SKF four-row taper roller bearings

Set new performance standards

Contents

The SKF brand now stands for more than ever before, and means more to you as a valued customer.

While SKF maintains its leadership as the hallmark of quality bearings throughout the world, new dimensions in technical advances, product support and services have evolved SKF into a truly solutions-oriented supplier, creating greater value for customers.

These solutions encompass ways to bring greater productivity to customers, not only with breakthrough application-specific products, but also through leading-edge design simulation tools and consultancy services, plant asset efficiency maintenance programmes, and the industry's most advanced supply management techniques.

The SKF brand still stands for the very best in rolling bearings, but it now stands for much more.

SKF – the knowledge engineering company

A Product information

B Recommendations

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Quality and choice

Why four-row taper roller bearings?

Four-row taper roller bearings are used successfully worldwide for rolling mill bearing arrangements, particularly as work and back-up roll bearings for hot as well as cold rolling mills. As they can support both heavy radial loads and simultaneously acting axial loads they permit simple and cost effective roll neck bearing arrangements.

Why four-row taper roller bearings from SKF?

SKF is long acquainted with the use of rolling bearings in rolling mills. As early as 1922 SKF introduced roller bearings as roll neck bearings in the SKF steelworks Hofors Bruk. Since then both builders and operators of rolling mills have benefitted from innovative SKF bearing technology.

SKF four-row taper roller bearings are available in a wide range of sizes and designs appropriate to the application. These include

- TQO and TQI configuration (face-to-face or back-to-back arrangement)
- sealed and open bearings
- bearings with or without extended inner rings
- bearings with cylindrical or tapered bore
- bearings with and without spacer rings.

Specific features of these SKF bearings are, among others

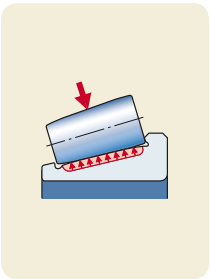
- logarithmic contact profile between rollers and raceways provides a more favourable stress distribution in the bearing and considerably enhances operational reliability
- special roller end/flange contact geometry designed to promote lubrication and minimise friction and, of course
- quality of SKF manufacture.

However, the technical development of SKF four-row taper roller bearings has been driven yet further. The result – the SKF Explorer four-row taper roller bearings – sets a completely new performance standard.

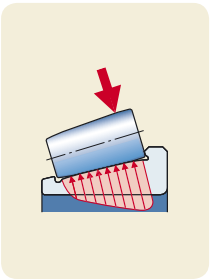
To appreciate the excellent features and benefits of SKF Explorer bearings, read more about them on the following pages.

Unique design features

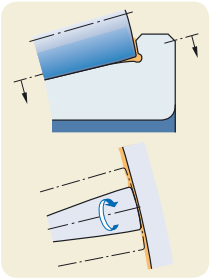
Even load distribution under normal loads; extended roller/raceway contacts, i.e. lower stresses



Improved stress distribution due to reduced edge stresses under heavy loads and also when misaligned, i.e. much higher operational reliability



Improved roller end/flange contact, i.e. optimized lubrication, minimized friction



The C design of the seal leaves space for rollers that are almost as long as those of open bearings so that the load carrying capacity is almost equal

Bearings without spacer rings are simpler to mount and the load distribution is better

SKF taper roller bearings are state-of-the-art products. This was particularly true for the contact conditions in standard bearings, but is even more so for the SKF Explorer bearings.

Favourable stress distribution

The contact geometry between the rollers and raceways has been much improved by the use of logarithmic contact profile geometry resulting in optimized stress distribution in the bearing under all conditions of load and misalignment.

Efficient lubrication

The superior logarithmic contact profile and the optimized raceway surfaces of the rings and rollers not only improve lubrication conditions but are also less demanding of the lubricant.

Efficient lubrication of the flange

The special form of the surfaces of the inner ring guide flanges and the large ends of the rollers considerably enhance lubricant film formation in the sliding roller end/flange contacts.

Well-designed seals

The radial shaft seals of SKF four-row taper roller bearings have the form of a C and extend over the cages of the two outboard roller and cage assemblies. Because of the compact design the bearing can incorporate rollers of the same, or almost the same length as the open bearing of the same dimensions so that the load carrying capacity is the same or very similar.

A stainless steel garter spring enables the sealing lip to exert the requisite pressure. The seals are thermally and chemically stable and can operate at high sliding velocities.

O-rings inserted in grooves in the outer ring outside surface prevent dirt and water from penetrating between the outer rings and the chock bore, from where it can contaminate the bearing and cause corrosion.

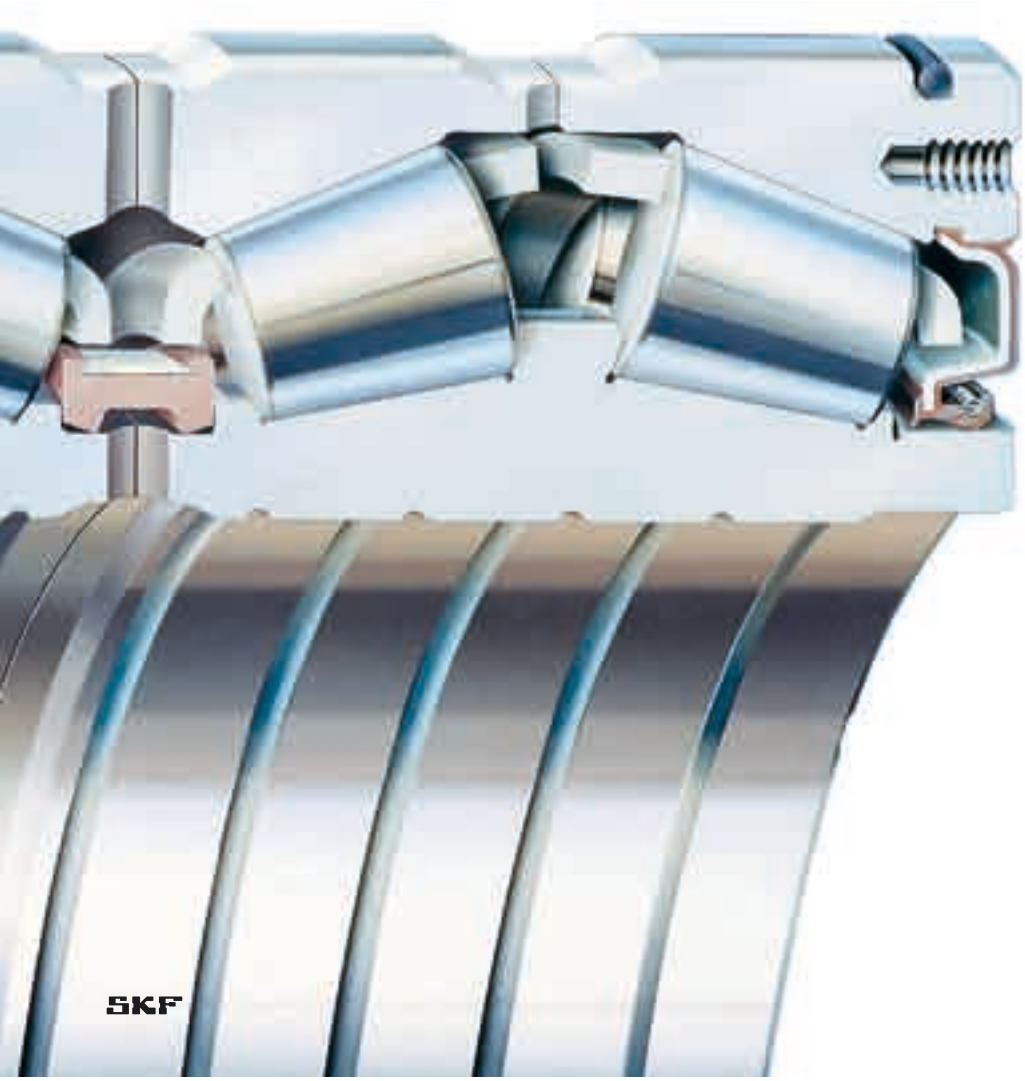
Spacer rings – if needed

Even though most of the bearings in the SKF range of four-row taper roller bearings are now made without spacer rings, bearings with spacer rings are available for applications where they are needed.

Better: without spacer rings

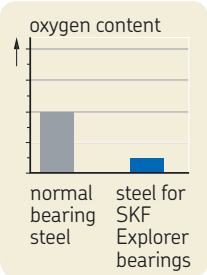
Bearings without spacer rings are generally the better engineering solution and have two main advantages:

- They comprise fewer component parts and can thus be mounted more easily and quickly.
- Four separate outer rings contribute to a more even load distribution and consequently, a longer service life.



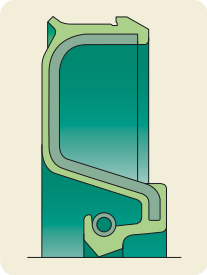
SKF Explorer bearings – a quantum leap forwards

SKF Explorer bearings are made of extremely clean steel



Modified cage pocket design improves lubrication

The new seal made of environmentally friendly material seals more efficiently against the rotating inner ring



The cage and roller assemblies can be separated from the inner rings – no special tools are required

The maintenance-friendly seals are easy to remove and reinstall

The performance of the previous standard taper roller bearings has confirmed the benefits of the improved roller/raceway geometry and the optimized roller end/flange contact. In addition the new SKF Explorer performance class four-row taper roller bearings meet important customer demands and are characterized by

- higher load carrying capacity
- longer service life
- unique inspection/maintenance capabilities
- improved seals.

Higher load carrying capacity

The steel used for SKF Explorer bearings has high purity and extreme low oxygen content. The reduction in the number of inclusions increases the fatigue strength as well as the wear resistance and enhances the ability to support heavy and shock loads and increases the dynamic load carrying ability.

Longer service life

Increased dynamic load carrying capacity implies longer service life and this is reinforced and extended by the benefits derived from

- a further refinement of the contact geometry
- an increase in flange strength
- an increase in manufacturing quality.

A new heat treatment process provides an excellent balance between material hardness and toughness. The high surface hardness increases wear resistance, which is particularly important under the tough operating conditions in rolling mills, characterized by contamination by scale and water.

The lubrication conditions in the bearings have also been further improved. Modified cage pocket design improves lubrication at the sliding contact between rollers and cages. The special raceway surface contributes to excellent lubricant film formation at the contacts between rollers and raceways.

Finally, the precise matching between the roller rows makes for a more even load distribution over all four rows of rollers.

There is thus a solid foundation for the longer service life of the SKF Explorer bearings compared with their predecessors.

Improved seals

The new seals are made of environmentally friendly hydrogenated acrylonitrile butadiene rubber. The new seal design has resulted in improved retention and sealing in the outer ring and increased sealing efficiency against the inner ring land.

Unique inspection/maintenance capabilities

Under the operating conditions which some four-row taper roller bearings are exposed to even the best bearings require efficient maintenance. The newly developed cage allows the cage and roller assemblies to be removed from the inner rings and to be reinstalled. It is now possible to inspect the inner rings completely and if necessary, to refurbish them.

The seals also have been redesigned to be more maintenance-friendly. They are simply snapped into their retaining grooves. Dismounting and reinstallation could not be easier.

Efficient refurbishment

The SKF Explorer four-row taper roller bearings have decisive advantages when it comes to refurbishment:

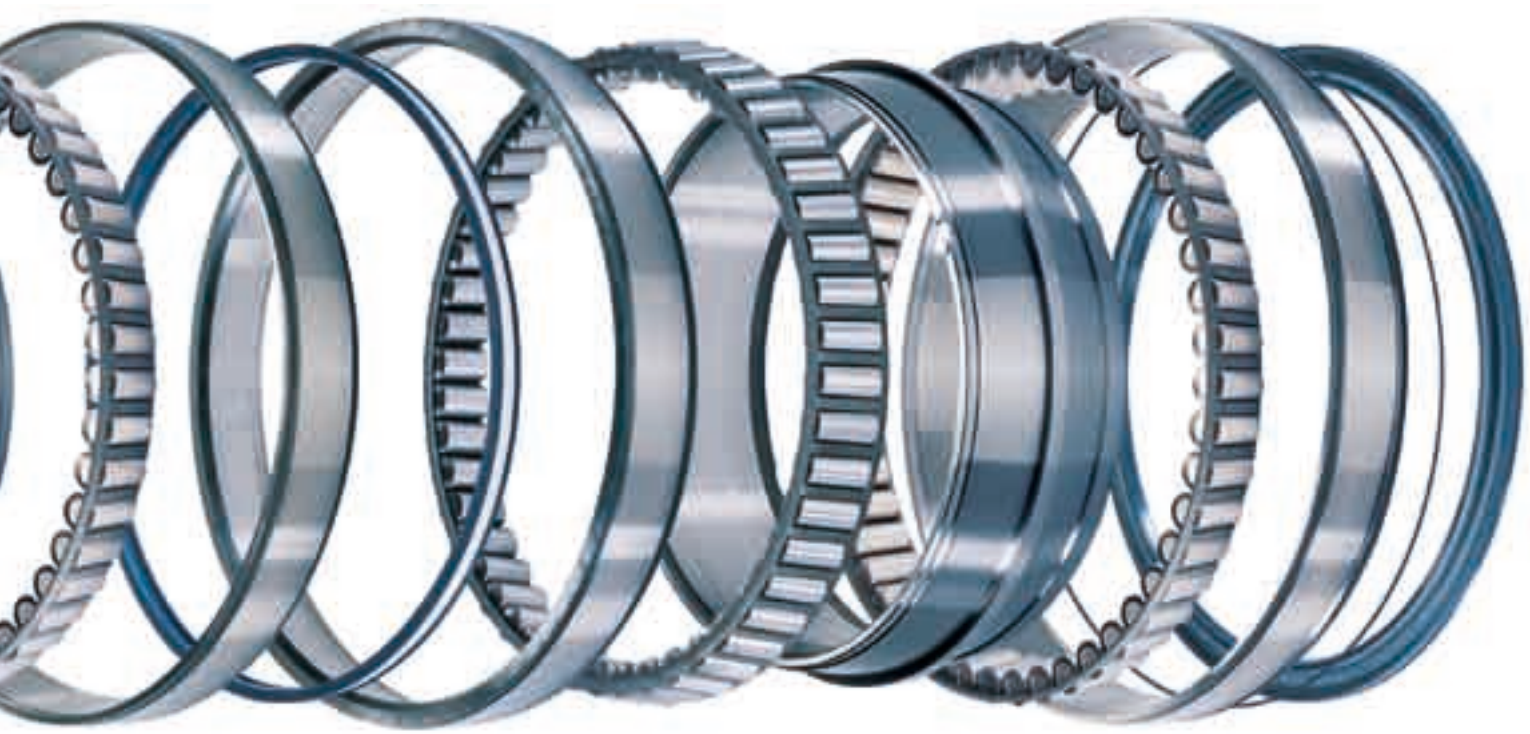
- The cage and roller assemblies can now be easily dismantled from, and reassembled to the inner rings, allowing full inspection and eventual refurbishment.
- Cage and roller assemblies and inner and outer rings of various bearings can now be combined as desired to form “new” bearings. All that is required is to regrind the ring side faces, which is now also possible for inner rings.
- The new seal design permits quick removal and installation.

Availability

The most popular four-row taper roller bearings are already produced to the SKF Explorer performance class specifications. The designations of the SKF Explorer bearings are printed in blue in the product table.

Product identification

The designation of an SKF Explorer four-row taper roller bearing is the same as that of the previous standard bearing except that it carries the suffix E for easy recognition.



Proven bearing arrangements

Applications
- heavy plate mills
- hot strip mills
- cold rolling mills
- skin pass mills
- roughing mills
- universal beam mills
- rod, bar and wire mills

Requirements
- long service life
- precisely defined performance
- low maintenance
- no unplanned stoppages
- environmental friendliness
- technical support

Solution

SKF four-row taper roller bearings have been successfully used in rolling mills around the world for decades. The bearings are characterized by accuracy and reliability even under extreme operating conditions.

Whether in hot or cold rolling mills for flat products or profiles, SKF four-row taper roller bearings are often the first choice.

Over the past 80 years, SKF has accumulated considerable experience with rolling bearings in the steel industry and this know-how is always available to customers of the world's leading rolling bearing manufacturer. SKF application engineers provide support to both machine builders and end users around the world. On request, SKF experts will assist in mounting bearings and training maintenance personnel. When needed, SKF specialists are available on site anywhere in the world – saving time and money for the customer.

Application advice

Design of bearing arrangements

Roll neck requirements

In most rolling mill applications four-row taper roller bearings are mounted with a loose fit on the roll neck. The roll neck journal and the axial abutment for the inner rings must have a certain minimum hardness. The recommended hardness is

- 45 Shore (≈ 34 HRC) for the roll neck surface
- 60 Shore (≈ 45 HRC) for the axial abutments for the inner rings.

Axial location of inner rings on the roll neck

The inner rings must not be axially clamped. A total axial clearance of 0,4 to 1,3 mm (**fig. 1**) must remain between the inner rings and their abutments.

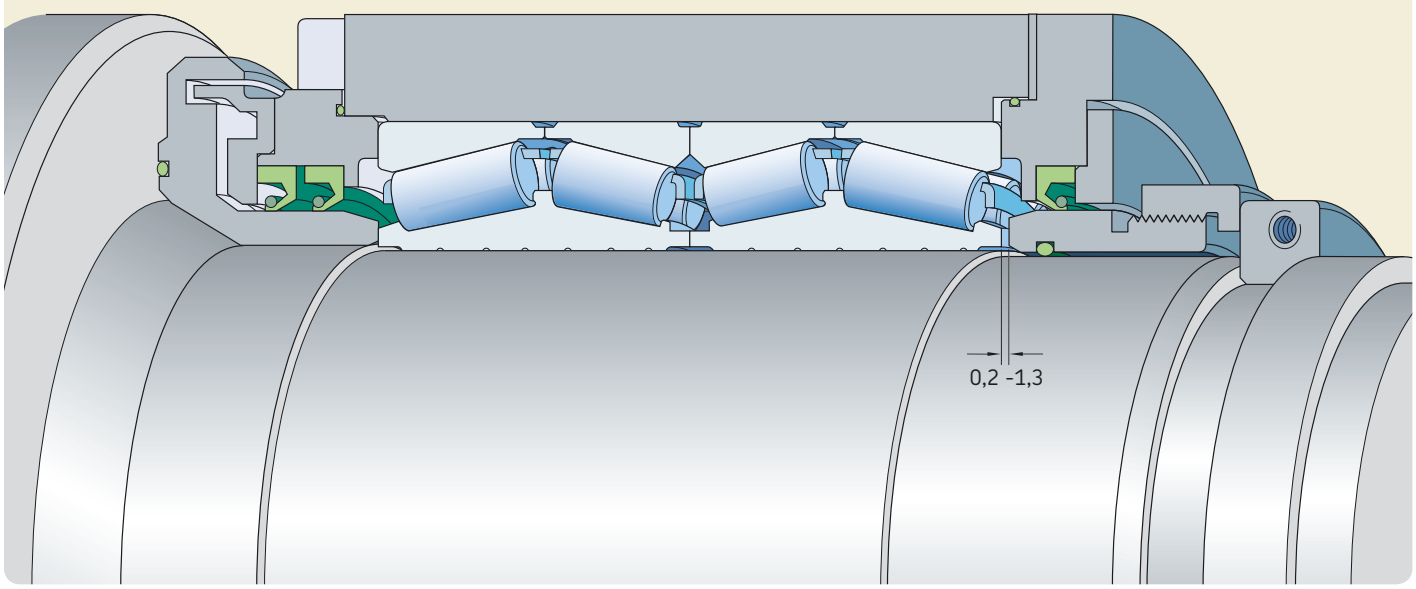
The SKF four-row taper roller bearings in the advanced design without spacer rings and the Explorer bearings are produced with an extremely limited width tolerance "B" of +/– 0,25 mm (**fig. 1**).

When following the recommended tolerances of the customer specific dimensions "A", "C" and "L" (**fig. 1**), the suitable axial clearance as mentioned is automatically given. Due to this fact, adjustment by a big lock nut becomes no longer necessary. When changing over the application to other designs or in the case of new developments, there will be no need for a lock anymore (**fig. 1**).

For applications with sealed four-row taper roller bearings, drain slots should be refitted or allowed for. These slots are to be arranged in the 6 o'clock position at the surrounding parts (**fig. 1**), thus ensuring that the possible water intruding from external seals can be drained.

Standard application of a grease-lubricated four-row taper roller bearing with axial location of the inner rings

Fig. 1



Lubrication

No bearing arrangement will function properly unless it is adequately lubricated. Depending on the design, several options are available for the lubrication of SKF four-row taper roller bearings.

Bearings without seals may be lubricated with grease (continuously or periodically) or with oil: oil bath, oil bath supplemented with oil-air, oil mist or circulating oil.

Sealed four-row taper roller bearings are manufactured to two designs

- bearings which can be relubricated, the VA901 and VA903 or E1 and E3 executions for grease or oil lubrication
- completely sealed bearings, the VA902 or E2 executions only for grease lubrication.

Completely sealed bearings without lubrication facility

The bearings without relubrication facility should be filled with a high quality grease on mounting. The SKF grease LGHB 2 (→ **page 36**), is recommended. The bearings normally are in operation in the chock for some 1 000 to 1 500 hours, depending on the working conditions. They are then removed from the chock, dismounted, washed, preserved, inspected and then filled with grease and remounted in the cleaned and inspected chock, the outer rings having been turned to expose a fresh loaded zone.

Oil-air lubrication for sealed bearings

The sealed bearings with relubrication feature when lubricated by oil-air can contribute to improved operational economy and reliability, particularly in cold rolling mills. The oil-air mixture is introduced from above via the grooves in the side faces of the individual outer rings (→ **fig. 2**). Compared with oil mist lubrication, only about one tenth of the lubricant quantity is required. The oil can be very accurately metered so that there is no risk of over-lubrication with its attendant heat generation at high rolling speeds.

Oil having a viscosity of up to 700 mm^2/s can be used and requires no heating. Metered drops are transported to the bearing along the walls of the ducts and leads by air. The drops are released from the ducts and finally collect at the bottom of the bearing. The air exits via the seals and is clean so that it does not contaminate the environment. The air stream then exits via the radial shaft seal, the V-ring and the labyrinth and serves to enhance the sealing efficiency of the labyrinth seal.

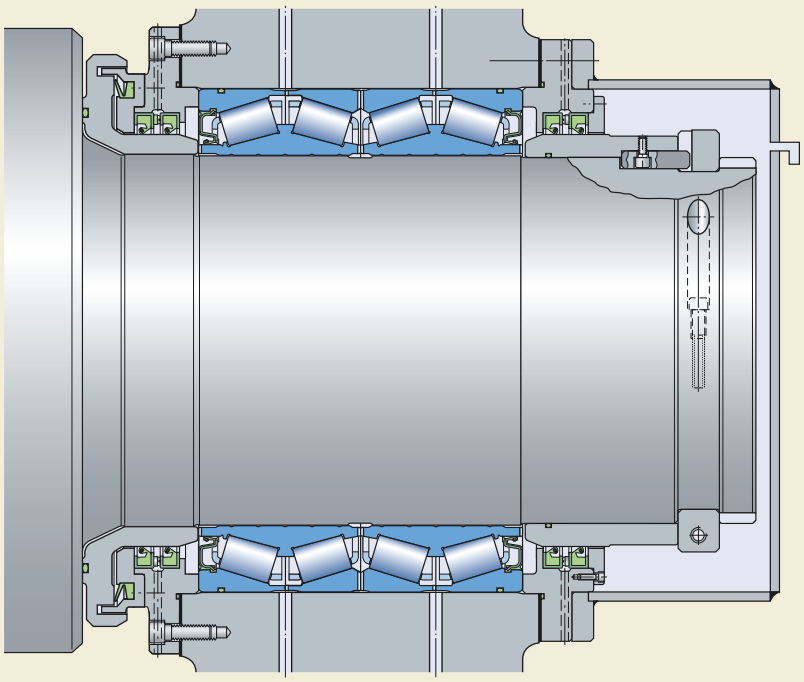
The air supplied to the oil-air lubrication equipment should be dried to prevent moisture being introduced into the bearing and causing corrosion.

Because the conditions in the chock are relatively clean, the use of the oil-air method can appreciably extend the service life of the bearings.

For applications with oil-air lubrication and when changing over to sealed four-row taper roller bearings, contact the SKF application engineering service.

Sealed four-row taper roller bearing lubricated by oil-air

Fig. 2



Mounting

Four-row taper roller bearings are high-precision mechanical components and should therefore be handled with appropriate care when mounting and dismounting. It is important to use the appropriate aids and tools and to follow the instructions supplied with each bearing. Detailed information is also contained in the SKF publications

- "Mounting and maintenance instructions for four-row taper roller bearings"
- "Four-row taper roller bearings without spacer rings – mounting and maintenance instructions".

Matching the bearing components

When mounting four-row taper roller bearings, the individual components of the bearing must be mounted in the correct order. Parts belonging together are identified by letter markings. All the components of one bearing are also marked with the same serial number, so that the parts of one bearing are not mixed with those of another when several bearings are mounted at the same time (→ **fig. 3**).
Note: To make sure that the bearing components are mounted in the correct order, a sheet containing mounting instructions is packed with each bearing. This carefully describes the various steps involved (→ **fig. 4**).

Loaded zone markings

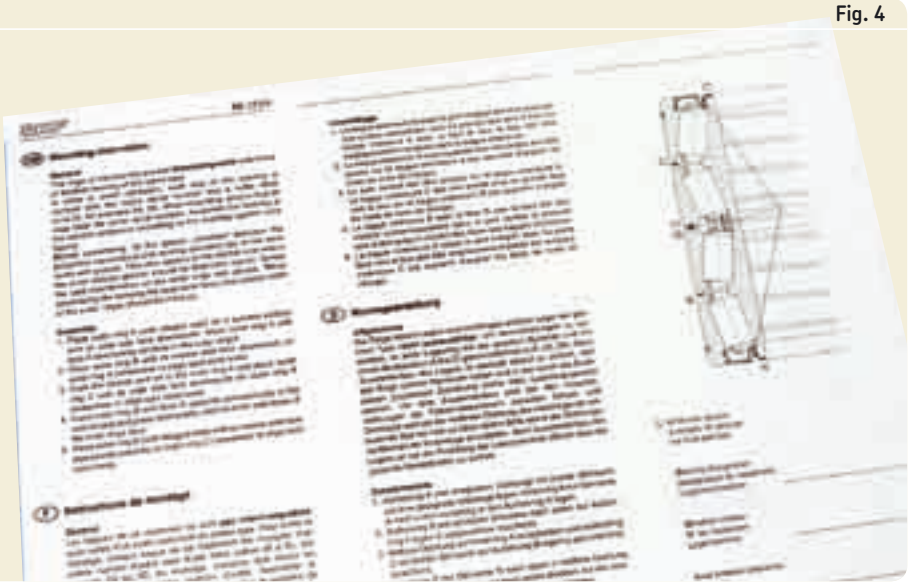
In the majority of cases in rolling mills, the outer rings of the bearings are subjected to a point load (constant direction). This means that only a section of the outer ring raceway will be under load. For this reason, the outer rings are divided into four zones which are indicated by the markings I to IV on the side faces of the rings (→ **fig. 5**). The markings indicating load zone I are also indicated by a line extending across the whole width of the outer rings. When mounting for the first time it is customary to install the bearing so that the zone I lies in the direction of the load. After each inspection, the outer rings should be turned so that another zone becomes the loaded zone. The order I, III, II, IV is recommended.

Fig. 3

Marking of parts belonging together with serial number and letters

Mounting instructions are supplied with every bearing

Fig. 4



Load zone markings on the outer ring

Fig. 5

Monitoring the bearings in operation

SKF has considerable experience in the field of condition monitoring. The procedures developed by SKF are based on multi-parameter measurements. In addition to vibration measurements involving vibration velocity, vibration acceleration enveloping and SEE (Spectral Emitted Energy) other physical measurement categories are also measured for condition monitoring. The SKF system "Smart Chock Unit" has been specially developed for roll neck bearing monitoring.

Roll neck bearing arrangement with the Smart Chock Unit

The SKF system "Smart Chock Unit" enables reliable online monitoring of rolling mill bearing arrangements as well as the registration of the forces and temperatures occurring. The system includes intelligent analysis software as well as all the sensors and wiring required for condition monitoring (→ **fig. 6**). The SKF Smart Chock Unit can be used to

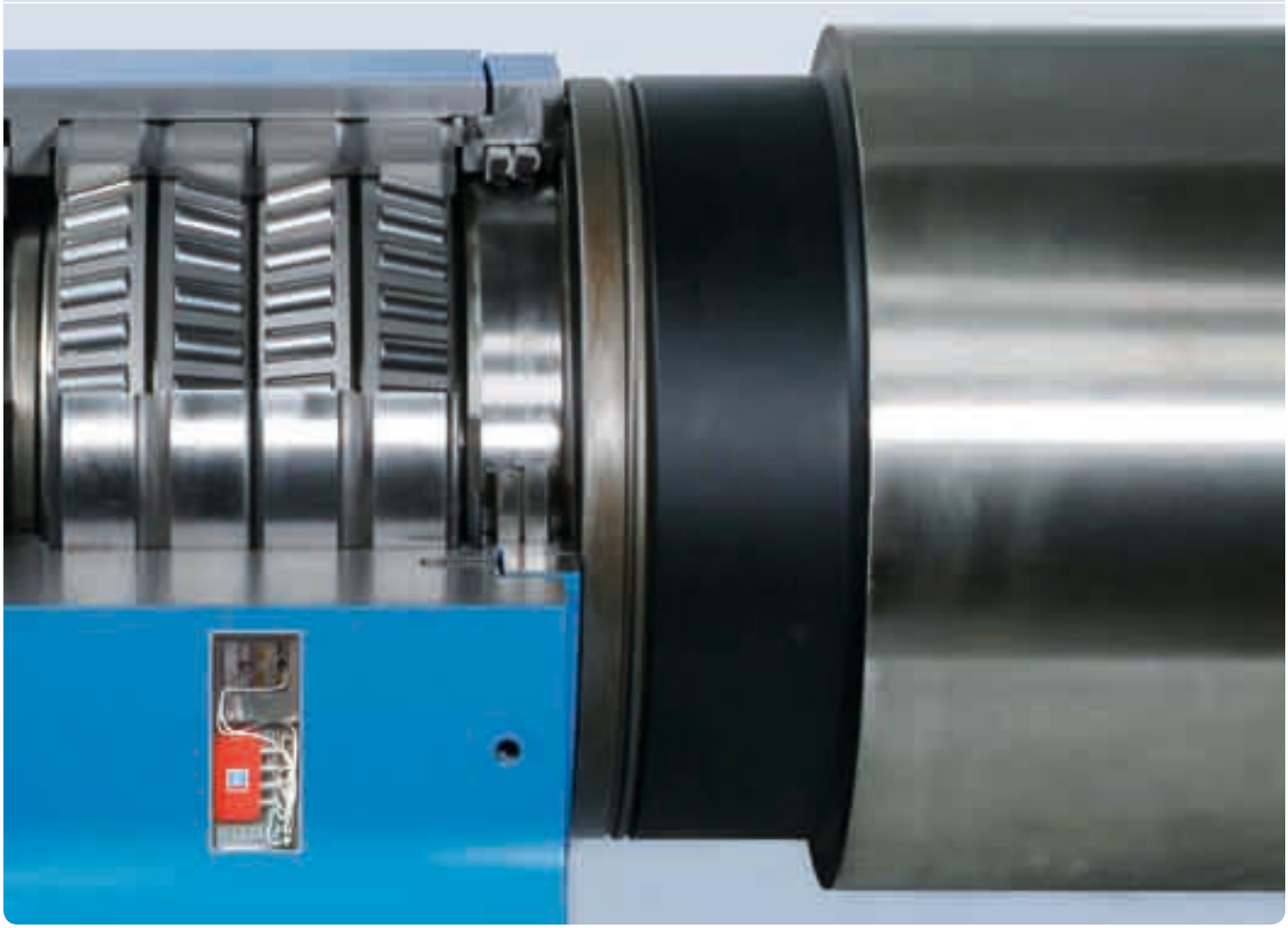
- measure the axial and radial forces in operation
- record the temperatures and temperature distribution
- continually monitor the condition of the roll neck bearing arrangement.

The following benefits for the rolling mill operator derive from the above:

- By detecting the signs of impeding failure at an early stage, failures can be virtually eliminated, thus unplanned stoppages and costly damage to plant can be avoided.
- Productivity is increased. Fewer unplanned stoppages increase plant uptime.
- The quality of the rolled material can be improved. The system supports process control by providing input data.

The "Smart chock unit", an SKF solution for roll neck bearing arrangements

Fig. 6



Dismounting

Four-row taper roller bearings are dismounted in the reverse order of mounting. Bearings that are to be reused after dismounting should be treated with the same care as when mounting.

The bearing components should be carefully washed and oiled. If damage is detected in the outer ring raceway, the rollers and inner ring raceways must also be checked for damage. Bearings that are damaged can often be repaired by an SKF Service Centre.

Inspection of SKF Explorer bearings

The inner rings with cage and roller assemblies of SKF Explorer four-row taper roller bearings can be separated (**fig. 7–10**). This allows for full inspection of the inner ring raceways and refurbishment if required.

In order to avoid damage to the bearing due to improper handling during separation, the mechanics should be well-versed in these applications and suitable tools are to be used only.

SKF recommends consulting the SKF Service Centre that will provide optimal technical support. On request, SKF also offers specific training courses on the spot thus equipping their customers with SKF knowledge. For further information contact the SKF application engineering service.

Bearing storage

Before being packaged in wooden crates, SKF four-row taper roller bearings are treated with a rust-inhibiting medium. They can be stored in their original unopened packaging for several years, provided the relative humidity in the storage room does not exceed 60 %.

The bearings must be stored lying down and should only be removed from the packaging just before mounting in order to prevent them from becoming dirty.

Fig. 7

Fig. 8

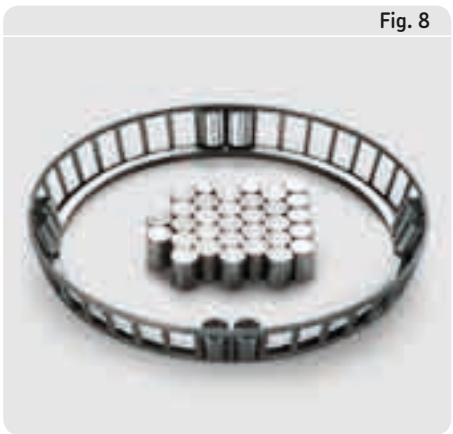


Fig. 9

Fig. 10

General bearing data

Designs

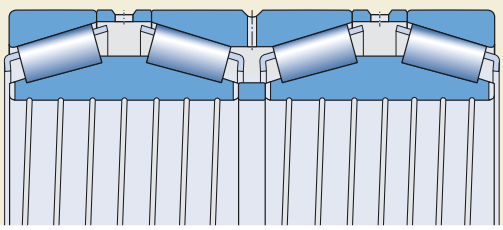
Open bearings

SKF four-row taper roller bearings are primarily produced with the TQO configuration (→ **fig. 1**) in the TQON design without spacer rings (→ **fig. 2**) In the TQO configuration, there are two roller and cage assemblies arranged face-to-face. The bearings are normally supplied with pressed steel window-type cages, although the larger sizes may have pierced rollers and steel pin-type cages (→ **fig. 3**).

Four-row taper roller bearings are also produced with extended inner rings, which can serve as counterfaces for radial shaft seals (→ **fig. 4**). Also these bearings can be supplied without spacer rings (design TQOEN) or with spacer rings (design TQOE).

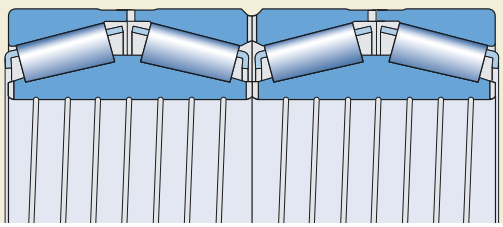
Four-row taper roller bearings that are to be mounted with a loose fit on the roll neck, are normally supplied with a helical groove in the inner ring bore and lubrication grooves in the side faces of the inner rings. The lubrication grooves enable lubricant to be supplied to the contact surfaces of the inner rings and journal seating where there is a risk of wear occurring. Lubricant is stored and wear particles can be deposited in the helical grooves. This reduces wear of the roll neck.

Fig. 1



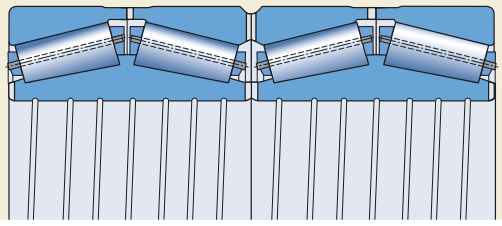
TQO configuration
Open bearing with spacer rings

Fig. 2



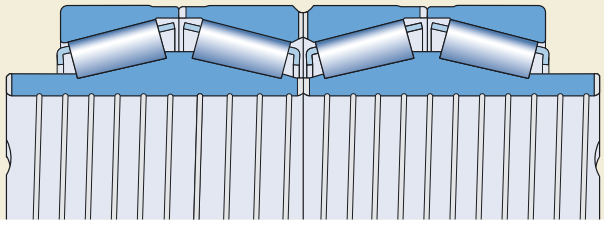
TQON design
Open bearing without spacer rings

Fig. 3



TQON.1 design
Open bearing without spacer rings with pierced rollers and steel pin-type cage

Fig. 4



TQOEN design
Open bearing with extended inner rings. The extensions to the inner rings are designed as concentric sliding surfaces for radial shaft seal

Sealed bearings

Sealed SKF four-row taper roller bearings are available in many sizes and designs. Whenever possible, sealed bearings should be used for rolling mills. Compared with open bearings they offer considerable advantages

- they achieve longer service lives
- grease consumption is reduced (by up to 90 %)
- maintenance intervals can be extended
- grease does not escape from the bearings and the emulsions used for rolling do not become contaminated.

Sealed bearings meet the ecological and economic requirements now being set. Sealed bearings can simply replace open bearings as part of a rebuild or refurbishment because the boundary dimensions are the same. Sealed bearings are fitted with specially developed, C-shaped radial shaft seals on both sides. The seals permit high sliding velocities and are intended for operating temperatures between –20 and +140 °C.

The SKF Explorer bearings have sheet steel reinforced radial shaft seals made of hydrogenated acrylonitrile butadiene rubbern (HNBR). They are snapped into the groove in the outer ring.

The other standard bearings have seals made of fluoro rubber (FPM) and reinforced with sheet steel. They are staked in a groove

in the outer ring. Fluoro rubber seals require special handling ("Safety precautions").

O-rings inserted in grooves in the outer ring outside surface prevent dirt or water from entering between the outer rings and the chock bore.

Design E1 and VA901

Sealed E1 and VA901 design bearings (→ **fig. 5**) can be relubricated via lubrication grooves in the outer rings. In bearings without spacer rings, the seal between the two inner rings consists of a steel reinforced ring of acrylonitrile butadiene rubber. In bearings with spacer rings, the sealing between the inner rings is performed by two O-rings as shown in **fig. 8**. The permissible operating temperature range for these seals is –40 to +100 °C.

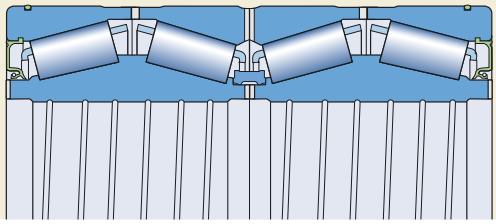
Design E2 and VA902

Sealed E2 and VA902 design bearings (→ **fig. 6**) correspond to the E1 and VA901 designs, but cannot be relubricated.

Design E3 and VA903

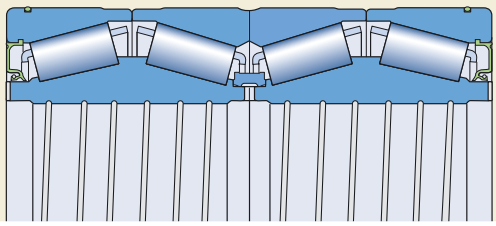
Sealed E3 and VA903 design bearings (→ **fig. 7**) have no seal between the inner rings. All other features are same as for E1 and VA091 design bearings.

Fig. 5



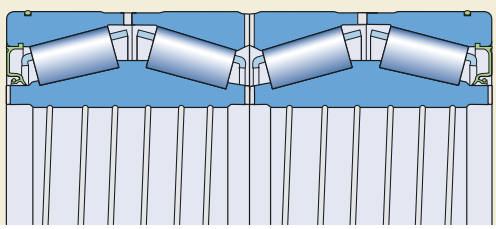
Designs E1 and VA901
Sealed bearing without spacer rings, with lubrication grooves in the outer ring faces

Fig. 6



Designs E2 and VA902
Sealed bearing without spacer rings, no relubrication facilities

Fig. 7



Designs E3 and VA903
Sealed bearing, with lubrication grooves in the outer ring faces but without seal between the inner rings

Warning: Safety precautions for fluoro rubber!

Fluoro rubber is very stable and harmless in normal operating conditions up to +200 °C. However, if exposed to extreme temperatures above 300 °C, e.g. fire or the flame of a cutting torch, fluoro rubber seals give off hazardous fumes. These fumes can be harmful if inhaled, as well as to the eyes. In addition, once the seals have been heated to such temperatures, they are dangerous to handle even after they have cooled and should not touch the skin. If it is necessary to handle bearings with seals that have been subjected to high temperatures, such as when dismounting the bearing, the following safety precautions should be observed

- always wear protective goggles, gloves and appropriate breathing apparatus
- place the remains of the seals in an airtight plastic container marked with a symbol for "material will etch"
- follow the safety precautions in the appropriate material safety data sheet (MSDS).

If there is unintentional contact with the seals, wash hands with soap and plenty of water and flush eyes with plenty of water and consult a doctor immediately. If the fumes have been inhaled, consult a doctor immediately.

The user is responsible for the correct use of the product during its service life and its proper disposal. SKF takes no responsibility for the improper handling of fluoro rubber seals or for any injury resulting from their use.

Other bearing design variants

In addition to the bearings shown in the product table starting on **page 22**, SKF also supplies four-row taper roller bearings in another configuration and many other design variants.

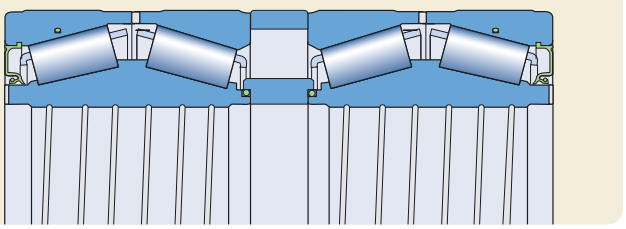
This includes, for example, bearings with inner and outer intermediate (spacer) rings between the roller rows Nos. 2 and 3 (→ **fig. 8**).

Bearings with the taper roller and cage assembly pairs in a back-to-back arrangement are also produced (TQI configuration). These bearings have one double row and two single row inner rings and two double row outer rings (→ **fig. 9**). This arrangement of the roller rows provides relatively stiff bearing arrangements which can take up high tilting moments.

For certain applications SKF also supplies bearings with a tapered bore. These are required when the bearing is to be mounted with a tight fit on the journal, for example, when high rolling speeds are to be employed.

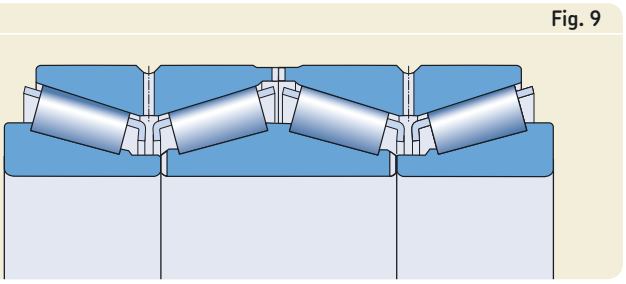
Details of these other bearings will be found in the SKF catalogue "Large bearings" and the "SKF Interactive Engineering Catalogue" online at www.skf.com.

Fig. 8



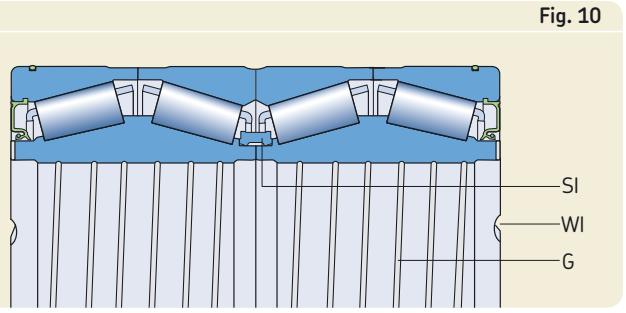
TQOSNP design
Sealed bearing without spacer rings, but with a spacer sleeve between the pairs of roller and cage assemblies

Fig. 9



TQI design
Open bearing, pairs of roller and cage assemblies arranged back-to-back

Fig. 10



Design variant identification

Design identification

To enable the easy identification of the various different designs and variants, letters or letter combinations are given under the heading "Design" in the product table e.g. TQON/GW. The first part of the identification corresponds to the configurations and designs described on **pages 15** to **17** and shown in **figs. 1** to **9**. The letters following the oblique stroke identify variants (→ **fig. 10**) and are explained below.

G helical groove in the bearing bore
GW G + W
GWI G + WI
GWSI G + W + SI
GWISI G + WI + SI
GWOY G + WO + Y
LS lubrication holes in the inner ring extensions
W lubrication grooves in the side faces of both outer and inner rings (WI + WO)
WI lubrication grooves in the inner ring side faces
WILS WI + LS
WO lubrication grooves in the outer ring side faces
SI seal between the two inner rings
Y annular groove and lubrication holes in the inner rings and gap between the inner rings
.1 pierced rollers and steel pin-type cage

SKF Explorer class bearings

SKF Explorer four-row taper roller bearings are available as open bearings without spacer rings or as sealed bearings. The helical groove in the bore and case hardened bearing rings are standard for SKF Explorer bearings and are thus not identified by suffixes in the designation.

Dimensions

The boundary dimensions of four-row taper roller bearings have not been standardized by ISO. The dimensions of many of the cones and cups of the inch-size bearings do, however, conform to the ABMA Standard 19-1974 or ANSI B3.19-1975. The bore and outside diameters, however, often approximate to those of ISO 15:1998 Diameter Series 9 or 0.

Tolerances

SKF four-row taper roller bearings are produced with dimensional accuracy corresponding to the Normal tolerance classes for metric and inch-size bearings, respectively.

The running accuracy of all bearings is to tolerance class P5 specifications for metric taper roller bearings.

The width tolerance of the inner rings is

- ± 0,25 mm for bearings without spacer rings and for SKF Explorer bearings
- ± 1,524 mm for bearings with spacer rings.

Exceptions to this are indicated in the product table by footnotes.

The tolerances of the metric bearings conform to ISO 492:2002 and those of the inch-size bearings follow class 4, ISO 578:1987 and ABMA Standard 19.2-1994.

Internal clearance

SKF four-row taper roller bearings are delivered as ready-to-mount bearing units with an axial internal clearance adapted to the actual application. For the SKF Explorer bearings the mean value of the axial internal clearance expressed in µm is shown in the designation, preceded by the suffix C, e.g. C300 for a mean clearance of 300 µm (from 270 to 330 µm).

Influence of operating temperatures on bearing material

SKF four-row taper roller bearings are subjected to a special heat treatment such that they can be operated at temperatures of up to +150 °C without any inadmissible dimensional changes occurring.

Minimum load

In order to guarantee the satisfactory performance the bearings must always be subjected to a given minimum load. Otherwise the inertia forces of the rollers and cages and the friction in the lubricant can have a detrimental influence on rolling conditions in the bearing and may cause sliding movements to occur between the rollers and raceways.

The requisite minimum load to be applied can be obtained from

$$F_{rm} = 0{,}02\ C$$

where
F_{rm} = minimum radial load, kN
C = basic dynamic load rating, kN

The weight of the components supported by the bearing, together with the external rolling forces, almost always exceed the requisite minimum load. If this is not the case an additional radial load must be applied.

Equivalent dynamic bearing load

For dynamically loaded four-row taper roller bearings

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

The values for the calculation factors e, Y_1 and Y_2 will be found in the product table.

Equivalent static bearing load

For statically loaded four-row taper roller bearings

$$P_0 = F_r + Y_0 F_a$$

Values for the calculation factor Y_0 will be found in the product table.

Comparative load ratings

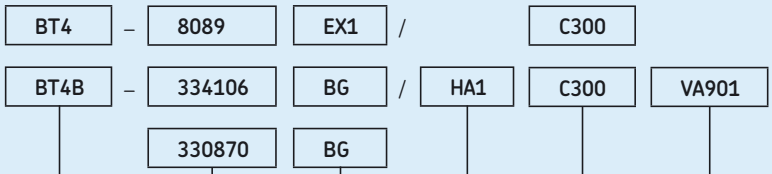
For rolling mill applications, load ratings are often used which are not calculated according to ISO 281:2007 but by a different method based on a rating life of 90 million revolutions (500 r/min for 3 000 operating hours). As a direct comparison of these load ratings with ISO load ratings is not possible, even if they are converted for 1 million revolutions (ISO life definition) "comparative" load ratings calculated by the same non-ISO method are given in the product table. These comparative load ratings cannot be used to calculate ISO lives.

For further information please refer to the SKF catalogue "Large bearings" or the "SKF Interactive Engineering Catalogue" online at www.skf.com.

Designations and suffixes

SKF four-row taper roller bearings are generally special bearings and are usually identified by a drawing number. The numbering system has undergone some changes over the years (→ designation scheme next page). Bearings having a modified internal design compared with the original are identified by a suffix letter A, B or C or a combination of these letters, e.g. AB. The meaning of these suffixes is specific to the drawing number.

Bearings to the SKF Explorer class specifications are identified by the suffix E and have inner and outer rings of case hardened steel as standard. The helical groove in the bore is also standard. Therefore, the relevant suffixes (HA1 and G) are not used for these bearings.



Prefixes

BT4	four-row taper roller bearing (current prefix)
BT4B	four-row taper roller bearing (earlier prefix)
–	the bearing type is only defined by the drawing (old SKF system for special bearings)

Drawing No.

0(000)	special bearing with outside diameter < 420 mm
8(000)	special bearing with outside diameter ≥ 420 mm
328000 to **334999**	special taper roller bearing

Design

–	original (standard) design
A, B, C	or combinations of these letters: modified internal design
E	SKF Explorer bearing without spacer rings
EX	SKF Explorer bearing with spacer rings
E(X)1	SKF Explorer bearings with seals of hydrogenated acrylonitrile butadiene rubber (HNBR), otherwise to VA901 specification
E(X)2	SKF Explorer bearings with seals of hydrogenated acrylonitrile butadiene rubber (HNBR), otherwise to VA902 specification
E(X)3	SKF Explorer bearings with seals of hydrogenated acrylonitrile butadiene rubber (HNBR), otherwise to VA903 specification
G	helical groove in bearing bore

Material

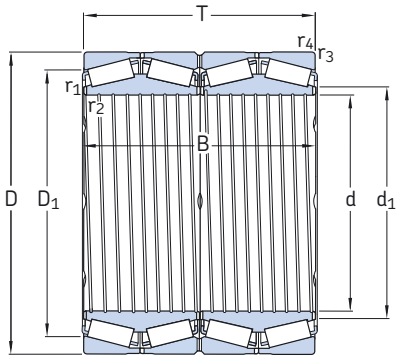
–	standard
HA1	outer and inner rings of case hardened steel
HA4	outer and inner rings and rollers of case hardened steel
HE1	outer and inner rings of vacuum remelted steel

Internal clearance

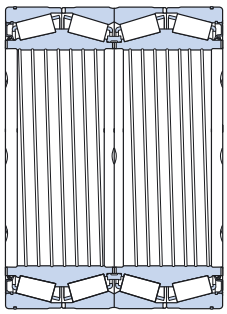
–	standard
C300	axial internal clearance, mean value 300 µm
C400	axial internal clearance, mean value 400 µm
etc.	

Seal design

VA901	fluoro rubber (FPM) seals at both sides, sealing ring between inner rings, can be relubricated via outer ring
VA902	fluoro rubber (FPM) seals at both sides, sealing ring between inner rings, cannot be relubricated
VA903	as VA901 but without sealing ring between inner rings
VA917	Sealed design bearing without seals, recesses for seals and O-rings available
VA919	fluoro rubber (FPM) seals at both sides, can be relubricated via outer ring, inner rings without lubrication grooves in side faces, but with annular groove in bore and lubrication holes through guide flange
VA941	fluoro rubber (FPM) seals at both sides, cannot be relubricated via outer ring, inner ring with lubrication grooves in inboard side faces and annular groove and lubrication holes at outboard side between inner rings

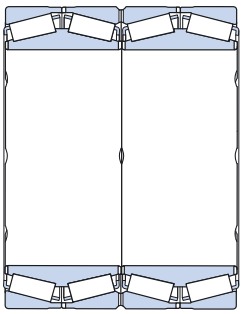


TQON/GW

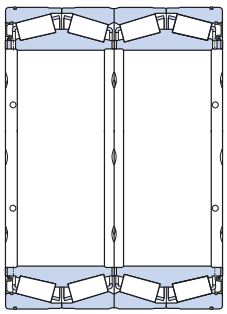


TQOSN/GWSI

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
139,700	200,025	160,338	157,162	158	178	0,8	3,3	15,5	**331138 AG**	TQO/GWI
5,5000	7,8750	6,3125	6,1875							
177,800	247,650	192,088	192,088	193	216	1,5	3,3	29	**331480**	TQO/WI
7,0000	9,7500	7,5625	7,5625							
	247,650	192,088	192,088	192	209	1	3,3	27	**BT4-0010/HA1C400VA903**	TQOS/GWI
	9,7500	7,5625	7,5625							
198,438	284,162	225,425	225,425	217	250	3,3	3,3	45,4	**BT4-0027/HA1**	TQON/W
7,8125	11,1875	8,8750	8,8750							
205,000	320,000	203,500	203,5	233	280	4	3	54,5	**BT4B 328065/HA1**	TQO/WI
8,0709	12,5984	8,0118	8,0118							
206,375	282,575	190,500	190,5	223	247	0,8	3,3	36,5	**331486 G**	TQO/GWI
8,1250	11,1250	7,5000	7,5000							
	282,575	190,500	190,5	222	240	0,6	3,3	32	**BT4-0013 G/HA1C400VA903**	TQOS/GWI
	11,1250	7,5000	7,5000							
	282,575	190,500	190,5	223	247	0,8	3,3	35,8	**BT4-0021 G/HA1**	TQON/GW
	11,1250	7,5000	7,5000							
216,103	330,200	269,875	263,525	238	274	1,5	3,3	84	**BT4B 328204/HA1**	TQO/W
8,5080	13,0000	10,6250	10,3750							
220,662	314,325	239,712	239,712	242	278	1,5	3,3	61,5	**331156 G**	TQO/GWI
8,6875	12,3750	9,4375	9,4375							
240,000	338,000	248,000	248	258	298	4	3	69,3	**BT4-0020/HA1**	TQON/W
9,4488	13,3071	9,7638	9,7638							
241,503	349,193	228,600	228,6	271	308	1,5	3,3	74,5	**330782 AG**	TQO/GWI
9,5080	13,7478	9,0000	9,0000							
244,475	327,025	193,675	193,675	264	299	1,5	3,3	46	**330862 B**	TQO/WI
9,6250	12,8750	7,6250	7,6250							
254,000	358,775	269,875	269,875	272	320	1,5	3,3	84	**BT4B 329071 G/HA1VA901**	TQOS/GWISI
10,0000	14,1250	10,6250	10,6250							
	358,775	269,875	269,875	279	319	1,5	3,3	88	**331275 B**	TQO/WI
	14,1250	10,6250	10,6250							
266,700	355,600	228,600	230,188	285	315	1	3,3	60,5	**BT4-0014 G/HA1C400VA903**	TQOS/GWI
10,5000	14,0000	9,0000	9,0625							
	355,600	228,600	230,188	288	322	1,5	3,3	65,5	**BT4B 328209 G/HA1C455**	TQO/WI
	14,0000	9,0000	9,0625							
269,875	381,000	282,575	282,575	296	339	3,3	3,3	105	**BT4B 331168 B**	TQO/WI
10,6250	15,0000	11,1250	11,1250							



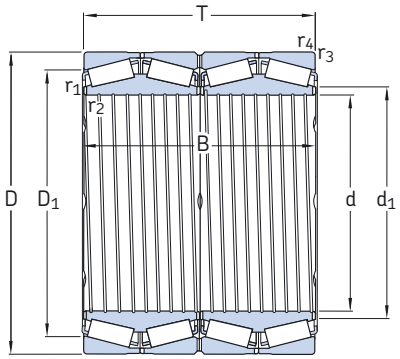
TQON/W



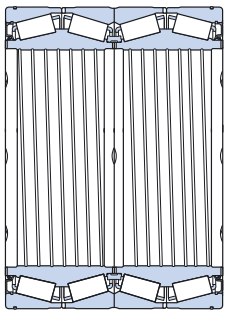
TQOSN/WILS

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
331138 AG	858	2 080	208	0,33	2	3	2	250	41,4	1,91
331480	1 230	3 000	285	0,44	1,5	2,3	1,4	360	78,2	1,33
BT4-0010/HA1C400VA903	1 020	2 500	232	0,4	1,7	2,5	1,6	290	59,4	1,43
BT4-0027/HA1	1 680	3 550	335	0,4	1,7	2,5	1,6	415	81,1	1,48
BT4B 328065/HA1	1 900	3 650	345	0,46	1,5	2,2	1,4	500	113	1,29
331486 G	1 300	3 350	305	0,5	1,35	2	1,3	340	85,2	1,15
BT4-0013 G/HA1C400VA903	1 140	2 500	240	0,5	1,35	2	1,3	300	72,7	1,19
BT4-0021 G/HA1	1 300	3 350	305	0,5	1,35	2	1,3	340	85,2	1,15
BT4B 328204/HA1	2 240	5 100	475	0,54	1,25	1,8	1,3	600	160	1,06
331156 G	2 200	5 200	465	0,33	2	3	2	585	94,3	1,76
BT4-0020/HA1	2 550	5 500	490	0,4	1,7	2,5	1,6	620	119	1,51
330782 AG	2 160	5 000	455	0,35	1,9	2,9	1,8	570	98,8	1,65
330862 B	1 830	4 300	390	0,33	2	3	2	475	75,3	1,82
BT4B 329071 G/HA1VA901	2 330	5 400	480	0,33	2	3	2	620	102	1,76
331275 B	2 860	7 100	620	0,33	2	3	2	765	125	1,76
BT4-0014 G/HA1C400VA903	1 870	4 650	415	0,35	1,9	2,9	1,8	490	85,6	1,67
BT4B 328209 G/HA1C455	2 200	5 600	500	0,35	1,9	2,9	1,8	585	102	1,62
BT4B 331168 B	3 080	7 500	655	0,33	2	3	2	815	132	1,76

Four-row taper roller bearings
d **276,225 – 343,052** mm



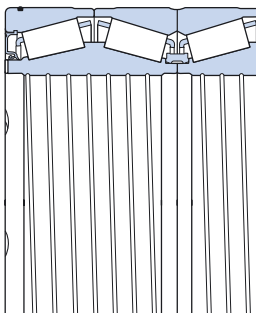
TQON/GW



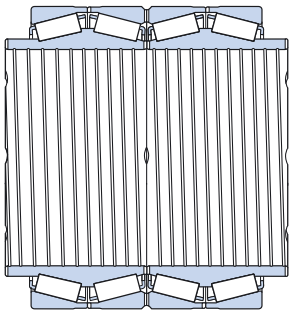
TQOSN/GWSI

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
276,225	393,700	269,875	269,875	302	358	1	6,4	98,5	**BT4-0012 G/HA1C500VA901**	TQOS/GWISI
10,8750	15,5000	10,6250	10,6250							
279,400	393,700	269,875	269,875	302	347	1	6,4	95,5	**BT4-0011 G/HA1C500VA901**	TQOS/GWISI
11,0000	15,5000	10,6250	10,6250							
279,503	380,943	244,475	244,475	308	337	1,5	3,3	86	**330540 AG**	TQO/WI
11,0041	14,9978	9,6250	9,6250							
285,750	380,898	244,475	244,475	308	337	1,5	3,3	81	**330337 AG**	TQO/WI
11,2500	14,9960	9,6250	9,6250							
	380,898	244,475	244,475	301	346	1	3,3	74	**BT4-0015 G/HA1C400VA903**	TQOS/GW
	14,9960	9,6250	9,6250							
288,950	406,451	298,450	298,45	314	361	3,3	3,3	125	**BT4B 331452 G/HA1**	TQO/WI
11,3760	16,0020	11,7500	11,7500							
304,902	412,648	266,700	266,7	328	378	1	3,3	99	**BT4-0016 G/HA1C200VA901**	TQOS/GWISI
12,0040	16,2460	10,5000	10,5000							
	412,648	266,700	266,7	328	374	3,3	3,3	102,5	**330758 BG**	TQO/GWI
	16,2460	10,5000	10,5000							
	412,648	266,700	266,7	325	374	3,3	3,3	100	**BT4-0004 G/HA1**	TQON/GW
	16,2460	10,5000	10,5000							
317,500	422,275	269,875	269,875	342	384	1,5	3,3	105	**330870 BG**	TQON/GW
12,500	16,625	10,625	10,625							
	422,275	269,875	269,875	338	389	1,5	3,3	94,5	* **BT4B 334023 E1/C675**	TQOSN/GWSI
	16,625	10,625	10,625							
	447,675	327,025	327,025	340	398	3,3	3,3	165	**BT4B 331161 BG/HA1**	TQON/GW
	17,625	12,875	12,875							
330,302	438,023	254	247,65	345	405	1	3,3	105	* **BT4-8113 E2/C500**	TQOSN/GWSI
13,004	17,245	10	9,75							
333,375	469,9	342,9	342,9	362	420	3,3	3,3	185	**BT4-8017/HA1C600VA941**	TQOSN/WILS
13,125	18,5	13,5	13,5							
340,000	520	323,5	323,5	378	490	6	6	240	**BT4B 332963 B/HA1**	TQON/W
13,386	20,4724	12,7362	12,7362							
342,900	533,4	301,625	307,975	390	475	3,3	3,3	240	**BT4-8034 G/HA1**	TQON/GW
13,500	21	11,875	12,125							
343,052	457,098	254	254	366	413	1,5	3,3	110	* **330661 E/C475**	TQON/GW
13,506	17,996	10	10							
	457,098	254	254	362	420	1	3,3	110	* **BT4B 328817 E1/C475**	TQOSN/GWSI
	17,996	10	10							
	457,098	254	254	362	420	1	3,3	105	**BT4B 334106 BG/HA1C300VA901**	TQOSN/GWSI
	17,996	10	10							

* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously.
Please ask for availability of further SKF Explorer bearings



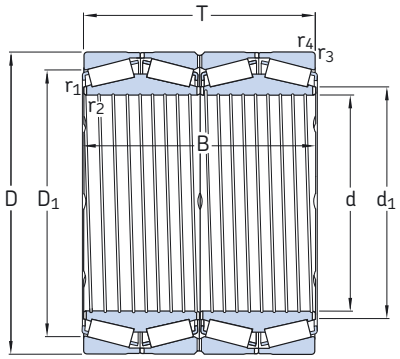
TQOSN/GW



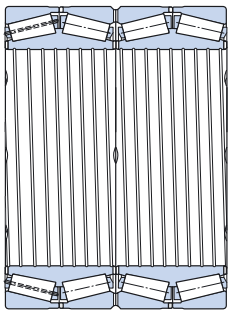
TQOEN/GW

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
BT4-0012 G/HA1C500VA901	2 750	5 850	530	0,37	1,8	2,7	1,8	720	134	1,55
BT4-0011 G/HA1C500VA901	2 750	5 850	530	0,37	1,8	2,7	1,8	720	134	1,55
330540 AG	2 290	6 400	540	0,43	1,6	2,3	1,6	600	128	1,35
330337 AG	2 290	6 400	540	0,43	1,6	2,3	1,6	600	128	1,35
BT4-0015 G/HA1C400VA903	2 200	5 500	480	0,43	1,6	2,3	1,6	585	120	1,38
BT4B 331452 G/HA1	3 580	9 000	765	0,33	2	3	2	950	159	1,73
BT4-0016 G/HA1C200VA901	2 700	6 700	585	0,31	2,2	3,3	2,2	710	110	1,85
330758 BG	2 970	7 500	640	0,31	2,2	3,3	2,2	780	122	1,83
BT4-0004 G/HA1	3 190	7 500	640	0,31	2,2	3,3	2,2	780	122	1,83
330870 BG	3 360	8 150	680	0,31	2,2	3,3	2,2	815	129	1,83
BT4B 334023 E1/C675	3 250	6 550	570	0,33	2	3	2	695	114	1,76
BT4B 331161 BG/HA1	4 730	10 800	880	0,33	2	3	2	1 160	193	1,74
BT4-8113 E2/C500	3 400	6 400	550	0,45	1,5	2,2	1,45	720	158	1,29
BT4-8017/HA1C600VA941	4 130	10 200	830	0,33	2	3	2	1 000	165	1,76
BT4B 332963 B/HA1	5 610	10 400	880	0,3	2,3	3,4	2,2	1 370	194	2,01
BT4-8034 G/HA1	4 730	8 800	720	0,33	2	3	2	1 160	190	1,76
330661 E/C475	3 450	6 800	570	0,48	1,4	2,1	1,4	735	171	1,24
BT4B 328817 E1/C475	3 350	6 400	540	0,48	1,4	2,1	1,4	710	166	1,23
BT4B 334106 BG/HA1C300VA901	2 550	6 000	510	0,68	1	1,5	1	610	210	0,84

Four-row taper roller bearings
d **374,662 – 395,000** mm



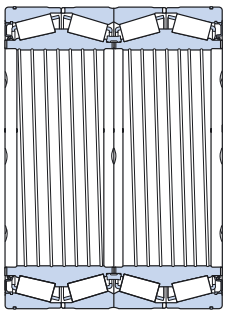
TQON/GW



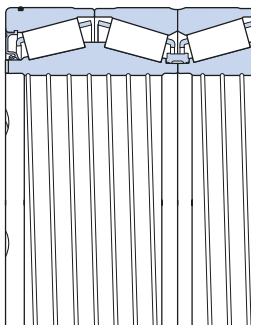
TQON.1/GW

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
347,662 13,687	469,9 18,5	260,35 10,25	260,35 10,25	372	430	1,5	3,3	125	**BT4B 331077 BG/HA1**	TQON/GW
350,000 13,780	480 18,8976	420 16,5354	420 16,5354	376	436	1	4	211	* **BT4-8117 E1/C475**	TQOSN/GWSI
355,000 13,976	490 19,2913	316 12,4409	316 12,4409	382	446	1,5	3,3	170	**BT4-8020 G/HA1VA901**	TQOSN/GWSI
355,600 14,000	482,6 19	269,875 10,625	265,113 10,4375	382	432	1,5	3,3	140	* **330662 E/C480**	TQON/GW
	482,6 19	269,875 10,625	265,113 10,4375	380	436	1,5	3,3	134	* **BT4B 328870 EX1/C480**	TQOS/GWSI
	488,95 19,25	317,5 12,5	317,5 12,5	392	448	1,5	3,3	180	**331271 BG**	TQON/GW
	488,95 19,25	317,5 12,5	317,5 12,5	382	446	1	3,3	170	* **BT4B 328912 E3/C675**	TQOSN/GW
	488,95 19,25	317,5 12,5	317,5 12,5	382	446	1	3,3	170	* **BT4B 328912 E1/C300**	TQOSN/GWSI
360,000 14,173	540 21,2598	325 12,7953	325 12,7953	398	485	1,5	3	250	**BT4-8015 G/HA1**	TQON/GW
380,000 14,961	560 22,0472	360 14,1732	390 15,3543	417	500	3,3	5	300	**BT4-8033 G/HA1**	TQOEN/GW
384,175 15,125	546,1 21,5	400,05 15,75	400,05 15,75	416	496	3,3	6,4	300	**BT4-8025 G/HA1C300VA903**	TQOSN/GW
	546,1 21,5	400,05 15,75	400,05 15,75	419	484	3,3	6,4	311	* **331149 E/C675**	TQON/GW
385,762 15,188	514,35 20,25	317,5 12,5	317,5 12,5	411	471	1	3,3	175	* **BT4B 334042 E1/C575**	TQOSN/GWSI
395,000 15,551	545 21,4567	288,9 11,374	268 10,551	435	498	5	10	192	* **BT4B 332824 E/C475**	TQON/GW

[1] Non-standard inner ring width tolerance
* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously. Please ask for availability of further SKF Explorer bearings



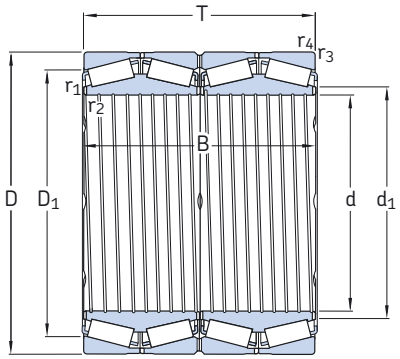
TQOSN/GWSI



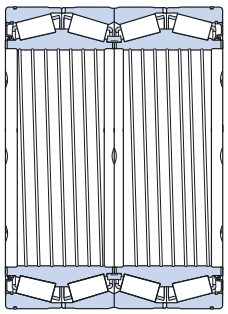
TQOSN/GWISI

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
BT4B 331077 BG/HA1	3 910	8 500	695	0,33	2	3	2	950	153	1,76
BT4-8117 E1/C475	4 750	10 200	815	0,46	1	2,2	1,45	1 020	227	1,28
BT4-8020 G/HA1VA901	4 460	10 000	830	0,33	2	3	2	1 080	177	1,75
330662 E/C480	4 000	8 000	655	0,48	1,4	2,1	1,4	850	198	1,24
BT4B 328870 EX1/C480	3 550	7 500	630	0,46	1,5	2,2	1,4	815	187	1,24
331271 BG	4 460	11 000	880	0,33	2	3	2	1 080	179	1,76
BT4B 328912 E3/C675	5 100	10 000	830	0,33	2	3	2	1 080	177	1,75
BT4B 328912 E1/C300	5 100	10 000	830	0,33	2	3	2	1 080	177	1,75
BT4-8015 G/HA1	5 720	10 800	900	0,3	2,3	3,4	2,2	1 400	207	1,93
BT4-8033 G/HA1	6 710	13 700	1 080	0,4	1,7	2,5	1,6	1 630	330	1,4
BT4-8025 G/HA1C300VA903	6 160	15 000	1 180	0,35	1,9	2,9	1,8	1 500	256	1,68
331149 E/C675	8 000	16 600	1 290	0,33	2	3	2	1 730	278	1,24
BT4B 334042 E1/C575	4 800	10 000	780	0,4	1,7	2,5	1,6	1 020	195	1,49
BT4B 332824 E/C475	4 800	9 500	750	0,48	1,4	2,1	1,4	1 020	238	1,22

Four-row taper roller bearings
d **406,400 – 447,600** mm



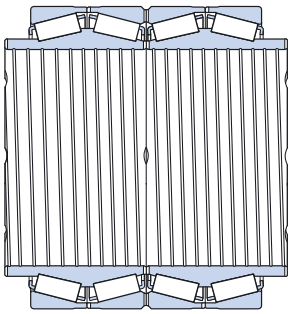
TQON/GW



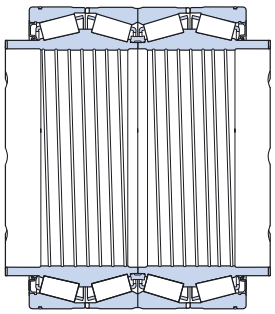
TQOSN/GWSI

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
406,400	546,1	288,925	288,925	434	494	1,5	6,4	186	* **BT4B 330650 E/C500**	TQON/GW
16,000	21,5	11,375	11,375							
	546,1	288,925	288,925	434	494	1,5	6,4	186	* **BT4B 330650 EX/C500**	TQO/GW
	21,5	11,375	11,375							
	546,1	288,925	288,925	434	498	1,5	6,4	180	**BT4B 328838 BG/HA1VA901**	TQOSN/GWSI
	21,5	11,375	11,375							
	546,1	288,925	288,925	434	498	1,5	6,4	180	**BT4B 328838 BG/HA1VA902**	TQOSN/GWISI
	21,5	11,375	11,375							
	546,1	288,925	288,925	434	498	1,5	6,4	185	**BT4-8014 G/HA1VA901**	TQOSN/GWSI
	21,5	11,375	11,375							
	546,1	288,925	268,288	434	494	1,5	6,4	180	**331465 BG**	TQON/GW
	21,5	11,375	10,5625							
	546,1	330	330	434	498	1,5	6,4	200	**BT4B 334093 BG/HA1VA902**	TQOSN/GWISI
	21,5	12,9921	12,9992							
	546,1	330	330	438	498	1,5	6,4	225	**BT4B 334092 AG/HA1**	TQON/GW
	21,5	12,9921	12,9992							
	565,15	440	440	436	508	1,5	6,4	340	**BT4-8002 G/HA1**	TQON/GW
	22,25	17,3228	17,3228							
409,575	546,1	334,962	334,962	434	498	1	6,4	205	**BT4-8021 G/HA1VA919**	TQOSN/GWOY
16,125	21,5	13,1875	13,1875							
	546,1	334,962	334,962	434	498	1	6,4	205	* **BT4B 329004 E1/C575**	TQOSN/GWSI
	21,5	13,1875	13,1875							
	546,1	334,962	334,962	438	490	1,5	6,4	220	* **BT4B 331333 E/C575**	TQON/GW
	21,5	13,1875	13,1875							
420,000	574	480	480	450	530	2,5	5	345	**BT4-8018 G/HA1VA901**[1)]	TQOSN/GWSI
16,535	22,5984	18,8976	18,8976							
430,000	570	380	380	458	510	2	5	260	**BT4-8049 G/HA1**	TQON/GW
16,929	22,4409	14,9606	14,9606							
	575	380	380	458	518	1,5	5	280	**BT4-8006 BG/HA1**	TQON/GW
	22,6378	14,9606	14,9606							
	640	465	465	486	578	2,5	4	530	**BT4-8040 G/HA4**	TQON.1/GW
	25,1969	18,3071	18,3071							
431,800	571,5	279,4	279,4	458	530	1,5	3,3	185	**BT4-8019 G/HA1VA901**	TQOSN/GWSI
17,000	22,5	11	11							
	571,5	336,55	336,55	458	516	1,5	3,3	240	**BT4B 331226 BG/HA1**	TQON/GW
	22,5	13,25	13,25							
	571,5	336,55	336,55	458	530	1,5	3,3	215	* **BT4-8003 E2/C550**	TQOSN/GWISI
	22,5	13,25	13,25							
440,000	590	480	480	468	539	1	5	365	**BT4B 334055 ABG/HA1VA902**[1)]	TQOSN/GWISI
17,323	23,2283	18,8976	18,8976							
447,600	635	463,5	463,5	488	588	3,3	6,4	470	**BT4-8039 G/HA1VA901**	TQOSN/GWSI
17,622	25	18,248	18,248							

[1)] Non-standard inner ring width tolerance
* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously. Please ask for availability of further SKF Explorer bearings



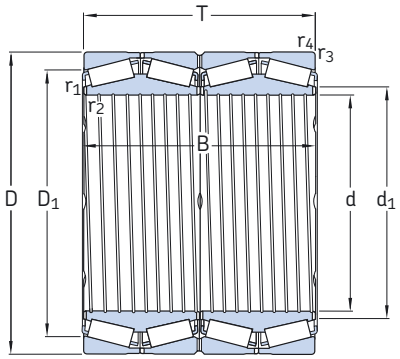
TQOEN/GW



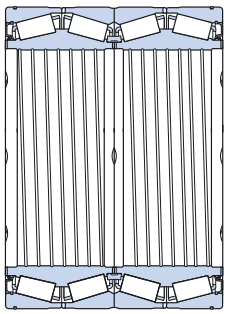
TQOESN/GWSI

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
BT4B 330650 E/C500	5 000	10 200	815	0,48	1,4	2,1	1,4	1 080	252	1,23
BT4B 330650 EX/C500	4 650	10 200	815	0,48	1,4	2,1	1,4	1 080	252	1,23
BT4B 328838 BG/HA1VA901	4 180	9 500	750	0,48	1,4	2,1	1,4	1 020	238	1,22
BT4B 328838 BG/HA1VA902	4 180	9 500	750	0,48	1,4	2,1	1,4	1 020	238	1,22
BT4-8014 G/HA1VA901	3 300	7 800	655	0,68	1	1,5	1	800	276	0,84
331465 BG	4 180	9 500	750	0,48	1,4	2,1	1,4	1 020	238	1,22
BT4B 334093 BG/HA1VA902	4 400	10 200	815	0,48	1,4	2,1	1,4	1 080	252	1,23
BT4B 334092 AG/HA1	5 010	13 200	1 000	0,43	1,6	2,3	1,6	1 220	254	1,4
BT4-8002 G/HA1	7 650	18 600	1 430	0,33	2	3	2	1 900	302	1,82
BT4-8021 G/HA1VA919	4 840	12 000	950	0,4	1,7	2,5	1,6	1 200	231	1,47
BT4B 329004 E1/C575	5 600	12 000	950	0,4	1,7	2,5	1,6	1 200	231	1,47
BT4B 331333 E/C575	5 700	13 200	1 000	0,43	1,6	2,3	1,6	1 220	254	1,4
BT4-8018 G/HA1VA901[1)]	7 210	18 600	1 430	0,31	2,2	3,3	2,2	1 760	279	1,83
BT4-8049 G/HA1	5 280	14 000	1 060	0,44	1,5	2,3	1,4	1 290	282	1,33
BT4-8006 BG/HA1	6 440	16 600	1 250	0,4	1,7	2,5	1,6	1 560	315	1,43
BT4-8040 G/HA4	9 520	21 200	1 560	0,26	2,6	3,9	2,5	2 360	308	2,21
BT4-8019 G/HA1VA901	3 740	9 000	735	0,54	1,25	1,8	1,3	915	243	1,07
BT4B 331226 BG/HA1	5 280	14 000	1 060	0,44	1,5	2,3	1,4	1 290	282	1,33
BT4-8003 E2/C550	5 600	12 700	980	0,44	1,5	2,3	1,4	1 180	254	1,34
BT4B 334055 ABG/HA1VA902[1)]	7 650	20 000	1 460	0,28	2,4	3,6	2,5	1 860	255	2,12
BT4-8039 G/HA1VA901	7 650	20 000	1 460	0,33	2	3	2	1 900	313	1,76

Four-row taper roller bearings
d **450,000 – 482,600** mm



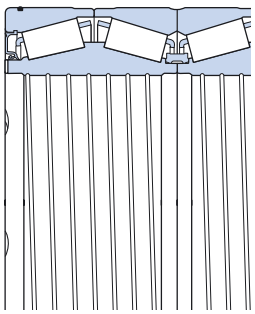
TQON/GW



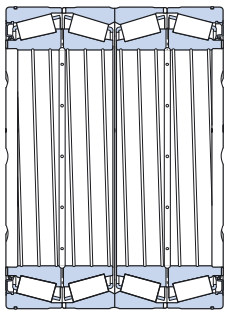
TQOSN/GWSI

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
450,000	595	368	368	484	550	3	6	265	**BT4-8023 G/HA1VA919**	TQOSN/GWOY
17,717	23,4252	14,4882	14,4882							
	595	368	368	486	542	3	6	285	* **BT4B 332773 E/C725**	TQON/GW
	23,4252	14,4882	14,4882							
	595	404	404	480	545	2	6	305	**BT4-8044 G/HA1VA902**[1)]	TQOSN/GWISI
	23,4252	15,9055	15,9055							
	595	415	415	478	544	1,5	6	320	**BT4-8024 G/HA1**	TQON/GW
	23,4252	16,3386	16,3386							
457,200	596,9	279,4	276,225	484	550	1,5	3,3	190	**BT4B 328827 ABG/HA1VA902**	TQOSN/GWISI
18,000	23,5	11	10,875							
	596,9	279,4	276,225	484	550	1,5	3,3	190	* **BT4B 328827 E2/C500**	TQOSN/GWISI
	23,5	11	10,875							
	596,9	279,4	276,225	487	544	1,5	3,3	197	* **331169 E/C500**	TQON/GW
	23,5	11	10,875							
460,000	610	360	360	488	562	1,5	6	279	* **BT4-8111 E2/C725**	TQOSN/GWISI
18,110	24,0157	14,1732	14,1732							
	610	360	360	479	565	3	6	290	* **BT4B 331977 E/C725**	TQON/GW
	24,0157	14,1732	14,1732							
	615,95	330,2	330,2	505	577	1	6,4	233	* **BT4B 328842 E1/C725**	TQOSN/GWSI
	24,25	13	13							
475,000	600	368	368	500	554	2	6	250	**BT4B 328913 BG/HA1C555**	TQON/GW
18,701	23,622	14,4882	14,4882							
	640	360	360	512	568	2	6	335	**BT4-8035 G/HA1**	TQON/GW
	25,1968	14,1732	14,1732							
479,425	679,45	495,3	495,3	520	610	3,3	6,4	585	**BT4B 330886 CG/HA1**	TQON/GW
18,875	26,75	19,5	19,5							
	679,45	495,3	495,3	520	610	3,3	6,4	565	**BT4B 334116 BG/HA1VA901**	TQOSN/GWSI
	26,75	19,5	19,5							
482,600	615,95	330,2	330,2	512	570	3,3	6,4	240	* **330641 E/C725**	TQON/GW
19,000	24,25	13	13							
	615,95	330,2	330,2	505	577	1	6,4	233	* **BT4B 328842 E1/C725**	TQOSN/GWSI
	24,25	13	13							
	615,95	330,2	330,2	505	577	1	6,4	233	* **BT4B 328842 E2/C725**	TQOSN/GWISI
	24,25	13	13							
	615,95	330,2	419,1	505	577	1	6,4	240	**BT4B 334072 BG/HA1VA901**	TQOESN/GWSI
	24,25	13	16,5							
	615,95	330,2	419,1	505	577	1	6,4	240	**BT4B 334072 BG/HA1VA903**	TQOESN/GW
	24,25	13	16,5							
	615,95	330,2	419,1	512	570	3,5	6,4	250	**BT4B 331626 BG/HA1**	TQOEN/GW
	24,25	13	16,5							
	615,95	420	420	505	577	2,8	4,4	280	**BT4-8062 G/HA1VA901**	TQOSN/GWSI
	24,25	16,5354	16,5354							
	635	421	421	512	578	3	6,4	365	**BT4B 334105 BG/HA1**	TQON/GW
	25	16,5748	16,5748							

* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously.
Please ask for availability of further SKF Explorer bearings

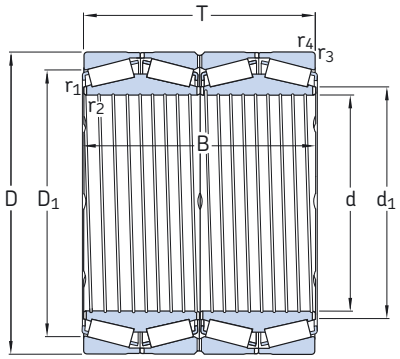


TQOSN/GWISI

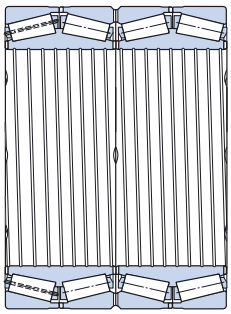


TQOSN/GWOY

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
BT4-8023 G/HA1VA919	5 280	13 700	1 040	0,31	2,2	3,3	2,2	1 290	206	1,82
BT4B 332773 E/C725	6 800	16 300	1 220	0,33	2	3	2	1 460	236	1,76
BT4-8044 G/HA1VA902[1)]	5 940	16 300	1 220	0,33	2	3	2	1 460	236	1,76
BT4-8024 G/HA1	7 040	19 000	1 400	0,31	2,2	3,3	2,2	1 730	267	1,87
BT4B 328827 ABG/HA1VA902	4 290	10 000	780	0,48	1,4	2,1	1,4	1 040	242	1,24
BT4B 328827 E2/C500	4 900	10 000	780	0,48	1,4	2,1	1,4	1 040	242	1,24
331169 E/C500	5 200	10 800	830	0,48	1,4	2,1	1,4	1 100	254	1,24
BT4-8111 E2/C725	6 800	14 300	1 100	0,33	2	3	2	1 430	236	1,76
BT4B 331977 E/C725	7 500	16 300	1 250	0,33	2	3	2	1 600	259	1,76
BT4B 328842 E1/C725	6 100	13 700	1 060	0,33	2	3	2	1 290	213	1,76
BT4B 328913 BG/HA1C555	5 720	16 600	1 250	0,3	2,3	3,4	2,2	1 400	200	2,03
BT4-8035 G/HA1	5 500	15 300	1 120	0,33	2	3	2	1 340	222	1,76
BT4B 330886 CG/HA1	10 100	25 500	1 830	0,33	2	3	2	2 500	409	1,76
BT4B 334116 BG/HA1VA901	9 350	22 400	1 660	0,33	2	3	2	2 280	372	1,76
330641 E/C725	6 300	15 300	1 120	0,33	2	3	2	1 340	222	1,76
BT4B 328842 E1/C725	6 100	13 700	1 060	0,33	2	3	2	1 290	213	1,76
BT4B 328842 E2/C725	6 100	13 700	1 060	0,33	2	3	2	1 290	213	1,76
BT4B 334072 BG/HA1VA901	5 280	13 700	1 060	0,33	2	3	2	1 290	213	1,76
BT4B 334072 BG/HA1VA903	5 280	13 700	1 060	0,33	2	3	2	1 290	213	1,76
BT4B 331626 BG/HA1	5 500	15 300	1 120	0,33	2	3	2	1 340	222	1,76
BT4-8062 G/HA1VA901	5 500	15 300	1 120	0,33	2	3	2	1 340	222	1,76
BT4B 334105 BG/HA1	7 370	20 400	1 460	0,33	2	3	2	1 800	295	1,76



TQON/GW



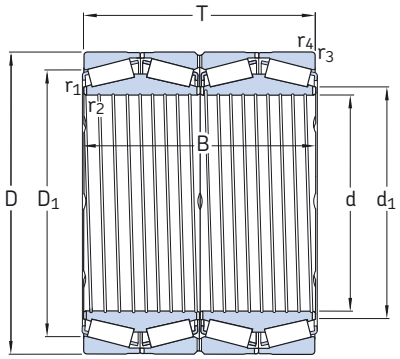
TQON.1/GW

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
489,026 19,253	634,873 24,995	320,675 12,625	320,675 12,625	522	584	3,3	3,3	267	* **331090 E/C700**	TQON/GW
	634,873 24,995	320,675 12,625	320,675 12,625	516	588	2,5	3,3	240	**BT4B 334014 AAG/HA1VA901**	TQOSN/GWSI
501,650 19,750	711,2 28	520,7 20,5	520,7 20,5	550	655	3,3	6,4	610	**BT4-8059 G/HA1VA901**	TQOSN/GWSI
510,000 20,979	655 25,7874	379 14,9213	377 14,8425	539	602	1,5	6,4	323	* **BT4B 331747 E/C775**	TQON/GW
514,350 20,250	673,1 26,5	422,275 16,625	422,275 16,625	537	606	3,3	6,4	395	**BT4-8045 G/HA1VA901**	TQOSN/GWSI
	673,1 26,5	422,275 16,625	422,275 16,625	545	614	3,3	6,4	405	**331157 BG**	TQON/GW
530,000 20,866	680 26,7717	440 17,3228	440 17,3228	558	624	1,5	3	405	**BT4-8043 G/HA1**	TQON/GW
540,000 21,260	690 27,1654	400 15,748	400 15,748	568	635	2	5	364	* **BT4-8108 E/C625**	TQON/GW
	690 27,1654	440 17,3228	440 17,3228	565	636	2	5	395	**BT4-8038 G/HA1VA901**	TQOSN/GWSI
558,800 22,000	736,6 29	409,575 16,125	409,575 16,125	594	672	3,3	6,4	480	**BT4B 330993 AG/HA1**	TQON/GW
	736,6 29	457,2 18	455,612 17,9375	591	666	3,3	6,4	515	**BT4-8022 G/HA1VA919**	TQOSN/GWOY
584,200 23,000	730,25 28,75	349,25 13,75	342,9 13,5	601	678	1,5	3,3	327	* **BT4B 331189 E/C600**	TQON/GW
585,788 23,063	771,525 30,375	479,425 18,875	479,425 18,875	622	704	3,3	6,4	620	**BT4B 331093 BG/HA1**	TQON/GW
595,312 23,438	844,55 33,25	615,95 24,25	615,95 24,25	642	754	3,3	6,4	1 180	* **BT4B 331300 E/C775**	TQON/GW
603,250 23,750	857,25 33,75	622,3 24,5	622,3 24,5	656	760	3,3	6,4	1 182	* **BT4B 331625 E/C800**	TQON/GW
609,600 24,000	787,4 31	361,95 14,25	361,95 14,25	645	735	3,3	6,4	425	**BT4-8054 G/HA1VA902**	TQOSN/GWISI
620,000 24,409	800 31,4961	363,5 14,311	363,5 14,311	655	740	2	6	440	**BT4-8055 G/HA1VA902**	TQOSN/GWISI
625,000 24,606	815 32,0866	480 18,8976	480 18,8976	656	746	3,2	6,5	660	* **BT4-8031 E/C800**	TQON/GW

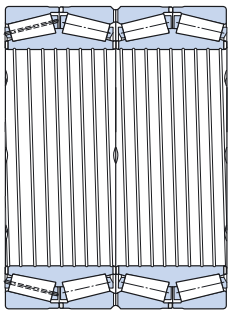
* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously. Please ask for availability of further SKF Explorer bearings

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
331090 E/C700	6 300	14 600	1 080	0,35	1,9	2,9	1,8	1 340	224	1,7
BT4B 334014 AAG/HA1VA901	5 230	12 500	950	0,37	1,8	2,7	1,8	1 270	234	1,54
BT4-8059 G/HA1VA901	8 090	19 600	1 460	0,33	2	3	2	2 000	324	1,76
BT4B 331747 E/C775	7 800	19 000	1 370	0,33	2	3	2	1 660	273	1,76
BT4-8045 G/HA1VA901	6 820	19 000	1 370	0,33	2	3	2	1 660	273	1,76
331157 BG	7 810	21 600	1 560	0,31	2,2	3,3	2,2	1 930	301	1,83
BT4-8043 G/HA1	8 250	23 600	1 630	0,33	2	3	2	2 040	321	1,82
BT4-8108 E/C625	8 150	19 300	1 400	0,4	1,7	2,5	1,6	1 730	345	1,45
BT4-8038 G/HA1VA901	7 480	21 200	1 500	0,33	2	3	2	1 860	301	1,76
BT4B 330993 AG/HA1	8 250	22 000	1 560	0,35	1,9	2,9	1,8	2 040	346	1,69
BT4-8022 G/HA1VA919	8 580	23 200	1 630	0,35	1,9	2,9	1,8	2 120	355	1,69
BT4B 331189 E/C600	6 800	17 000	1 200	0,43	1,6	2,3	1,6	1 460	305	1,36
BT4B 331093 BG/HA1	10 600	30 000	2 040	0,33	2	3	2	2 650	426	1,76
BT4B 331300 E/C775	17 300	39 000	2 550	0,33	2	3	2	3 750	602	1,76
BT4B 331625 E/C800	18 300	40 500	2 700	0,33	2	3	2	3 900	648	1,76
BT4-8054 G/HA1VA902	7 370	18 600	1 370	0,37	1,8	2,7	1,8	1 800	323	1,58
BT4-8055 G/HA1VA902	7 040	18 000	1 320	0,37	1,8	2,7	1,8	1 730	314	1,56
BT4-8031 E/C800	13 200	31 000	2 120	0,33	2	3	2	2 850	468	1,74

Four-row taper roller bearings
d **650,000 – 1 346,200** mm



TQON/GW



TQON.1/GW

Dimensions								Mass	Designation	Design
d	D	T	B	d_1 ≈	D_1 ≈	$r_{1,2}$ min	$r_{3,4}$ min			
mm/in								kg	–	–
650,000	1 030	560	560	741	916	15	10	1 790	* **BT4B 332827 E/C850**	TQON/GW
25,591	40,551	22,047	22,0472							
	1 040	610	610	740	905	15	10	1 970	**BT4-8036 G/HA1**	TQON/GW
	40,9449	24,0157	24,0157							
	1 040	610	610	730	905	15	10	1 970	**BT4-8037 G/HA1VA901**	TQOSN/GWSI
	40,9449	24,0157	24,0157							
660,000	1 070	648	648	760	960	6	10	2 260	**BT4-8060 G/HA4C300VA901**	TQOSN.1/GWSI
25,984	42,126	25,5118	25,5118							
660,400	812,8	365,125	365,125	698	756	3,3	6,4	415	**BT4B 331190 BG/HA1**	TQON/GW
26,000	32	14,375	14,375							
	812,8	365,125	365,125	692	784	2	6,4	395	**BT4B 328977 BG/HA1VA901**	TQOSN/GWSI
	32	14,375	14,375							
679,450	901,7	552,45	552,45	722	824	3,3	6,4	970	**BT4B 334015 BG/HA1VA901**	TQOSN/GWSI
26,750	35,5	21,75	21,75							
685,800	876	355,6	352,425	730	805	3,3	6,4	525	**BT4B 331089 CG/HA1**	TQON/GW
27,000	34,5	14	13,875							
	876,3	355,6	352,425	730	818	3,3	6,4	505	**BT4B 328955 ABG/HA1VA902**	TQOSN/GWISI
	34,5	14	13,875							
	876,3	355,6	352,425	730	818	3,3	6,4	505	**BT4B 328955 BG/HA1VA901**	TQOSN/GWISI
	34,5	14	13,875							
708,025	930,275	565,15	565,15	740	850	3,3	6,4	1 015	* **BT4-8109 E1/C800**	TQOSN/GWSI
27,875	36,625	22,25	22,25							
710,000	900	410	410	750	835	3	6	620	**BT4B 331351 BG/HA1**	TQON/GW
27,953	35,4331	16,1417	16,1417							
750,000	950	410	410	800	878	3	6	705	* **BT4-8048 E/C725**	TQON.1/GW
29,528	37,4016	16,1417	16,1417							
762,000	1 066,8	736,6	723,9	825	952	8,9	12,7	2 090	**BT4B 331907 BG/HA4**	TQON.1/GW
30,000	42	29	28,5							
785,000	1 040	560	560	853	953	3	6	1 336	* **BT4-8114 E/C700**	TQON.1/GW
30,906	40,945	22,047	22,047							
1 346,200	1 729,74	1 143	1 143	1 415	1 580	5	12	6 980	**BT4-8042 G/HA4**	TQON.1/GW
53,000	68,1	45								

* SKF Explorer bearing. Other bearings will be converted to the Explorer class continuously.
Please ask for availability of further SKF Explorer bearings

Designation	Basic load ratings dyn.	stat.	Fatigue load limit	Calculation factors				Comparative data Load ratings radial	axial	Thrust factor
	C	C_0	P_u	e	Y_1	Y_2	Y_0	C_F	C_{Fa}	K
–	kN		kN	–				kN		–
BT4B 332827 E/C850	20 800	38 000	2 550	0,31	2,2	3,3	2,2	4 500	701	1,84
BT4-8036 G/HA1	17 600	36 500	2 500	0,31	2,2	3,3	2,2	4 400	679	1,84
BT4-8037 G/HA1VA901	17 600	36 500	2 500	0,31	2,2	3,3	2,2	4 400	679	1,84
BT4-8060 G/HA4C300VA901	19 000	38 000	2 500	0,31	2,2	3,3	2,2	4 750	749	1,83
BT4B 331190 BG/HA1	7 210	22 400	1 530	0,33	2	3	2	1 760	284	1,76
BT4B 328977 BG/HA1VA901	7 210	20 400	1 430	0,33	2	3	2	1 730	284	1,76
BT4B 334015 BG/HA1VA901	13 200	36 000	2 400	0,33	2	3	2	3 250	528	1,76
BT4B 331089 CG/HA1	7 810	22 000	1 500	0,43	1,6	2,3	1,6	1 900	393	1,4
BT4B 328955 ABG/HA1VA902	7 650	20 000	1 400	0,37	1,8	2,7	1,8	1 860	333	1,62
BT4B 328955 BG/HA1VA901	7 650	20 000	1 400	0,37	1,8	2,7	1,8	1 860	333	1,62
BT4-8109 E1/C800	15 600	37 500	2 400	0,33	2	3	1,8	3 350	548	1,76
BT4B 331351 BG/HA1	9 680	27 000	1 800	0,35	1,9	2,9	1,8	2 360	404	1,66
BT4-8048 E/C725	11 400	28 500	1 860	0,37	1,8	2,7	1,8	2 400	440	1,58
BT4B 331907 BG/HA4	22 000	58 500	3 600	0,33	2	3	2	5 500	909	1,76
BT4-8114 E/C700	16 000	41 500	2 600	0,37	1,7	2,5	1,6	3 400	649	1,51
BT4-8042 G/HA4	49 500	163 000	8 300	0,31	2,2	3,3	2,2	12 200	1 940	1,83

Other SKF products

SKF Rubber Outside Diameter Large Diameter Seals

Proven sealing technology

The environmental conditions in rolling mills such as considerable quantities of water, emulsion and solid contaminations are very unfavourable where bearings are concerned. This requires for open and sealed bearings an external seal with a proven and robust sealing technology. The new SKF Rubber Outside Diameter Large Diameter Seal (ROD LDS) offers a reliable and suitable sealing solution for the demanding metal industry. The SKF ROD LDS consists of a heavy-duty metal cased core and a proven lip design based on decades of performance. Its robust shell covers three sides of the seal body, and the outer diameter is furnished with an elastomeric coating, which offers new benefits

- high protection of the housing bore due to no metal-to-metal contact
- reduced risk of damages from seal and housing during installation and removal
- high performance also with inadequately finished housing bores.

Complete coverage offers extreme flexibility

SKF offers several design variations and sizes – both inch and metric – for the ROD LDS, fitting virtually all rolling mill applications under difficult and arduous conditions. Depending on the application, the main sealing lips are available in four different elastomeric compounds.

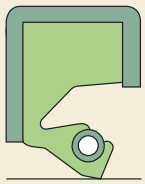
HDS1 as the basic seal design features already the spring-lock which keeps the spring in position during handling and installation as well as during seal removal.

HDS2 additionally offers a flexible spring cover if dirt or other contaminants may damage the spring or where the spring could be dislodged.

HDS3 design includes adjustable lugs, which allow two seals in tandem for installation, or can be useful when an exact position in the housing is required.

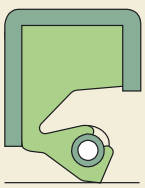
Radial shaft seal of the HDS1 design

Fig. 1



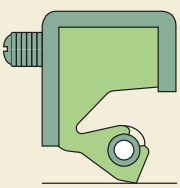
Radial shaft seal of the HDS2 design

Fig. 2



Radial shaft seal with spacer lugs, HDS3 design

Fig. 3



HDS design radial shaft seals mounted adjacent to each other

Fig. 4

HDS7 consists of a springless lip profile designed to retain lubricants and aggressively pumps contamination away from the lip. This provides also low radial load with low wear to lip and shaft and longer service life.

HDSA, B, C are combined with a non-spring loaded auxiliary lip for maximum exclusion which can be placed on spring or on opposite side with different arrangement of the chamfer. These designs are available with or without spring cover.

HDSD, E have two sealing elements where both lips can be faced in the same or in opposed direction.

ROD LDS of the HDS2 and HDS7 designs are particularly recommended for use in rolling mills. For further information on SKF ROD LDS contact the SKF application engineering service.

SKF Large Diameter Wear Sleeves

In order to seal efficiently, radial shaft seals must run against a smooth round surface – the seal counterface. Preferably the surface should be hardened and ground without directionality. High pressures, temperatures and speeds, inadequate lubrication and solid contaminants, they all have a negative influence on sealing performance and also lead to grooving on the shaft. In such cases a simple seal replacement will not solve the problem, and it is generally necessary to rework the shaft, which is time-consuming and costly.

SKF Large diameter wear sleeves (LDSLV) are the ideal solution in such cases, providing a new counterface

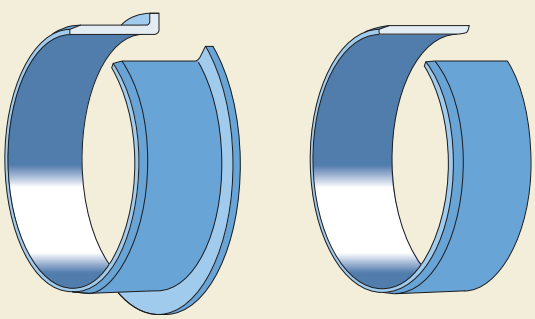
- made of high strength, hot-rolled and surface-treated steel
- fine-machined surface to enhance the wear and corrosion resistance
- eliminates the need for reworks
- simply to be pressed onto the shaft
- available either with a flange as LDSLV3 design, or without a flange as LDSLV4 design
- two alternative ways of repairing the shaft.

In cases where seal wear and damage of the counterface on the shaft can be expected, it is recommended that LDSLV wear sleeves are designed into the application from the outset. During repairs, it will then not be necessary to rework the shaft, and the original seal size can always be used as a replacement.

For additional information on SKF LDSLV consult the SKF application engineering service.

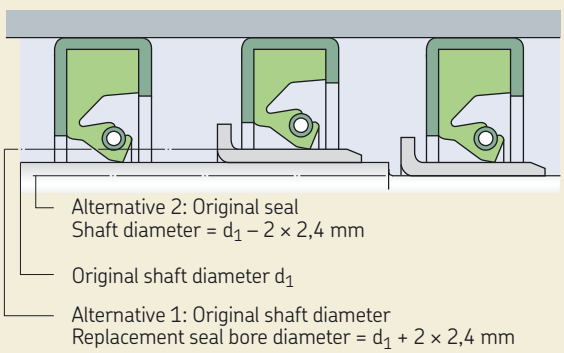
CR shaft repair sleeve with flange, LDSLV3 design, and without flange, LDSLV 4 design

Fig. 5



Alternatives to repair shafts using LDSLV sleeves

Fig. 6



SKF greases

The SKF greases have been developed based on the latest information about rolling bearing lubrication and have been thoroughly tested both in the laboratory and in the field. Their quality is continuously monitored by SKF.

In the vast majority of applications, SKF four-row taper roller bearings are lubricated with the SKF grease "LGHB 2" featuring the special characteristics

- excellent lubrication properties even under heavy loads
- high friction-reducing and anti-wear properties
- very good mechanical stability
- extremely good resistance to water and anti-corrosion properties

The most important technical specifications on commonly applied SKF greases for such applications are given in **table 1**.

Table 1

Technical specifications of SKF greases

Characteristics	LGHB 2	LGEP 2	LGEV 2
NLGI consistency class **Thickener**	2 Complex calcium sulphonate	2 Lithium	2 Lithium-calcium
Base oil	Mineral oil	Mineral oil	Mineral oil
Temperature range, °C	–20 to +150	–20 to +110	–10 to +120
Base oil viscosity, mm^2/s at 40 °C at 100 °C	 400 to 450 26,5	 200 16	 1 020 58
EP Performance, N 4-ball test, welding load DIN 51350/4	 min. 3 000	 min. 2 800	 min. 3 000

The SKF Traffic Light Concept

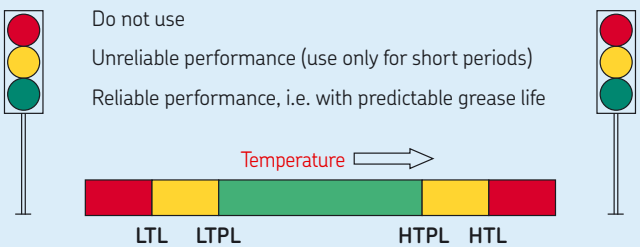
The temperature range over which a grease can be used depends largely on the type of base oil and thickener used as well as the additives. Many decades of research and development have successfully led to "The SKF Traffic Light Concept" (**diagram 1**). The test results are also used to calculate and evaluate the grease life.

Within the green zone the grease works reliably, and the grease life can be determined accurately. Operations within the red zones are advised against. Within the yellow limits the lubrication may become insufficient and uncontrolled. The relevant temperatures are schematically illustrated in **diagram 1** in the form of a "double traffic light".

For further information contact the SKF application engineering service. The appropriate grease for a specific bearing type and the relevant application thereof can also be selected by accessing the internet-based SKF grease selection program "LubeSelect". This program can be found online at www.aptitudeexchange.com.

Diagram 1

The SKF traffic light concept



LTL – Low temperature limit
The lowest temperature at which the grease will allow the bearing to be started up without difficulty

LTPL – Low temperature performance limit
Below this limit, the supply of grease to the contact surfaces of rolling elements and raceways may become insufficient

HTPL – High temperature performance limit
Above this limit the grease will age and oxidise in an uncontrolled way, so that grease life cannot be determined accurately

HTL – High temperature limit
When exceeding this limit, the grease loses its structure permanently

See also "SKF General Catalogue", catalogue "SKF Maintenance and Lubrication Products" or online at www.mapro.skf.com.

SKF – the knowledge engineering company

From the company that invented the self-aligning ball bearing 100 years ago, SKF has evolved into a knowledge engineering company that is able to draw on five technology platforms to create unique solutions for its customers. These platforms include bearings, bearing units and seals, of course, but extend to other areas including: lubricants and lubrication systems, critical for long bearing life in many applications; mechatronics that combine mechanical and electronics knowledge into systems for more effective linear motion and sensorized solutions; and a full range of services, from design and logistics support to conditioning monitoring and reliability systems.

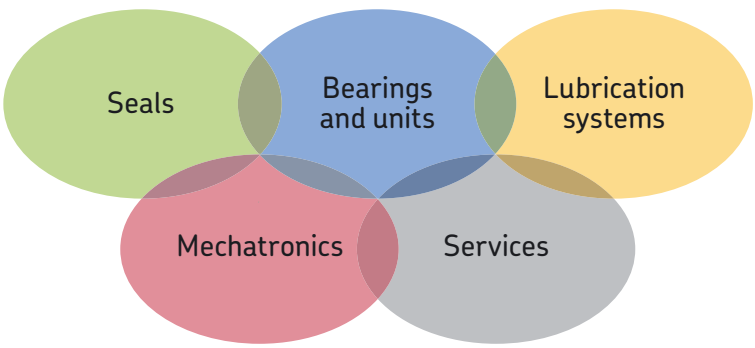
Though the scope has broadened, SKF continues to maintain the world's leadership in the design, manufacture and marketing of rolling bearings, as well as complementary products such as radial seals. SKF also holds an increasingly important position in the market for linear motion products, high-precision aerospace bearings, machine tool spindles and plant maintenance services.

The SKF Group is globally certified to ISO 14001, the international standard for environmental management, as well as OHSAS 18001, the health and safety management standard. Individual divisions have been approved for quality certification in accordance with either ISO 9000 or QS 9000.

With some 100 manufacturing sites worldwide and sales companies in 70 countries, SKF is a truly international corporation. In addition, our distributors and dealers in some 15 000 locations around the world, an e-business marketplace and a global distribution system put SKF close to customers for the supply of both products and services. In essence, SKF solutions are available wherever and whenever customers need them. Overall, the SKF brand and the corporation are stronger than ever. As the knowledge engineering company, we stand ready to serve you with world-class product competencies, intellectual resources, and the vision to help you succeed.

Evolving by-wire technology
SKF has a unique expertise in fast-growing by-wire technology, from fly-by-wire, to drive-by-wire, to work-by-wire. SKF pioneered practical fly-by-wire technology and is a close working partner with all aerospace industry leaders. As an example, virtually all aircraft of the Airbus design use SKF by-wire systems for cockpit flight control.

SKF is also a leader in automotive by-wire technology, and has partnered with automotive engineers to develop two concept cars, which employ SKF mechatronics for steering and braking. Further by-wire development has led SKF to produce an all-electric forklift truck, which uses mechatronics rather than hydraulics for all controls.



Harnessing wind power
The growing industry of wind-generated electric power provides a source of clean, green electricity. SKF is working closely with global industry leaders to develop efficient and trouble-free turbines, providing a wide range of large, highly specialized bearings and condition monitoring systems to extend equipment life of wind farms located in even the most remote and inhospitable environments.

Working in extreme environments
In frigid winters, especially in northern countries, extreme sub-zero temperatures can cause bearings in railway axleboxes to seize due to lubrication starvation. SKF created a new family of synthetic lubricants formulated to retain their lubrication viscosity even at these extreme temperatures. SKF knowledge enables manufacturers and end user customers to overcome the performance issues resulting from extreme temperatures, whether hot or cold. For example, SKF products are at work in diverse environments such as baking ovens and instant freezing in food processing plants.

Developing a cleaner cleaner
The electric motor and its bearings are the heart of many household appliances. SKF works closely with appliance manufacturers to improve their products' performance, cut costs, reduce weight, and reduce energy consumption. A recent example of this cooperation is a new generation of vacuum cleaners with substantially more suction. SKF knowledge in the area of small bearing technology is also applied to manufacturers of power tools and office equipment.

Maintaining a 350 km/h R&D lab
In addition to SKF's renowned research and development facilities in Europe and the United States, Formula One car racing provides a unique environment for SKF to push the limits of bearing technology. For over 50 years, SKF products, engineering and knowledge have helped make Scuderia Ferrari a formidable force in F1 racing. (The average racing Ferrari utilizes more than 150 SKF components.) Lessons learned here are applied to the products we provide to automakers and the aftermarket worldwide.

Delivering Asset Efficiency Optimization
Through SKF Reliability Systems, SKF provides a comprehensive range of asset efficiency products and services, from condition monitoring hardware and software to maintenance strategies, engineering assistance and machine reliability programmes. To optimize efficiency and boost productivity, some industrial facilities opt for an Integrated Maintenance Solution, in which SKF delivers all services under one fixed-fee, performance-based contract.

Planning for sustainable growth
By their very nature, bearings make a positive contribution to the natural environment, enabling machinery to operate more efficiently, consume less power, and require less lubrication. By raising the performance bar for our own products, SKF is enabling a new generation of high-efficiency products and equipment. With an eye to the future and the world we will leave to our children, the SKF Group policy on environment, health and safety, as well as the manufacturing techniques, are planned and implemented to help protect and preserve the earth's limited natural resources. We remain committed to sustainable, environmentally responsible growth.

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