203	8,3	4,5	2,1	152	153	213	2	0,35	1,9	2,9	1,8
150	162	206	5,5	3	2,1	161	162	214	2	0,28	2,4	3,6	2,5
	163	221	8,3	4,5	2,1	162	163	238	2	0,37	1,8	2,7	1,8
160	173	218	8,3	4,5	2,1	171	173	229	2	0,28	2,4	3,6	2,5
	180	244	13,9	7,5	2,1	172	180	259	2	0,28	2,4	3,6	2,5
170	184	235	8,3	4,5	2,1	181	184	249	2	0,30	2,3	3,4	2,2
	185	249	8,3	4,5	2,1	182	185	268	2	0,37	1,8	2,7	1,8
180	195	251	8,3	4,5	2,1	191	195	269	2	0,31	2,2	3,3	2,2
190	210	284	11,1	6	3	204	210	306	2,5	0,40	1,7	2,5	1,6
200	220	300	11,1	6	3	214	220	326	2,5	0,40	1,7	2,5	1,6
	227	318	16,7	9	4	217	225	343	3	0,35	1,9	2,9	1,8
220	239	284	8,3	4,5	2,1	231	239	289	2	0,16	4,2	6,3	4

Related SKF products

Special spherical roller bearings

Their robust design and high reliability make SKF spherical roller bearings suitable for the majority of applications. However, extraordinary demands call for bearings with extraordinary features. Therefore, the SKF standard range includes special spherical roller bearings, which are adapted for specific applications:

Sealed bearings for continuous casting applications
These bearings are specially adapted for the high loads and operating temperatures and low speeds present in continuous casting slab guides. They feature seals made of fluoro rubber, and are filled with a very stable high temperature grease, allowing maintenance-free operation in this demanding environment.

Bearings for vibrating applications
Series 223 bearings with special clearance are modified to cope with shaft deflection encountered in vibrating applications. They are characterised by a hardened floating guide ring centred in the outer ring which guides the highly wear resistant, surface hardened window-type steel cages. To prevent fretting corrosion at the non-locating bearing position, a special version with PTFE-coated cylindrical bore is available.

Rolling mill bearings
Rolling mill bearings must meet a variety of different demands. For cold tube mills (Pilger mills), for example, the bearings must be able to withstand high acceleration forces, whereas for finishing trains or wire mills, they must be able to be mounted and dismounted with ease. SKF offers the appropriate spherical roller bearings for these applications.

SKF Pop Release units
These plummer block type mounted bearing units with series 222 Explorer bearing on a special adapter sleeve are greased, sealed and ready to install as delivered. With the saw-tooth profile of the inner ring and adapter sleeve, the unit can be mounted and dismounted easily via the incorporated screws without having to use special tools.

See also SKF brochures 4954 "The SKF Copperhead system solution for vibrating screens" and 5103 "Pop Release bearing units for speedier mounting".

Accessories

Any system is only as strong as its weakest member. Therefore, SKF offers not only a wide range of excellent spherical roller bearings, but also an appropriate range of quality bearing accessories to go with them.

Bearing housings
SKF offers a comprehensive range of high-quality standard and custom housings designed to accommodate the various demands placed on the bearings which they house, e.g. load, accuracy, type of lubrication and lubricant, sealing, etc.

Along with the appropriate SKF spherical roller bearings, these SKF housings comprise an economic and interchangeable unit which meets all the performance demands of a bearing application.

See also SKF catalogue 3766 "Bearing accessories" and SKF brochures 4403 "SNL plummer block housings solve the housing problems" and 5101 "SNL 30 and SNL 31 plummer block housings solve the housing problems".

Adapter and withdrawal sleeves
Adapter and withdrawal sleeves are used to locate bearings with tapered bore on smooth or stepped shafts. They facilitate bearing mounting and dismounting and, in many cases, simplify bearing arrangement design. Several series of quality sleeves are included in the SKF product range.

Lock nuts
SKF lock nuts, also referred to as shaft nuts, are available in several designs to axially locate bearings on shaft ends. The most popular are those of series KM, KML and HM. These nuts have four or eight equally spaced slots in the outside diameter and are locked in position with locking washers or locking clips engaging a groove in the shaft. The nut dimensions are in accordance with ISO 2982-2:1995 as are the dimensions of the series MB and MBL locking washers.

Other lock nuts produced by SKF include series KMT, KMTA, KMK and KMFE, that do not require a groove in the shaft.

SKF adapter and withdrawal sleeves

SKF lock nuts

Lubricants and lubrication equipment

Spherical roller bearings operate under the most varying load, speed, temperature and environmental conditions. They require the type of high-quality lubricating greases, which SKF provides.

SKF greases have been specially developed for rolling bearings in their typical applications. The SKF range includes fifteen environmentally friendly greases and covers practically all application requirements.

The range is complemented by a selection of lubrication accessories including

- automatic lubricators,
- grease guns,
- lubricant metering devices and
- a wide range of manually and pneumatically operated grease pumps.

Products for mounting and dismounting

Like all rolling bearings, SKF spherical roller bearings require a high degree of skill when mounting or dismounting, as well as the correct tools and methods.

The comprehensive SKF range of tools and equipment includes everything that is required:

- mechanical tools,
- heaters,
- hydraulic tools and equipment,
- pullers and withdrawal tools for all sizes of bearings.

Induction heater, hydraulic pumps, hydraulic nut, mounting fluid and anti-fretting paste from SKF

See also SKF catalogue MP3000 "SKF Maintenance and Lubrication Products".

SKF lubricants: always the best choice for any kind of bearing application

Condition monitoring equipment

The goal of condition monitoring is to maximise the time that the machine is functioning well and minimise the number of breakdowns, thereby significantly reducing operating downtime and maintenance costs.

To achieve this, it is recommended that the bearing and machine condition be monitored either periodically or continuously. Condition monitoring enables incipient bearing damage to be detected and evaluated, so that bearing replacement can be scheduled for a time when the machine is not in operation, to avoid unplanned stoppages. Applied to all machinery (not just sensitive or problematic machines), condition monitoring improves machinery operation to an optimum level, often exceeding the original equipment specifications.

SKF provides a comprehensive range of condition monitoring equipment to measure all important parameters. These include

- temperature,
- speed,
- noise,
- oil condition,
- shaft alignment,
- vibration and
- bearing condition.

The range includes lightweight, handheld devices for manual use as well as complex continuous monitoring systems for fixed installations in connection with preventive maintenance.

One example is the Machine Reliability Inspection System MARLIN™ which is at the leading edge of technology and allows storage of up to 2 000 measuring points. It can be used to diagnose machines and individual bearings and is backed by tailored software for the evaluation of the readings including enveloping vibration acceleration curves.

Recording vibration values using an SKF Microlog data collection unit

Taking the temperature

Noise testing

The MARLIN™ machine reliability inspection system

The SKF Group – a worldwide corporation

SKF is an international industrial Group operating in some 130 countries and is world leader in bearings.

The company was founded in 1907 following the invention of the self-aligning ball bearing by Sven Wingquist and, after only a few years, SKF began to expand all over the world.

Today, SKF has some 40 000 employees and around 80 manufacturing facilities spread throughout the world. An international sales network includes a large number of sales companies and some 7 000 distributors and retailers. Worldwide availability of SKF products is supported by a comprehensive technical advisory service.

The key to success has been a consistent emphasis on maintaining the highest quality of its products and services. Continuous investment in research and development has also played a vital role, resulting in many examples of epoch-making innovations.

The business of the Group consists of bearings, seals, special steel and a comprehensive range of other high-tech industrial components. The experience gained in these various fields provides SKF with the essential knowledge and expertise required in order to provide the customers with the most advanced engineering products and efficient service.

The SKF Group is the first major bearing manufacturer to have been granted approval according to ISO 14001, the international standard for environmental management systems. The certificate is the most comprehensive of its kind and covers more than 60 SKF production units in 17 countries.

The SKF Engineering & Research Centre is situated just outside Utrecht in The Netherlands. In an area of 17 000 square metres (185 000 sq.ft) some 150 scientists, engineers and support staff are engaged in the further improvement of bearing performance. They are developing technologies aimed at achieving better materials, better designs, better lubricants and better seals – together leading to an even better understanding of the operation of a bearing in its application. This is also where the SKF Life Theory was evolved, enabling the design of bearings which are even more compact and offer even longer operational life.

SKF has developed the Channel concept in factories all over the world. This drastically reduces the lead time from raw material to end product as well as work in progress and finished goods in stock. The concept enables faster and smoother information flow, eliminates bottlenecks and bypasses unnecessary steps in production. The Channel team members have the knowledge and commitment needed to share the responsibility for fulfilling objectives in areas such as quality, delivery time, production flow etc.

SKF manufactures ball bearings, roller bearings and plain bearings. The smallest are just a few millimetres (a fraction of an inch) in diameter, the largest several metres. SKF also manufactures bearing and oil seals which prevent dirt from entering and lubricant from leaking out. SKF's subsidiaries CR and RFT S.p.A. are among the world's largest producers of seals.

SKF®

This publication supersedes the previous publications 4401 and 4404.

Publication **5100 E** · December 2001

Printed in Sweden on environmentally friendly, chlorine-free paper (Multiart Silk) by Hyltebruks Tryckeri AB.

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