



Das NKE-Werk in Steyr

NKE AUSTRIA GmbH

NKE AUSTRIA GmbH mit dem Hauptsitz in Steyr, Österreich, ist ein Wälzlagerhersteller der Premium-Klasse.

NKE entwickelt, konstruiert und produziert sowohl **Standard-** als auch **Sonderlager** für sämtliche Industrieanwendungen. Die Kernkompetenzen des Unternehmens – Technik, Produktentwicklung, Fertigung/Endbearbeitung der Komponenten, Montage, Qualitätssicherung, Logistik, Verkauf und Marketing – werden in dem nach ISO 9001, ISO 14001 und OHSAS 18001 zertifizierten Werk in Steyr konzentriert.

Neben dem umfassenden Produktsortiment bietet NKE auch komplette **Serviceunterstützung** an, wie z.B.

- Anwendungsberatung
- Entwicklung und Konstruktion
- Technische Berechnungen
- Versuche
- Schulungen



Das umfassende Standardlager-Programm von NKE

NKE Hauptkatalog

Der NKE Hauptkatalog enthält das NKE Standardprogramm, d.h. jenes Typenspektrum, das großteils aus Vorrat lieferbar oder relativ kurzfristig verfügbar ist.

Darüber hinaus entwickeln und fertigen wir auftragsbezogen auch Sonderlager nach Kundenspezifikation.

Der **NKE Hauptkatalog** ist in zwei Teile gegliedert:

- Der **Technische Teil** umfasst u.a. wesentliche Informationen zur Lagerauswahl und Dimensionierung, Gestaltung der Lagerstellen, Handling, Ein- und Ausbau, Schmierung sowie Angaben über Toleranzen von Lagern.
- Der **Produktteil** besteht aus den eigentlichen Produkttabellen, aber auch bauart- bzw. typenspezifischen Angaben zu jeder Produktgruppe.

Was ist neu in der fünften Auflage?

Wir haben das Produktsortiment gestrafft und die technischen Daten, wie z.B. die Lebensdauerberechnung, Ermüdungsgrenzbelastung, wie auch die Referenzdrehzahl, ergänzt.

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The NKE plant in Steyr

NKE AUSTRIA GmbH

NKE AUSTRIA GmbH, headquartered in Steyr, Austria, is a bearing manufacturer in the premium class.

NKE develops and manufactures **standard** and **special bearings** for all industrial applications. The company's core competences – such as engineering, manufacturing/ final processing of components, assembly, quality assurance, logistics, sales and marketing – are centralised at our headquarters in Steyr. The site is certified to ISO9001:2008, ISO14001:2004 and OHSAS 18001.

In addition to the comprehensive product range, NKE also offers total **service support**, such as:

- application consultation
- product development and design
- technical calculations
- tests
- training



The comprehensive range of NKE standard bearings

NKE General Catalogue

This general catalogue contains the NKE **standard product range**, i.e. the range of products that are available either from stock or within a short-term delivery lead time.

Additionally, NKE produces special bearings according to customer requirements. Please contact us for more details.

The **NKE General Catalogue** is subdivided into two main sections:

- The **Technical Section** provides basic knowledge and essential information about topics on selection and dimensioning of bearing arrangements, design of bearing locations, handling, mounting and dismounting, lubrication of bearings including data for bearing tolerances etc.
- The **Product Section** consists of the actual product tables with a text section dealing with defined specific technical information on every individual bearing type.

What's New in the Fifth Edition?

We have updated the product range and complemented the technical data, such as bearing life calculation, limited speed ratings as well as thermal speed ratings.

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Introduction

Rolling element bearings are standardised machine units.

They transmit forces, moments and rotating movements, including the guidance of shafts and spindles.

Transmission of forces and movements generate friction. Such frictional resistance proportionally increases torque and thus generating additional undesirable heat gain.

Any reduction in frictional resistance minimises these criteria. This directly reduces the required input power torque of a machine, thereby enabling a more compact design, higher efficiency and a simple construction of machines.

Basic Principles

In general, there are two different types of bearings. The principal differences are

- **sliding friction** (e.g. plain bearings)
- **rolling friction** (e.g. rolling bearings)

For plain bearings, sliding friction occurs when two surfaces, generally separated by a third medium (e.g. air and/or lubricant), move relative to each other (fig 1.1).

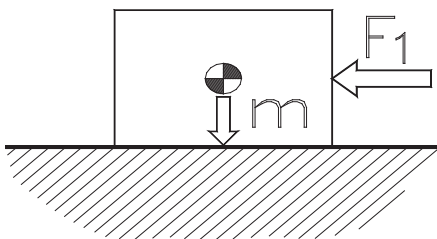


Fig. 1.1

The maximum forces transmitted by plain bearings are determined basically by the permissible specific pressure in the contacting area between the component elements.

The specific pressure is determined by the strength of material selected.

This historical principle is used for all types of plain bearings in their various applications (e.g. carriages, etc.)

The main advantage of plain bearings lies in their very simple and thus inexpensive structure. They are frequently used in maintenance-free designs and require less space in the machine design.

Their main disadvantages are limited ability in transferring forces, less accuracy in guiding shafts and spindles plus a relatively large starting torque.

Rolling element bearings, however, work with the principle of rolling friction (fig. 1.2).

The applied load is transmitted by rolling elements, rotating around and between two bearing rings, normally guided by ring raceway grooves. Usually the rolling elements are positioned within the bearing by separators, also termed retainers or cages. As described for plain bearings, rolling bearings also require lubricant separation of the metallic parts.

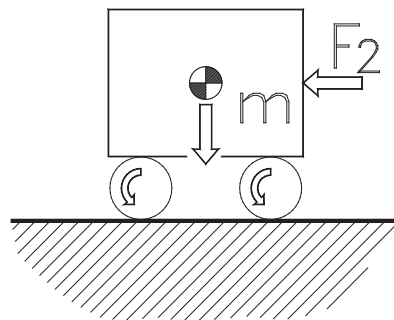


Fig. 1.2

Basic, Components of Rolling Element Bearings

This along with good surface finish ensures smooth running surfaces and reduces friction from the transmitted forces, resulting in minimising power loss.

In practice no pure rolling motion occurs within rolling bearings. The basic rolling motion of the rolling elements will include elements of sliding friction.

The amount of sliding friction within the bearing is dependant upon the kinematic properties of the respective bearing itself.

An excessive amount of sliding friction may cause serious damage on the bearing components and thus may cause premature failure.

Sliding friction is common, but it may cause problems in the event of high speeds, accelerations or the bearing runs under too lightly applied load. There is supporting evidence that rolling bearings require an effective load to perform efficiently.

Rolling element bearings, compared to plain bearings, have the following advantages:

- less starting torque, energy conservation.
- greater availability of different types and sizes, globally and standardised.
- many capable of taking combined radial and axial loads.
- greater load carrying capabilities within limited design space.
- maintenance free, sealed "for-life" design arrangements.
- less lubrication consumption.
- very precise guidance of shafts.
- rolling element bearings are more suitable to greater operating temperatures.
- rolling element bearings are also available in special designs to meet particular applications, such as stainless steel bearings, special greasing etc.

Rolling Bearing Components

Normally rolling bearings (fig. 1.3) consist of two rings (fig. 1 and 4) or – in case of thrust bearings – washers, with rolling elements (2), mostly retained by a cage (3), in between.

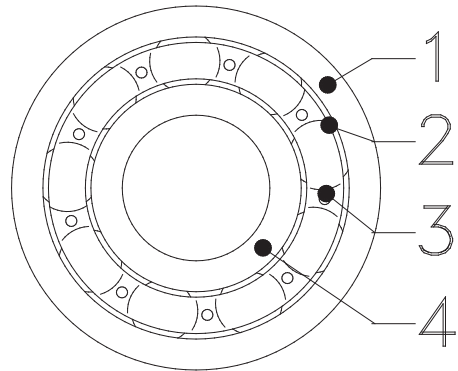


Fig. 1.3

In certain cases the rolling elements may run directly onto running surfaces of connecting parts such as shafts or housings.

Several bearing types are available with integrated seals or shields.

Rings and Washers

The bearing rings or washers (fig. 1.4) accommodate loads which are transmitted onto the seating positions of shafts and housings.

A bearing ring or washer normally has a raceway groove where the rolling elements rotate and locate.

To assist in their precise location the outer ring (O.D.) and inner ring (bore) have similar surface finishes.

Rolling bearings depending upon type are able to accommodate radial or axial loads, many are capable of combined loads.

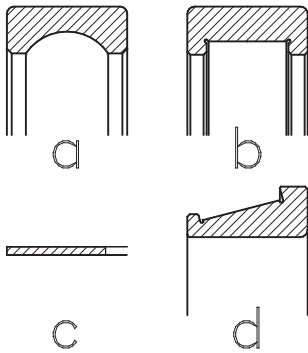


Fig. 1.4

Figure 1.4 shows some examples of different bearing rings.

- 1.4a) Outer ring single row deep groove ball bearing
- 1.4b) Outer ring single row cylindrical roller bearing
- 1.4c) Flat thrust washer of a needle roller thrust bearing
- 1.4d) Inner ring single row tapered roller bearing

Types of Rolling Elements

Rolling elements are simple geometrical bodies i.e. balls, rollers or bearing needles, which transmit the applied forces.

The principle distinction between rolling element bearings and their initial bearing description is generally classified solely due to the rolling element shape (e.g. ball bearing, roller bearing, needle roller bearing, etc.)

The difference between ball and roller bearings is also considered in the calculation formula for rolling bearings. This is due to the differences in geometric surface contact behaviour.

- a) A ball lying on a flat surface makes contact at a single point. This is termed “**point contact**” (fig 1.5).

In practice a ball under load will have elastic deformation. The curved shape of ball bearing raceway changes this contact shape to become ellipsoidal.

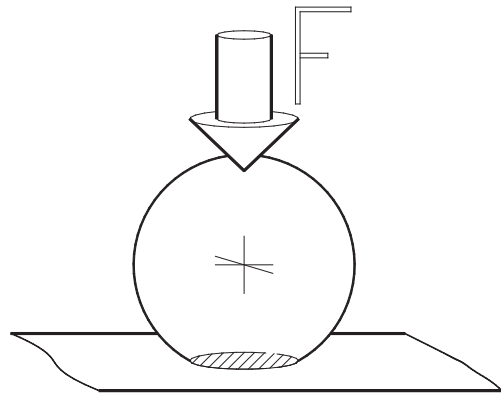


Fig. 1.5

Due to this usually very small contacting area ball bearings have less frictional resistance and are more suitable in high speed applications.

These small contact areas result in higher specific pressure at given loads when compared to roller bearings of equal size (i.e. less load carrying capability).

b) A roller lying on a flat surface makes contact in a line. This is termed “line contact” (fig 1.6).

When a load is applied the line contact changes basically to a rectangle for cylindrical surfaces and trapezoidal for conical surfaces.

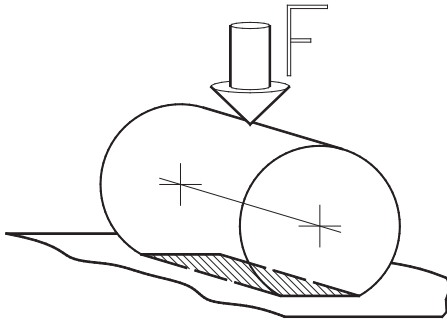


Fig. 1.6

Under a given load the contacting areas for line contact is larger than that of point contact. Thus rolling bearings have higher load ratings than ball bearings, although they also have higher friction.

The length of this contacting area makes roller bearings more sensitive to misalignment between rollers and raceways. Misalignment causes undesired stress at the roller ends. Such stress peaks may cause a local overloading of the bearing steel. To eliminate these stress concentrations, termed “edge loading”, it is usual to profile rollers and raceways.

As stated earlier, there are calculation formula differences for ball and roller bearings, e.g. when calculating the nominal bearing life rating according to the standardised method the different geometric surface contact behaviour is considered by different life exponents.

The life exponent p in the standardised equation is for

- ball bearings: $p = 3$
- roller bearings: $p = 10/3$ (3.333333)

Roller Shapes

Rollers used in rolling bearings are of different shape. The most important base shapes are shown in fig. 1.7:

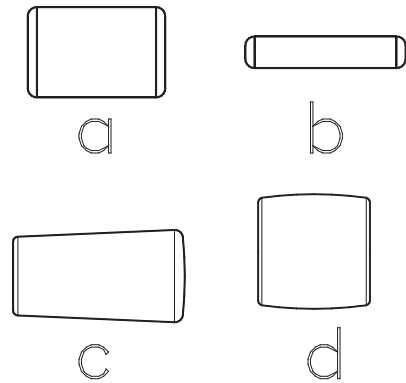


Fig. 1.7

- 1.7a) **Cylindrical roller**
Mainly produced with a profiled shape of roller diameter to avoid excessive edge stresses.
- 1.7b) **Needle roller**
Needle rollers are basically cylindrical rollers with a large ratio of length to diameter.
- 1.7c) **Tapered roller**
Formed as a conical shaped solid element and profiled shape of diameter.
- 1.7d) **Barrel roller**
Barrel shaped rollers are produced either symmetric or asymmetric in design (i.e. as used in self-aligning spherical roller bearings).

Cage

A cage fulfils several functions within a rolling bearing:

- to separate the individual rolling elements.
- to guide and position the rolling elements between the raceways.
- to retain the rolling elements.

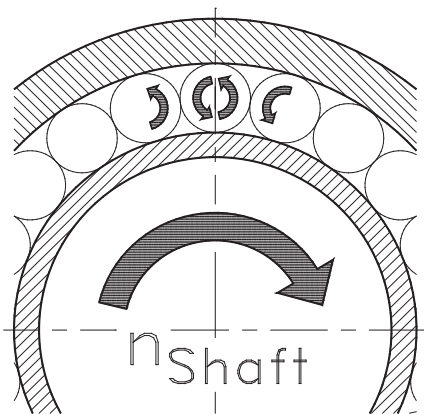


Fig. 1.8

Under certain conditions a cage may be omitted from the assembled bearing type. This is termed **full complement** bearing.

This enables a maximum load carrying capacity by utilising the bearing cross sectional area with the optimum number of rollers.

This causes higher friction therefore lower speed capabilities.

It can be seen (fig 1.8) that each rolling element contacts the other in a contrarotating motion, thereby, generating higher bearing friction and thus having lower speed capabilities.

For rolling bearings fitted with cages, however, minimal sliding friction occurs between the respective surfaces of rolling elements and cage pockets (fig 1.9).

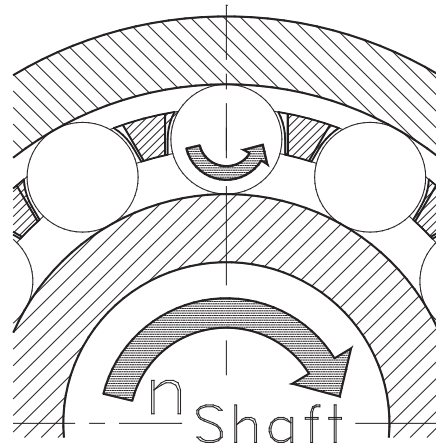


Fig. 1.9

Rolling bearing cages are manufactured from the following materials;

- pressed mild steel sheet,
- pressed brass or bronze sheet,
- brass or bronze,
- plastics (e.g. polyamide or nylon),
- light metal alloys,
- steel,
- resin,
- sintered metals,
- special materials.

Additional Parts and Accessories

Several bearing types are manufactured with integrated shields or seals.

There is a wide variety of designs and materials used for seals and shields when fitted to rolling bearings. Additionally, rolling bearing seals are manufactured in materials suitable for high temperature applications.

Some bearing types, mainly deep groove ball bearings, are manufactured with snap ring grooves on their outer diameter. This feature enables simple axial location at mounting when used in conjunction with a snap ring. These bearings can be fitted with or without a snap ring (see fig 1.10).

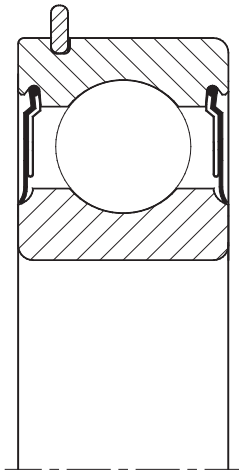


Fig. 1.10

Other bearing types similarly have loose, yet matching parts (e.g. cylindrical roller bearing – separate thrust collar or side plates). (fig 1.11)

Many of these parts are individually available.

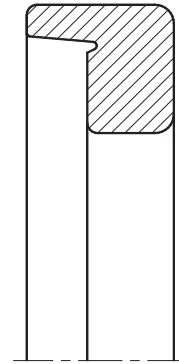


Fig. 1.11

Accessories are usually integral parts to a rolling bearing assembly. Examples are adapter sleeves, withdrawal sleeves, lock nuts (see fig. 1.12), locking devices and rolling elements etc.

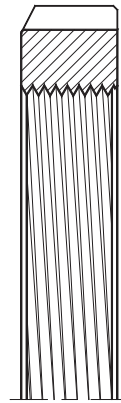


Fig. 1.12

Some of these accessories are used for different purposes, not only in connection with bearings. Separate balls, for example, are often used in vents or even for calibrating gauges.

Lock nuts are also frequently used for locking of other machine components like couplings, gears or disks.

Classification of Rolling Bearings

Design engineers may select the most suitable bearing for their purposes from a large number of different bearing types and designs. In making a selection it is necessary to have some knowledge of the different bearing types and their specific behaviours.

The selection of rolling element bearings is based on the following general criteria:

- a) Based on the direction of applied load (i.e. rolling element shape)
 - **Deep groove ball bearings**
 - **Angular contact ball bearings**
 - **Cylindrical roller bearings**
 - **Tapered roller bearings**
 - **Spherical roller bearings**
 - **Needle roller bearings**
 - b) Based on their load capacity and capability (i.e. radial, angular contact, axial or thrust forces)
 - **Radial deep groove ball bearings**
 - **Angular contact thrust ball bearings**
 - **Cylindrical roller thrust bearings**
 - **Radial tapered roller bearings**
 - **Spherical roller thrust bearings**
 - c) Based on availability and suitability whether standard bearings or bearings for special application requirements.
- d) Based on application and unit design assembly.
- d 1) **Separable** bearings:
Where one or more bearing components may be mounted or dismounted easily within an application assembly procedure, e.g. taper roller, cylindrical roller, needle roller bearings, thrust ball bearings and split bearings.
 - d 2) **Non-separable** bearings:
Where each bearing is mounted and dismounted as a complete unit, e.g. deep groove ball, angular contact bearings and spherical roller bearings.

NKE will design, develop and produce special bearings and associated products to individual customer application requirements with specific reference to **reliability, performance** and **service** operations.

- **Clutch release bearings**
- **Traction motor bearings for railway vehicles**
- **Track runner bearings and support rollers**
- **Stainless steel bearings**
- **Ball and roller bearing for high-temperature applications**
- **High precision bearings for machine tool spindles**
- **Roll neck bearings for steel rolling mills**
- **Profiled rollers**
- **Shaker screen bearings**
- **Electric insulated bearings**

Overview of the More Popular Bearing Types and their Characteristics

Radial Deep Groove Ball Bearing

Single row deep groove ball bearings (fig. 2.1) are the most commonly used rolling bearings.

The balls run in deep grooves in both the outer and inner rings. This enables the bearing type to accommodate radial loads as well and some axial loads in either direction.

Deep groove ball bearings are especially suitable for high speed applications due to their low friction. They achieve the highest speed ratings of all rolling bearing types. Deep groove ball bearings are available in a wide variety of designs with different shields and seals. This enables greased “for life” bearings, maintenance free and more efficient designs.

Other classifications of single row deep grooved ball bearing are **miniature bearings** – up to and including 3.175 mm inner bore diameter

Extra small bearings – over 3.175 mm up to and including 9.525 mm inner bore diameter

Max type bearings – greater number of balls than normal allowing higher radial loads, with limited axial loads in one direction.

For more information see page **371**.



Fig. 2.1

Angular Contact Ball Bearings

Single row angular contact ball bearings (fig. 2.2) support axial loads applied at a certain contact angle to their axis in one direction only. These bearing types are not separable; therefore, they are mounted in bearing pairs or a combination of bearing sets.

This bearing is suitable for high and very high speeds, commonly used in machine tool spindle applications.

For more information see page 440.

Single row angular contact ball bearings for universal matching are specially manufactured for applications, where two individual bearings are mounted side by side in random order, e.g. in back-to-back arrangement (fig. 2.3).

The rings are machined to ensure that specific clearances or preload values are attained within a mounting arrangement. Individual bearings can be arranged in either back-to-back, face-to-face or tandem mounting arrangement and demonstrate excellent ability to absorb radial and axial loads.

For more information see page 462.

Double row angular contact ball bearings (fig. 2.4) are similar in their internal design to two single row angular contact bearings mounted in a back-to-back arrangement.

Double row angular contact ball bearings have less overall width than two single row ball bearings. They can accommodate heavy radial loads and axial loads in either direction additionally, providing a very rigid bearing arrangement.

Designs with polyamide cage are without filling slots. This execution can operate at temperature up to +120°C. Bearings fitted with pressed steel or brass cages have ball filling slots on one side face, therefore, are less suited to accommodate equal axial loadings. These bearing types are sensitive to misalignment.

For more information see page 470.

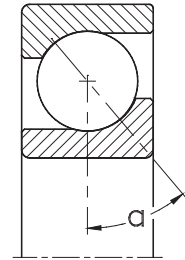


Fig. 2.2

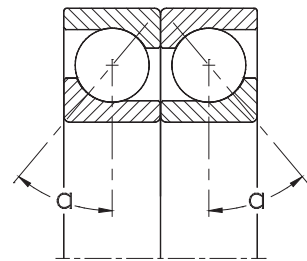


Fig. 2.3

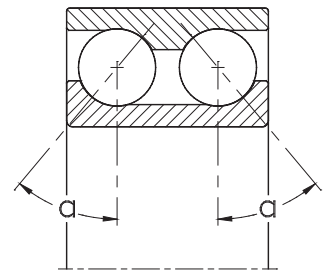


Fig. 2.4

Four-Point Contact Ball Bearings

Four-point contact ball bearings (fig. 2.5) are basically single row angular contact ball bearings with split inner ring (i.e. two half inners). This bearing is separable.

The contact geometry between rolling element and raceway is “four-point” contact, due solely to raceway form design (i.e. Gothic arch) this enables the support of equal axial loads in either direction.

Where necessary there are locating grooves in the outer rings to prevent undesirable rotation.

For more information see page 484.

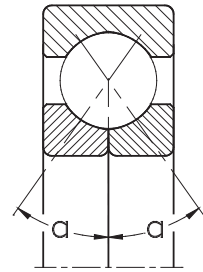


Fig. 2.5

Self Aligning Ball Bearings

Self aligning ball bearings (fig. 2.6) are double row ball bearings, each set of balls rotate within a single outer ring spherical raceway. This gives the bearing a self aligning feature to overcome misalignments, shaft deflections and housing variations.

Self aligning ball bearings are non-separable. They are suitable for medium radial loads and low axial forces.

Engineers should be aware and consider in their application designs that some self aligning ball bearing units have balls that protrude beyond the bearing faces.

Self aligning ball bearings are frequently used with a 1:12 tapered bore (fig. 2.7) for mounting using adapter sleeves.

This feature enables direct mounting onto shafts for applications where high running accuracy is unnecessary.

Other design variants include the use of extended inner rings; these rings have slots on one side face to which dowel pin location via the shaft is permitted. The inner ring bore diameter variation for these types is to tolerance class J7.

Some self aligning ball bearings are available fitted with rubber seals on both sides (i.e. sealed “for-life”).

For more information see page 496.

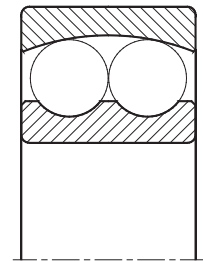


Fig. 2.6

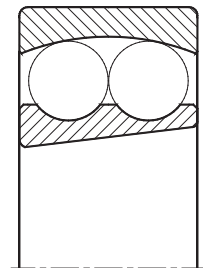


Fig. 2.7

Cylindrical Roller Bearings

Single row cylindrical roller bearings are used in the transmission of high radial forces. Depending on their rib design arrangement single row cylindrical roller bearings also have the following features:

N and NU, (fig. 2.8), may be used as a floating bearing.

NJ and NF types also support axial loads in one direction only.

NH (i.e. NJ+HJ) and NUP provide axial location and support axial loads in either direction.

Most cylindrical roller bearings are separable, therefore, provide simple mounting and dismounting. These types are suitable for high speed applications.

For more information see page **535**.

Full complement cylindrical roller bearings (fig. 2.9) are cageless bearings designed to accommodate maximum radial load capacity.

Under service conditions the roller elements contact each other in a contra rotating motion resulting in considerably higher friction when compared to caged bearing types. This additional friction results in a lower speed rating.

Standard full complement cylindrical roller bearings are manufactured in either single row or in double row designs.

Bearing type **NNF 50... -2LS-V** has seals fitted.

For more information see page **598**.

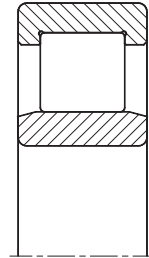


Fig. 2.8

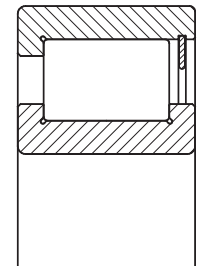


Fig. 2.9

Spherical Roller Bearings

Spherical roller bearings are two rows of barrel-shaped rollers running in a single spherically formed outer ring (fig. 2.10).

This allows the self-aligning bearing feature thereby accommodating the manufacturing and assembly misalignments of shaft to housing, including shaft bending and deflections.

Spherical roller bearings are non-separable and can accommodate very high radial loads and certain axial loads in either direction.

Due to their kinematic characteristics spherical roller bearings are not suitable for very high speeds.

Typical applications for spherical roller bearings are mining and heavy industries.

The majority of spherical roller bearings are produced with a circumferential groove and lubrication holes in the outer ring this allows relubricating the bearings.

Spherical roller bearings are less frequently used with **tapered bore** (fig. 2.11) mounted directly onto a tapered shaft.

Generally, mounting of these bearing types is in conjunction with either adapter or withdrawal sleeves. The most common tapered bore is 1:12, namely designation **suffix K**. Other spherical roller bearings with a small radial cross section (i.e. series **240** and **241**) have slower tapers 1:30, namely designation **suffix K30**.

Large spherical roller bearings are often mounted and dismantled using hydraulic nuts in conjunction with the standard adapter and withdrawal sleeves, or alternatively, using the oil injection method with modified adapter and withdrawal sleeves.

Spherical roller bearings for vibrating screen applications (suffix **SQ34**) have differing design features, namely machined solid brass cages, closer geometric tolerances and radial clearances when compared to standard bearings.

For more information see page **707**.

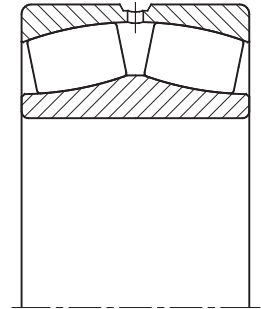


Fig. 2.10

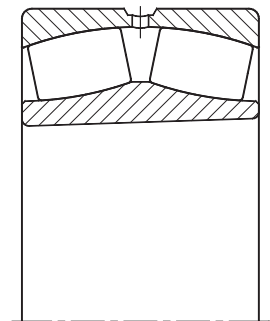


Fig. 2.11

Tapered Roller Bearings

Tapered roller bearings (fig. 2.12) are normally separable radial bearings. They comprise of a cone assembly (i.e. inner ring, with cage and roller assembly) and separable “cup” (i.e. outer ring). Due to the contact angle each radial load applied on a tapered roller bearing generates an internal thrust force. Since single row tapered roller bearings accommodate thrust loads in one direction only they have to be arranged against a second taper roller bearing to accommodate thrust loading in the opposite direction. Tapered roller bearings support high radial and thrust forces even at high speeds.

They do not permit large misalignment.

For more information see page **649**.

Paired single row tapered roller bearings are two single row tapered roller bearings paired using spacers and distance pieces for defined axial clearance or preload.

These bearing are supplied back-to-back, face-to-face or tandem arrangements according to customer requirements.

The pairing of bearings is completed during the manufacturing stages, therefore, mounting time and cost is reduced.

Several types of paired single row tapered roller bearings are available in face-to-face arrangement as standard bearings, identified by suffix **DF** (fig. 2.13).

Other sizes and /or designs are available on request.

Double row tapered roller bearings (fig. 2.14) are ready-for-use **units**. Depending on the application they are arranged either in face-to-face or back-to-back arrangement.

They consist of an inner ring with two roller rows and a one-piece or multiple-part outer ring.

Such units are used in machine tool spindles and as axle box bearings of railroad vehicles.

Double row tapered roller bearings belong to the supplementary range and are available on request.

Four row tapered roller bearings (fig. 2.15) also belong to the supplementary product range.

They are ready for use **bearing units** for rolling stands in steel mills. Due to the many different sizes and designs such bearing units are manufactured to customer order only.

For more information on **NKE multi-row tapered roller bearings** please contact NKE.

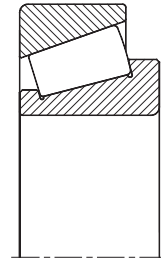


Fig. 2.12

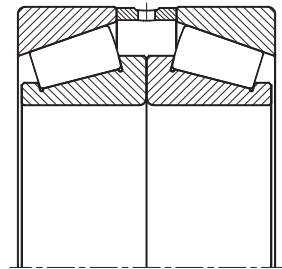


Fig. 2.13

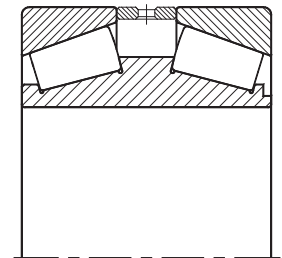


Fig. 2.14

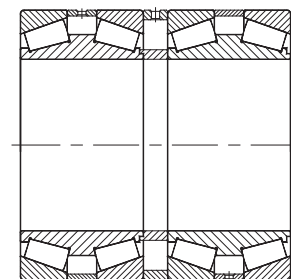


Fig. 2.15

Thrust Ball Bearings

Thrust ball bearings are available as single direction and double direction designs. They are separable and thus easy to mount. Thrust ball bearings can support axial loads only.

They are unsuitable for high speed use.

These bearing types do not permit any misalignments. However, to overcome this problem, design variations incorporating spherical housing washers and seating rings are available.

To ensure optimum function, thrust ball bearings require a specific minimum load.

Single direction thrust ball bearings (fig. 2.16) consist of a shaft (i.e. small bore) and housing washer (i.e. large bore) each having a face raceway groove. These washers are separated by a cage and ball assembly.

This design will take thrust loads in one direction only.

Double direction thrust ball bearings (fig. 2.17) are suitable for accommodating axial forces in both directions. They consist of two shaft washers, a central housing washer located in the middle of the assembly separated by two ball and cage assemblies. These bearings do not permit any misalignment.

However they are also available with spheroid housing washers for applications where some misalignment may occur.

For more information see page **798**.

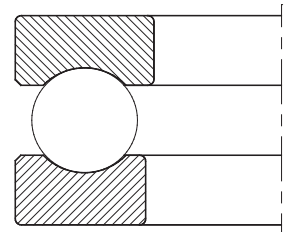


Fig. 2.16

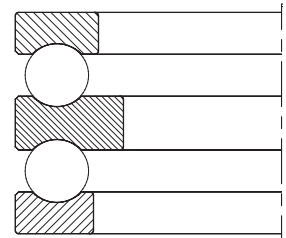


Fig. 2.17

Cylindrical Roller Thrust Bearings

Cylindrical rollers thrust bearings (fig. 2.18) are of very simple design consisting of a shaft washer, housing washer, cage and roller assembly. Cylindrical roller thrust bearings are capable of supporting higher loads compared to thrust ball bearings, therefore, are suitable for applications where very high thrust load carrying capability is required. These bearing types are insensitive to shock loading, unsuitable for radial loading and do not permit any misalignment.

Double direction acting cylindrical roller thrust bearings (fig. 2.19) may be built using components of single direction acting cylindrical roller thrust bearings together with **intermediate washers ZS**.

Such intermediate washers belong to the NKE supplementary product range. Details are available upon request.

For more information see page **841**.

Spherical Roller Thrust Bearings

Additional to the thrust bearings previously mentioned **spherical roller thrust bearings** (fig. 2.20) are self aligning bearings that are separable and thus easy to mount.

Spherical roller thrust bearings are single direction acting and can accommodate high thrust loads as well as a certain amount of radial loads.

For an optimum function spherical roller thrust bearings need a certain minimum load. These bearings are used in applications where high capability in taking thrust loads and misalignments is necessary.

For more information see page **857**.

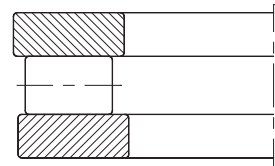


Fig. 2.18

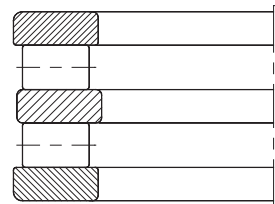


Fig. 2.19

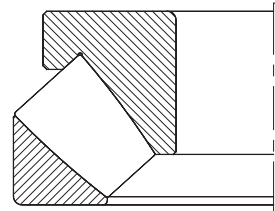


Fig. 2.20

Cam Rollers

Cam rollers are ball bearings with a very thick-walled outer ring that runs directly onto a guiding surface or a track.

Due to this thick-walled outer ring they are capable to run even under shock loads.

Because of the fact that cam rollers are usually used under very rough operating conditions they are supplied with incorporated seals or shields.

To avoid excessive edge stresses when running on tracks or to compensate for misalignments the cam rollers are frequently used with crowned outer diameter (suffix **R**).

Single row cam rollers are similar to sealed single row deep groove ball bearings. They are usually used with two seals, but on request they are also available with shields.

Single row cam rollers are frequently used with crowned outer diameter (fig. 2.21).

Double row cam rollers (fig. 2.22) are based on double row angular contact ball bearings of series **32...** and **33...**

They feature polyamide cages and shields; these rollers are also often used with a crowned outer diameter.

To guarantee a long service life even under tough operating conditions these rollers have a lubrication hole on their inner rings.

For more information see page **875**.

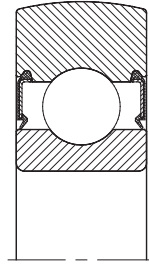


Fig. 2.21

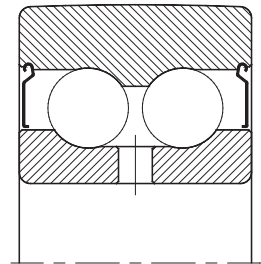


Fig. 2.22

Accessories

The term “accessories” used by NKE is applicable to separable products as used in specific bearing assemblies.

Examples:

- a) **Separate cylindrical roller bearing thrust collars**
- b) **Separate needle roller bearing inner rings**
- c) **Adapter sleeves, washers and locking nuts (fig. 2.23)**
- d) **Withdrawal sleeves (fig. 2.24)**

Other examples for bearing accessories are snap rings, sealing washers, spacers, etc.

For more information see page **968**.

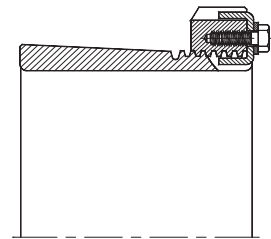


Fig. 2.23

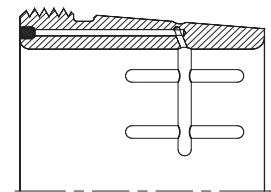


Fig. 2.24

General

The **designations** of rolling element bearings consist of combinations of letters and numbers. Although the designation system has been built up following a logical principle the classification of individual bearing types may sometimes be hard to understand for the layman.

The designation code of rolling element bearings has been built up in such a way that different parts of the designation exactly identify the bearings type, size and specific characteristics.

Besides the classification system of standard bearings, there are a large number of individual special bearing designations for "special" bearings or standard bearings that feature some special characteristics. Such special designation may differ according to manufacturer standards.

The basis of the rolling element bearing designation system is DIN-standard **DIN 623**.

ISO Standards

Basic bearing design, their boundary dimensions and the tolerances of **standard bearings** are defined by internationally recognised standard plans (e.g. **ISO 15**, **ISO 355** and **ISO 104** reps. in **DIN 616** and **DIN ISO 355**.) Boundary dimensions as defined by the standard plans include bearing cross sections and their boundary dimensions according to mathematical rules.

In these standard plans for each **bore diameter** several different possible **outer diameters** and **widths** or, in the case of thrust bearings, **heights** have been assigned.

In this way **diameter series** and **width series** for standard bearings have been defined.

Some examples for the structure of standard plans are shown in fig. 3.1.

Defined in these standards are bearing base design, **bore diameter (d)**, **outer diameter (D)**, **width (B)**, or, in the case of thrust bearings, **height (H, T)** and minimum values for chamfer **dimensions (r)** (fig.3.2).

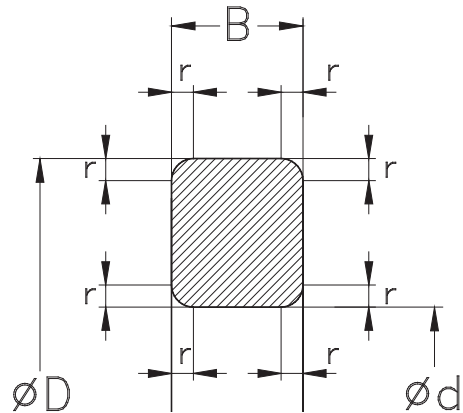


Fig.3.2

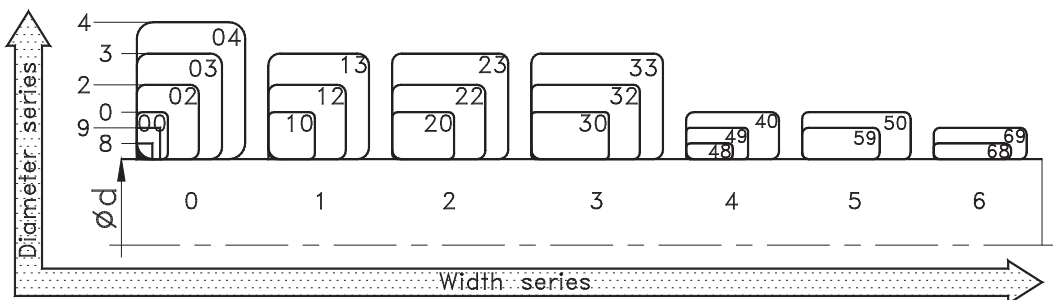


Fig.3.1

Designation System of Standard Bearings

The general classification system of standard bearing bases includes the **diameter series** and **width series**.

The standard classification system includes:

- prefixes
- a base designation
- suffixes

(see fig.3.3)

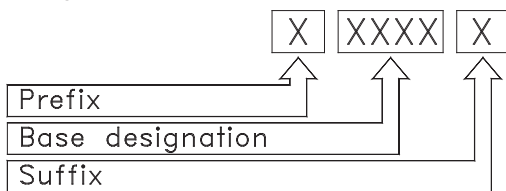


Fig.3.3

For metric tapered roller bearings the “traditional” designation system according to DIN 720 has a new “parallel” designation system now established according to **DIN ISO 355**.

Fig. 3.4 shows in principle the structure of the designation system for standard bearings.

In the following more important symbols are explained.

Prefixes

Prefixes usually identify **separate parts** of bearings, special bearings or in the case of stainless steel bearings the different bearing material.

Examples for bearing parts:

Separable bearing types, (e.g. cylindrical roller bearings or needle roller bearings), sometimes are used without specific components.

In these cases the used components are identified by the following prefixes:

L..... separate ring

e.g. LNU314-E

Inner ring of cylindrical roller bearing
NU314-E

IR..... ring

e.g. IR40X50X20

Separate inner ring of a needle roller bearing

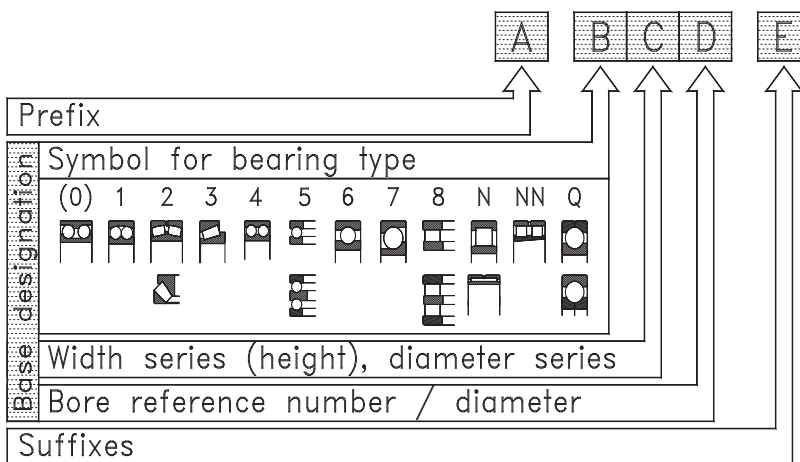


Fig. 3.4

Examples for bearing parts:

R..... ring with roller set
e.g. **RNU314-E**
Outer ring with roller set of a cylindrical roller bearing NU314-E

e.g. **RNA6912**
Outer ring with needle roller assembly of a needle roller bearing NA6912

BO..... loose rib
e.g. **BO-NUP220-E**
Loose rib of a cylindrical roller bearing NUP220-E

AXK... Needle roller and cage thrust assembly
e.g. **AXK5578**

GS..... housing washer
e.g. **GS-81111**
Housing washer of a cylindrical roller thrust bearing 81111

WS..... shaft washer
e.g. **WS-81111**
Shaft washer of a cylindrical roller thrust bearing 81111

Base Designations

The **base designation** describes bearing type, base design and its size.

Standard bearings usually have base designations that consist of letters and numbers or a combination of both. They indicate:

- type and base design (**bearing series**)
- size (**bearing bore diameter**)

Fig.3.5 shows a schematic representation of the structure of base designation of standard bearings.

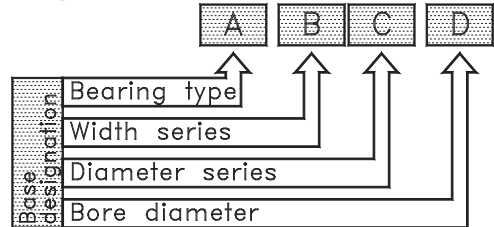


Fig. 3.5

Bearing Series

The symbol of the bearing series contains information about the **type of bearing** and its assignment to a certain **width** or **diameter series** or, in the case of thrust bearings, to a certain **height** and **diameter series**.

The individual bearing series is identified by letters or numbers, or a combination of both.

Bearing Types

The identification of the **bearing type** is made by the first symbols of the base designation.

The different bearing types may be distinguished by letters or numbers or a combination of both.

In some cases it has been established to omit the first numbers of the identification symbol of the Bearing type, particularly the first figure of the dimension series.

The most common **bearing series** are:

0 Double Row Angular Contact Ball Bearings

For practical use the "0" is omitted.

Common series: (0)32
(0)33

1 Self Aligning Ball Bearings

The "1" is omitted in some cases. Common series:

122 1(0)3 1(1)0
104 1(0)2
(1)23 (1)22

2 Spherical Roller Bearing

Standard series:

Radial spherical roller bearings:

223 231 238
213 240 248
232 241 239
222 230 249

Spherical roller thrust bearings

292
293
294

3 Tapered Roller Bearings

Standard series:

302 303 313
320 322 323
330 331 332
329

4 Double Row Deep Groove Ball Bearings

The "2" in the designation of width series is omitted for practical use:

Series: 4(2)2
4(2)3

5 Thrust Ball Bearings

The most commonly used series:

510 511
512 513 514
522 523 524
532 533 534
542 543 544

6 Single Row Deep Groove Ball Bearings

In most cases the "0" and the "1" from the symbol of width series is omitted for practical use.

The most important series are:

618 619
(60)2 (60)3
622 623 630
16(0)0 16(0)1
6((1)0 6(0)2 6(0)3 6(0)4

7 Single Row Angular Contact Ball Bearings

For single row angular contact ball bearings the "0" and the "1" from the symbol of width series is omitted for practical use.

The most common series are:

708 718 719
7(1)0 7(0)2 7(0)3 7(0)4

8 Cylindrical Roller Thrust Bearings

The most common series are:

811 812
893 894

N Cylindrical Roller Bearings

The letter **N** may be followed by other letters which indicate the design of the bearing in more detail.

Examples: **NU, NJ, NUP, NCF, NNU, NNCF**, etc.

If the bearing designation starts with “**NN**”, double or multi-row bearings are indicated.

In most cases for cylindrical roller bearings the “**0**” and the “**1**” from the symbol of width series is omitted.

The most frequently used bearing series are:

(0)2	(0)3	(0)4	
22	23		
10	20	30	50
18	29	39	
48	49	69	

NA Needle Roller Bearings

The designation of needle roller bearings with machined rings starts with **NK** or **NA**.

Q Four-Point Contact Ball Bearings

Depending upon their design four-point contact ball bearings are identified either by “**Q**” (split outer ring) or “**QJ**” (with split inner ring).

For four-point contact bearings the “**0**” of the symbol for the width series is omitted for practical use.

The most commonly used series are:

10	(0)2	(0)3
----	------	------

T Tapered Roller Bearings

The designation of metric standard tapered roller bearings is in accordance with DIN ISO355 the first letter being “**T**”.

Bore Diameter

Normally the bore diameter of a standard bearing is integrated in its base designation as a two-digit number, termed the **bore reference number**.

This bore reference number is written after the symbol indicating the bearing series, (see fig. 3.4 and fig. 3.5). The **bore reference number**, when multiplied by 5, indicates the bore diameter in millimetres.

Examples:

6205	Single row deep groove ball bearing Bore diameter 05 x 5 = 25mm
NU2336	Single row cylindrical roller bearing Bore diameter 36 x 5 = 180mm
3318	Double row angular contact ball bearing Bore diameter 18 x 5 = 90mm

Exceptions to this rule:

In specific cases the bore diameter is indicated differently, as follows:

a) Bearings with bore diameters of 10, 12, 15 or 17 mm.

These bore diameters are identified by the following code numbers:

00	= 10 mm
01	= 12 mm
02	= 15 mm
03	= 17 mm

Example:

6002	Single row deep groove ball bearing, Bore diameter 15mm
------	---

b) Bearing having bore diameters less than 10 mm and over 500 mm.

For such bearings their bore diameter will be given directly in millimetres. It is separated from the symbol of bearing series by an oblique slanting line.

Examples:

62/2,5	Single row deep groove ball bearing bore diameter	<u>2.5mm</u>
230/710	Spherical roller bearing bore diameter	<u>710mm</u>
618/850	Single row deep groove ball bearing bore diameter	<u>850mm</u>

c) Bearings having bore diameters that deviate from standard sizes.

Such bore diameters are also indicated directly in millimetres, separated from the bearing base symbol using an oblique slanting line.

This also applies to bearings having bore diameters of 22, 28 and 32 mm.

For other bearings the principle has already been established in identifying the bore size in a direct uncoded manner following the identification symbol of the bearing series.

Examples:

320/22	Tapered roller bearing bore diameter	<u>22mm</u>
608	Single row deep groove ball bearing bore diameter	<u>8mm</u>
62/32	Single row deep groove ball bearing bore diameter	<u>32mm</u>
127	Self aligning ball bearing bore diameter	<u>7mm</u>

d) Certain bearing series

For **Magneto bearings** of the series **E, BO, L** and **M** the bore diameter is given directly in millimetres.

Example:

E17 Magneto bearing
Bore diameter **17mm**

Suffixes

Suffixes are written following the bearings base designation.

They give some information regarding details of bearing design, as far as it deviates from the defined standard.

Suffixes must always be considered in relation to the bearing type used. As an example, the letter "E" will have a completely different meaning according to its bearing type.

Not all suffixes are standardised. Many details, such as details of cage or seals are defined according to the manufacturers' standards.

The following features which may deviate from the standard design will have defined and differing suffixes

- **Internal design**
- **Outer shape or profile**
- **Seals and shields**
- **Design and material of cage**
- **Tolerances and accuracy**
- **Clearance**
- **Heat treatment**
- **Grease filling**

In many cases several suffixes are presented in different combinations.

Examples of Suffixes

Suffixes of Internal Design

Changes or modifications to internal design are identified by suffixes. These suffixes are not standardised and will be used when necessary.

Examples: Suffixes **A, B, C, D, E**

3210B Double row angular contact ball bearing, modified design without filling slots

Suffixes Indicating Boundary Shape

Suffix K

Bearing with tapered bore, taper 1:12
Example: **1207-K**

Suffix K30

Bearing with tapered bore, taper 1:30
Example: **24138-K30**

Suffix Z

Bearing with one shield
Example: **6207-Z**

Suffix -ZZ

Bearing with two shields
Example: **6207-ZZ**

Suffix RS

Bearing with one seal
Example: **6207-RS**

Suffix -2RS

Bearing with two seals
Example: **6207-2RS**

Suffix -2RSR

Bearing with two RSR-seals
Example: **6208-2RSR**

Suffix -2LS

Cylindrical roller bearing with two land riding seals located on its inner ring.
Example: **NNF 5016-2LS-V**

Suffix -2LFS

Bearing with two non-contacting LFS-seals (**LFS = Low Friction Seal**).
Example: **6205-2LFS**

Suffix N

Bearing with a snap ring groove in its outer ring.

Example: **6207-N**

Suffix NR

Bearing with a snap ring groove in its outer ring and fitted with a snap ring.

Example: **6008-NR**

Suffix Z-N

Bearing having a shield on one face side and a snap ring groove in the outer diameter on the opposite face.

Example: **6206-Z-N**

For bearings fitted with seals the suffix is **-RS-N**.

When fitted with two seals or shields:

Examples: **6206-ZZ-N** (e.g. with two shields)
or
6206-2RS-N (e.g. with two seals)

Suffix N2

Bearing having two locating grooves on one side of outer ring or housing washer.

Example: **QJ228-N2**

Suffix R

Bearing with flanged outer ring
Example: **33217-R**

Suffixes of Cage Design

When a cage is the “primary or standard” one fitted within a bearing no cage suffix coding is shown.

Therefore, where designs and materials of cages differ from the standard the bearing designation will have defining suffixes. The following are some suffixes used.

Cage Materials

J Pressed steel cages

pressed steel cages are the standard cage of many bearing types.

Thus pressed steel cages in most cases do not indicate a separate suffix.

M Solid brass cage

F Solid cage made from steel or iron

TV Polyamide cage

Normally polyamide 6.6 with or without glass fibres is used.

Cage Designs

Cage design symbols are normally used in conjunction with the cage material symbols.

P Window-type cage

H Claw-type cage

A Cage guided on the bearing outer ring

B Cage guided on the bearing inner ring

S Cage with lubricating slots in the guiding surfaces.

Examples:

MB Inner ring guided solid brass cage

MPB Inner ring guided solid brass cage, designed as window one piece type.

MAS Outer ring guided solid brass cage with lubricating slots in the guiding surfaces.

Where there are numbers following the cage symbol, these may indicate design variants of that cage type.

Examples:

M6 Roller guided solid brass cage for cylindrical roller bearings, cage body designed with trapezoid-shaped machined rivets.

MA6 Outer ring guided solid brass cage for cylindrical roller bearings, cage body designed with trapezoid-shaped machined rivets.

Bearings without Cages

Under certain circumstances a bearing may be used without cages.

In such cases the bearings are **full complement**.

Full complement bearings are identified by the following suffixes:

V full complement ball or roller bearing

VH full complement cylindrical roller bearing with self retaining roller set.

Tolerance Classes

Rolling element bearings are produced in different **tolerance classes**.

Bearings of the **standard tolerance class PN** fulfil the demands of general machinery in respect to their running and dimensional accuracy.

For special applications that require higher dimensional and geometrical accuracy the bearings can be produced to a higher precision class tolerance (i.e. P6, P5, P4 and P2).

Tolerances for most of the bearing types are standardised according to DIN 620.

For the standardised tolerance classes the following suffixes are used:

PN(P0) Bearings in **standard tolerance**.

As this is the standard the suffix PN is not used in the bearing description, historically the symbol (P0) was used.

- P6** Bearings having closer tolerances than standard bearings
- P5** Tolerances closer than P6
- P4** Tolerances closer than P5
- P2** Tolerances closer than P4

For special applications certain rolling element bearings are also produced with closer tolerances for certain features like radial run-out, side run-out with reference face etc.

Examples of bearings with close tolerances are spherical roller bearings for vibrating screen applications, design suffix **SQ34**.

The particular tolerances of those bearings are as shown in the respective product tables.

Clearance

To adjust the operating clearance of a rolling bearing when it is mounted in an optimum way most bearings are produced in different clearances.

Depending upon the particular bearing type one differentiates between **radial clearance** and **axial clearance**.

For the more common bearing types and sizes values of clearances have been defined in clearance groups according to **DIN 620**.

Clearance groups:

C1 **Smaller** clearance than C2

C2 **Smaller** clearance than CN

CN(C0) Clearance "**Normal**"

As this is the standard the suffix CN is not used in the bearing description, historically the symbol (C0) was used.

C3 Clearance **larger** than CN

C4 Clearance **larger** than C3

C5 Clearance **larger** than C4

Special clearance:

Where individual or special clearances are required which are not according to the clearance groups standardised in DIN 620 suffixes are used as part of the bearing description.

Depending upon either "radial" or "axial" clearances the suffixes "R" and "A" are used together with the minimum and maximum values of clearance expressed in microns (μm), each value separated by a "&". The following are typical suffixes used.

R80&150 Special **radial** clearance.
Clearance between 80 and 150 μm

A70&110 Special **axial** clearance
Clearance between 70 and 110 μm

If required the values of a clearance may be controlled within a part of a standard clearance group.

Such a restriction is indicated by a letter (**H**, **M** or **L**) that follows the symbol of the bearing clearance group.

Examples:

C2L Clearance controlled within the **lower half** of clearance group **C2**.

C3M Clearance controlled within the **middle range** of clearance group **C3**.

C4H Clearance controlled within the **upper half** of clearance group **C4**.

Tolerances and Clearance

When bearings have a special tolerance class and a specific clearance both features are combined in one symbol. In such cases the “C” for bearing clearance is omitted. The following are typical suffixes used:

Tolerance class **P6** + clearance **C2** = **P62**
Tolerance class **P5** + clearance **C4** = **P54**

Special Greases

For special operating conditions NKE bearings can also be supplied with special grease fillings according to customer’s specification or with variable grease fill mass than the standard.

To distinguish them from standard bearings these types are identified by different suffixes.

The **NKE designation system** for bearings containing special grease is as follows:



A) Symbol for temperature range of grease:

- LT** Low Temperature grease
- MT** Medium Temperature grease
- HT** High Temperature grease
- LHT** Special grease suitable for Low and High Temperatures

XX) Continual number

B) Symbol for grease fill mass as a % of bearings free space

- A** Filling volume 10% ÷ 15%
- B** 15% ÷ 25% free space of bearing
- Filling volume 25% up to 50% (Standard)

- M** Filling volume 45% up to 60%
- X** Filling volume 70% up to 90% (Bearing is fully filled with grease)
- C** Filling volume according to Individual customers’ specifications

Example: **LHT23**

- LHT** Special grease suitable for Low and High Temperatures
- 23** Continual number
- Standard grease filling mass

Designation System of Metric Tapered Roller Bearings According to DIN ISO 355

In the case of the metric taper roller bearings historically there are two different designation systems in use.

Designations for the series of metric taper roller bearings according to **DIN 616** begin with the number “3” (see also page 234).

According to **DIN ISO 355** the designation system of metric taper roller bearings begins with a “**T**” which stands for **Tapered roller bearing**, followed by a 6-digit combination of letters and numbers (fig. 3.6).

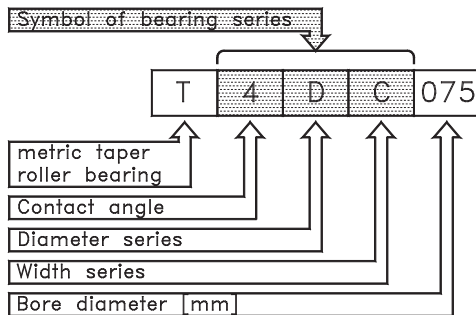


Fig. 3.6

Symbols of contact angle:

Symbol	Contact angle α	
	>	\leq
1	reserved	
2	10°	13°52'
3	13°52'	15°59'
4	15°59'	18°55'
5	18°55'	23°
6	23°	27°
7	27°	30°

Table 3.1

Diameter series:

The diameter series of metric tapered roller bearings is defined by the ratio of their cross section (e.g. the ratio of bore to outer diameter):

Symbol	$\frac{D}{d^{0,77}}$	
	>	\leq
A	reserved	
B	3,4	3,8
C	3,8	4,4
D	4,4	4,7
E	4,7	5,0
F	5,0	5,6
G	5,6	7,0

Table 3.2

Width series:

The width series are also defined by their boundary dimensions:

Symbol	T (D - d)0,95	
	>	\leq
A	reserved	
B	0,50	0,68
C	0,68	0,80
D	0,80	0,88
E	0,88	1,00

Table 3.3

Bore diameter:

In the designation system according **DIN ISO 355** the bore diameter of metric tapered roller bearings are given as their denomination uncoded in millimetres.

Special Quality Requirements

In many applications standard bearings that are in use have been optimised for specific requirements.

Such an adjustment may be actioned by specifying certain features according to the special demands.

Such adjustments are fulfilled by the so-called Special Quality requirements (suffix SQ) which accommodate particular features, defined and required, in a bearing design for certain applications.

Some examples of **NKE Special Quality Requirements** are:

- SQ1** Rolling element bearings used in railway traction motors
- SQ2** Rolling element bearings used in railway axle boxes
- SQ34** Spherical roller bearings for vibrating applications (shaker screens etc.)

Special Bearings

For applications where standard bearings do not perform effectively **special bearings** may be used to meet customer application requirements.

Such special bearings are “tailor-made” to suit these very special demands.

In many cases they do not have much in common with standard bearings.

To prevent these special bearings getting mixed up with standard bearings and to cover the entire range of possible variations, these special bearings have a separate designation system unique to each manufacturer.

The **NKE** designation system for **special bearings** is shown in Fig. 3.7:

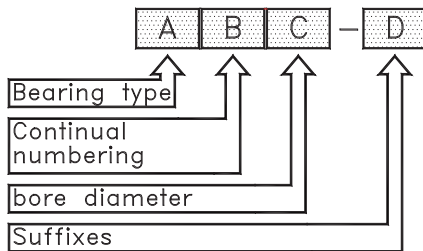


Fig. 3.7

A) Symbol for bearing type:

- CRB** Special cylindrical roller bearing
- DGB** Special deep groove ball bearing
- ACB** Special angular contact ball bearing
- SRB** Special spherical roller bearing
- TRB** Special taper roller bearing
- THB** Special thrust bearing
- SG** Special bearing housing

B) Continual numbering

C) Symbol for bore diameter

As for standard bearings, the bore diameter will be written according to bearing size either as a **bore reference number** (bore diameter in mm divided by 5) or as a direct size in millimetres.

If the bore diameter is written as a direct size (mm), it is separated from the bearings number by an oblique slanting line (/)

D) Suffixes

If required, special bearings may also have suffixes.

Designation System of Accessories and Parts

Adapter and Withdrawal Sleeves

The designations of **adapter and withdrawal sleeves** are combinations of one or more letters followed by several identification numbers for the bearing series they belong to including the size of the sleeves.

The **bore identification number** of an adapter or a withdrawal sleeve always identifies the bore diameter of the bearing the particular sleeve belongs to.

For the identification of the sleeve bore diameter the same system is used as for bearings.

If the bore diameter of such sleeves does not apply in the standard designation system, the nominal dimension of the sleeve bore diameter is written after the base designation, separated by an oblique slanting line.

Large sleeves are frequently used with oil holes and connecting bores for applying the oil injection method during mounting the bearing.

Examples of adapter or withdrawal sleeves:

- H** Metric standard adapter sleeve
- H320** Adapter sleeve for shaft $\varnothing 90$ mm series H3, for $d = \varnothing 100$ mm
- OH** Adapter sleeve with oil grooves for mounting the bearing by oil injection method. In all other features they are identical to standard.

OH31/500

Adapter sleeve with oil grooves,
series OH 31, d = Ø500 mm

AH Metric standard withdrawal sleeve

AH314

Withdrawal sleeve for shaft Ø65 mm,
series AH3, for d = Ø70 mm

AHX Withdrawal sleeve with boundary dimensions
already defined to ISO- standards.

AHX2310

Withdrawal sleeve for shaft Ø45 mm,
series AHX23, for d = Ø50 mm

AOH and **AOHX**

Withdrawal sleeve with oil grooves for
mounting the bearing by oil injection method.
In all other features they are identical to
standard sleeves of the series AH and AHX.

HA and **HE**

Adapter sleeves for inch-sized shaft di-
ameters are for all other features identical to
metric standard adapter sleeves.

Lock Nuts

The designations of **lock nuts** normally begin
with "**KM**" or "**HM**", followed by letters and an
identification number for the size of their thread. This
thread identification number gives, when multiplied
by 5, the nominal thread diameter in millimetres.

The only exception to this is locking nuts of the
series **HM 30** and **HM 31**. For these types the base
designation consists of a four-digit number where
the first two numbers identify the series and the
second two numbers indicate the size of the thread.

For locking nuts with thread diameters larger than
500 mm the nominal thread diameter is written
behind the base designation, separated by an
oblique slanting line.

Examples:

KM Standard lock nut with metric ISO-thread

KM30

Lock nut with metric thread M 150x2.
Outer diameter 195 mm.

KML Lock nut with metric ISO thread; narrower
cross section compared to standard KM
lock nuts.

KML30

Lock nut with thread M 150x2. Outer
diameter 180 mm.

HM

Lock nuts with metric ISO trapezoidal
thread.

HM52-T

Lock nut with trapezoidal thread
Tread 260x4. Outer diameter 330 mm.

HML

Lock nuts with metric ISO trapezoidal
thread; narrower cross section compared
to standard HM-lock nuts.

HML52-T

Lock nut with trapezoidal thread
Thread 260x4. Outer diameter 310 mm.

KMT

Lock nut with metric ISO thread; with grub
screws for axial fixing.

KMT30

Lock nut with grub screws, thread M
150x2.

KMTA

Lock nut with metric ISO thread; with grub
screws for axial fixing. Although KMTA
type lock nuts are similar to KMT type lock
nuts, the KMTA design have a smooth
cylindrical outside diameter

KMTA30

Lock nut with grub screws. Smooth outer
diameter, thread M 150x2.

Locking Washers

For securing lock nuts and to protect them from becoming loose **Locking Washers** are used.

The designations of locking washers begin with “**MB**” or “**MBL**”, followed by the identification number of the size. This identification number gives, multiplied by 5, the nominal bore diameter of the locking washer in millimetres.

- MB** Standard locking washer
- MB30** Standard locking washer for lock nut KM30
- MBL** Locking washer for lock nuts of the KML series, cross section narrower than in case of standard MB type locking nuts.
- MBL30** Locking washer for lock nut KML30

Bearing Sets

In certain application, such as bearings used in machine tool spindles, individual bearings are often combined as bearing sets.

Although this applies mainly to taper roller bearings and angular contact ball bearings, other bearing types like deep groove ball bearings may be paired as sets.

For use in sets the bearings have to be matched or paired carefully.

Bearing sets usually are identified by suffixes indicating the number of single bearings the set consists of and the arrangement of the bearings to each other.

Also the clearance or even the preload of the bearing set is normally stated.

- DB** Set consisting of two single bearings, (single row deep groove ball bearings, angular contact ball bearings or taper roller bearings) matched for mounting in a back-to-back arrangement.
- DF** Two single bearings matched for mounting in a face-to-face arrangement.
- TQO** Two matched double row taper roller bearings.
- QBC** Four single row deep groove ball bearings or angular contact ball bearings, each pair of bearings are arranged in tandem arrangement, for mounting in a back to back arrangement.
- QBT** Set of four single row deep groove ball bearings or angular contact ball bearings, one bearing pair is arranged back to back, this will be combined with the other bearing pair in tandem arrangement.
- TR** Three single row deep groove ball bearings or cylindrical roller bearing matched for equal radial load distribution.
- 2S** Two selected bearings to be used in pairs for equal radial load distribution.

General

As well as the individual type dependent characteristics, all rolling element bearings have several common features which are clearly defined within the ISO, DIN and BSI standards.

Materials

Materials of Rings and Rolling Elements

Rings and rolling elements of NKE standard bearings are made from direct or through-hardening steels according to DIN 17230/ISO 683-17: normal section (**100Cr6**) (SAE 52100), larger bearings or heavier wall sections (**100CrMn6**).

Rolling bearings operating under severe shock loading are made from case hardening steels.

In special cases of prolonged high temperature and hardness retention requirements a variety of **tool steels** are available for rolling bearing manufacture although, the temperatures are usually restricted by the lubrication properties.

For rolling bearings operating in corrosive environments **stainless steels** are used, although this has a markedly lower hardness than the standard and therefore reduced load carrying capacity.

Heat Treatment

NKE rolling element bearings are hardened using the most modern heat treatment facilities. The rings have dimensional stability for standard operating temperatures up to **120°C (248°F)**, also short operating periods of up **150°C (302°F)** are permissible. The normal hardness values for standard heat treated components are:

Rings	58-64 HRC
Rolling elements	58-64 HRC

There is no suffix marking shown on the bearing components having the standard heat treatment (i.e. **SN**)

Constant operating temperatures of more than **+150°C (302°F)**, however, will lead to several metallurgical processes within the bearing steel that cause undesired changes, loss of hardness, dimensional and geometric accuracy.

This is why bearings which operate at constantly higher temperatures than standard require special heat treatment.

NKE produce such stabilised bearings on request. Please see data and designation in table 4.1:

Thermal Stabilisation		
up to max.	Class	Factor f_t^*
120°C (248°F)	SN	1,00
150°C (302°F)	S0	1,00
200°C (392°F)	S1	0,90
250°C (482°F)	S2	0,75
300°C (572°F)	S3	0,60

Table 4.1

Important *)

f_t = temperature reduction factor, see chapter "Selection of bearing type and size", page 255.

Cage Materials

The majority of all rolling bearings are fitted with cages. The standard cages of NKE rolling bearings are carefully selected to meet the individual characteristics of each bearing type and size including the required operating criterion in an optimum way.

Pressed steel cages:

Single or multiple piece pressed steel cages are made from mild steel. The multiple cage designs are riveted or welded together.

As pressed steel cages are "standard" for many bearing types such as deep groove ball bearings or tapered roller bearings, the cage type suffix marking will not appear in the bearing description.

Pressed brass cage:

Used in magneto bearings and some small deep groove ball bearings, pressed brass cages are identified by the suffix Y.

Polyamide cages:

The standard cage for some bearing types due to its optimum shape accuracy and ease of assembly, especially for double-row bearings.

Polyamide cages are often used with a filling of glassfibres to strengthen its mechanical properties. They are designed as snap-type cage or as solid window-type cage.

These cages are injection moulded and often have superior performance due to their reduced weight and design conformance.

They are suitable within the temperature range of **- 40°C up to + 120°C (- 40°F up to + 248°F)**. Polyamide cages are identified by the letter "T", followed by other letters and/or numbers, such as **TVP**, **TV** or **TH** this indicates design or material variants.

Solid metal cages:

These cages are machined from bar, tube, forging and cast material forms. Solid metal cages are used, when

- a very strong cage is required due to special operating conditions, such as heavy vibrations, shock loads etc. In these cases the cages are often guided either on the outer or the inner ring ribs.
- small volumes are produced where it is not economic to make expensive equipment, tooling or moulds for other cage types (e.g. special "bespoke" bearings and large bearings).

Generally, solid metal cages are manufactured in brass; other materials used are bronze, steel, and alloys etc.

The designation for solid metal cages usually contains a letter indicating its material (**M** stands for **brass**, **F** means **steel**, **L** indicates **light metal alloys**,...) and other letters or combinations of letters and figures provide more detailed information with reference to cage type and design. Examples are: **MA**, **MB**, **MPA**, **MPB**, **M6**, **FPA**, etc.

Special cage materials:

In the event of very special operating conditions other cage materials may be used.

Examples are wound fabric resin cages used for high speed spindle bearings and cages made from sintered materials etc.

Materials of Bearing Seals and Shields

Several bearing types are available fitted with either seals or shields. In this way the bearing position is sealed in an effective, efficient and spaces saving design arrangement as the seals or shields are contained within the overall bearing width.

Although the vast majority of bearings offered with seals or shields are ball bearings, there are some types of sealed cylindrical roller or needle roller bearings available.

Bearings that feature shields or seals on both faces are already supplied with a grease fill.

In principle a distinction has to be made between **shields** and **seals**:

Shields (-Z, -2Z)

Shields represent the simplest form of sealing. In the locating grooves, form turned (1) into the outer ring, profiled **shims of steel sheet** (2) are press fitted (see fig. 4.1).

For small bearings or miniature bearings the shields sometimes are fixed using snap rings located beside the shields

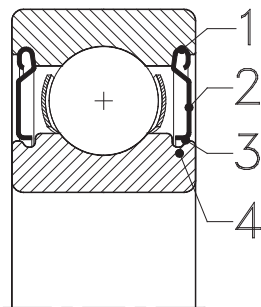


Fig. 4.1

In this way shields (Z-shields) form a simple gap seal (3) against the inner ring shoulder (4). Shields avoid an escape of grease from the bearing and provide some protection against the penetration of dust or larger foreign particles.

Seals

Deep groove ball bearing seals (fig.4.2) usually consist of a flexible material that forms a sealing closure (3). To stiffen the seal, steel washers (2) have been integrated into the rubber compound.

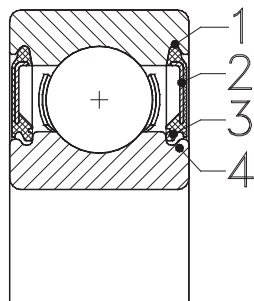


Fig. 4.2

The seals are located in grooves in the outer ring (1); one or more sealing lips are lightly rubbing under certain preload against the contacting inner ring face (4).

This provides excellent sealing and eliminates the penetration of most contamination, foreign particles and water splash.

Due to the rubbing action such seals are also called “**contacting**” or “**rubbing**” seals. Historically, many design variations have been developed.

Some examples are shown in fig. 4.3, complete:

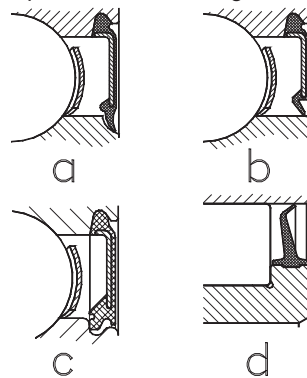


Fig. 4.3

- 4.3a) Contacting ball bearing seal, **RS**-type. The sealing lip touches the inner ring axially.
- 4.3b) Contacting ball bearing seal, **RSR**-type. In this case the sealing lip rubs radially against the ground inner ring shoulder.
- 4.3c) Contacting ball bearing seal, **RS2**-type. The sealing lip touches the inner ring axially.
- 4.3d) The land riding seal of full complement cylindrical roller bearings, type **LS** sits on the inner ring shoulder and runs on the outer ring raceway.

Speed limitation of contacting seals

All **contacting seals** generate additional heat due to the rubbing of their preloaded sealing lips.

This is why the maximum permissible speeds of bearings with contacting seals (suffix **-RS2**, **-RS2**, **-RSR**, **-2RSR** etc.) is limited.

Their maximum speed must not exceed 2/3 of the speed ratings recommended for these bearings whether open or sealed design with grease lubrication.

$$n_{gRS} = \frac{n_{gGrease} * 2}{3} \quad \text{(Eq. 4.1)}$$

where

- n_{gRS} = Speed limit for the bearing, sealed version [rpm]
- $n_{gGrease}$ = Speed limit for the bearing with grease lubrication [rpm]

Non-Contacting Seals

For applications with higher speeds where the sealed bearings are necessary, a special designed seal is available.

This so-called **LFS-seal** (**LFS** stands for **Low Friction Seal**, see fig. 4.4) features two sealing lips, a radial one and another in axial direction (3). The radial seal lip fits into a groove turned in the inner ring (4) and thus forms a non-contacting seal.

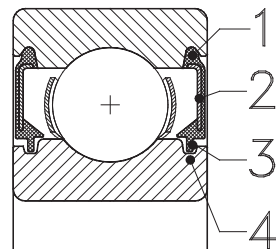


Fig. 4.4

The sealing effectiveness of **LFS**-seals is much better than shields (Z-shields), but less than the contacting seals of types **-RS2**, **-2RS2**, **-RSR**, **-2RSR**.

On the other hand, **LFS-seals** do not generate additional heat.

Thus bearings that are fitted with **LFS**-seals do not have a restriction in operating speed as do the other contacting seals.

Materials of Seals

The standard contacting seals of the types **-RS2**, **-2RS2**, **-RSR**, **-2RSR** etc, including the non-contacting LFS seals are produced using a synthetic rubber compound (Nitrile-Butadien-Rubber, in short **NBR**).

Integrated steel washers increase the seals rigidity. **NBR** is the standard material for all NKE bearings fitted with seals, therefore, suffix marking is unnecessary.

Standard seals made from synthetic **NBR** rubber are suitable for operating temperatures from **-30°C** up to **+120°C** (**-22°F** up to **+248°F**).

For special applications, however, seals are also available in other materials.

Some examples are listed in the table below:

Seal material		Temperature - range ¹⁾	
Symbol	Material	>	≤
NBR	Nitrile-Butadien-rubber	-30°C (-22°F)	+120°C (+248°F)
ACM	Acrylic rubber	-20°C (-4°F)	+150°C (+302°F)
MVQ	Silicon rubber	-60°C (-76°F)	+180°C (+356°F)
FPM	Flour rubber	-30°C (-22°F)	+200°C (+392°F)

Table 4.2

¹⁾ Values for guidance only. The temperature range may vary according to the individual material composition.

Grease Filling

NKE rolling bearings with seals or shields on both sides (suffixes **-2Z**, **-2RS2**, **-2RSR** or **-2LFS**) are already supplied grease filled.

The normal grease-fill is approximately 25% to 50% of the bearings cavities.

As standard grease NKE uses:

- Single deep groove ball bearings with inner diameter up to 60mm: NKE lithium soap LHT23, Di-Esteröl, NLGI class2

This grease is qualified for working temperature -50°C (-58°F) to $+150^{\circ}\text{C}$ ($+302^{\circ}\text{F}$). LHT23 is characteristics about low noise level and noise absorbing.

- For larger deep groove ball bearings and sealed angular contact ball bearing, spherical roller bearings, cam rollers and housing bearings: NKE lithium soap MT2, mineral oil NLGI class 3.

This grease is qualified for working temperatures -30°C (-22°F) to $+120^{\circ}\text{C}$ ($+266^{\circ}\text{F}$).

- NKE IKOS integral tapered roller bearings: NKE lithium soap MT32, mineral oil NLGI class 2.

This grease is qualified for working temperature -20°C (-4°F) to $+130^{\circ}\text{C}$ ($+266^{\circ}\text{F}$).

Special grease fillings

For special applications all NKE rolling bearings can also be supplied with different grease types and specific grease filling mass.

To identify these variants from standard greased bearings, they have different designations.

The **NKE designation system** for rolling element bearings with special greasing consists of following symbols:

Boundary Dimensions of Rolling Bearings

The boundary dimensions for all standard bearings are standardised and comply with the relevant national and international standards (i.e. ISO, DIN, BS...)

This ensures that standard rolling bearings are internationally interchangeable.

The **standard plans** defined in the above provide boundary dimensions for the different bearing types. The standardised dimensions like **bore diameter (d)**, **outer diameter (D)**, **bearing width (B)** or **height (H, T)** and **minimum chamfer dimensions (r)** (see also fig. 4.5).

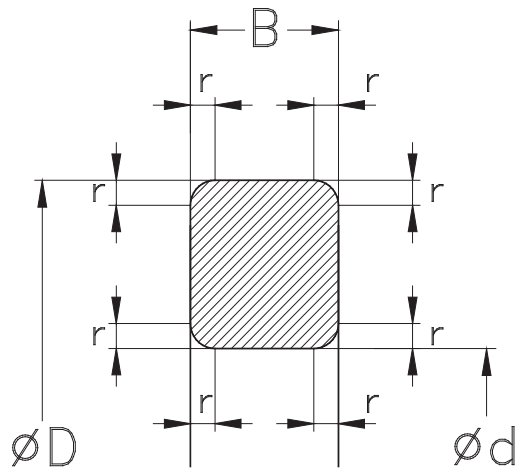


Fig. 4.5

Standard Plans Boundary Dimensions

The standard plans as defined by **ISO**, **BS**, **DIN** standards determine the cross section of the **standard bearings** according to mathematical formula.

In these standard plans for each **bore diameter** several different possible **outer diameters**, **widths** or, in case of thrust bearings, **heights** have been determined.

In this way **diameter series** and **width series** for standard bearings has been defined.

The organisation of standard bearing designations is also based on this.

The **base designation** of a standard bearing, for example, consists of a symbol for each bearing type, the width series and its diameter series, (fig. 4.6).

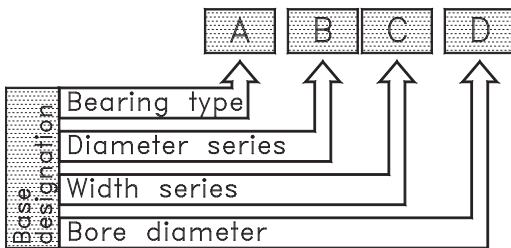


Fig. 4.6

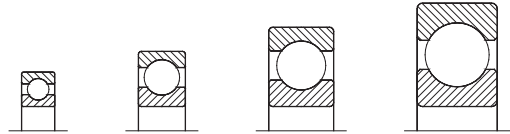
Using this system it is possible to select, for a given shaft diameter, bearings with different cross sections and thus different load ratings. See the example shown in fig. 4.7.

This enables the optimum solution to accommodate the requirements of the machine or equipment, with particular reference to shaft sizes, space utilisation and bearing service life expectations.

Some examples of different width and diameter series are shown below.

Deep groove ball bearings, series

60 62 63 64



Cylindrical roller bearings, NU-type

10 2 22 3 23 4

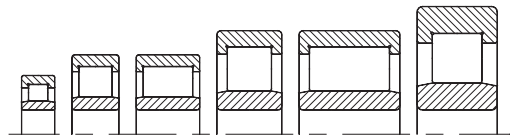


Fig. 4.7

As shown in fig. 4.7 there are also wider width series of cylindrical roller bearings (series **N 22**, **N 23**..).

These wider width series provide higher load ratings but require more space compared to "normal" cylindrical roller bearings, despite the identical shaft and outer diameter sizes.

For more detailed information see section "**Designation System**", page 212.

Fillet Dimensions

To avoid sharp edges and assist in their mounting, bearing rings have profiled corners.

The **fillet dimensions** are defined by the values in **ISO 582** and respectively **DIN 620 / part 6**.

These standards give minimum and maximum values of fillet dimensions both in radial (r_1 , r_3) and axial directions (r_2 , r_4), (fig. 4.8).

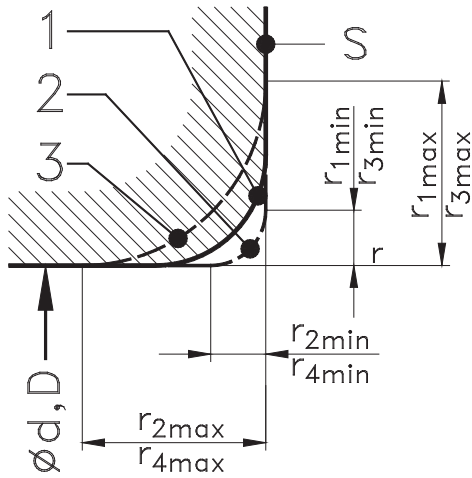


Fig. 4.8

$\varnothing d, D$ bearing bore or outer diameter

S bearing face

r_{1min} smallest single fillet dimension
 r_{3min} in radial direction

r_{2min} smallest single fillet dimension
 r_{4min} in axial direction

r_{1max} largest single fillet dimension
 r_{3max} in radial direction

r_{2max} largest single fillet dimension
 r_{4max} in axial direction

1 real fillet profile

2 profile of smallest permissible fillets

3 profile of largest permissible fillets

Minimum values for fillet dimensions of each individual bearing are stated in the product tables. The maximum values are listed in the following tables:

**Limit Values of Fillet Dimensions for Metric Radial Bearings
(Excluding Tapered Roller Bearings)**

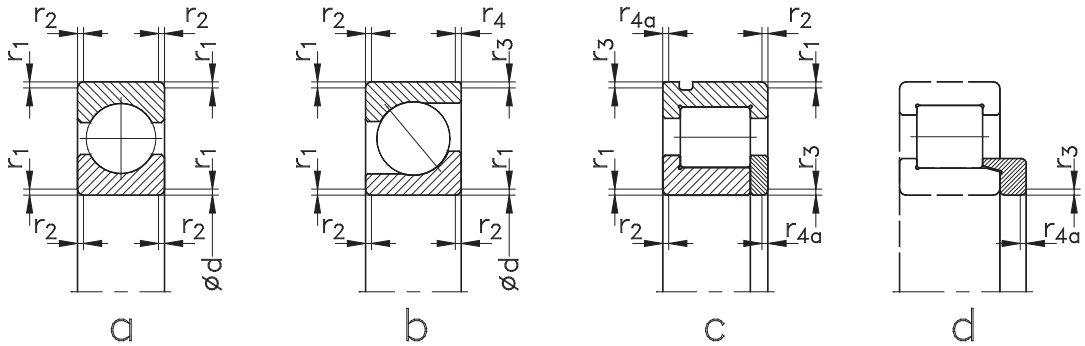


Fig. 4.9

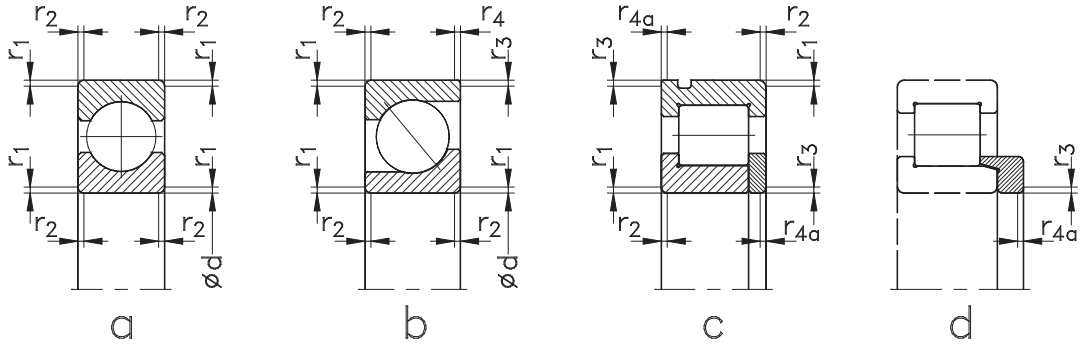
- 4.9 a)** Value of fillet dimensions for **symmetric** bearing sections
- 4.9 b)** Fillet dimensions for **asymmetric** bearing sections
- 4.9 c)** Fillet dimensions for snap ring grooves on outer rings and side plate
- 4.9 d)** Value of fillet dimensions for separate thrust collars
(identical indices mean same nominal values)

Table 4.3: Limit values for fillet dimensions of radial bearings (except tapered roller bearings)

$r_{s \min}$	$\varnothing d, D$		$r_1; r_3$ max	$r_2; r_4^{1)}$ max	r_{4a} max
	$>$	\leq			
0,05	-	-	0,1	0,2	0,1
0,08	-	-	0,16	0,3	0,16
0,1	-	-	0,2	0,4	0,2
0,15	-	-	0,3	0,6	0,3
0,2	-	-	0,5	0,8	0,5
0,3	-	40	0,6	1	0,8
	40	-	0,8	1	0,8
0,5	-	40	1	2	1,5
	40	-	1,3	2	1,5
0,6	-	40	1	2	1,5
	40	-	1,3	2	1,5
1	-	50	1,5	3	2,2
	50	-	1,9	3	2,2
1,1	-	120	2	3,5	2,7
	-	-	2,5	4	2,7

¹⁾ For miniature bearings with widths ≤ 2 mm, the $r_{1\max}$ values apply.

**Limit Values for Fillet Dimensions of Metric Radial Bearings
 (excluding Tapered Roller Bearings)**



Continued from table 4.3:

$r_{s \min}$	$\varnothing d, D$		$r_1; r_3$ max	$r_2; r_4$ max	r_{4a} max
	>	\leq			
1,5	-	120	2,3	4	3,5
	120	-	3	5	3,5
2	-	80	3	4,5	4
	80	220	3,5	5	4
2,1	-	280	4	6,5	4,5
	280	-	4,5	7	4,5
2,5	-	100	3,8	6	5
	100	280	4,5	6	5
3	-	280	5	8	5,5
	-	-	5,5	8	5,5
4	-	-	6,5	9	6,5
5	-	-	8	10	8
6	-	-	10	13	10
7,5	-	-	12,5	17	12,5
9,5	-	-	15	19	15
12	-	-	18	24	18
15	-	-	21	30	21
19	-	-	25	38	25

**Limit Values for the Fillet Dimensions
of Metric Tapered Roller Bearings**

$r_{s \min}$	$\varnothing d, D$		$r_1; r_3$ max	$r_2; r_4$ max
	>	\leq		
0,3	-	40	0,7	1,4
	40	-	0,9	1,6
0,6	-	40	1,1	1,7
	40	-	1,3	2
1	-	50	1,6	2,5
	50	-	1,9	3
1,5	-	120	2,3	3
	120	250	2,8	3,5
	250	-	3,5	4
2	-	120	2,8	4
	120	250	3,5	4,5
	250	-	4	5
2,5	-	120	3,5	5
	120	250	4	5,5
	250	-	4,5	6
3	-	120	4	5,5
	120	250	4,5	6,5
	250	400	5	7
	400	-	5,5	7,5
4	-	120	5	7
	120	250	5,5	7,5
	250	400	6	8
	400	-	6,5	8,5
5	-	180	6,5	8
	180	-	7,5	9
6	-	180	7,5	10
	-	-	9	11

Table 4.4

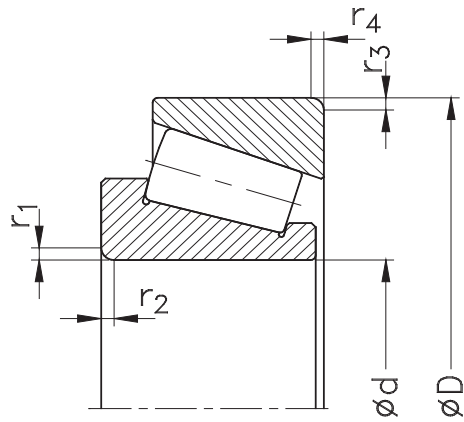


Fig. 4.10

Limit Values for the Fillet Dimensions of Thrust Bearings

$r_{s \text{ min}}$	$r_1; r_2$ max
0,05	0,1
0,08	0,16
0,1	0,2
0,15	0,3
0,2	0,5
0,3	0,8
0,6	1,5
1	2,2
1,1	2,7
1,5	3,5
2	4
2,1	4,5
3	5,5
4	6,5
5	8
6	10
7,5	12,5
9,5	15
12	18
15	21
19	25

Table 4.5

- 4.11a) Single direction thrust ball bearing
- 4.11b) Double direction thrust ball bearing with spheroid housing washers and seating washers + centre washer
- 4.11c) Single direction cylindrical roller thrust bearing
- 4.11d) Spherical roller thrust bearing

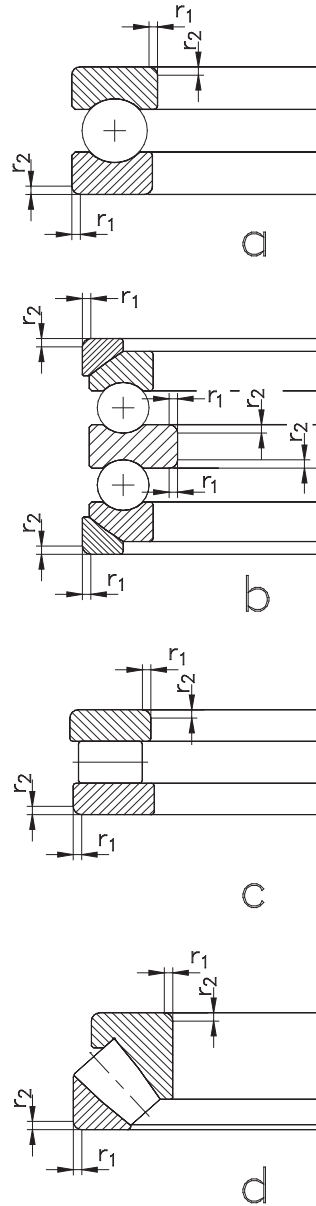


Fig. 4.11

General

The following tables are standardised and defined in the international valid standards DIN ISO 1132 and relevant DIN 620 part 2.

Standard values for tolerances including the symbols used.

Tolerance Symbols Used

Bore Diameter

d	nominal bore diameter
d_s	single bore diameter
d_{mp}	mean bore diameter in one radial plane
d_{ps max}	largest bore diameter in one radial plane
d_{ps min}	smallest bore diameter in one radial plane
Δ_{dmp}	d_{mp} - d deviation of mean bore diameter from nominal
Δ_{ds}	d_s - d deviation of a single bore diameter from nominal
Δ_{d1mp}	d_{1mp} - d_i deviation of mean bore diameter from nominal, in the case of tapered bores at the large theoretical bore diameter
V_{dp}	d_{ps max} - d_{ps min} variation of bore diameter in one radial plane
V_{dmp}	d_{mp max} - d_{mp min} variation of mean bore diameter; difference between largest and smallest mean bore diameter

Outer Diameter

D	nominal outer diameter
D_s	single outer diameter
D_{mp}	mean outer diameter in one radial plane
D_{ps max}	largest outer diameter in one radial plane
D_{ps min}	smallest outer diameter in one radial plane
Δ_{Dmp}	D_{mp} - D deviation of mean outer diameter from nominal
Δ_{Ds}	D_s - D deviation of a single outer diameter from nominal
V_{Dp}	D_{ps max} - D_{ps min} variation of outer diameter in one radial plane
V_{Dmp}	D_{mp max} - D_{mp min} variation of mean outer diameter; difference between largest and smallest mean outer diameter

Width and Height

B	nominal inner ring width
C	nominal outer ring width
B_s	single width of inner ring
C_s	single width of outer ring
Δ_{Bs}	B_s - B deviation of a single inner ring ring width from nominal
Δ_{Cs}	C_s - C deviation of a single outer ring width from nominal
V_{Bs}	B_{smax} - B_{smin} variation of inner ring width
V_{Cs}	C_{smax} - C_{smin} variation of outer ring width
T	nominal total height of tapered roller bearings
T_s	single height of a tapered roller bearing
T_{1s}	single height of a tapered roller bearing cone assembled with master cup
T_{2s}	single height of a tapered roller bearing cup assembled with master cone
ΔT_s	T_s - T, ΔT_{1s} = T_{1s} - T₁, ΔT_{2s} = T_{2s} - T₂ deviation of a single width of a tapered roller bearing from nominal
H_s, H_{1s}, H_{2s}, H_{3s}, H_{4s}	single height of a thrust bearing
ΔH_s	H_s - H, ΔH_{1s} = H_{1s} - H₁, ΔH_{2s} = H_{2s} - H₂ deviation of a single bearing height of a thrust bearing from nominal

Running Accuracy

K_{ia}	radial run out of inner ring within assembled bearing
K_{ea}	radial run out of outer ring within assembled bearing
S_d	side face run out of inner ring side face to bearing bore
S_D	outside inclination variation; variation in inclination of the outside of cylindrical surface to outer ring side face
S_{ia}	side face run out of radial bearings
S_{ea}	side faces run out of radial bearings
S_i	thickness variation of the shaft washer for thrust bearings, raceway to outside or back face
S_e	thickness variation of the housing washer for thrust bearings, raceway to outside or back face

Tolerances for NKE radial bearings (excluding tapered roller bearings)

Inner ring

All dimensions shown in [mm]

Nominal	over	2,5	10	18	30	50	80	120	180	250	315	400	500	630	800	1000	1250	1600
bore diameter	incl.	10	18	30	50	80	120	180	250	315	400	500	630	800	1000	1250	1600	2000

Tolerance class PN (normal)

Tolerances in [µm]

Bore, deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-8	-8	-10	-12	-15	-20	-25	-30	-35	-40	-45	-50	-75	-100	-125	-160	-200	
Variation V_{dp}	Diameter series 7, 8, 9	10	10	13	15	19	25	31	38	44	50	56	63						
	0, 1	8	8	10	12	19	25	31	38	44	50	56	63						
	2, 3, 4	6	6	8	9	11	15	19	23	26	30	34	38						
Variation Bore, taper 1:12 Deviation	V_{dmp}	6	6	8	9	11	15	19	23	26	30	34	38						
	Δ_{dmp}	+15	+18	+21	+25	+30	+35	+40	+46	+52	+57	+63	+70	+80	+90	+105	+125	+150	0
Deviation	Δ_{d1mp-}	+15	+18	+21	+25	+30	+35	+40	+46	+52	+57	+63	+70	+80	+90	+105	+125	+150	0
	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variation	V_{dp}	10	10	13	15	19	25	31	38	44	50	56							
Bore, taper 1:30 Deviation	Δ_{dmp}					+15	+20	+25	+30	+35	+40	+45	+50	+75	+100	+125	+160	+200	0
	Δ_{d1mp-}					+35	+40	+50	+55	+60	+65	+75	+85	+100	+100	+115	+125	+150	0
Deviation	Δ_{dmp}					0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variation	V_{dp}					19	25	31	38	44	50	56	63						
Ring width deviation	Δ_{Bs}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-120	-120	-120	-120	-150	-200	-250	-300	-350	-400	-450	-500	-750	-1000	-1250	-1600	-2000	
Ring width Variation	V_{Bs}	15	20	20	20	25	25	30	30	35	40	50	60	70	80	100	120	140	
Radial run out	K_{ra}	10	10	13	15	20	25	30	40	50	60	65	70	80	90	100	120	140	

Tolerance class P6

Tolerances in [µm]

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-7	-7	-8	-10	-12	-15	-18	-22	-25	-30	-35	-40	-50	-60	-75	-90	-115	
Variation V_{dp}	Diameter series 7, 8, 9	9	9	10	13	15	19	23	28	31	38	44	50						
	0, 1	7	7	8	10	15	19	23	28	31	38	44	50						
	2, 3, 4	5	5	6	8	9	11	14	17	19	23	26	30						
Variation	V_{dmp}	5	5	6	8	9	11	14	17	19	23	26	30						
Ring width deviation	Δ_{Bs}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-120	-120	-120	-120	-150	-200	-250	-300	-350	-400	-450	-500	-750	-1000	-1250	-1600	-2000	
Ring width variation	V_{Bs}	15	20	20	20	25	25	30	30	35	40	45	50	55	60	70	70	80	
Radial run out	K_{ra}	6	7	8	10	10	13	18	20	25	30	35	40	45	50	60	70	80	

Tolerances for NKE radial bearings (excluding tapered roller bearings)

Outer ring

All dimensions shown in [mm]

Nominal outer diameter	over incl.	6 18	18 30	30 50	50 80	80 120	120 150	150 180	180 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250	1250 1600	1600 2000	2000 2500
------------------------	---------------	---------	----------	----------	----------	-----------	------------	------------	------------	------------	------------	------------	------------	------------	-------------	--------------	--------------	--------------	--------------

Tolerance class PN (normal)

Tolerances in [µm]

Deviation	$\Delta_{Dmp}^{1)}$	0 -8	0 -9	0 -11	0 -13	0 -15	0 -18	0 -25	0 -30	0 -35	0 -40	0 -45	0 -50	0 -75	0 -100	0 -125	0 -160	0 -200	0 -250
Variation V_{Dp}	Diameter series 7, 8, 9	10	12	14	16	19	23	31	38	44	50	56	63	94	125				
	0, 1	8	9	11	13	19	23	31	38	44	50	56	63	94	125				
	2, 3, 4	6	7	8	10	11	14	19	23	26	30	34	38	55	75				
	sealed bearings 2, 3, 4	10	12	16	20	26	30	38											
Variation	V_{Dmp}	6	7	8	10	11	14	19	23	26	30	34	38	55	75				
Radial run out	K_{ea}	15	15	20	25	35	40	45	50	60	70	80	100	120	140	160	190	220	250

¹⁾ The deviation Δ_{Dmp} for all Magneto bearings is uniform 0 / +10 µm
The width tolerances Δ_{Cs} and V_{Cs} are identical to Δ_{Bs} and V_{Bs} of the inner ring of the same bearing.

Tolerance class P6

Tolerances in [µm]

Deviation	Δ_{Dmp}	0 -7	0 -8	0 -9	0 -11	0 -13	0 -15	0 -18	0 -20	0 -25	0 -28	0 -33	0 -38	0 -45	0 -60	0 -75	0 -90	0 -115	0 -135
Variation V_{op}	Diameter series 7, 8, 9	9	10	11	14	16	19	23	25	31	35	41	48	56	75				
	0, 1	7	8	9	11	16	19	23	25	31	35	41	48	56	75				
	2, 3, 4	5	6	7	8	10	11	14	15	19	21	25	29	34	45				
	sealed bearings 0,1,2, 3, 4	9	10	13	16	20	25	30											
Variation	V_{Dmp}	5	6	7	8	10	11	14	15	19	21	25	29	34	45				
Radial run out	K_{ea}	8	9	10	13	18	20	23	25	30	35	40	50	60	75	85	100	100	120

The width tolerances Δ_{Cs} and V_{Cs} are identical to Δ_{Bs} and V_{Bs} of the inner ring of the same bearing.

Tolerances for NKE radial bearings (excluding tapered roller bearings)

Inner ring

All dimensions shown in [mm]

Tolerances in [μm]

Nominal bore diameter	over incl.	2,5	10	18	30	50	80	120	180	250	315	400	500	630	800	1000	1250	1600
		10	18	30	50	80	120	180	250	315	400	500	630	800	1000	1250	1600	2000

Tolerance class P5

Tolerances in [μm]

Deviation Δ_{dmp}		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-5	-5	-6	-8	-9	-10	-13	-15	-18	-23	-28	-35	-45	-60	-75	-90	-115
Variation V_{dp}	Diameter series 7, 8, 9	5	5	6	8	9	10	13	15	18	23							
	0, 1, 2, 3, 4	4	4	5	6	7	8	10	12	14	18							
Variation V_{dmp}		3	3	3	4	5	5	7	8	9	12							
Ring width deviation Δ_{Bs}		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-40	-80	-120	-120	-150	-200	-250	-300	-350	-400	-450	-500	-750	-1000	-1250	-1600	-2000
Ring width variation V_{Bs}		5	5	5	5	6	7	8	10	13	15	17	20	26	32	38	45	55
Radial run out K_{ia}		4	4	4	5	5	6	8	10	13	15	17	19	22	26	30	35	40
side face runout S_{d}		7	7	8	8	8	9	10	11	13	15	17	20	26	32	38	45	55
side face runout S_{ia}		7	7	8	8	8	9	10	13	15	20	23	25	30	30	30	30	30

¹⁾ The values of side face run out S_{ia} apply to deep groove ball bearings

Tolerances for NKE radial bearings (excluding tapered roller bearings)

Outer ring

All dimensions shown in [mm]

Nominal outer diameter	over	6	18	30	50	80	120	150	180	250	315	400	500	630	800	1000	1250	1600	2000
	incl.	18	30	50	80	120	150	180	250	315	400	500	630	800	1000	1250	1600	2000	2500

Tolerance class P5

Tolerances in [µm]

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-5	-6	-7	-9	-10	-11	-13	-15	-18	-20	-23	-28	-35	-50	-63	-80	-100	-125
Variation	Diameter series 7, 8, 9	5	6	7	9	10	11	13	15	18	20	23	28	35					
V_{Dp}		0, 1, 2, 3, 4	4	5	5	7	8	8	10	11	14	15	17	21	26				
Variation	V_{Dmp}	3	3	4	5	5	6	7	8	9	10	12	14	18					
Ring width variation	V_{Cs}	5	5	5	6	8	8	8	10	11	13	15	18	20	25	30	35	38	45
Radial run out	K_{ea}	5	6	7	8	10	11	13	15	18	20	23	25	30	35	40	45	55	65
Outside inclination variation	S_D	8	8	8	8	9	10	10	11	13	13	15	18	20	25	30	35	40	50
Side face run out	$S_{ea}^{1)}$	8	8	8	10	11	13	14	15	18	20	23	25	30	35	45	55	55	55

¹⁾ The values of side face run out S_{ea} apply to deep groove ball bearings
The width tolerance Δ_{Cs} is identical to Δ_{Bs} of the inner ring of the same bearing.

Tolerances for metric NKE tapered roller bearings

Inner ring

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter	over incl.	10	18	30	50	80	120	180	250	315	400	500	630	800
		18	30	50	80	120	180	250	315	400	500	630	800	1000

Tolerance class PN (normal)

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0
		-12	-12	-12	-15	-20	-25	-30	-35	-40	-45	-50	-75	-100
Variation	V_{dp}	12	12	12	15	20	25	30	35	40	45	50	75	100
	V_{dmp}	9	9	9	11	15	19	23	26	30				
Ring width deviation	Δ_{Bs}	0	0	0	0	0	0	0	0	0	0	0	0	0
		-120	-120	-120	-150	-200	-250	-300	-350	-400	-450	-500	-750	-1000
Radial run out	K_{α}	15	18	20	25	30	35	50	60	70	70	85	100	120
Ring width variation	Δ_{Ts}	+200	+200	+200	+200	+200	+350	+350	+350	+400	+400	+500	+600	+750
		0	0	0	0	-200	-250	-250	-250	-400	-400	-500	-600	-750
	Δ_{T1s}	+100	+100	+100	+100	+100	+150	+150	+150	+200				
		0	0	0	0	-100	-150	-150	-150	-200				
	Δ_{T2s}	+100	+100	+100	+100	+100	+200	+200	+200	+200				
		0	0	0	0	-100	-100	-100	-100	-200				

Tolerance class P6X

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0				
		-12	-12	-12	-15	-20	-25	-30	-35	-40				
Variation	V_{dp}	12	12	12	15	20	25	30	35	40				
	V_{dmp}	9	9	9	11	15	19	23	26	30				
Ring width deviation	Δ_{Bs}	0	0	0	0	0	0	0	0	0				
		-50	-50	-50	-50	-50	-50	-50	-50	-50				
Radial run out	K_{α}	15	18	20	25	30	35	50	60	70				
Ring width variation	Δ_{Ts}	+100	+100	+100	+100	+100	+150	+150	+200	+200				
		0	0	0	0	0	0	0	0	0				
	Δ_{T1s}	+50	+50	+50	+50	+50	+50	+50	+100	+100				
		0	0	0	0	0	0	0	0	0				
	Δ_{T2s}	+50	+50	+50	+50	+50	+100	+100	+100	+100				
		0	0	0	0	0	0	0	0	0				

Tolerances for metric NKE tapered roller bearings

Outer ring

All dimensions shown in [mm]
Tolerances in [μm]

Nominal	over	18	30	50	80	120	150	180	250	315	400	500	630	800	1000
outer diameter	incl.	30	50	80	120	150	180	250	315	400	500	630	800	1000	1250

Tolerance class PN (normal)

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-12	-14	-16	-18	-20	-25	-30	-35	-40	-45	-50	-75	-100	-125
Variation	V_{Dp}	12	14	16	18	20	25	30	35	40	45	50	75	100	125
	V_{Dmp}	9	11	12	14	15	19	23	26	30	34	38			
Radial run out	K_{ba}	18	20	25	35	40	45	50	60	70	80	100	120	120	120

The width tolerance Δ_{Cs} is identical to Δ_{Bs} of the inner ring of the same bearing.

Tolerance class P6X

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0				
		-12	-14	-16	-18	-20	-25	-30	-35	-40	-45	-50			
Variation	V_{Dp}	12	14	16	18	20	25	30	35	40	45	50			
	V_{Dmp}	9	11	12	14	15	19	23	26	30	34	38			
Ring width deviation	Δ_{Cs}	0	0	0	0	0	0	0	0	0	0				
		-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100			
Radial run out	K_{ba}	18	20	25	35	40	45	50	60	70	80	100			

The width tolerance Δ_{Cs} is identical to Δ_{Bs} of the inner ring of the same bearing.

Tolerances for metric NKE tapered roller bearings

Inner ring

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter	over incl.	10	18	30	50	80	120	180	250	315	400	500	630
		18	30	50	80	120	180	250	315	400	500	630	800

Tolerance class P5

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0
		-7	-8	-10	-12	-15	-18	-22	-25	-30	-35	-40	-75
Variation	V_{dp}	5	6	8	9	11	14	17					
	V_{dmp}	5	5	5	6	8	9	11					
Ring width deviation	Δ_{Bs}	0	0	0	0	0	0	0					
		-200	-200	-240	-300	-400	-500	-600					
Radial run out	K_{ra}	5	5	6	7	8	11	13					
Side face run out	S_{d}	7	8	8	8	9	10	11	13	15	17	20	30
Ring width deviation	Δ_{Ts}	+200	+200	+200	+200	+200	+350	+350	+350	+400	+400	+500	+600
		-200	-200	-200	-200	-200	-250	-250	-250	-400	-400	-500	-600

Tolerances for metric NKE tapered roller bearings

Outer ring

All dimensions shown in [mm]

Tolerances in [μm]

Nominal	over	18	30	50	80	120	150	180	250	315	400	500	630	800
outer diameter	incl.	30	50	80	120	150	180	250	315	400	500	630	800	1000

Tolerance class P5

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0
		-8	-9	-11	-13	-15	-18	-20	-25	-28	-33	-38	-45	-60
Variation	V_{Dp}	6	7	8	10	11	14	15	19	22				
	V_{Dmp}	5	5	6	7	8	9	10	13	14				
Radial run out	K_{ra}	6	7	8	10	11	13	15	18	20	23	25	30	35
Outsideinclination variation deviation	S_D	8	8	8	9	10	10	11	13	13	15	18	20	30

The width tolerance Δ_{Cs} is identical to Δ_{Bs} of the inner ring of the same bearing.

Tolerances for NKE inch-sized tapered roller bearings

Inner ring

All dimensions in [mm]

Nominal bore diameter	over Incl.	-- 76,2	76,2 266,7	266,7 304,8	304,8 609,6	609,6 914,4
-----------------------	------------	------------	---------------	----------------	----------------	----------------

Tolerance class 4 (Normal)

tolerance n μm

Deviation	Δ_{ds}	+13 0	+25 0	+25 0	+51 0	+76 0
Ring width deviation	Δ_{Bs}	+76 -254	+76 -254	+76 -254	+76 -254	+76 -254

Tolerance class 2

Deviation	Δ_{ds}	+13 0	+25 0	+25 0	+51 0	+76 0
Ring width deviation	Δ_{Bs}	+76 -254	+76 -254	+76 -254	+76 -254	-- --

Tolerance class 3

Tolerance class 2						
Deviation	Δ_{ds}	+13 0	+13 0	+13 0	+25 0	+38 0
Ring width deviation	Δ_{Bs}	+76 -254	+76 -254	+76 -254	+76 -254	+76 -254

Overall width of the bearing, single row

Nominal bore diameter	over Incl.	-- 101,6	101,6 266,7	266,7 304,8	304,8 609,6	304,8 609,6	609,6 --
Nominal outer diameter	over Incl.	-- --	-- --	-- --	-- 508	508 --	-- --

Width deviation	Class 4	+203 0	+356 -254	+356 -254	+381 -381	+381 -381	+381 -381
		Class 2	+203 0	+203 0	+203 0	+381 -381	-- --
	Class 3	+203 -203	+203 -203	+203 -203	+203 -203	+381 -381	+381 -381

Tolerances for NKE inch-sized tapered roller bearings

Outer ring

All dimensions in [mm]

Nominal	over	--	266,7	304,8	609,6	914,4	1219,2
outer diameter	incl.	266,7	304,8	609,6	914,4	1219,2	--

Tolerance class 4 (Normal)

tolerance in μm

Deviation	Δ_{Ds}	+25 0	+25 0	+51 0	+76 0	+102 0	+127 0
Ring width deviation	Δ_{Cs}	+51 -254	+51 -254	+51 -254	+51 -254	+51 -254	+51 -254

Tolerance class 2

Deviation	Δ_{Ds}	+25 0	+25 0	+51 0	+76 0	-- --	-- --
Ring width deviation	Δ_{Cs}	+51 -254	+51 -254	+51 -254	+51 -254	-- --	-- --

Tolerance class 3

Deviation	Δ_{Ds}	+13 0	+13 0	+25 0	+38 0	+51 0	+76 0
Ring width deviation	Δ_{Cs}	+51 -254	+51 -254	+51 -254	+51 -254	+51 -254	+51 -254

Tolerances for NKE thrust bearings

Shaft washer

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter	over incl.	-	18	30	50	80	120	180	250	315	400	500	630	800	1000
		18	30	50	80	120	180	250	315	400	500	630	800	1000	1250

Tolerance class PN (normal)

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-8	-10	-12	-15	-20	-25	-30	-35	-40	-45	50	-75	-100	-125
Variation	V_{dp}	6	8	9	11	15	19	23	26	30	34	38			
Thickness variation	S_i *)	10	10	10	10	15	15	20	25	30	30	35	40	45	50
Seating washer Deviation	Δ_{du}	+70	+70	+85	+100	+120	+140	+140	+160	+180	+180				
		0	0	0	0	0	0	0	0	0	0				

Tolerance class P6

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-8	-10	-12	-15	-20	-25	-30	-35	-40	-45	-50	-75	-100	-125
Variation	V_{dp}	6	8	9	11	15	19	23	26	30	34	38			
Thickness variation	S_i *)	5	5	6	7	8	9	10	13	15	18	21	25	30	35

Tolerance class P5

Deviation	Δ_{dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-8	-10	-12	-15	-20	-25	-30	-35	-40	-45	-50	-75	-100	-125
Variation	V_{dp}	6	8	9	11	15	19	23	26	30	34	38			
Thickness variation	S_i *)	3	3	3	4	4	5	5	7	7	9	11	13	15	18

*) The values for thickness variation S_i of shaft washers also apply to housing washers

Tolerances for NKE thrust bearings

Housing washer

All dimensions shown in [mm]

Tolerances in [μm]

Nominal	over	-	30	50	80	120	180	250	315	400	500	630	800	1000	1250
outer diameter	incl.	30	50	80	120	180	250	315	400	500	630	800	1000	1250	1600

Tolerance class PN (normal)

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-13	-16	-19	-22	-25	-30	-35	-40	-45	-50	-75	-100	-125	-160
Variation	V_{Dp}	10	12	14	17	19	23	26	30	34	38	55	75		
Seating washer Deviation	Δ_{Du}	0	0	0	0	0	0	0	0	0					
		-30	-35	-45	-60	-75	-90	-105	-120	-135	-180				

Tolerance class P6

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-13	-16	-19	-22	-25	-30	-35	-40	-45	-50	-75	-100	-125	-160
Variation	V_{Dp}	10	12	14	17	19	23	26	30	34	38	55	75		

Tolerance class P5

Deviation	Δ_{Dmp}	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		-13	-16	-19	-22	-25	-30	-35	-40	-45	-50	-75	-100	-125	-160
Variation	V_{Dp}	10	12	14	17	19	23	26	30	34	38	55	75		

Tolerances for bearing heights of NKE thrust bearings

Values apply to tolerance classes PN (normal), P6, P5

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter	over incl.	- 30	30 50	50 80	80 120	120 180	180 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250
Deviation	Δ_{Hs}	+20	+20	+20	+25	+25	+30	+40	+40	+50	+60	+70	+80	+100
		-250	-250	-300	-300	-400	-400	-400	-500	-500	-600	-750	-1000	-1400
	Δ_{H1s}	+100	+100	+100	+150	+150	+150	+200	+200	+300	+350	+400	+450	+500
		-250	-250	-300	-300	-400	-400	-400	-500	-500	-600	-750	-1000	-1400
	Δ_{H2s}	+150	+150	+150	+200	+200	+250	+350	+350	+400	+500	+600	+700	+900
		-400	-400	-500	-500	-600	-600	-700	-700	-900	-1100	-1300	-1500	-1800
	Δ_{H3s}	+300	+300	+300	+400	+400	+500	+600	+600	+750	+900	+1100	+1300	+1600
		-400	-400	-500	-500	-600	-600	-700	-700	-900	-1100	-1300	-1500	-1800
	Δ_{H4s}	+20	+20	+20	+25	+25	+30	+40	+40	+50	+60	+70	+80	+100
		-300	-300	-400	-400	-500	-500	-700	-700	-900	-1200	-1400	-1800	-2400

See fig. 5.1:

- a) Thrust ball bearing, single direction
- b) Thrust ball bearing, single direction with spheroid housing washer and seating washer
- c) Thrust ball bearing, double direction, with centre washer
- d) Thrust ball bearing, double direction with spheroid housing washers, seating washers and centre washer
- e) Cylindrical roller thrust bearing, single direction
- f) Cylindrical roller thrust bearing, double direction
- g) Spherical roller thrust bearing

Bearing heights of NKE thrust bearings

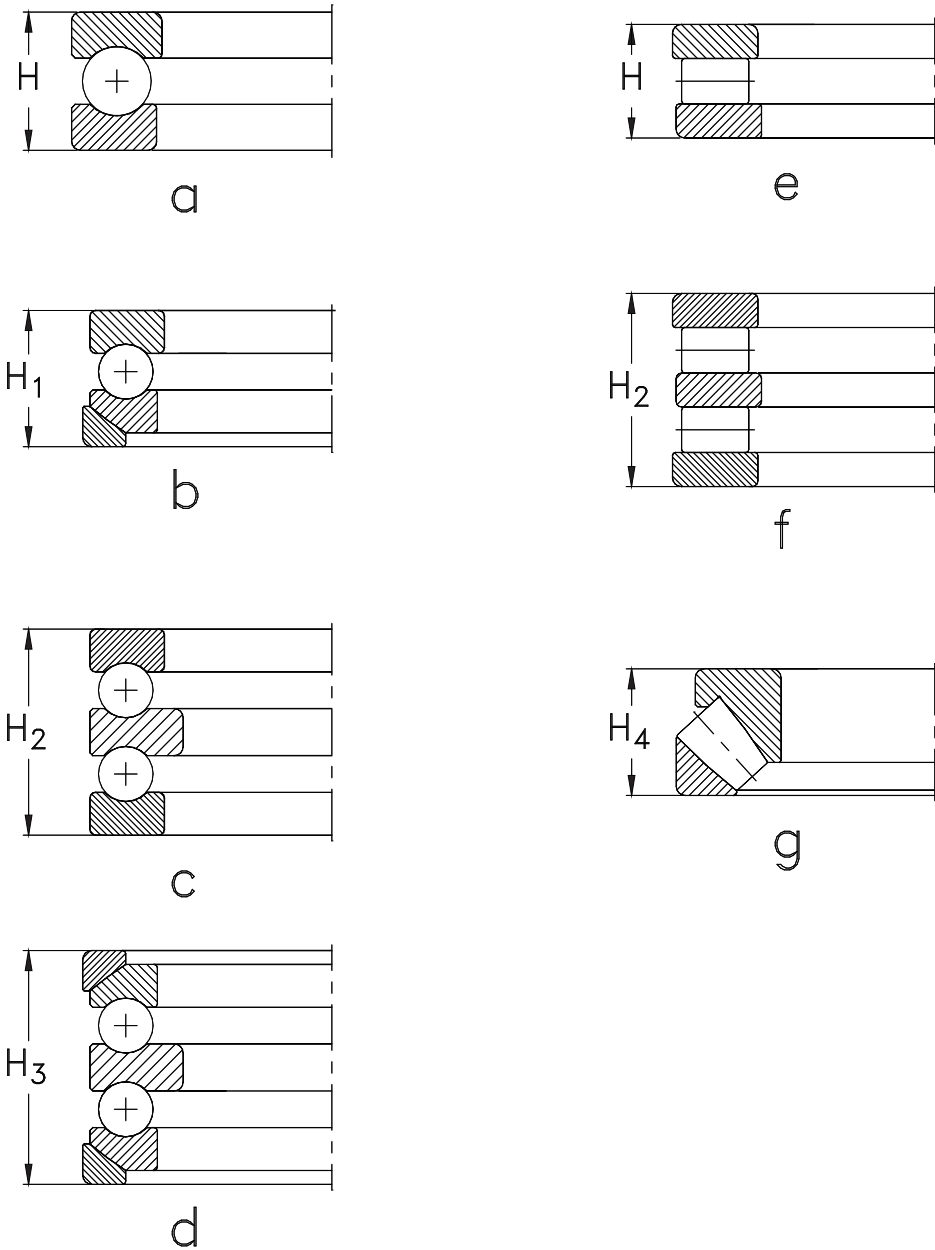


Fig. 5.1

Tolerances for tapered bearing bores

For definitions (see fig.5.2)

Tapered bore, taper 1:12

Half angle of taper 1:12: $\alpha = 2^{\circ}23'9,4''$
Theoretical large diameter d_1 for taper 1:12

$$d_1 = d + \frac{B}{12} \tag{Eq. 5.1}$$

Values for tolerance classes PN (normal) and P6

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter [mm]	over incl.	18	30	50	80	120	180	250	315	400	500	630	800	1000
		30	50	80	120	180	250	315	400	500	630	800	1000	1250
Deviation Δ_{dmp}		+21 0	+25 0	+30 0	+35 0	+40 0	+46 0	+52 0	+57 0	+63 0	+70 0	+80 0	+90 0	+105 0
Deviation $\Delta_{d1mp} - \Delta_{dmp}$		+21 0	+25 0	+30 0	+35 0	+40 0	+46 0	+52 0	+57 0	+63 0	+70 0	+80 0	+90 0	+105 0
Deviation V_{dp}		13	15	19	25	31	38	44	50	56	-	-	-	-
		13	15	19	25	31	38	44	50	56	-	-	-	-

Tapered bore, taper 1:30

Half angle of taper 1:30 $\alpha = 0^{\circ}57'17,4''$

Theoretical large diameter d_1 for taper 1:30

$$d_1 = d + \frac{B}{30} \tag{Eq. 5.2}$$

Values for tolerance classes PN (normal)

All dimensions shown in [mm]
Tolerances in [μm]

Nominal bore diameter [mm]	over incl.	50	80	120	180	250	315	400	500	630	800	1000
		80	120	180	250	315	400	500	630	800	1000	1250
Deviation Δ_{dmp}		+15 0	+20 0	+25 0	+30 0	+35 0	+40 0	+45 0	+50 0	+75 0	+100 0	+125 0
Deviation $\Delta_{d1mp} - \Delta_{dmp}$		+35 0	+40 0	+50 0	+55 0	+60 0	+65 0	+75 0	+85 0	+100 0	+100 0	+125 0
Deviation V_{dp}		19	25	31	38	44	50	56	63	-	-	-
		19	25	31	38	44	50	56	63	-	-	-

Tolerances for tapered bearing bores

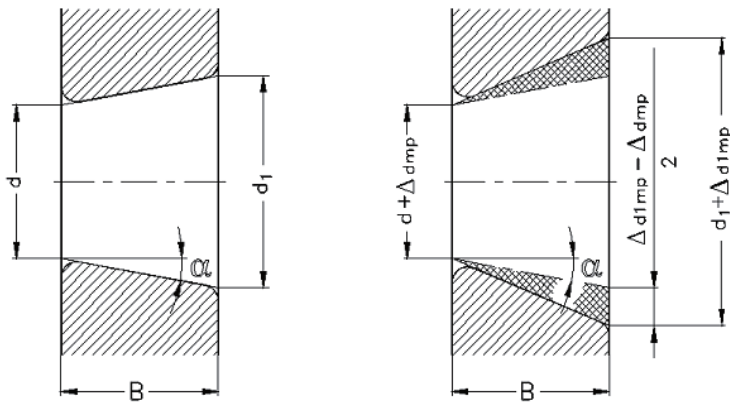


Fig. 5.2

See above fig. 5.2:

- d theoretical small diameter
- d_1 theoretical large diameter
- α half angle of taper
- B bearing width
- Δd_{mp} deviation of mean bore diameter from nominal
- Δd_{1mp} deviation of mean large diameter from nominal at tapered

General

Rolling element bearings are machine elements that satisfy key functions in rotating machines. They transmit forces, moments and rotating motions and guide axles, shafts and machine tool spindles.

The bearing selection has to be made carefully in terms of high reliability, balanced life expectations and economics.

This is why prior to making a bearing determination and calculating its fatigue life for a given application, it is necessary to determine all the important input data and parameters for the specific application.

In many cases experience with common or similar applications and bearing arrangements is available and is a useful guide.

For new applications it is recommended to collect all operational requirements and details and make use of NKE application engineering services.

Basic Considerations

In order to design the optimum bearing arrangement, both technically and economically, the following general aspects have to be considered.

- type of expected loads and moments to select adequate bearing type.
- magnitude and characteristic of the most important parameters that determine the bearing's function and its life.
- interdependence of bearing type, applied loads, operating conditions, maintenance and bearing life expectations.
- impact of professional mounting and lubrication on the flawless function of a rolling bearing.

Detailed Considerations

Size and direction of applied loads

This information is usually stated within the specific machine or application performance data. The initial step for selecting a bearing type is not the load magnitude, but the direction and characteristic of applied loads.

- Is a thrust bearing needed additionally or will a radial bearing fulfill the requirements?
- Is the bearing operated under dynamic load or stationary load only?
- Is the applied force a pure radial or pure thrust load? Or is it a combination of both? If yes what is the ratio of radial to thrust load.
- Does the direction of load change?
- Will vibrations or even shock loads occur?

Available space

At this stage of bearing selection usually the main data of the machine such as shaft diameter, housing dimensions, space etc. have already been set. Thus the available space to accommodate the bearing arrangement within the machine is often determined and is a limiting factor in bearing size selection.

Rigidity, misalignments

- Will misalignments occur due to variations of shaft, housing, manufacturing tolerances, etc.?
- Will deformation of the housing and / or shaft occur under load?
- Does the bearing arrangement require certain rigidity?

Arrangement of shaft and bearing position

- Are the shafts that have to be supported arranged in vertical or horizontal direction?
- Based on the load applied to the bearing what are the necessary shaft and housing fits?

Selection of Bearing Type and Size

- Where should the locating and the non-locating bearing be positioned?
- Does the proposed bearing arrangement require adjustment or preloading?
- Will the bearing require a special lubrication (minimum lubrication, oil mist lubrication) etc.?
- Is additional heat dissipation required?

Bearing life expectation

- What bearing life is requested by customer?
- What bearing life is realistically reasonable and cost effective?
- Which comparisons can be made with the experience and knowledge of well operating existing applications?
- How will the lubrication system be designed, how should lubrication slots, oil pipes, relubricating vents, etc. be arranged?
- Is the bearing position sealed?

Precision, running accuracy, running noise

- Is there any requirement for specific running accuracy or low noise levels for certain applications (e.g. household appliances, fans, electric motors, etc.)?
- Will precision guidance of the shaft be necessary?
- Will the bearing arrangement require a reduced starting torque?
- In which manner may the bearings be mounted in a quick, reliable and economic way?
- How much time is needed for adjusting the bearings? It may be reasonable in some cases to select pre-adjusted bearing arrangements.

Environmental effects

- Is the application affected by negative environmental influences (e.g. abrasive materials, sand, dust, water or corrosive media)?
- Is there any additional heat source, adjacent to the bearing arrangement?
- How can the heat dissipation be assured? Is a cooling device installed?
- Will the bearing arrangement operate at normal or extremes temperature?
- Will it be more economic to mount the bearings using adapter sleeves or even withdrawal sleeves to reduce expensive machining of bearing seats?
- How will the bearing be dismantled or replaced in a quick and economic way? What design features may ease the maintenance of bearings?
- Where will the bearing relubrication points be located for easy access and service?
- What practical and economic design features and arrangements facilitate bearing monitoring and inspection?

Lubrication, mounting and maintenance

- What type of lubrication is projected?
- Are other lubricating means available within the machine that may be used to lubricate the bearings?

Economic effects

Design engineers have to bear in mind the economic aspects of their activities, too.

In general the standard catalogue program of rolling bearing manufacturers should be preferred. This ensures an excellent availability and price level because of mass production volumes. Such standard bearings are proven in the vast majority of applications.

Non-standard bearings should only be used in very special cases, where standard bearings cannot fulfil the requirements sufficiently.

When requiring special bearings, it has to be considered that they are usually produced according to customer's order only, and consequently have longer lead times and restricted availability.

Therefore the following questions should also be answered:

- Is a standard bearing or a variation of a standard bearing able to fulfil the requirements in this application?
- Can one of the ready-to-mount plummer block or flanged housing units be used?
- How wide-spread is the bearing you have selected?
- What is the demand of bearings or accessories?
- When should the delivery commence?
- What delivery time has to be taken into consideration?
- What is the long term availability of the selected bearing or the lubricant?
- Will the designated bearing be available in the aftermarket as a OEM customer part number or through general resale distributor outlets?

Selection of Bearing Type

At this initial stage of bearing selection the specific characteristics of different bearing types are described in detail in the bearing tables provided.

Table 6.1 lists some of the main characteristics of the most important bearing types.

Explanation of the symbols used in table 6.1:

- +++ highly suitable
- ++ adequately suitable
- + fairly suitable
- a depending upon the particular bearing design (for more detailed information please consult the particular product tables)
- in one direction
- ↔ in both directions

The table 6.1 is for **basic guidance only**. Therefore for each application the selected bearing type and size or arrangement must be checked and approved for suitability. Additionally at this stage and where applicable, the relative positions for the locating and the non-locating bearings should already be determined.

Bearing type	radial loads	axial loads	combined loading	tilting moments	speed	mis-alignment
Single row deep groove ball bearings	+	+ ↔	+ ↔		+++	+ a
Double row deep groove ball bearings	+	+ a ↔	+ ↔	+	+	
Single row angular contact ball bearings	+	++ →	+ →		+++	
Paired angular contact ball bearings	++	++ a ↔	++ a ↔	++ a	++	
Double row angular contact ball bearings	++	++ a ↔	++ ↔	++	++	
Four-point contact ball bearings		++ ↔	+ ↔	++	++	
Self aligning ball bearings	+				++	+++
Single row cylindrical roller bearings	++		+ a		++	
Spherical roller bearings	+++	+ ↔	++ ↔		+	+++
Single row tapered roller bearings	++	++ →	+++ →		+	
Single row tapered roller bearings, paired	+++	++ ↔ a	+++ ↔ a	++ a	+	
Thrust ball bearings		+ a				
Cylindrical or needle roller thrust bearings		++ a				
Spherical roller thrust bearings		+++	+ →			+++
Full complement cylindrical roller bearings	+++		+ a			

Table 6.1

Load Ratings and Bearing Life

Each bearing application is affected by several influencing parameters during operation.

That is why one has to distinguish between different terms which determine the fitness of a bearing.

These terms are defined as follows:

Static load calculation

- is the calculation to investigate the impact of the maximum contact pressure on a stationary, oscillating or very slow rotating bearing without permanent damage to raceway or rolling elements by residual plastic deformation.

Dynamic load calculation

- is a statistical value based on the fatigue life of the bearing materials.

Service life

- is a term which tries to describe the overall life of the bearing in its application and may differ from application to application, even for the same fatigue life.

For example, the service life of a machine that is fitted with sealed deep groove ball bearings may be far below the theoretical life rating of the bearings, because the grease fill within the bearings may have a shorter life, when compared to the life ratings of the bearings.

Thus the extended life calculation has to be applied taking into account environmental impacts such as lubrication and cleanliness (see page 267).

The service life of a bearing is additionally altered by additional influences which are hardly computable, e.g.

- wear,
- misalignment,
- deviating operational conditions,

- inadequate operational clearance,
- vibrations, deterioration during mounting and transport, grease degrading.

Static Load Rating

Rolling element bearings are able to accommodate high loads that will be transmitted via very small areas between the rolling elements and the bearing rings.

Thus in the contacting areas very high pressure, the so-called **Hertzian pressure**, occurs.

This pressure may cause some deformation on the contacting bearing parts.

Up to a certain limit the deformations lie within the elastic range which means that if the pressure is removed the parts spring back to their initial shape.

If the forces are too high, a plastic deformation may remain.

Extended tests and practical experiences have proven that a remaining deformation of less than .0001 (**0.01%**) of the respective rolling element diameter will not have a negative impact on the performance of a bearing.

Subsequently the standardized **static load rating** of a bearing, as defined in the ISO 76:2009 indicates the magnitude of load which will generate this residual deformation in the contact zone of the top loaded rolling element and the adjacent raceway.

The corresponding values of the **Hertzian pressure** have been calculated for the different bearing types:

for self aligning ball bearings:	4600 MPa
for ball bearings in general:	4200 MPa
for roller bearings:	4000 MPa
	(1 MPa = 1N/mm ²)

Values of static load ratings (**C_{0r}** for **radial bearings** and **C_{0a}** for **thrust bearings**) are listed in the product tables.

Calculating Rolling Bearings at Static Loads

The **static load safety margin** (S_0) has been checked. This is the ratio of the **static load** acting upon the bearing and the **static load rating** of the bearing.

When radial bearings are exposed to pure radial load, or thrust bearings are exposed to pure axial loads the **static load safety margin** (S_0) is calculated by the following formula:

$$S_0 = \frac{C_0}{P_0} \quad (\text{Eq. 6.1})$$

where

- S_0 = static load safety margin
- C_0 = static load rating [kN]
 C_{0r} for radial bearings,
 C_{0a} for thrust bearings
- P_0 = maximum static equivalent load applied [kN]

For recommended values of static load safety margins see **table 6.2**.

Static Equivalent Load P_0

If a bearing is exposed to combined loads (radial and axial loads simultaneously) these forces have to be converted into an imaginary load that would generate the same deformation in the bearing as the actual forces. This imaginary load is called the **static equivalent load** (P_0).

where:

$$P_0 = X_0 * F_r + Y_0 * F_a \quad (\text{Eq. 6.2})$$

or:

$$P_0 = F_r \quad (\text{Eq. 6.3})$$

The **greater** of these two values must be used as (P_0) for checking the static carrying safety.

where

- P_0 = static equivalent load [kN]
- X_0 = static radial factor
(given in product tables)
- F_r = radial load on bearing [kN]
- Y_0 = static axial factor
(given in product tables)
- F_a = axial load [kN]

Recommended Values for the Static Load Safety Margin

Required running accuracy	Recommended values for S_0	
	ball bearings	roller bearings
High	≥ 2	≥ 3
Normal	≥ 1	$\geq 1,5$
Low	$\geq 0,5$	≥ 1

Table 6.2

Exceptions:

For the following bearing types the minimum values for static load safety margins must be higher for specific reasons:

Spherical roller thrust bearings: $S_{0min} \geq 4$

Dynamic Rating Life

The bearing rating life calculation is based on the bearing **steel fatigue mechanism**.

Such fatigue of bearing material is a natural phenomenon depending upon both the stresses caused by the induced tumescent loads and the cleanliness of the material being used for the bearing rings. These cyclic load stresses generated by the frequently overrolling of the raceways by the rolling elements will finally cause micro cracks within the bearing steel and subsequently they can be observed as spalling in the raceways.

This natural process follows statistical theories making this phenomenon predictable and even calculable.

For calculating the dynamic rating life of a bearing the **dynamic load ratings** listed in the product tables must be used.

The calculation of the dynamic load rating of a bearing is done in accordance with the international standard DIN ISO 281:2009.

Dynamic Load Ratings C_r or C_a

This reference value is defined in DIN ISO 281 as an in its magnitude and direction constantly acting radial load, when applied to radial bearings, or axial and central load, when applied to thrust bearings, thus providing a nominal bearing life of 10^6 revolutions (i.e. one million revolutions) before material fatigue happens.

Nominal Rating Life L_{10}

This is defined as the life expectancy reached by **90%** of the same bearing group subjected to equal operating conditions prior to the occurrence of material fatigue.

The definition is based on collective data over several years and forms the basis of acceptable reliable engineering design practice.

It is well proven that the majority of bearings exceed their calculated rating life successfully; in fact 50% of bearings exceed the calculated nominal rating life by a factor of up to 5 times.

Calculation of Dynamic Loaded Bearings

For a calculation of the nominal bearing rating life L_{10} in terms of millions of revolutions the formula below must be applied:

$$L_{10} = \left(\frac{C}{P} \right)^p \tag{Eq. 6.4}$$

where

- p** = life exponent
for ball bearings: **p = 3**
for roller bearings: **p = 10/3**
- L_{10}** = nominal rating life [10^6 U]
- C** = dynamic load rating [kN]
 C_r for radial bearings,
 C_a for thrust bearings
- P** = dynamic equivalent load [kN]

If stating the nominal **rating life L_{10h}** in terms of **operating hours**, the formula below must be applied:

$$L_{10h} = \frac{\left(\frac{C}{P} \right)^p * 10^6}{60 * n} \tag{Eq. 6.5}$$

where

- p** = life exponent
for ball bearings: **p = 3**
for roller bearings: **p = 10/3**
- L_{10h}** = nominal rating life [h]
- C** = dynamic load rating [kN]
 C_r for radial bearings,
 C_a for thrust bearings
- P** = dynamic equivalent load [kN]
- n** = operating speed [min^{-1}]

Recommended values for nominal rating life L_{10h} are listed in **table 6.3**.

Application	L10h [h]	Remarks
Elevators, lifts	10,000 ÷ 15,000	high reliability required
Construction equipment	2,000 ÷ 8,000	often running in harsh environment
Crusher, mills	20,000 ÷ 40,000	frequent shock loads
Electric motors		
Small electric motors, e.g. for household equipment	2,000 ÷ 5,000	very quiet running noise requirement
Industrial motors	30,000 ÷ 70,000	
Large motors	50,000 ÷ 100,000	
Household machines	500 ÷ 2,000	short-term operation
Motor tools	3,000 ÷ 10,000	short-term operation
Woodworking machines	3,000 ÷ 10,000	usually high speeds
Conveyors		
Conveyors, general	15,000 ÷ 20,000	often running in harsh environment
Conveyor belt rollers	15,000 ÷ 100,000	
Gear boxes		
Industrial gear boxes	5,000 ÷ 20,000	high reliability is usually required
Large gear boxes	40,000 ÷ 100,000	
Railway axle gearboxes	20,000 ÷ 75,000	
Compressors	5,000 ÷ 30,000	
Power plants	80,000 .. 200,000	high reliability required
Agricultural equipment		
Tractors	4,000 ÷ 8,000	often running in harsh environment
General agricultural equipment	1,000 ÷ 2,000	often long inactive or stationary periods
Paper mills	75,000 ÷ 150,000	high reliability required
Presses	10,000 ÷ 50,000	
Pumps		
Circular pumps	20,000 ÷ 80,000	
Piston pumps	1,000 ÷ 10,000	
Gear pumps	1,000 ÷ 10,000	
Shaker screens	10,000 ÷ 20,000	special bearing design requirements
Out-of-balance motors	2,500 ÷ 7,500	special bearing design requirements
Fans	20,000 ÷ 100,000	sometimes high reliability required
Steel mills	10,000 ÷ 50,000	bearings often being exposed to humidity, shock loads, dirt etc.
Machine tools	10,000 ÷ 50,000	high accuracy required
Centrifuges	10,000 ÷ 20,000	high accelerations

Table 6.3

Selection of Bearing Type and Size



If the nominal **rating life** L_{10S} is stated in terms of **running kilometres** the formula below must be applied:

$$L_{10S} = \left(\frac{C}{P} \right)^p * \pi * D \tag{Eq. 6.6}$$

where

- p** = life exponent
for ball bearings: **p = 3**
for roller bearings: **p = 10/3**
- L_{10S}** = nominal rating life [km]
- C** = dynamic load rating [kN]
C_r for radial bearings
C_a for thrust bearings
- P** = dynamic equivalent load [kN]
- D** = wheel diameter [mm]

Please find in **table 6.4 below** typical recommendations regarding nominal bearing life L_{10S} requirements:

Axle box bearings of railway vehicles	
Freight cars	800,000 ÷ 1,000,000
Underground	1,000,000
Trams	1.500,000
Locomotives	3,000,000 ÷ 5,000,000
Personal wagons	3,000,000
Railcars	3,000,000 ÷ 4,000,000

Table 6.4

The above listed examples are for reference **only**.

Practical values may differ considerably.

Dynamic equivalent load P

The formulas for the calculation of the dynamic bearing life as previously stated, anticipate a load of uniform magnitude and direction that acts radially only (for radial bearings) or axially and centrally (for thrust bearings.)

In case of bearings that are exposed to **combined dynamic loads** the single load components have to be transferred into an imaginary load which affects the bearings in the same way as the actual forces.

This imaginary load is called **dynamic equivalent load P**.

P is calculated in the following manner:

$$P = X * F_r + Y * F_a \tag{Eq. 6.7}$$

where

- P** = dynamic equivalent load [kN]
- X** = dynamic radial factor
(given in product tables)
- F_r** = radial bearing load [kN]
- Y** = dynamic axial factor
(given in product tables)
- F_a** = axial load [kN]

Limiting load ratio e

When calculating the dynamic equivalent load **P** for a single row radial bearing, axial loading of less than the limiting load ratio **e** can be neglected.

This applies to thrust bearings that may accommodate radial loading, too. An example of such a bearing is a spherical roller thrust bearing.

In case of **double row radial bearings**, however, even small axial loads have to be considered.

The value of this **limiting load ratio e** depends on the specific suitability of a certain bearing type to take up combined loads.

For more detailed information on the ability of each single bearing type see product tables.

Determination of Operating Load

To obtain a reliable result when calculating the bearing life all forces acting on the bearing must be identified and included in the calculations.

The weight forces derived from the mass of the shaft and its adjacent parts should be known, including the forces generated by the input and output power and gear transmissions.

Some dynamic forces especially shock loads or vibrations, usually cannot be determined precisely.

The magnitude and direction of load, including the operating speed may vary during operation, too. A valuable contribution to estimate the loads is practical experience with comparable applications.

Below factors can be applied:

$$P_{\text{eff}} = P_{\text{nom}} * f_s * f_z \quad (\text{Eq. 6.8})$$

where

- P_{eff} = effective dynamic load acting on bearing [kN]
- P_{nom} = nominal load on bearing [kN]
- f_s = shock factors (see table 6.5)
- f_z = additional factors for dynamic bearing load (see table 6.6)

Shock factor f_s :

In many applications shock loads or vibrations may occur in addition to the known calculated forces.

Such additional loads have to be considered by using a **shock factor f_s** .

The movable masses in a machine are to be multiplied by the shock factors listed in table 6.5:

Shock loads	Application examples	Shock factor f_s
little shock loads	electric motors generator machine tools pumps	1.0 ÷ 1.2
normal shocks	fans conveyors general machinery	1.2 ÷ 1.5
heavy or frequent shocks	crusher shaker screens mills rolling stands	1.5 ÷ 3.0

Table 6.5

Gear factor f_z :

Gear drives and gearboxes create additional forces generated by pitch errors of the gears and/or by manufacturing tolerances and geometric inaccuracies.

Out of balance forces of gears and shafts also create additional loads.

Such forces will increase the load on the bearings and thus must be considered when calculating the bearing life using the **gear factor f_z** .

Values of gear factor f_z for reference are listed in table 6.6.

Accuracy of gear	Gear factor f_z
high precision gears pitch and form errors less than .02 mm	1.05 ÷ 1.1
standard accuracy pitch and form errors between .02 and .1 mm	1.1 ÷ 1.3

Table 6.6

Additional Forces of Chain and Belt Drives

Chain and belt drives create additional forces that must be considered for bearing dimensioning.

Belt drives always run under preload to enable the transmission of forces. This invariably causes vibrations.

In case of **chain drives** vibrations and shock loads occur frequently.

Some empirical values for consideration of these additional forces are listed in table 6.7 by applying the factor f_z .

Type of drive	Factor f_z
Chain drives	1.1 ÷ 1.5
Belt drives	
V-belt	1.5 ÷ 2.5
Toothed belt	1.1 ÷ 1.5
Flat belt	3 ÷ 4
Flat belt with pulley	2.5 ÷ 3

Table 6.7

Calculation of Bearing Load and Speed under Variable Operating Conditions

It is the exception that machines operate at uniform load and constant speed all the time.

Normally the magnitude of load, forces, and the rotational speed vary during operation.

However, more often the parameters follow a certain pattern, such as during a CNC machine production cycle, when this cycle loading and speed change is repetitive. In some cases load patterns are defined by customer requirements and as such included within the bearing design arrangement.

To determine a realistic magnitude for the estimation of bearing life the variable loads and speeds have to be transferred into an imaginary (fictitious) constantly acting **mean load F_m** and respectively a uniform **mean speed n_m** .

Depending upon the individual conditions or the load or speed pattern the **mean load F_m** and the **mean speed n_m** may be calculated according to the formula shown on page 288 Ep. 6.9 and Ep. 6.10, respectively.

Rectangular Course (fig. 6.1):

A typical load and speed pattern for power transmissions, e.g. in a mechanical gear box is represented by a staircase input of load and/or speed.

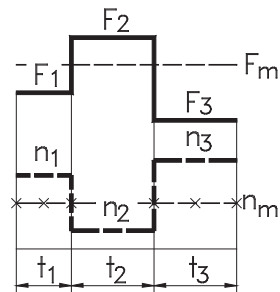


Fig. 6.1

To calculate the **mean load** as in fig. 6.1., the formula **Eq. 6.9** shall be applied.

$$F_m = \left[\frac{\sum (F_i^p * n_i * t_i)}{\sum (n_i * t_i)} \right]^{1/p} \quad (\text{Eq. 6.9})$$

where

- F_m = mean load [kN]
- F_i = load during time period i [kN]
- n_i = speed during time period i [rpm]
- t_i = duration of time period i.

The duration can be calculated as a percentage of the total duration of load cycle

- p = life exponent
 - for ball bearings: $p = 3$
 - for roller bearings: $p = 10/3$

At constant load the **mean speed** is calculated according to formula **Eq. 6.10**:

$$n_m = \frac{\sum (n_i * t_i)}{\sum t_i} \quad (\text{Eq. 6.10})$$

Periodic Linear Load Changes

For conveyor applications there may be changes in linear loading during the operational time at constant speed (fig. 6.2).

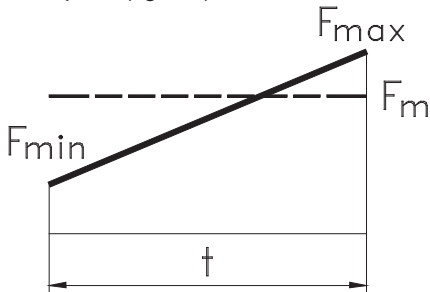


Fig. 6.2

The mean load on the bearing F_m may be evaluated with sufficient accuracy using formula Eq. 6.11:

$$F_m = \frac{F_{min} + 2 * F_{max}}{3} \quad (\text{Eq. 6.11})$$

where

- F_m = mean load [kN]
- F_{min} = minimum load [kN]
- F_{max} = maximum load [kN]

Sinusoidal Load Pattern:

The changes in magnitude of load correspond in its course to a sine wave-form.

Two main load patterns have to be distinguished:

- a) the magnitude of load returns to zero and peaks in the next phase again (fig. 6.3).

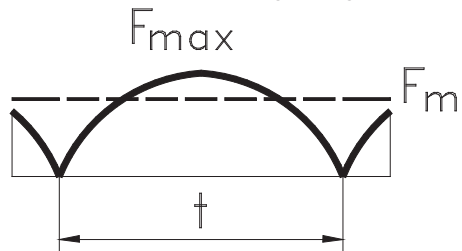


Fig. 6.3

At constant speed the mean load F_m may be calculated roughly according to the following formula:

$$F_m = 0,75 * F_{max} \quad (\text{Eq. 6.12})$$

b) The load changes its magnitude in a sine wave-form course between two extreme values (fig. 6.4).

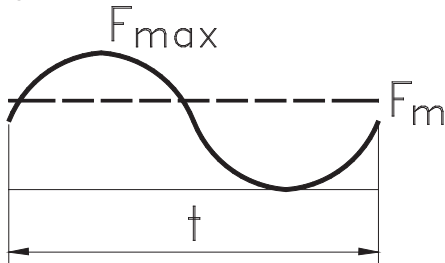


Fig. 6.4

At constant speed the mean load F_m can be calculated with sufficient accuracy by the following formula:

$$F_m = 0,65 * F_{max} \quad (\text{Eq. 6.13})$$

Calculation of Bearing Load for Paired Tapered Roller Bearings and Angular Contact Ball Bearings

Angular contact ball bearings and tapered roller bearings transmit loads through their inclined raceways with a specific contact angle α towards the shaft axis (fig. 6.5).

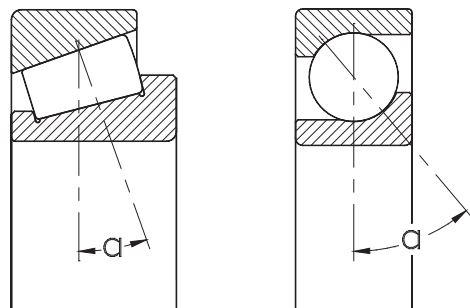


Fig. 6.5

In this way each external applied load, even pure radial load, generates an internal force that converts into an external thrust force towards the opposite bearing (fig. 6.6).

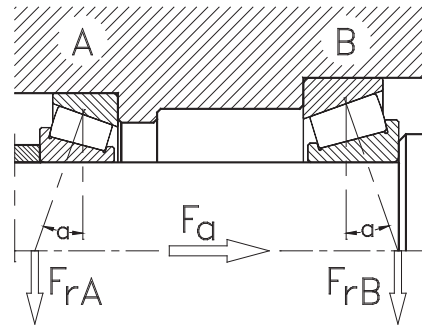


Fig. 6.6

This induced axial force has only to be considered when it exceeds the **limiting load ratio e**. The bearing that generates the smaller thrust load has to be observed.

For more detailed information see the product chapter and tables.

Calculation of Nominal Rating Life of Oscillating Bearings

Where bearings do not rotate, but have some oscillating movements only (fig. 6.7),

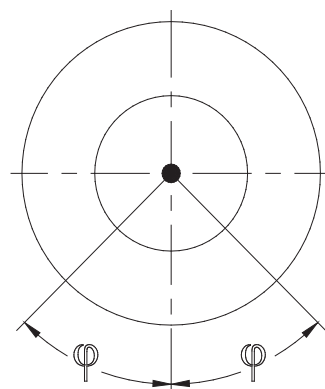


Fig. 6.7

the calculation of nominal life rating is according to the formula below:

$$L_{10\text{ osc}} = \frac{\left(\frac{C}{P}\right)^p * 180}{2 * \varphi} \quad (\text{Eq. 6.14})$$

where

- p** = Life exponent
for ball bearings: **p = 3**
for roller bearings: **p = 10/3**
- L_{10osc}** = nominal rating life for oscillating movement [10⁶ movements]
- C** = dynamic load rating [kN]
C_r for radial bearings,
C_a for thrust bearings
- P** = equivalent bearing load [kN]
- φ** = half oscillating amplitude [°]

Modified Rating Life

A comparison between the calculated nominal rating life values and the actual experienced bearing life times differ significantly.

This has brought the bearing manufacturers to advance calculation methods that got standardized as **extended rating life calculation** by latest DIN ISO 281:2009.

The extended rating life calculation considers and evaluates the influences of material quality and operating conditions.

These influences are as follows:

- **reliability,**
- **lubrication condition,**
- **contamination,**
- **bearing material strength.**

The formula to be used for calculating the extended **rating life L_{nm}** is:

$$L_{nm} = a_1 * a_{iso} * L_{10} \quad (\text{Eq. 6.15})$$

or

$$L_{nm} = a_1 * a_{iso} * \left(\frac{C}{P}\right)^p \quad (\text{Eq. 6.16})$$

where

- L_{nma}** = extended rating life [10⁶ rev]
- a₁** = factor for reliability
- a_{iso}** = factor for combined consideration of lubrication, bearing material, contamination

Factor for Reliability a₁

The nominal rating life calculation as per standardised method (see formula Eq. 6.4) assumes a **reliability of 90%**.

This means that within a group of identical bearings operating under the same running conditions 10 % may fail theoretically by reasons of material fatigue and will not attain their calculated rating life.

Practical experiences, however, have proven that more than half of these bearings exceed the life expectations by up to 5 times of the rating life.

For general machinery applications 90% reliability may be acceptable; other cases may require higher reliability with subsequent higher safety. This can be achieved using the reliability factors a₁, listed in table 6.8.

Selection of Bearing Type and Size

Reliability [%]	Reliability	Factor a_1
	L_{nm}	
90	L_{10m}	1.00
95	L_{5m}	0.64
96	L_{4m}	0.50
97	L_{3m}	0.47
98	L_{2m}	0.37
99	L_{1m}	0.25

Table 6.8

It can be clearly observed that in order to achieve 99% reliability (L_{1m}), the rating life value will be reduced to $\frac{1}{4}$ of the standard rating life calculated at 90% reliability (L_{10m}).

Factor a_{ISO} for System Consideration of Lubrication, Contamination, Bearing Material

If lubrication conditions, cleanliness and other operating conditions are favourable, NKE bearings made of high grade steels and high manufacturing quality can reach an infinite life when exposed below a certain load level. Usually the bearing material's limiting tensile strength is reached when the contact pressure of the top loaded rolling element levels at some 1,500 MPa. The corresponding bearing limit load C_u is defined by the type of bearing, the internal bearing design, the profile of the rolling elements and material and is shown in the product tables.

If the lubrication gap between rolling element and raceway is contaminated by solid particles residual indentations act as bearing life consuming stress raisers.

Table 6.9 gives good practical indications.

Grade of Contamination	e_c for d_m	e_c for d_m
	< 100 mm	≥ 100 mm
extreme cleanliness	1	1
high cleanliness	0,8 to 0,6	0,9 to 0,8
normal cleanliness	0,6 to 0,5	0,8 to 0,6
light contamination	0,5 to 0,3	0,6 to 0,4
medium contamination	0,3 to 0,1	0,4 to 0,2
severe contamination	0,1 to 0	0,1 to 0
extremely severe contamination	0	0

Table 6.9

e_c = contamination factor

One of the most important requirements for a satisfactory function of a rolling bearing is the proper lubrication selection. The main task of the lubricant in a bearing is to separate the metallic bearing parts from each other (fig. 6.8).

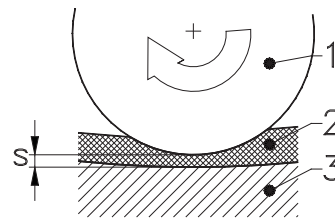


Fig. 6.8

The standard formula for calculating the **nominal** rating life (see formula Eq. 6.4) assumes a good, clean lubricant that provides a sufficient separation of the bearing parts.

Such a separation will be achieved only when the **lubrication layer (2)** builds up between the **bearing rings (3)** and the **rolling elements (1)** to separate the adjacent surfaces.

Therefore the lubrication layer must have a **thickness (s)** greater than the sum of both the surface roughnesses.

Additionally, no other solid particles or impurities may contaminate the lubricant.

The build up of a lubrication layer in a bearing is basically dependant on the lubricant's consistency during operation, this is termed **operating viscosity**.

The term **kinematic viscosity** is defined as the extent to which a fluid resists the tendency to flow. It is one of the most significant characteristics of lubricating oil. For grease lubricants the base oil viscosity will be stated.

For further information (see page **330**).

Temperature affects the oil viscosity; subsequently, viscosity values are relative to individual temperatures. The kinematic viscosity (ν_{40}) therefore refers to an ambient temperature of 40 °C (104°F).

The required minimum viscosity of a lubricant during operation depends on the following factors:

- **bearing size**
- **operating temperature**
- **rotational speed**

A simple and generally accurate estimate of the influences of lubrication on the rated bearing life is possible using the following diagrams and instruction steps:

- 1) **Calculation of bearing mean diameter d_m**
- 2) **Estimation of (required) rated viscosity ν_1**
- 3) **Determination of (actual) operating viscosity ν**
- 4) **Building of the ratio of rated to operating viscosity κ**
- 5) **Determination of factor a_{ISO} .**

These steps are specified on the following pages.

v- t-Diagram

The dynamic viscosity of a lubricant varies considerably with its actual temperature. Mineral oils get thinner at higher temperatures, this means the viscosity decreases. At low temperatures, however, lubricants get stiffer this means that their viscosity increases relative to their kinematic viscosity ν_{40} . Therefore as the base oils react differently to temperature and other variations, the viscosity of oils and greases also are affected differently.

The **v-t-diagram** (fig. 6.10) shows the correlation of the most common grades of nominal viscosity ν_{40} for mineral oil based lubricants.

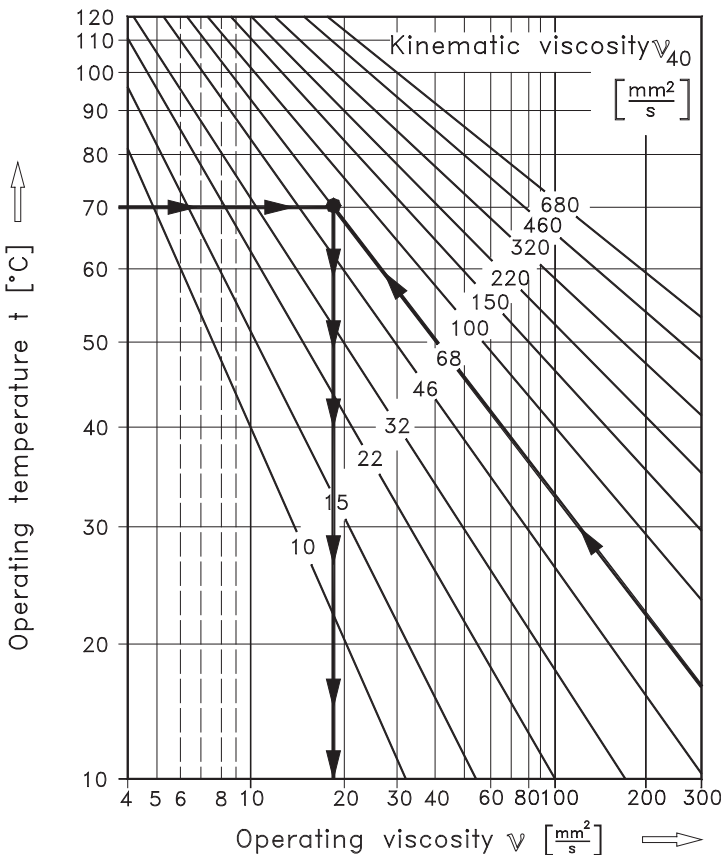


Fig. 6.10

Step 3: Follow the line of the kinematic oil viscosity $\nu_{40} = 68 \text{ mm}^2 / \text{s}$ in diagram fig. 6.10 until crossing the line representing the operating temperature $t = 70^\circ\text{C}$ (158°F). Strike a line downwards to the horizontal axis to get the viscosity ν for this operating temperature. In this example the (actual) operating viscosity ν is approximately $18 \text{ mm}^2 / \text{s}$.

Viscosity ratio

With the values for ν and ν_1 , the **viscosity ratio** κ may be determined using formula Eq. 6.17. This figure indicates the ratio of **operational viscosity** ν to the **(required) rated viscosity** ν_1 .

$$\kappa = \frac{\nu}{\nu_1} \tag{Eq. 6.17}$$

where

- κ = Viscosity ratio
- ν = **(Actual) operating viscosity** anticipated for the given conditions [mm² / s] (see evaluation in fig. 6.10)
- ν_1 = For the actual bearing size and speed **(required) rated viscosity** [mm² / s] (see evaluation in fig. 6.9)

A “ κ ”-value of ≥ 1 indicates good or even very good lubrication. If “ κ ” is below 1, pure separation will not occur and lubricants with additives should be used.

Further information is provided in the chapter “**Lubrication of Rolling Bearings**” (page 330).

Step 4:

In the given example the viscosity ratio κ is:

$$\kappa = \frac{\nu}{\nu_1} = \frac{18}{16} = 1,125 \tag{Eq. 6.18}$$

This shows that the selected lubricant is in terms of its viscosity a good choice for the anticipated operation conditions.

The viscosity anticipated should enable sufficient separation of the bearing surfaces.

Step 5:

Determination of factor a_{ISO}

With the κ -value obtained in Step 4 the right curve selection has to be made for the right product.

- Fig. 6.11 for radial ball bearings
- Fig. 6.12 for radial roller bearings
- Fig. 6.13 for axial ball bearings
- Fig. 6.14 for axial roller bearings

The intersection of the quotient ($\frac{e_c^* C_u}{P}$) with the curve of corresponding κ gives the desired coefficient a_{ISO} .

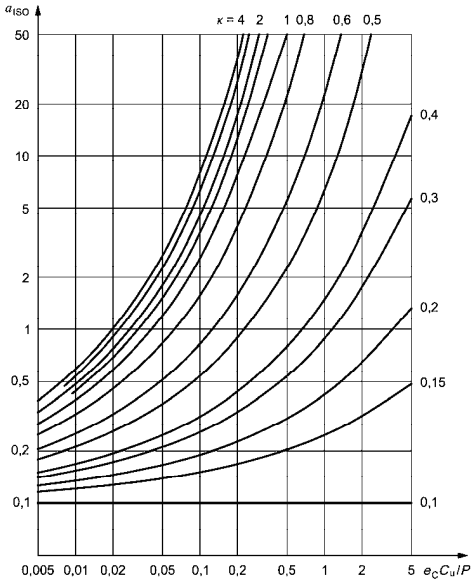


Fig. 6.11

The factor a_{ISO} for radial ball bearings

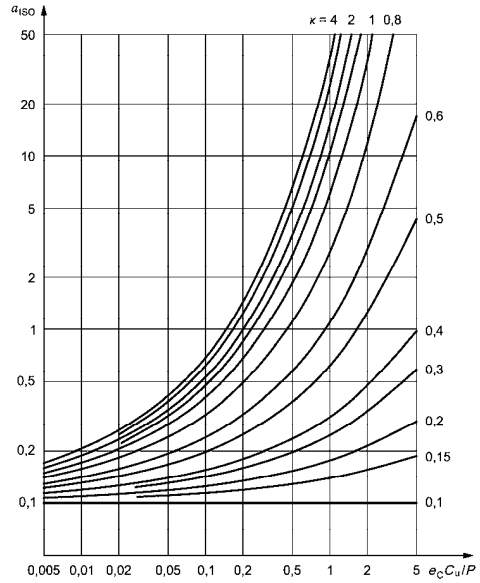


Fig. 6.12

The factor a_{ISO} for radial roller bearings

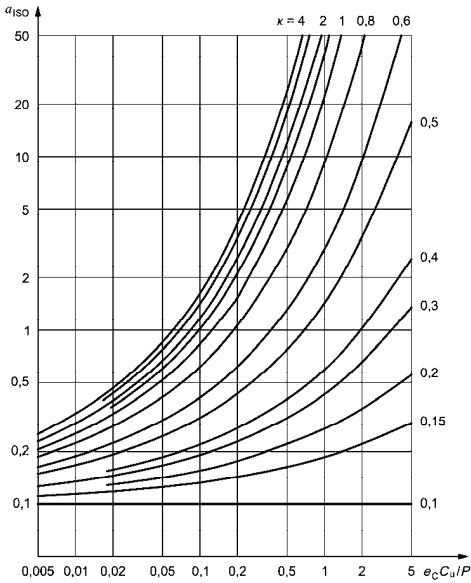


Fig. 6.13

The factor a_{ISO} for axial ball bearings

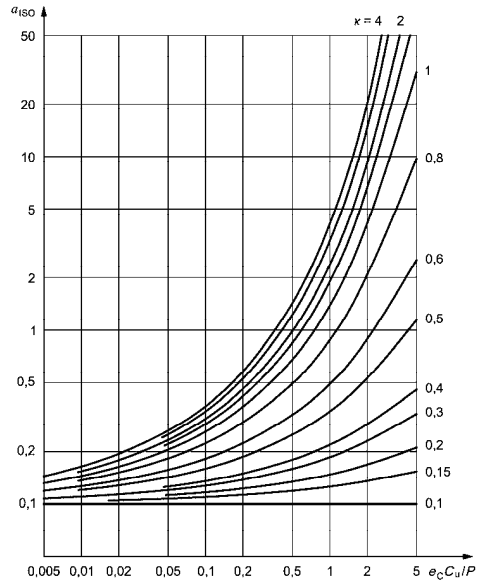


Fig. 6.14

The factor a_{ISO} for axial roller bearings

**Further Parameters to be Considered at
Bearing Selection**

Required Minimum Load

Rolling bearings may fail not only due to overloading but due to underloading, too.

A certain minimum load is required to force the rolling elements to rotate along and around the raceways in an optimum way, without generating excessive sliding friction.

For applications where the bearings do not attain this required minimum load the probability of sliding friction will occur resulting in excessive wear.

When excessive sliding friction occurs, the lubrication layer between the bearing components may be sheared through and metallic contact will occur.

Such metal to metal contact causes wear and material smearing to the contacting partners. Subsequently this bearing damage will give noticeable high running noise, rough running and high vibrations. Additionally the operating temperature will rise quickly until eventually the bearing will fail. The fatigue based rating life is not capable of taking these effects into account.

The minimum magnitude of load for satisfactory running performance depends on the bearing type used and the individual operation speed.

In the vast majority of applications the required minimum load will already be satisfied by the weights of shaft and other assembled associated part.

Certain bearing types, particularly thrust bearings, however, are more sensitive to few load conditions due to their kinematic characteristics.

Specific information regarding the minimum load required for **thrust bearings** is given in the individual product information.

For **radial bearings** the following reference values of minimum loads may be applied as long as not stated otherwise in the relevant product chapter.

Bearing type	Required minimum load P_{min}
Radial ball bearing Bearings with cages Full complement types	$\geq 1 \% * C_r$ $\geq 4 \% * C_r$
Radial roller bearing Bearings with cages Full complement types	$\geq 2 \% * C_r$ $\geq 4 \% * C_r$

Table 6.10

Influence of Operating Temperature

The dynamic load rating of rolling bearings is standardised in accordance with **DIN ISO 281:2009**. This calculation assumes a certain hardness of the bearing rings and rolling elements usually made of chromium steel.

For all NKE rolling bearings the required hardness is granted by the standard heat treatment of rings and rolling elements up to 150 °C (302 °F).

If the bearing is exposed to permanent high operating temperatures some structural changes within the bearing steels grain structure will occur. Such circumstances may cause changes in the dimensional and geometrical accuracy of bearing rings, including the loss of component hardness. Subsequently the bearing load rating will also decrease.

For these operating conditions NKE offers on request special bearing steel heat treatment designated with:

- S1 for temperatures up to 200 °C
- S2 for temperatures up to 250 °C
- S3 for temperatures up to 300 °C

Friction of Rolling Bearings

Very low friction is one of the major characteristics of rolling element bearings. The frictional moments of rolling bearings are usually so small that they can almost always be neglected in practice, although for some applications even small frictional resistance must be considered.

The frictional resistance for all rolling bearings is dependant not just upon the bearing type and size, but includes specific application data like speed, load and lubrication.

According to their internal contacting geometry deep groove ball bearings in general perform with very low friction which makes them suitable for high speeds. A comparatively high friction, however, is generated with bearing types like cylindrical roller thrust bearings etc.

Contacting **seals** (suffixes **-RS**, **-2RS**, **-RSR**, **-2RSR** etc.) always generate additional friction due to the preloading of their sealing lips, unlike **shields** (suffixes **-Z**, **-2Z**), that build a non-contacting gap seal to the inner ring and subsequently do not generate additional friction.

An estimation of the frictional moment providing results of sufficient practical accuracy is possible by applying the following formula:

$$M = \frac{\mu \cdot P_{\max} \cdot d}{2} \quad (\text{Eq. 6.19})$$

where

- M** = frictional moment [Nmm]
- μ** = frictional coefficient (see table 6.10)
- P** = equivalent bearing load [kN]
- D** = bore diameter [mm]

Bearing types	Frictional coefficient μ
Deep groove ball bearing, open	0.0010 ÷ 0.0015
Angular contact ball bearing, single row	0.0020
Angular contact ball bearing, double row	0.0025
Four-point contact ball bearing	0.0025 ÷ 0.0040
Self aligning ball bearing, sealed	0.0010 ÷ 0.0020
Cylindrical roller bearing	0.0015 ÷ 0.0020
Cylindrical roller bearing, full complement	0.0020 ÷ 0.0040
Spherical roller bearing	0.0020 ÷ 0.0025
Tapered roller bearing, single row	0.0015 ÷ 0.0020
Tapered roller bearing, paired	0.0025 ÷ 0.0040
Thrust ball bearing	0.0010 ÷ 0.0020
Cylindrical roller thrust bearing	0.0050 ÷ 0.0070
Spherical roller thrust bearing	0.0020 ÷ 0.0030

Table 6.11

Friction of Sealed Bearings

Bearings with **contacting seals** (suffixes **-RS**, **-2RS**, **-RSR**, **-2RSR** etc.) always have high friction due to the preloading of their sealing lips touching the inner ring.

This additional friction is estimated using the following formula:

$$M_D = \left(\frac{d + D}{f_3} \right)^2 + f_4 \quad (\text{Eq. 6.20})$$

where

- M_D** = additional frictional moment due to contacting seals [Nmm]
- d** = bore diameter of bearing [mm]
- D** = outer diameter of bearing [mm]
- f₃** = type related factor (see table 6.12)
- f₄** = type related factor (see table 6.12)

Selection of Bearing Type and Size

Bearing types	Factors	
	f ₃	f ₄
Deep groove ball bearing	20	10
Angular contact ball bearing, double row	20	10
Self aligning ball bearing	20	15
Cylindrical roller bearing, full complement	10	50

Table 6.12

The estimated total friction of a sealed bearing equates to approximately:

$$M_{\text{total}} = M + M_D \quad (\text{Eq. 6.21})$$

The accuracy of calculated values by using the formula mentioned above is sufficient in practical use.

For more accurate calculations please contact our application engineering department.

The crossing point of the κ curve with the value of $(\eta_c * Cu/P)$ on the horizontal axis determines the factor a_{ISO} for system consideration of lubrication, contamination and bearing material

Selection of Specific Bearing Features

General

After the selection of a suitable bearing type and the determination of its size requirements, several more specific bearing features have to be considered to satisfy the application requirements.

Suitability for Speeds

Bearings can be operated safely to a certain limiting speed. This limiting speed is determined by the type of bearing, its size, the internal bearing design, the external load, the lubrication conditions, etc.

Two rotational speeds are displayed in the product tables:

- the (thermal) speed rating and
- the (kinematic) limiting speed.

Thermal Speed Rating

The calculation of the thermal speed rating n_{gr} is standardized in ISO 15312. It is the rotational speed at which a bearing equilibrium temperature of 70°C is reached under reference conditions. The speed rating is an auxiliary term for calculation of the permissible thermal rotational speed n_{th} .

Reference Conditions

The reference conditions reflect common operating conditions of the most important types of bearings and sizes. ISO 15312 defines:

- reference ambient temperature $\theta_{\text{Ar}} = 20^\circ\text{C}$
- reference temperature (on outer ring) $\theta_r = 70^\circ\text{C}$
- load for radial bearings $P_{1r} = 0.05 C_{0r}$
- reference load for axial bearings $P_{1a} = 0.02 C_{0a}$
- kinematic oil viscosity at reference temperature
 - for radial bearings: $12 \text{ mm}^2\text{s}^{-1}$ (ISO VG 32)
 - for axial bearings: $24 \text{ mm}^2\text{s}^{-1}$ (ISO VG 68)
- the heat flow q_r via the heat emitting reference surface area A_r for
 - radial bearings
 - o $A_r \leq 50\,000 \text{ mm}^2$, then $q_r = 0,016 \text{ W / mm}^2$ (Eq. 6.22)
 - o $A_r > 50\,000 \text{ mm}^2$, then $q_r = 0,016 * \left(\frac{A_r}{50000} \right)^{-0,34} \text{ W / mm}^2$ (Eq. 6.23)
 - axial bearings
 - o $A_r \leq 50\,000 \text{ mm}^2$, then $q_r = 0,020 \text{ W / mm}^2$ (Eq. 6.24)
 - o $A_r > 50\,000 \text{ mm}^2$, then $q_r = 0,020 * \left(\frac{A_r}{50000} \right)^{-0,16} \text{ W / mm}^2$ (Eq. 6.25)

Limiting Speed

The (kinematic) limiting speed n_G is based on practical experience and considers additional criteria such as mechanical strength, running behaviour, sealing and centrifugal forces.

Caution!

The limiting speed shall not be exceeded, even at favourable operating or cooling conditions.

For grease lubricated bearings the limiting speed listed in the product tables must be reduced by 25%. An exception are the thrust cylindrical roller bearings, for which the limiting speed must be reduced by 60%.

For sealed and progressed bearings, the reduction in limiting speed was already taken into consideration in the applicable product tables.

Permissible Thermal Rotational Speed

The permissible thermal rotational speed n_θ is calculated in accordance with DIN 732. It is based on the equilibrium of the heat generated by bearing friction and the heat dissipation through the bearing seating, thus resulting in a constant temperature.

The acceptable operating temperature determines the thermal rotational speed n_θ .

Correct mounting, normal radial operating internal clearance and constant operating conditions are a necessary precondition for the calculation.

The calculation is not applicable for

- sealed bearings with contact seals, because the maximum rotational speed is limited by the maximum relative gliding of the seal lip,
- track rollers,
- axial ball bearings und axial angular contact ball bearings.

Calculation of Permissible Thermal Rotational Speed

The permissible thermal rotational speed n_θ is the product of the thermal reference rotational speed $n_{\theta r}$ multiplied with the speed ratio f_n :

$$n_\theta = n_{\theta r} * f_n \quad (\text{Eq. 6.26})$$

Caution!

Check limiting rotational speed n_G !

The rotational speed ratio is calculated by solving the equation (see fig. 6.15)

$$k_L * f_n^{5/3} + k_p * f_n = 1 \quad (\text{Eq. 6.27})$$

For common use in the range of $0.01 < k_L < 10$ and $0.01 < k_p < 10$ f_n can be approximated by:

$$f_n = \frac{490,77}{1+498,78 * k_L^{0,599} + 852,88 * k_p^{0,963} - 504,5 * k_L^{0,055} * k_p^{0,832}} \quad (\text{Eq. 6.28})$$

Heat dissipation via bearing seating areas Q_s , (see fig. 6.16)

$$Q_s = k_q * A_r * \Delta \vartheta_A \quad (\text{Eq. 6.29})$$

Heat dissipation via lubrication Q_L :

$$Q_L = 0,0286 * \frac{KW}{l / \text{min} * k} * V_L * \Delta \vartheta_L \quad (\text{Eq. 6.30})$$

Total heat dissipation Q :

$$Q = Q_s + Q_L - Q_E \quad (\text{Eq. 6.31})$$

Lubrication parameter k_L :

$$k_L = 10^{-6} * \frac{\pi}{30} * n_B * \frac{10^{-7} * f_0 * (V * n_B)^2 * d_M^3}{Q} \quad (\text{Eq. 6.32})$$

Load parameter k_p :

$$k_p = 10^{-6} * \frac{\pi}{30} * n_B * \frac{f_1 * P_1 * d_M}{Q} \quad (\text{Eq. 6.33})$$

**Selection of
Bearing Type and Size**

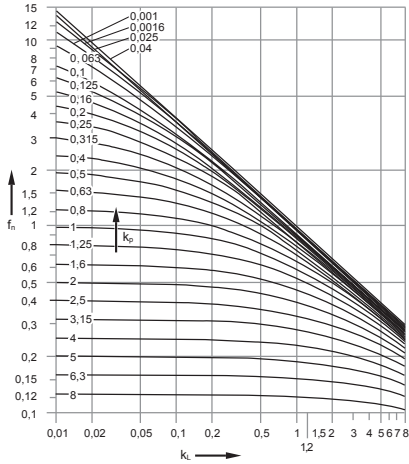


Fig. 6.15

f_n = rotational speed ratio
 k_L = lubrication parameter
 k_p = load parameter

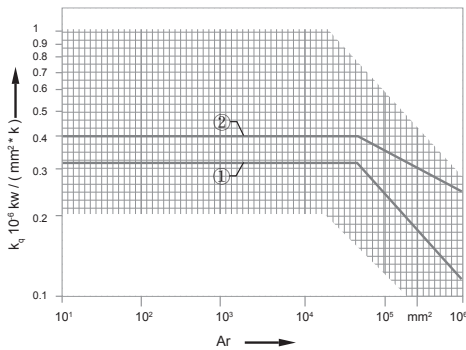


Fig. 6.16

k_q = thermal transmission coefficient
 A_r = heat emitting reference surface area
 thermal transmission coefficient K_q ,
 dependant on heat emitting reference
 surface area A_r
 ① standard conditions for radial bearings
 ② standard conditions for thrust bearings

Designations, Units, Definitions

Heat emitting reference surface area

- for radial bearings:

$$A_r = \pi \cdot B \cdot (D + d)$$

(Eq. 6.34)

- for axial bearings:

$$A_r = \pi/2 \cdot (D^2 - d^2)$$

(Eq. 6.35)

- for tapered roller bearings:

$$A_r = \pi \cdot T \cdot (D + d)$$

(Eq. 6.36)

- for axial self aligning roller bearings:

$$A_r = \pi/4 \cdot (D^2 + d_1^2 - D_1^2 - d^2)$$

(Eq. 6.37)

Adjustment of Adjacent Parts

For bearings running at high speeds the adjacent parts must also be of higher precision.

Bearing seats for shafts or housings also require a dimensional and geometrical accuracy which meets the requirements of high-speed applications.

Additionally, all out-of-balance forces of rotating parts must be seriously considered.

Running Noise

NKE rolling bearings run smoothly and therefore have low running noise levels. Some customer applications require varying levels of quiet running within their equipment (e.g. domestic appliances, electric motors, etc.) and subsequently require additional design features.

Bearings with Reduced Running Noise

For increase requirements concerning running noise the application of bearings with higher accuracy class (P6, P5, ...) with reduced tolerances is recommended.

These bearings feature closer geometric tolerances, such as reduced radial run-out value, therefore having higher component accuracy with less vibrations and subsequently noise levels.

Many of these applications run with light preload which dampens vibration and increases the rigidity of the whole bearing arrangement.

Special attention should also be taken to ensure optimum selection of the bearing's clearance.

A proven method to achieve quiet running bearing arrangements is to preload the bearings slightly by use of springs.

This method is often applied in small electric motors (fig. 6.17).

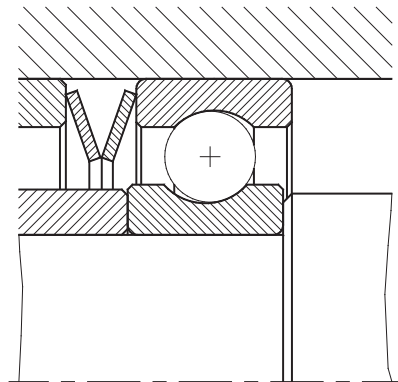


Fig. 6.17

Cage Designs

The vast majority of rolling element bearings has cages. The exception are full complement bearing types which are assembled without a cage.

Despite the fact that a cage is not directly involved in a transmission of forces it has to fulfill several functions:

Selection of Bearing Type and Size

- **to retain** rolling elements
- **to guide** the rolling elements
- **to reduce friction**
- **to prevent** the rolling elements contacting each other

Furthermore, the cage also affects the speed suitability of a bearing, its vibrating behaviour and its lubrication.

Depending on their type, size and design all NKE rolling element bearings feature a cage design that once established is defined as standard. When a cage is defined as standard the overall bearing description will not include a separate cage suffix.

Some examples of standard cages being used in NKE bearings are:

Pressed steel cage:

Standard cage for deep groove ball bearings and tapered roller bearings.

Polyamide cages:

Standard cage due to its optimum shape accuracy and ease of mounting, especially when dealing with double row bearings. Polyamide cage material is often reinforced with glass-fibres to strengthen its mechanical properties.

Solid cages:

Solid cages are machined from materials such as brass, bronze, steel, light metal alloys or non-metallic materials such as wound resin-coated fabric etc.

Solid brass cages are generally fitted to large bearing sizes, particularly cylindrical and spherical roller bearings.

The individual standard cage of a certain bearing type has been carefully defined and fulfills the overall requirements of general machinery.

All standard cage designs have been proven in countless applications over many years.

In certain circumstances special cage designs may be necessary for specific running conditions, e.g.

strong vibration

shock loads

high speeds

chemical influences

special operating conditions

The production of bearings with special cages may be to customer orders only and consequently extended delivery time and restrict availability.

In such cases we kindly ask you to consult our technical and commercial departments for detailed information.

Misalignments

For each bearing arrangement a certain amount of misalignment between the bearing seats on both shaft and housing must be taken in consideration.

Such misalignments are caused by manufacturing tolerances including shaft bending under external load.

In many applications misalignment may be eliminated by correctly defined manufacturing tolerances or alternative manufacturing procedures. In cases where this is neither practical nor economical, (e.g. large heavy machinery, long transmissions or multi-shaft transmissions) some compensation for assembly misalignment must be considered during the bearing selection and design stage.

According to their internal design each bearing type features different abilities to compensate misalignments.

A particularly good compensation of misalignments is allowed by the self-aligning bearing types, such as self-aligning ball bearings, spherical roller bearings and thrust ball bearings with spheroid housing washers. Single row deep groove ball bearings, for example, allow according to their individual operating clearance, angular misalignments up to 10 angular minutes.

In case of single row cylindrical roller bearings the maximum permissible amount of angular misalignment is limited from 2 up to 4 angular minutes.

Several bearing types do not permit any misalignment.

In all these cases a misalignment generates higher bearing internal forces on rolling elements and raceways, thus reducing bearing fatigue life.

For more detailed information on the individual capacity of each bearing type to accommodate misalignments see specific product information pages.

Rigidity

This term describes the magnitude of (elastic) displacement of a rolling bearing under load.

The elastic deformation is very small and therefore will not play any role in the majority of applications.

Only in specific applications, such as machine tool applications which demand a very stiff, rigid bearing arrangement, such displacement requires consideration.

In general, bearings with line contact such as roller bearings provide higher rigidity compared to ball bearings. The stiffness of a bearing arrangement can be improved by applying preload to the bearings.

The most frequently used bearing types in preloaded bearing arrangements are angular contact ball bearings (fig. 6.18) and tapered roller bearings.

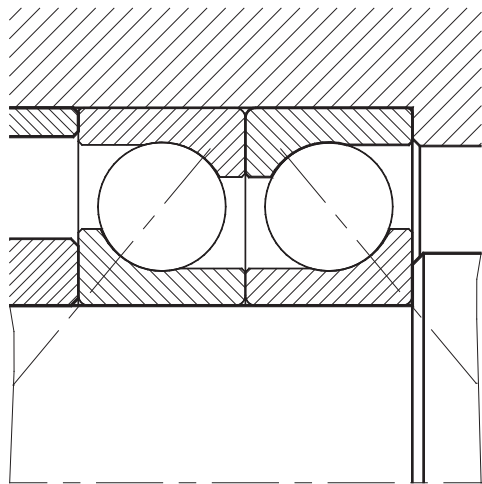


Fig. 6.18

For detailed information see chapter “**Bearing Clearance**” page 319.

General

Each bearing application has to be understood as a complex system that consists of several interacting factors.

The most important influencing parameters are:

- type and size of bearing.
- choice of specific bearing characteristics in accordance to actual operation conditions.
- bearing quality.
- correct mounting and ease of adjustment.
- proper design of bearing location.
- proper bearing fits.
- adequate dimensional and geometric accuracy of adjacent parts.
- efficient and effective lubrication.
- adequate sealing of bearing arrangement.
- effective heat dissipation.

This system must also be actioned collectively, objectively and equally for each influencing parameter, otherwise, the application design and bearing arrangement may result in premature failure.

Bearing Arrangements

At the design stage of bearing arrangements and locations proven designs may be used for reference.

Floating and Locating Bearings

Basic consideration for the arrangement of the single bearings within their locations to accommodate the specific function of the bearing as a **locating bearing** or **non-locating (floating) bearing**:

- **locating bearings** are those bearings that hold the position of the shaft axially.
Locating bearings always have to take thrust loads.
- Unlike the locating bearings, a shaft may have a **non-locating bearing** to accommodate

applied loads and to guide the rotating machine element precisely in the radial direction.

The non-locating bearings also compensate for any variation in length due to thermal movement. This compensation may occur either within the bearing (e.g. in case of needle roller bearings) or by suitable designed seats that allow the bearing to float.

Usually in each bearing arrangement one **locating bearing** guides the shaft in axial direction, all other bearings have to be nonlocating bearings.

A special configuration is embodied by so-called "**cross-locating**" bearing arrangements and by bearing arrangements that are mounted with preload.

These arrangements do not have defined locating or floating bearings. The axial location of the shaft is by one of the bearings based on the direction of load

Suitability of Different Bearing Types for Locating or Non-Locating Positions

In principle all types of radial bearings that may accommodate thrust loads can be used as **locating bearings**.

Examples are deep groove ball bearings, angular contact ball bearings (always used in pairs or sets), tapered roller bearings (to be used in sets), spherical roller bearing etc.

Also thrust bearings are suitable locating bearings, but do not accommodate radial loads in all most cases.

The ideal **non-locating bearings** are bearing types that allow axial displacement inside the bearing such as cylindrical roller bearings having one ring without flanges (N, NU, NN.., RNU, RN.. types), needle roller bearings, needle roller and cage assemblies.

Almost all other bearing types may be used as non-locating bearings, too, but the possibility to

accommodate length changes due to thermal expansion must be enabled by means of design measures, (e.g. by loose fits).

For “**cross-locating**” bearing arrangements all types of radial bearings are suitable that will accommodate thrust loads in at least one direction.

Examples are cylindrical roller bearings (types NJ, NF,..), also deep groove ball bearings, angular contact ball bearings and spherical roller bearings etc.

Examples of Bearing Arrangements

There are many different possibilities to design bearing arrangements of rotating machine components, which may be considered according to the particularly given circumstances.

For possible design solutions of locating and non-locating bearing arrangements used for rotating machine components, see fig. 7.1.

Note:

“**F**” means **position of locating bearing**

“**L**” indicates the **non-locating bearing**

Explanation to fig. 7.1

Fig. 7.1a)

Simple arrangement with two deep groove ball bearings, one acting as a locating bearing while the other one sits axially free in the housing to accommodate length changes.

A frequently used arrangement for small machines, gearboxes and electric motors.

Fig. 7.1b)

Arrangement similar to fig. 7.1a. However, in this arrangement the non-locating bearing has slight axial preload by means of **springs**.

This measure enables the elimination of the residual bearing clearance which results in very smooth running of the shaft.

Often used for small electric motors.

Fig. 7.1c)

Bearing arrangement comprising of a **deep groove ball bearing as the locating bearing** and a **NU-type cylindrical roller bearings as the non-locating bearing**.

Because the inner ring has no flanges, the cylindrical roller bearing enables length changes within itself.

Such an arrangement is adequate where tight fits on all bearing rings are required, e.g. for large electric motors or generators.

Examples of Locating and Non-Locating Bearing Arrangements

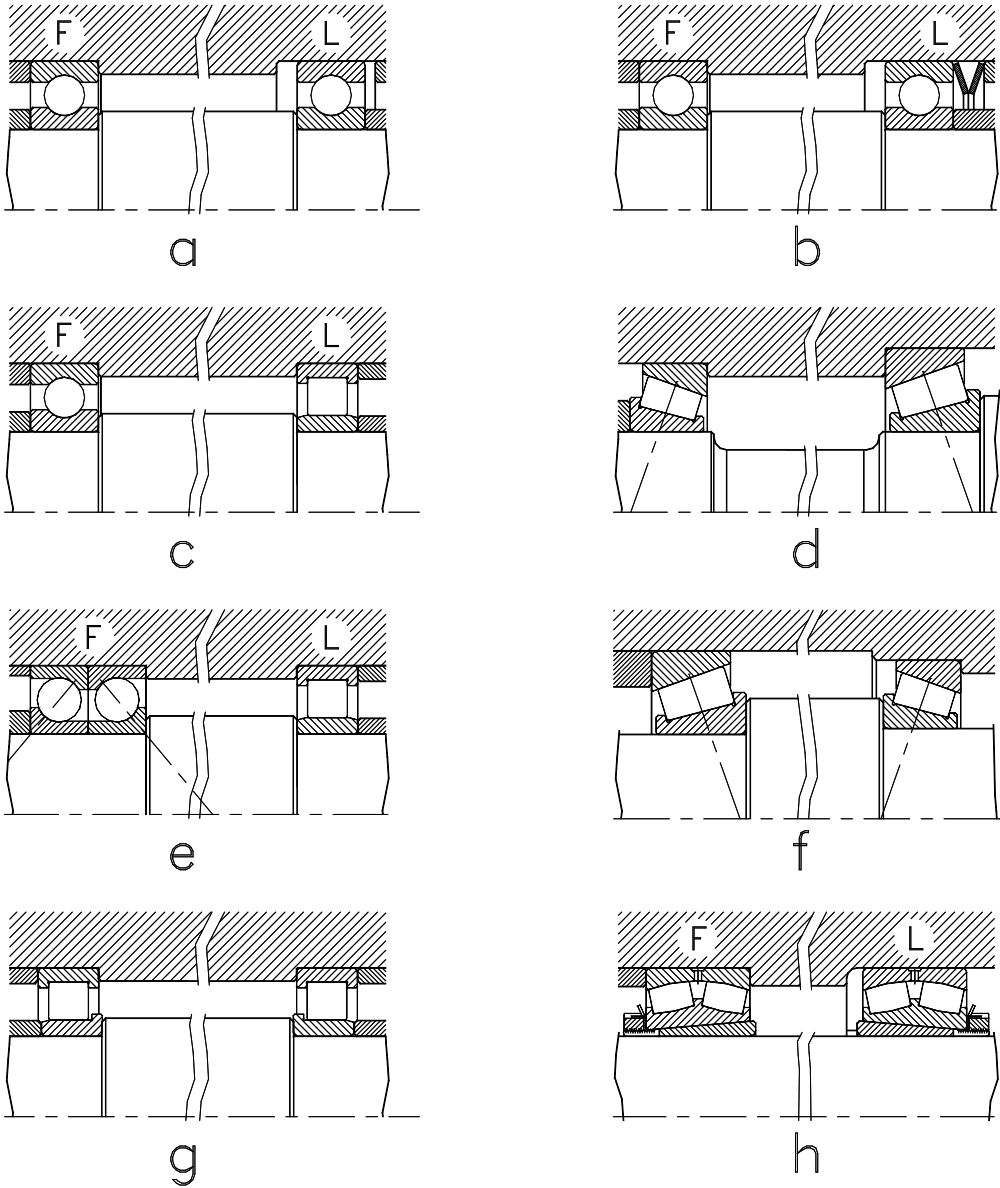


Fig. 7.1

Fig. 7.1d)

Assembly of two tapered roller bearings, located in back-to-back arrangement.

Due to the back-to-back arrangement the **support width**, that indicates the effective acting distance of bearing positions, will be enlarged which allows a very rigid bearing arrangement.

Such bearing arrangements enable a transmission of high forces within a limited space but require careful adjustment for the required clearance or preload.

Frequently angular contact ball bearings are also used in backto back arranged arrangements.

Typical application examples are pinion bearings and wheel bearing arrangements for motor vehicles.

This equally applies to **angular contact ball bearings** frequently used in this way.

When bearings are mounted face-to-face, they require careful adjustment.

Typical fields of applications are gearboxes.

Fig. 7.1g)

Cross locating arrangement with two NJ-type cylindrical roller bearings.

With this arrangement the axial location of the shaft is supported by both bearings alternating, as this bearing type allows for length change of shaft within the bearings. Thus tight fits are possible to both the bearing seats of shaft and housing.

Such arrangements are preferably used for vibrating shafts and some small gearboxes.

Fig. 7.1e)

Bearing arrangement is for running under combined loads where high axial running accuracy is required.

A pair of **angular contact ball bearings** in **back to back arrangement** acts as the locating bearing, a **NU-type cylindrical roller bearing** is used in the non-locating bearing position.

Such a bearing arrangement is suitable to accommodate thrust forces of medium size, even under high speeds.

Fig. 7.1h)

shows two **spherical roller bearings** enabling the transmission of very heavy radial loads; additionally, they will support limited thrust loads.

This bearing arrangement also allows misalignments and shaft deflections or bending.

When arranging spherical roller bearing in this way, care must be taken to allow axial movement of the non-locating bearing by using a loose fit in the housing.

Fig. 7.1f)

A pair of tapered roller bearings in face-to-face arrangement.

By arranging tapered roller bearings this way, the support width will become smaller than their nominal centre distance. Bearings arranged **face-to-face** provide less rigidity and thus a more flexible bearing arrangement which is not so sensitive to misalignments compared to back-to-back arrangements.

It is also possible for bearings with tapered bores to be mounted onto shafts using adapter or withdrawal sleeves; this allows shaft seats of less accuracy to be used.

Typical applications for such bearing arrangements are: the agricultural industry, for long transmissions and heavy machinery.

Selection of Bearing Fits

Rolling bearing rings have extremely thin sections when compared to their potential load ratings.

This is why bearing rings have to be supported sufficiently on their circumferences for optimum use of their capabilities.

This support and the correct selection of shaft and housing fits will ensure effective radial location at the bearing seating.

Therefore the correct choice of fits is significant for the optimum function of all bearing arrangements.

The pure axial location of a bearing is not a suitable substitute for a proper fit!

In the case of loose fits relative moment may occur between the bearing rings and the contacting faces of shaft or housing. This may lead to bearing ring rotation causing damage to all contacting surfaces and premature failures. Heavy interference fits, however, could cause outer ring diameter contraction and inner ring expansion this resulting in residual radial clearance reduction leading to potentially cracked rings and bearing failure.

It is now seen that all dimensions, tolerances and geometric values must be clearly defined to obtain an effective and optimum bearing seat.

To determine the correct fit for bearing shafts and housings the following criteria must be considered.

- a) **type and magnitude of applied load**
- b) **type and size of bearing**
- c) **required running accuracy of total bearing arrangement**
- d) **materials of shaft and housing**
- e) **possibilities of mounting and dismounting the bearing arrangement, when necessary**

We distinguish between the **two base fit types** as follows:

Interference fits

are very **tight contacts** of mating parts which cause stresses within the bearing material structure. Additionally, the bearing outer ring will contract and the inner ring will expand. This will have an influence on the remaining actual running clearance.

Loose fits

enable axial **displacement** of bearing rings relative to the bearing seats.

Furthermore bearing rings that have loose fits are usually easier to mount or dismount than rings with interference fits.

Type and Magnitude of Applied Loads

Type and magnitude of the load applied to a bearing are the most significant factors that determine the required bearing fit.

The main criterion is the **direction** of the load acting relative to the motion of a bearing ring.

Accordingly, three main features distinguish how a force acts relative to the bearing rings:

- as a **point load**
- as **circumferential load**
- with **indeterminate load direction**

Point load

Point loading occurs when either the load or bearing ring is stationary, or if both are rotating with the same angle speed.

In both cases a **point** is loaded on the circumference of the bearing raceway while the other areas are not affected.

Bearing rings exposed to **point loading** do not have a tendency to rotate. This is why loose fits are suitable for point loaded rings.

Circumferential load

In the case of **circumferential load**, however, each single point on the circumference of the raceway will be loaded. This occurs, if the bearing ring is stationary while the load rotates or, if the load is stationary on the rotating ring.

Bearing rings under circumferential load have a

tendency to rotate together with the shaft.

To prevent the rings from moving, all rings running under circumferential load should have tight fits.

Indeterminate load direction

This applies, when **both point loading and circumferential loading** occurs as in the case of the bearings used for crankshaft drives.

A more precise view of this topic can be seen from the examples shown in table 7.1

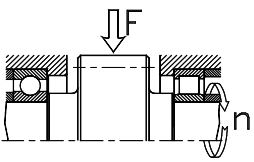
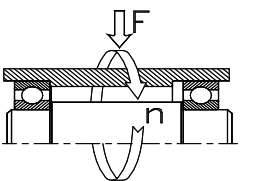
Examples of loading	Inner ring		Outer ring		Application examples
	Type of loading	Fit	Type of loading	Fit	
 <ul style="list-style-type: none"> - shaft rotates with inner ring - stationary loading - outer ring stands still 	circumferential load on inner ring	tight shaft fits required	point load on outer ring	loose housing fits permissible	electric motors spur gear
 <ul style="list-style-type: none"> - housing and outer ring rotate - constant direction of load - shaft and inner ring stand still 	point load on inner ring	loose shaft fits permissible	circumferential load on outer ring	tight housing fits necessary	track wheels rope sheaves wheel bearings
<ul style="list-style-type: none"> - shaft rotates with inner ring - load rotates with inner ring 	point load on inner ring	loose shaft fits permissible	circumferential load on outer ring	tight housing fits required	oscillating screens vibrating compactors
<ul style="list-style-type: none"> - indeterminate load direction 	in-determinate	tight fits required	in-determinate	tight fits required	crankshaft drives

Table 7.1

Magnitude of Loading

Along side its type, the magnitude of the applied load also has a significant role in the selection of bearing seating fits.

The higher the load the tighter the fit must be. This also applies if vibrations or heavy shock loads are to be expected.

The relative magnitude of load is defined in DIN 5425 part 1 as a ratio of the acting forces relative to the load capacity of a radial bearing (table 7.2).

Relative loading in % of radial load capacity C_r		Classification of the bearing for
>	≤	
--	7 %	low loaded
7 %	15 %	medium loaded
15 %		high loaded

Table 7.2

Following this classification the tolerance fields of bearing fits are chosen from the empirical values stated in the tables 7.7 to 7.10.

Bearing Type and Size

In general the larger the bearing the tighter the interference fit must be.

Fits for the mounting of roller bearings are usually tighter than those used for ball bearing applications.

The rings of cylindrical roller bearing types, which allow an internal compensation of length change of the shaft (**N**, **NU**, **NN**, etc.), may be mounted with interference fits on both rings, even if they are used as non/locating bearing.

Shaft and Housing Materials

Shafts and axles that require machined bearing seats are usually made from solid round stock of mild steel.

This is why the following values and recommendations for the selection of bearing fits refer to solid steel shafts and housings made either from steel, cast iron or cast steel.

In some cases **hollow shafts** are also used, which require tighter fits than comparable solid shafts.

When housings are made from light metal alloys, such as aluminium or magnesium tighter housing fits must be considered.

Housings made from light metal alloys have a much higher coefficient of expansion than bearing outer rings made from steel.

This causes a loss of clamping forces, the housing fit will become loose, allowing the outer ring to rotate in the housing.

Adjustment, Mounting and Dismounting

In the definition of bearing fits the requirements of mounting, adjusting and, when applicable, the dismounting of the bearings must be taken into consideration.

This applies particularly to bearing arrangements that require adjustment after bearing mounting.

Fits of Split Bearing Housings

For split housings the tolerance field of the housing seat should not be tighter than “**H**” or “**J**”.

This is due to the risk of roundness deformations of the bearing outer rings due to possible geometrical failures of the split housing.

Shaft Fits for Bearings on Adapter or Withdrawal Sleeves

Usually the required running accuracy of bearings that are mounted using adapter or withdrawal sleeves is not too high.

Small and medium sized bearings are frequently mounted using adapter or withdrawal sleeves directly onto bright drawn bars.

When mounting the bearings by adapter or withdrawal sleeves on solid **machined shafts** the following tolerances for dimensional and form accuracy of the bearing seats is to be used, see table 7.3:

Field of tolerance	Form tolerance
h 7, h8	$\frac{IT\ 5}{2}$
h 9	$\frac{IT\ 6}{2}$

Table 7.3

Required Running Accuracy of Bearing Seatings

The relatively thin walled bearing rings always adopt the form of their shafts and housing seats.

Therefore the **form accuracy** of the bearing seatings must correspond to the required running accuracy of the bearing itself.

The tolerances of **running and form accuracy** of the bearing seats have to be smaller than the diameter tolerances in the corresponding tolerance fields.

Values of more common ISO tolerance grades are shown in **table 7.4**.

For bearings of normal tolerance (**PN**) shaft seats should correspond to IT grade **5**.

Housing seats for less critical applications have to be machined according to ISO grade **IT6**.

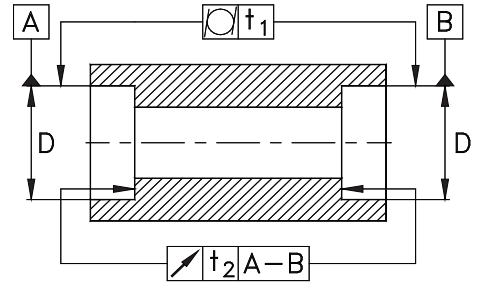
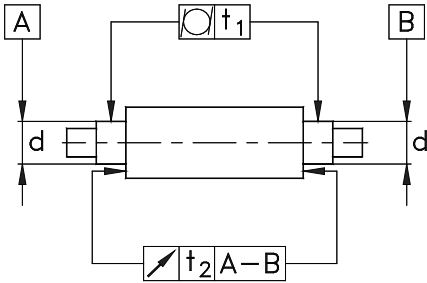
ISO tolerance grades (IT-qualities)

Dimensions are given in [mm], tolerance values are given in microns [µm]

over incl.	1 3	3 6	6 10	10 18	18 30	30 50	50 80	80 120	120 180	180 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250	1250 1600
IT 0	0,5	0,6	0,6	0,8	1	1	1,2	1,5	2	3	4	5	6	--	--	--	--	--
IT 1	0,8	1	1	1,2	1,5	1,5	2	2,5	3,5	4,5	6	7	8	--	--	--	--	--
IT 2	1,2	1,5	1,5	2	2,5	2,5	3	4	5	7	8	9	10	--	--	--	--	--
IT 3	2	2,5	2,5	3	4	4	5	6	8	10	12	13	15	--	--	--	--	--
IT 4	3	4	4	5	6	7	8	10	12	14	16	18	20	--	--	--	--	--
IT 5	4	5	6	8	9	11	13	15	18	20	23	25	27	29	32	36	42	50
IT 6	6	8	9	11	13	16	19	22	25	29	32	36	40	44	50	56	66	78
IT 7	10	12	15	18	21	25	30	35	40	46	52	57	63	70	80	90	105	125
IT 8	14	18	22	27	33	39	46	54	63	72	81	89	97	110	125	140	165	195
IT 9	25	30	36	43	52	62	74	87	100	115	130	140	155	175	200	230	260	310
IT 10	40	48	58	70	84	100	120	140	160	185	210	230	250	280	320	360	420	500
IT 11	60	75	90	110	130	160	190	220	250	290	320	360	400	440	500	560	660	780
IT 12	100	120	150	180	210	250	300	350	400	460	520	570	630	700	800	900	1050	1250

Table 7.4

Form Tolerances of Shaft and Housing Seats



t_1 tolerance of cylindricity
 t_2 tolerance of rectangularity

Bearing tolerance class	Location of bearing seat	Recommended tolerance field	Required cylindricity in case of		Tolerance for rectangularity t_2
			circumferential loading t_1	point loads t_1	
Normal, P6X	shaft	IT 6 (IT5)	$\frac{IT4}{2} \left(\frac{IT3}{2} \right)$	$\frac{IT5}{2} \left(\frac{IT4}{2} \right)$	IT 4 (IT3)
	housing $\varnothing D \leq 150$ mm	IT 6 (IT7)	$\frac{IT4}{2} \left(\frac{IT3}{2} \right)$	$\frac{IT4}{2} \left(\frac{IT5}{2} \right)$	IT 4 (IT5)
	housing $\varnothing D > 150$ mm	IT 7 (IT6)	$\frac{IT5}{2} \left(\frac{IT4}{2} \right)$	$\frac{IT6}{2} \left(\frac{IT5}{2} \right)$	IT 5 (IT4)
P6	shaft	IT5	$\frac{IT3}{2} \left(\frac{IT2}{2} \right)$	$\frac{IT4}{2} \left(\frac{IT3}{2} \right)$	IT3 (IT2)
	housing	IT6	$\frac{IT4}{2} \left(\frac{IT3}{2} \right)$	$\frac{IT5}{2} \left(\frac{IT4}{2} \right)$	IT4 (IT3)
P5	shaft	IT5	$\frac{IT2}{2}$	$\frac{IT3}{2}$	IT2
	housing	IT6	$\frac{IT3}{2}$	$\frac{IT4}{2}$	IT3

Table 7.5

Form Accuracy of Bearing Seats

The **form accuracy** of bearing seats is defined by the **cylindricity** of a bearing seat (roundness of bore or shaft diameter, respectively, parallelism and rectangularity) and by the perpendicularity of abutments like shaft shoulders etc.

With increasing expectations in the running accuracy of bearing arrangements and for bearings of higher precision classes, tolerances of cylindricity and rectangularity of bearing seats must be decreased accordingly.

Table 7.5 shows some empirical values for a simple selection of the tolerances of **form accuracy** (t_1) and the **rectangularity** (t_2) depending on the tolerance class of the bearing used.

The tolerance values given are for **cylindricity** (t_1) and refer to half the nominal diameter.

For measurements of shaft diameter or housing bores by **two-point measurement** the tolerance values have to be doubled, thus $2 * t_1$.

As a rule of thumb it is observed, that the value of the **cylindricity tolerance** (t_1) must not exceed half of the dimensional tolerance.

Surface Roughness of Bearing Seats

Along side the dimensional and form accuracy of bearing seats the **surface roughness** of a bearing seat may influence the function of a bearing arrangement.

The rougher the bearing seat surface the less effective is the surface of the abutting face, initial surface roughness is smoothed between contacting surfaces.

Such a smoothing causes a loss in interference which may affect the general characteristics of a bearing seat.

Bearing seats that have rougher surfaces are more affected by fretting corrosion than smooth surfaces.

Where high running accuracy is required it is particularly important that all abutment surfaces around the bearing arrangement are manufactured accordingly.

Table 7.6 contains some recommendations for the selection of surface roughness of bearing seats and shaft diameters for applications general machinery.

Nominal diameter of bearing seat [mm]		Accuracy of diameter tolerance of shaft and housing seats according to IT-quality					
		IT 7		IT 6		IT 5	
>	≤	R _z	R _a	R _z	R _a	R _z	R _a
--	80	10	1,6 (N7)	6,3	0,8 (N6)	4	0,4 (N5)
80	500	16	1,6 (N7)	10	1,6 (N7)	6,3	0,8 (N6)
500	1250	25	3,2 (N8)	16	1,6 (N7)	10	1,6 (N7)

Table 7.6

Shaft and Housing Fits

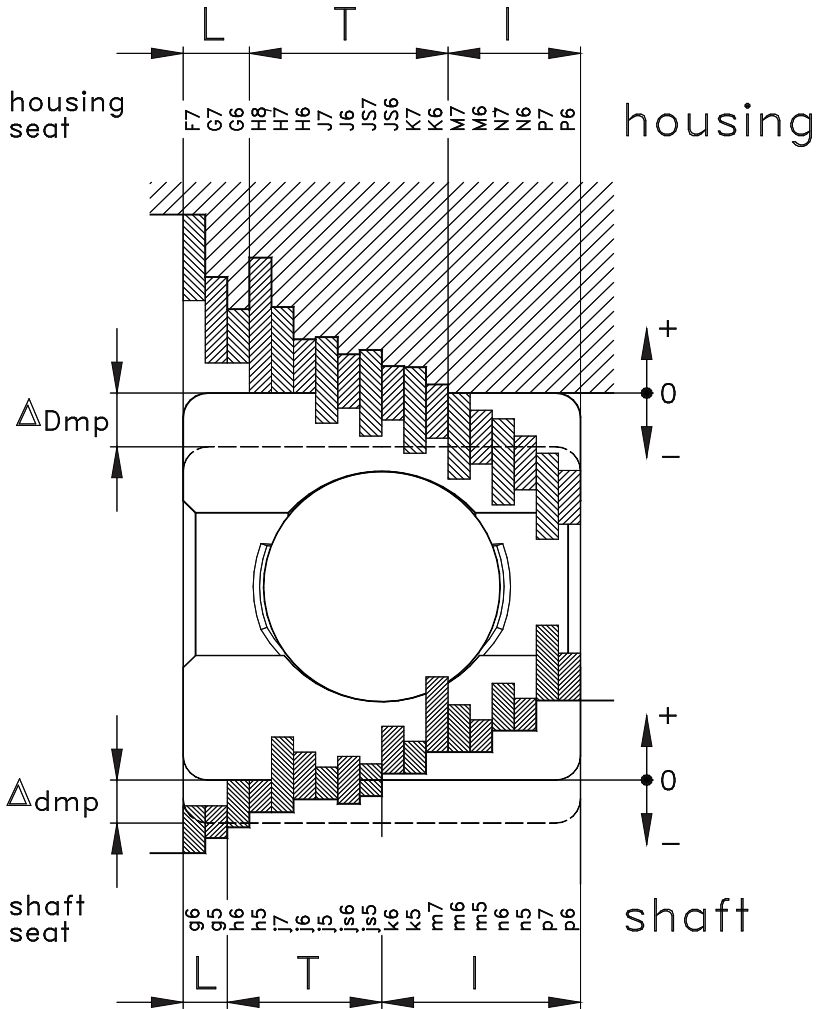


Fig. 7.2

Explanation:

- Δ_{Dmp} Tolerance of bearing outer diameter
- Δ_{dmp} Tolerance of bearing bore
- L** **Loose fit**
- T** **Transition fit**
- I** **Interference fit**

Fig. 7.2 shows schematic values of the most frequently used ISO tolerance fields, for metric radial bearings of normal tolerance class PN, experienced in general machinery applications.

Metric bearings, with some exceptions, generally have minus tolerances for bore diameter, outside diameter and width.

Please note:

Tolerances of inch-sized bearings follow different rules compared metric bearings.

Therefore, for shafts and housing fits these different rules must be considered.

Three different categories of fit may result this is dependant on the individual fits selected for the bearing seats.

Loose fit:

This enables axial displacement of the respective bearing in either direction.

Transition fit:

This is where the respective bearing has either slightly loose or tight bearing seat contact.

Interference fit:

This ensures a very tight fit on the respective bearing seat without axial displacement.

The use of heavy interference fits affects the residual radial clearance of a mounted bearing by expanding the inner ring and by contracting the outer ring.

Therefore, for some bearing applications this phenomenon must be considered at the bearing selection and design stage. It may be necessary to compensate for the clearance reduction by using a greater initial bearing clearance band, (i.e. **C3, C4, C5** or a **special clearance**).

Excessive interference on bearing inner shaft fits can, in extreme cases, result in inner rings cracking.

If in doubt, please contact the NKE technical department.

The simple solution for fits of bearing shaft and housing seats are listed in **tables: 7.7, 7.8, 7.9** and **7.10** these recommendations consider bearing type, size and the relative bearing load, (see also **table 7.2**).

Fits of Thrust Bearings

Generally, thrust bearings must not accommodate radial loading, the exception to this rule being for cylindrical roller thrust bearings or needle roller and cage thrust assemblies. To achieve this stationary washer normally will have a very loose fit whilst the rotating washer will be a close fit.

For thrust bearing washers special attention must be paid to the rectangularity of the supporting surfaces, to ensure uniform load distribution within the bearing, this tolerance should correspond to ISO tolerance field IT 5 or better.

For thrust bearings designed to accommodate radial and axial loads (e.g. spherical thrust roller bearings) the tolerance values for shaft and housing seats must be selected in the same way as the fits for radial bearings.

**Recommended Shaft Fits for
Radial Bearings with Cylindrical Bore**

Loading of inner ring	Bearing type	Bore diameter d		Relative loading axial displaceability	ISO tolerance fields
		>	≤		
Point load	Ball bearings Roller bearings Needle roller bearings	all diameters		non-locating bearing, inner ring displaceable	g6
				adjusted tapered roller bearings adjusted angular contact ball bearings	h6, j6
Circumferential load or indeterminate direction of roller bearings loading	Ball bearings	--	40	normal load	j6 (j5)
		40	100	slightly loaded	j6 (j5)
				normal and high loads	k6 (k5)
		100	200	slightly loaded	k6 (k5)
				normal and high loads	m6 (m5)
		200	--	normal loaded	m6 (m5)
	high loads, shock load			n6 (n5)	
	Roller bearings including needle roller bearing	--	60	slightly loaded	j6 (j5)
				normal and high loads	k6 (k5)
		60	200	slightly loaded	k6 (k5)
				normal loads	m6 (m5)
		200	500	high loads	n6 (n5)
				normal loads	m6 (n6)
		500	--	high loads, shock loads	p6
normal loads				n6 (p6)	
high loads	p6				

Table 7.7

**Recommended Fits for Shaft Washers
of Thrust Bearings**

Type of loading	Bearing type	Loading of shaft washer	Bore diameter d		ISO tolerance fields
			>	≤	
Pure thrust load	Thrust ball bearing, single direction		all diameters		j6
	Thrust ball bearing, double direction		all diameters		k6
	Cylindrical roller thrust bearings Needle roller and cage thrust assembly with shaft washer		all diameters		h6(j6)
	Cylindrical roller and cage thrust assembly Needle roller and cage thrust assembly with LS-raceway washer or AS-thrust washer		all diameters		h10
	Cylindrical roller and cage thrust assembly Needle roller and cage thrust assembly		all diameters		h8
Combined load	Spherical roller thrust bearings	Point load	all diameters		j6
		Circumferential load	--	200	j6(k6)
			200	--	k6(m6)

Table 7.8

**Recommended Housing Fits
for Radial Bearings**

Loading of outer ring	Relative loading, axial displaceability	Remarks	ISO tolerance fields
Point load	Non-locating bearing, outer ring may be moved easily	normal running accuracy	H8
		if high running accuracy is required	H7
		if very high running accuracy is required	H6
	Displaceable outer rings of paired tapered roller bearings and angular contact ball bearings	normal running accuracy	H7, J7
		if high running accuracy is required	H6, J6
In the case of additional heat fed via the shaft			G7
Circumferential load or Indeterminate load direction	Slightly loaded only	normal running accuracy	K7
		if high running accuracy is required	K6
	Normal load, some shock loading	normal running accuracy	M7
		if high running accuracy is required	M6
	High loads, shock load	normal running accuracy	N7
		if high running accuracy is required	N6
High loads, high shocks or thin-walled housings	normal running accuracy	P7	
	f high running accuracy is required	P6	

Table 7.9

**Recommended Housing Fits
for Thrust Bearing**

Type of Loading	Bearing types	Remarks	ISO - tolerance-felder
Pure thrust load only	Thrust ball bearing	for normal running accuracy	E8
		if higher running accuracy is required	H6
	Cylindrical roller thrust bearing Needle roller and cage thrust assembly with housing washer		H7 (K7)
	Cylindrical roller and cage thrust assembly Needle roller and cage thrust assembly with LS -raceway washer or AS -thrust washer		H11
	Cylindrical roller and cage thrust assembly Needle roller and cage thrust assembly		H10
	Spherical roller thrust bearings	for normal loads	E8
		for high loads	G7
Combined loading, in the case of point loaded housing washer	Spherical roller thrust bearings		H7
Combined loading, as for circumferentially loaded housing washer	Spherical roller thrust bearings		K7

Table 7.10

Tables of Fits

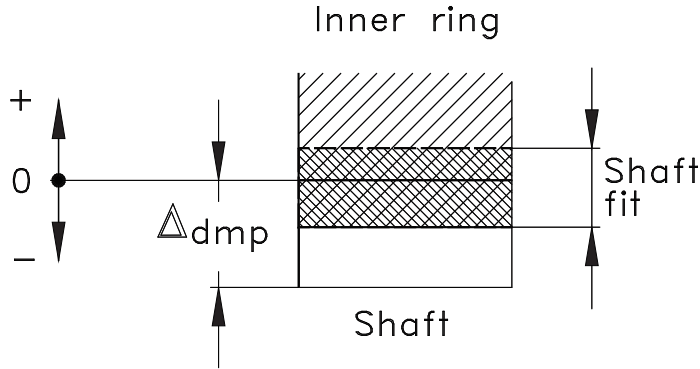


Fig. 7.3

For general machinery applications the most frequent bearing shaft and housing fits are tabulated on **following pages** inclusive.

To determine the theoretical tolerance fields and whether the results indicate loose or interference fit at the bearing seat each appropriate table lists the nominal shaft or housing diameters and their diameter size tolerance range, Δ_{dmp} for shafts and Δ_{Dmp} for housings, to be used in conjunction with a bearing of equal size and to tolerance class (PN) normal tolerance.

The following example shows:

Shaft nominal diameter	\varnothing 75 mm
ISO tolerance field j5	+0.006 mm - 0.007mm
Bearing nominal bore diameter	\varnothing 75 mm
Bearing bore diameter tolerance (PN)	Δd_{mp} +0.000 mm - 0.015 mm

Shaft fit \varnothing 75 j5:

	-21
+6	-12
-7	7

If these meet, the following values occur (please refer to fig. 7.3):

- a) A **maximum interference** will occur when the **largest allowed shaft diameter** meets the **smallest permissible bearing bore**.
In the above example:
 $|+6 + (-15)| = 21 \mu\text{m}$ (upper value)
- b) The **smallest interference** will occur when the **smallest allowed shaft diameter** meets the **largest permissible bearing bore**.
In the above example:
 $|-7 + 0| = 7 \mu\text{m}$ (lower value)
- c) The **probable interference** assumes the actual dimensions to lie 1/3 of the tolerance value apart from the tolerance go side.
In the above example:
12 μm (centre value)

Bold negative figures in the each right half of a field denote interference fit!

Shaft Fits

Nominal shaft diameter [mm]

Tolerances are in [μm]

Nominal shaft diameter	over incl.	3 6	6 10	10 18	18 30	30 50	50 80	80 120	120 180
Deviation		0	0	0	0	0	0	0	0
Δ_{dmp}		-8	-8	-8	-10	-12	-15	-20	-25
g5		-4	-5	-6	-7	-9	-10	-12	-14
		0	2	3	3	5	6	8	11
		9	11	14	16	20	23	27	32
g6		-4	-5	-6	-7	-9	-10	-12	-14
		1	3	4	5	6	6	8	11
		12	14	17	20	25	29	34	39
h5		0	0	0	0	0	0	0	0
		-4	-3	-3	-4	-4	-6	-8	-8
		5	6	8	9	11	13	15	18
h6		0	0	0	0	0	0	0	0
		-3	-2	-2	-2	-3	-4	-6	-6
		8	9	11	13	16	19	22	25
j5		+3	+4	+5	+5	+6	+6	+6	+7
		-7	-7	-8	-9	-10	-12	-14	-18
		2	2	3	4	5	7	9	11
j6		+6	+7	+8	+9	+11	+12	+13	+14
		-8	-9	-10	-11	-14	-16	-19	-22
		2	2	3	4	5	7	9	11
js5		+2,5	+3	+4	+4,5	+5,5	+6,5	+7,5	+9
		-6	-6	-6	-6	-10	-13	-16	-20
		3	3	4	4	6	7	8	9
js6		+4	+4,5	+5,5	+6,5	+8	+9,5	+11	+12,5
		-7	-7	-8	-9	-11	-13	-17	-21
		4	5	6	7	8	10	11	13

Example: Shaft \varnothing **75 j5** upper limit ("go - side") +6 μm
lower limit ("no - go side") -7 μm
Bearing with standard tolerances (PN), deviation $\Delta_{\text{dmp}} = 0 / -15 \mu\text{m}$

For shaft \varnothing **75 j5**:

go-side	+6	-21	interference or clearance if the go-sides meet
no-go side	-7	7	probable interference or clearance
			interference or clearance if the no-go sides meet

The bold negative figures in the right hand column denote interference!

Shaft Fits

Nominal shaft diameter [mm]

Tolerances are in [μm]

over incl.	180 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250								
Deviation	0	0	0	0	0	0	0	0								
Δ_{dmp}	-30	-34	-40	-45	-50	-75	-100	-125								
g5	-15 -35	-15 2 35	-17 -40	-18 1 40	-18 -43	-22 0 43	-20 -47	-25 1 47	-22 -51	-1 -24	-51 -15	-26 -62	-74 -29	-28 -70	-97 -41	-70
g6	-15 -44	-15 5 44	-17 -49	-18 4 49	-18 -54	-22 3 54	-20 -60	-25 3 60	-22 -66	-28 4 66	-24 -74	-9 -9	-26 -82	-24 -24	-28 -94	-33 94
h5	0 -20	-30 -13 20	0 -23	-35 -16 23	0 -25	-40 -18 25	0 -27	-45 -21 27	0 -29	-50 -23 29	0 -32	-75 -39 32	0 -36	-100 -55 36	0 -42	-125 -69 42
h6	0 -29	-30 -10 29	0 -32	-35 -13 32	0 -36	-40 -15 36	0 -40	-45 -17 40	0 -44	-50 -18 44	0 -50	-75 -33 50	0 -56	-100 -48 56	0 -66	-125 -61 66
j5	+7 -13	-37 -20 13	+7 -16	-42 -23 16	+7 -18	-47 -25 18	+7 -20	-52 -28 20								
j6	+16 -13	46 -26 13	+16 -16	-51 -29 16	+18 -18	-58 -33 18	+20 -20	-65 -37 20	+22 -22	-72 -40 22	+25 -25	-100 -58 25	+28 -28	-128 -76 28	+33 -33	-158 -94 33
js5	+10 -10	-40 -23 10	+11,5 -11,5	-47 -27 12	+12,5 -12,5	-53 -32 13	+13,5 -13,5	-59 -35 14	+14,5 -14,5	-65 -38 15	+16 -16	-91 -55 16	+18 -18	-118 -73 18	+21 -21	-146 -90 21
js6	+14,5 -14,5	-45 -25 15	+16 -16	-51 -29 16	+18 -18	-58 -33 18	+20 -20	-65 -37 20	+22 -22	-72 -40 22	+25 -25	-100 -58 25	+28 -28	-128 -76 28	+33 -33	-158 -94 33

The bold negative figures in the right hand column denote interference!

Shaft Fits

Nominal shaft diameter [mm]

Tolerances are in [μm]

Nominal shaft diameter	over incl.	3		6		10		18		30		50		80		120		180	
		6		10		18		30		50		80		120		180		180	
Deviation Δ_{dmp}		0		0		0		0		0		0		0		0		0	
		-8		-8		-8		-10		-12		-15		-20		-25			
k5		-14		-15		-17		-21		-25		-30		-38		-46			
	+6	-9	+7	-10	+9	-12	+11	-15	+13	-17	+15	-21	+18	-26	+21	-32	+21	-32	
	+1	-1	+1	-1	+1	-1	+2	-2	+2	-2	+2	-2	+3	-3	+3	-3	+3	-3	
k6		-17		-18		-20		-25		-30		-36		-45		-53			
	+9	-11	+10	-12	+12	-14	+15	-17	+18	-21	+21	-25	+25	-31	+28	-36	+28	-36	
	+1	-1	+1	-1	+1	-1	+2	-2	+2	-2	+2	-2	+3	-3	+3	-3	+3	-3	
m5		-17		-20		-23		-27		-32		-39		-48		-58			
	+9	-13	+12	-15	+15	-18	+17	-21	+20	-24	+24	-30	+28	-36	+33	-44	+33	-44	
	+4	-4	+6	-6	+7	-7	+8	-8	+9	-9	+11	-11	+13	-13	+15	-15	+15	-15	
m6		-20		-23		-26		-31		-37		-45		-55		-65			
	+12	-15	+15	-17	+18	-20	+21	-23	+25	-27	+30	-34	+35	-42	+40	-48	+40	-48	
	+4	-4	+6	-6	+7	-7	+8	-8	+9	-9	+11	-11	+13	-13	+15	-15	+15	-15	
n5		-21		-24		-28		-34		-40		-48		-58		-70			
	+13	-17	+16	-19	+20	-23	+24	-28	+28	-32	+33	-39	+38	-46	+45	-56	+45	-56	
	+8	-8	+10	-10	+12	-12	+15	-15	+17	-17	+20	-20	+23	-23	+27	-27	+27	-27	
n6		-24		-27		-31		-38		-45		-54		-65		-77			
	+16	-19	+19	-21	+23	-25	+28	-30	+33	-36	+39	-43	+45	-51	+52	-60	+52	-60	
	+8	-8	+10	-10	+12	-12	+15	-15	+17	-17	+20	-20	+23	-23	+27	-27	+27	-27	
p6		-28		-32		-37		-45		-54		-66		-79		-93			
	+20	-23	+24	-26	+29	-31	+35	-37	+42	-45	+51	-55	+59	-65	+68	-76	+68	-76	
	+12	-12	+15	-15	+18	-18	+22	-22	+26	-26	+32	-32	+37	-37	+43	-43	+43	-43	
p7		-32		-38		-44		-53		-63		-77		-92		-108			
	+24	-25	+30	-30	+36	-35	+43	-43	+51	-51	+62	-62	+72	-73	+83	-87	+83	-87	
	+12	-12	+15	-15	+18	-18	+22	-22	+26	-26	+32	-32	+37	-37	+43	-43	+43	-43	

Example: shaft \varnothing 100 m5 upper limit ("go-side") +28 μm
lower limit ("no-go side") +13 μm
Bearing with standard tolerances (PN), deviation $\Delta_{\text{dmp}} = 0 / -20 \mu\text{m}$

For shaft \varnothing 100 m5:

go-side	+28	-48	interference or clearance if the go-sides meet probable interference or clearance interference or clearance if the no-go sides meet
no-go side	+13	-36	
		-13	

The bold negative figures in the right hand column denote interference!

Shaft Fits

Nominal shaft diameter [mm]

Tolerances are in [μm]

over incl.	180 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250	
Deviation	0	0	0	0	0	0	0	0	
Δ_{dmp}	-30	-34	-40	-45	-50	-75	-100	-125	
k5	+24 -37 +4	-54 +27 +4	-62 -43 -4	-69 +29 +4	-77 -47 +5	-79 -53 0	-107 -71 0	-136 -91 0	-167 +42 0
k6	+33 -43 +4	-63 +36 +4	-71 -49 -4	-80 +40 +4	-90 -55 +5	-94 -62 0	-125 -83 0	-156 -104 0	-191 +66 0
m5	+37 -50 +17	-67 +43 +20	-78 -59 -20	-86 +46 +21	-95 -71 +23	-105 -78 +26	-137 -101 +30	-170 -125 +34	-207 +82 +40
m6	+46 -56 +17	-76 +52 +20	-87 -65 -20	-97 +57 +21	-108 -80 +23	-120 -88 +26	-155 -113 +30	-190 -138 +34	-231 +106 +40
n5	+51 -64 +31	-81 +57 +34	-92 -73 -34	-102 +62 +37	-112 -88 +40	-123 -96 +44	-157 -121 +50	-192 -147 +56	-233 +108 +66
n6	+60 -70 +31	-90 +66 +34	-101 -79 -34	-113 +73 +37	-125 +80 +40	-138 -106 +44	-175 -133 +50	-212 -160 +56	-257 +132 +66
p6	+79 -89 +50	-109 +88 +56	-123 -101 -56	-138 +98 +62	-153 +108 +68	-172 -140 +78	-213 -171 +88	-256 -204 +100	-311 +186 +120
p7	+96 -101 +50	-126 +108 +56	-143 -114 -56	-159 +119 +62	-176 +131 +68	-198 -139 +78	-243 -199 +88	-290 -227 +100	-350 +225 +120

The bold negative figures in the right hand column denote interference!

Housing Fits

Nominal diameter of housing bore [mm]

Tolerances are in [µm]

Nominal housing bore	over incl.	6	10	18	30	50	80	120	150	150						
		10	18	30	50	80	120	150	180	180						
Deviation		0	0	0	0	0	0	0	0	0						
Δ_{Dmp}		-8	-8	-9	-11	-13	-15	-18	-25	-25						
F7		13	16	20	25	30	36	43	43	43						
	+28	21	+34	25	+41	30	+50	37	+60	44	+71	53	+83	62	+83	64
	+13	36	+16	42	+20	50	+25	61	+30	73	+36	86	+43	101	+43	108
G6		5	6	7	9	10	12	14	14	14						
	+14	11	+17	12	+20	14	+25	18	+29	21	+34	24	+39	28	+39	31
	+5	22	+6	25	+7	29	+9	36	+10	42	+12	49	+14	57	+14	64
G7		5	6	7	9	10	12	14	14	14						
	+20	13	+24	15	+28	17	+34	21	+40	24	+47	29	+54	33	+54	36
	+5	28	+6	32	+7	37	+9	45	+10	53	+12	62	+14	72	+14	79
H6		0	0	0	0	0	0	0	0	0						
	+9	6	+11	6	+13	7	+16	9	+19	11	+22	12	+25	14	+25	17
	0	17	0	19	0	22	0	27	0	32	0	37	0	43	0	50
H7		0	0	0	0	0	0	0	0	0						
	+15	8	+18	9	+21	10	+25	12	+30	14	+35	17	+40	19	+40	22
	0	23	0	26	0	30	0	36	0	43	0	50	0	58	0	65
H8		0	0	0	0	0	0	0	0	0						
	+22	10	+27	12	+33	14	+39	17	+46	20	+54	23	+63	27	+63	29
	0	30	0	35	0	42	0	50	0	59	0	69	0	81	0	88
J6		-4	-5	-5	-6	-6	-6	-6	-7	-7						
	+5	2	+6	1	+8	2	+10	3	+13	5	+16	6	+18	7	+18	10
	-4	13	-5	14	-5	17	-6	21	-6	26	-6	31	-7	36	-7	43
J7		-7	-8	-9	-11	-12	-13	-14	-14	-14						
	+8	1	+10	1	+12	1	+14	1	+18	2	+22	4	+26	5	+26	8
	-7	16	-8	18	-9	21	-11	25	-12	31	-13	37	-14	44	-14	51
JS6		-4,5	-5,5	-6,5	-8	-9,5	-11	-12,5	-12,5	-12,5						
	+4,5	2	+5,5	1	+6,5	0	+8	1	+9,5	0	+11	1	+12,5	1	+12,5	3
	-4,5	12,5	-5,5	13,5	-6,5	15,5	-8	19	-9,5	22,5	-11	26	-12,5	30,5	-12,5	37,5

Example: Housing \varnothing 120 H6 upper limit ("no - go side") +22 µm
 lower limit ("go - side") 0 µm
 Bearing with standard tolerances (PN), tolerance of outer \varnothing deviation $\Delta_{Dmp} = 0 / -15$ µm

Housing \varnothing 120 H6:

no-go side
go-side

	0
+22	12
0	37

interference or clearance if the **go-sides** meet
probable interference or clearance
 interference or clearance if the **no-go sides** meet

Housing Fits

Nominal diameter of housing bore [mm]

Tolerances are in [μm]

over incl.	180 250	250 310	310 400	400 500	500 630	630 800	800 1000	1000 1250	1250 1600													
Deviation Δ_{Dmp}	0 -30	0 -35	0 -40	0 -45	0 -50	0 -75	0 -100	0 -125	0 -160													
F7	+96 +50	50 126	+108 +56	56 143	+119 +62	62 159	+131 +68	94 176	+104 +76	104 196	+146 +80	116 235	+160 +86	132 276	+176 +98	149 328	+203 +110	175 395	+235 +110	110 395		
G6	+44 +15	15 74	+49 +17	17 84	+54 +18	18 94	+60 +20	20 105	+48 +22	22 116	+74 +24	24 149	+66 +26	54 182	+74 +28	66 219	+82 +28	78 258	+94 +30	93 268	+108 +30	109 268
G7	+61 +15	15 91	+69 +17	17 104	+75 +18	18 115	+83 +20	20 128	+56 +22	22 142	+104 +24	24 179	+62 +26	62 216	+104 +28	76 258	+116 +28	89 258	+133 +30	105 315	+155 +30	125 315
H6	+29 0	0 59	+32 0	22 67	+36 0	25 76	+40 0	28 85	+44 0	28 94	+50 0	32 125	+56 0	42 156	+66 0	52 191	+66 0	64 191	+78 0	79 238	+78 0	79 238
H7	+46 0	25 76	+52 0	29 87	+57 0	32 97	+63 0	36 108	+70 0	40 120	+80 0	52 155	+90 0	63 190	+105 0	77 230	+125 0	95 285	+125 0	95 285	+125 0	95 285
H8	+29 0	20 59	+32 0	22 67	+36 0	25 76	+40 0	28 85	+44 0	32 94	+50 0	42 125	+56 0	52 156	+66 0	64 191	+78 0	79 238	+78 0	79 238	+78 0	79 238
J6	+22 -7	-7 52	+25 -7	15 60	+29 -7	18 69	+33 -7	21 78														
J7	+30 -16	-16 9	+36 -16	13 71	+39 -18	14 79	+43 -20	16 88														
JS6	+14,5 -14,5	-14,5 5	+16 -16	7 51	+18 -18	6 58	+20 -20	8 65	+22 -22	10 72	+25 -25	17 100	+28 -28	24 128	+33 -33	31 158	+39 -39	40 199	+39 -39	40 199	+39 -39	40 199

The bold negative figures in the right hand column denote interference!

Housing Fits

Nominal diameter of housing bore [mm]

Tolerances are in [µm]

Nominal housing bore over incl.	6		10		18		30		50		80		120		150	
	10		18		30		50		80		120		150		180	
Deviation Δ_{Dmp}	0		0		0		0		0		0		0		0	
	-8		-8		-9		-11		-13		-15		-18		-25	
JS7	+7,5 -7,5	-7,5 1 15,5	+9 -9	-9 17	+10,5 -10,5	-1 19,5	+12,5 -12,5	-1 23,5	+15 -15	-1 28	+17,5 -17,5	-1 32,5	+20 -20	1 38	+20 -20	1 45
K6	+2 -7	-7 -1 10	+2 -9	-3 10	+2 -11	-4 11	+3 -13	-4 14	+4 -15	-4 17	+4 -18	-6 19	+4 -21	-7 22	+4 -21	-4 29
K7	+5 -10	-10 -2 13	+6 -12	-3 14	+6 -15	-5 15	+7 -18	-6 18	+9 -21	-7 22	+10 -25	-8 25	+12 -28	-9 30	+12 -28	-6 37
M6	-3 -12	-12 -6 5	-4 -15	-9 4	-4 -17	-10 5	-4 -20	-11 7	-5 -24	-13 8	-6 -28	-16 9	-8 -33	-19 10	-8 -33	-16 17
M7	0 -15	-15 -7 8	0 -18	-9 8	0 -21	-11 9	0 -25	-13 11	0 -30	-16 13	0 -35	-18 15	0 -40	-21 18	0 -40	-18 25
N6	-7 -16	-16 -10 1	-9 -20	-14 -1	-11 -24	-17 -2	-12 -28	-19 -1	-14 -33	-22 -1	-16 -38	-26 -1	-20 -45	-31 -2	-20 -45	-28 5
N7	-4 -19	-19 -11 4	-5 -23	-14 3	-7 -28	-18 2	-8 -33	-21 3	-9 -39	-25 4	-10 -45	-28 5	-12 -52	-33 6	-12 -52	-30 13
P6	-12 -21	-21 -15 -4	-15 -26	-20 -7	-18 -31	-24 -9	-21 -37	-28 -10	-26 -45	-34 -13	-30 -52	-40 -15	-36 -61	-47 -18	-36 -61	-44 -11
P7	-9 -24	-24 -16 -1	-11 -29	-20 -3	-14 -35	-25 -5	-17 -42	-30 -6	-21 -51	-37 -8	-24 -59	-42 -9	-28 -68	-49 -10	-28 -68	-46 -3

Example: Housing \varnothing 160 **M6** upper limit ("no-go side") - 8 µm
lower limit ("go-side") -33 µm
Bearing with standard tolerances (**PN**), tolerance of outer \varnothing deviation Δ_{Dmp} = 0 / -25 µm

Housing \varnothing 160 **M6**:

no-go side
go-side

	-33
-8	-16
-33	17

interference or clearance if the **go-sides** meet
probable interference or clearance
interference or clearance if the **no-go sides** meet

Housing Fits

Nominal diameter of housing bore [mm]

Tolerances are in [μm]

over incl.	180 250	250 310	310 400	400 500	500 630	630 800	800 1000	1000 1250	1250 1600									
Deviation Δ_{Dmp}	0 -30	0 -35	0 -40	0 -45	0 -50	0 -75	0 -100	0 -125	0 -160									
JS7	+23 -23	-23 2 53	+26 -26	-26 3 61	+28,5 -28,5	3 68,5	+31,5 -31,5	4 76,5	+35 -35	5 85	+40 -40	12 115	+45 -45	18 145	+52 -52	24 177	+62 -62	32 222
K6	+5 -24	-24 -4 35	+5 -5	-5 +7 40	-27 -4 29	+7 -4 47	+8 -4 32	-4 -4 53	0 -12 44	-12 0 50	0 -8 75	-38 0 -50	-34 -4 75	-38 0 100	-40 -2 66	-45 0 125	-48 -2 160	-47 1 160
K7	+13 -33	-33 -8 43	+16 -7	-7 +17 51	-36 -8 40	+17 -8 57	+18 -9 45	-9 -9 63	0 -30 70	-30 0 50	0 -28 80	-80 0 75	-80 -27 90	0 -27 100	-105 -28 125	0 -28 125	-125 0 160	-125 -30 160
M6	-8 -37	-37 -17 22	-9 -9	-19 -19 26	-41 -10 46	-10 -10 30	-21 -10 50	-22 -10 35	-26 -26 70	-38 -30 24	-38 -30 80	-80 -34 45	-90 -34 90	-90 -34 66	-106 -40 106	-106 85	-126 -48 112	-126 -47 112
M7	0 -46	-46 -21 30	0 -52	-23 35	-52 -19 57	0 -25 40	-27 0 63	-27 -27 45	-26 -26 96	-56 -30 24	-58 -30 110	-110 45	-110 -34 124	-124 66	-145 -40 145	-145 85	-173 -48 112	-173 -78 112
N6	-22 -51	-51 -31 8	-25 -57	-35 10	-57 -26 62	-37 -27 14	-39 -27 18	-44 -39 88	-56 -50 6	-58 -50 100	-58 -56 25	-100 -112	-112 44	-112 44	-132 -66 132	-132 59	-156 -78 156	-156 -77 82
N7	-14 -60	-60 -35 16	-14 -66	-37 21	-66 -16 73	-16 -41 24	-17 -44 80	-28 -44 114	-44 -44 114	-114 -74 6	-50 -78 130	-130 25	-146 -56 146	-146 44	-171 -66 171	-171 59	-203 -78 203	-203 -108 82
P6	-41 -70	-70 -50 11	-47 -79	-57 -12	-79 -51 87	-62 -55 11	-67 -55 10	-78 -67 122	-90 -78 122	-90 -88 122	-122 -88 138	-138 -13	-156 -100 156	-156 0	-186 -120 186	-186 5	-218 -140 218	-218 -139 20
P7	-33 -79	-79 -54 3	-36 -88	-59 -1	-88 -41 98	-66 -41 98	-98 -45 108	-108 -72 108	-78 -78 148	-108 -78 148	-128 -88 168	-168 -13	-190 -100 190	-190 0	-225 -120 225	-225 5	-265 -140 265	-265 -159 20

The bold negative figures in the right hand column denote interference!

Design of Bearing Seats as Raceways

In several applications it may be advantageous to use roller and cage assemblies only instead of complete bearings.

Typical examples for such application are needle roller bearings without inner rings (RNA-type needle roller bearings), cylindrical roller bearings without inner rings (RNU-type) or without outer rings (RN-type), needle roller and etc., cage assemblies including full complement type arrangements where separate rolling elements such as rollers or bearing needles run directly onto the contacting surfaces of shafts or housings.

It can be seen that such bearing arrangements allow maximum utilisation of available design space. Additionally, the omission of the inner or outer rings enables the maximum shaft or housing sections ensuring a more rigid design arrangement.

In these cases the rolling elements run directly onto the contacting surfaces of the shaft or housing which must fulfil the functions of the omitted bearing ring. Therefore, in order to fulfil these functions correctly the dimensional, geometrical and surface finish accuracy, including the surface hardness values must be to the required bearing standards.

To provide an optimum use of the potential capacity of a bearing the running surfaces must have a hardness of **58 to 64 HRC**.

Also all surfaces supporting axial guidance to the bearing, such as shaft shoulders or contacting surfaces on adjacent parts, have to be similarly heat-treated.

Therefore suitable materials for such direct bearing arrangements are hardening steels, (see examples listed in **table 7.11**).

Following the individual specifications of each application either a suitable through hardening steel, case hardening steel or steels for flame or induction hardening with high core tenacity may be selected to manufacture the shafts or housings.

In the case of steels suitable for flame or induction hardening a partial hardening of the running surfaces only is possible which enables economic cost solutions.

But when applying such surface hardening, a certain **minimum case depth** must be considered. As the case depth is dependant upon the application and its operating conditions no specific rules apply to determine this depth, although, **it is generally accepted the minimum case depth must be 10% minimum of the rolling element diameter.**

Steel type	DIN material number	Remark
100Cr6	1.3505	through hardening bearing steel
100CrMn6	1.3520	through hardening bearing steel
100CrMo73	1.3536	through hardening bearing steel
17MnCr5	1.3521	case hardening steel
19MnCr5	1.3523	case hardening steel
16CrNiMo6	1.3531	case hardening steel
42CrMo4-V	1.7225	steel for flame or induction hardening
43CrMo4	1.3563	steel for flame or induction hardening
48CrMo4	1.3565	steel for flame or induction hardening

Table 7.11

Design of Bearing Location

Of equal importance is the **form accuracy** of the running surfaces.

The permissible **roundness deviation** for normal expectation of running accuracy must not exceed **20%** of the diameter tolerance of shaft or housing seat.

The **cylindricity deviation** should be less than half these values.

With increasing requirements in the running accuracy of the bearing application the tolerances of cylindricity and rectangularity have to be restricted accordingly.

The **surface roughness** of contacting faces designed as bearing raceways must not exceed a surface roughness of $R_a \leq 0,2 \mu\text{m}$.

If less running accuracy is adequate higher values of surface roughness may be defined.

Diameter Tolerances of Incorporated Raceways

Following the definition of diameter tolerances of bearing raceways, incorporating adjacent machine components the required **bearing clearance** must also be defined.

In the case of separable bearing types, (e.g. needle roller bearings or cylindrical roller bearings) the amount of radial clearance is defined by the raceway diameter of their loose rings.

The diameter tolerance of bearing rings is arranged in such a way that when matched with the tolerance of the diameter under the rollers this gives a certain range of radial clearance values. These values are arranged in clearance groups.

To avoid undesired preloading of the bearings or excessive clearance the tolerances for a certain clearance group must be considered carefully.

Values of clearance groups, including tolerances of diameters under rollers, are listed in the specific product information tables.

Axial Location of Bearing

Whilst rolling bearings, used in various applications, generally have radial location of their shaft and housing seats, they also require certain axial location using the appropriate fits (see **tables 7.7, 7.8, 7.9 and 7.10**).

Where heavy interference fits of shafts or housings provide clamping forces on the bearing seats they do not guarantee axial location in all circumstances.

True axial location of the bearings at their seats is best achieved by means of a closed-form arrangement usually by locking nuts and washers, housing cups, shaft shoulders, snap rings etc. (fig. 7.4) complete.

It is necessary to ensure the design of adjacent parts of the bearing arrangement consider the respective functions of both the locating and non-locating bearings.

For the floating bearing, high thrust loading seldom occurs, however, there is some axial force generated by the shafts thermal expansion. In such cases little effort is required to retain the bearing location axially and a simple solution is to use snap rings etc.

Locating bearings however transmit radial loads, including the acting thrust forces.

As these forces may act in either direction the location and the adjacent parts of the bearing arrangement must be designed accordingly.

Bearings arranged in sets that require adjustment or preloading will take thrust loads alternately, so the shaft is guided in an axial direction by one bearing.

However where the acting thrust force is in one direction only the complete axial location must be for the bearing set.

Examples of Axial Locations of Rolling Bearings

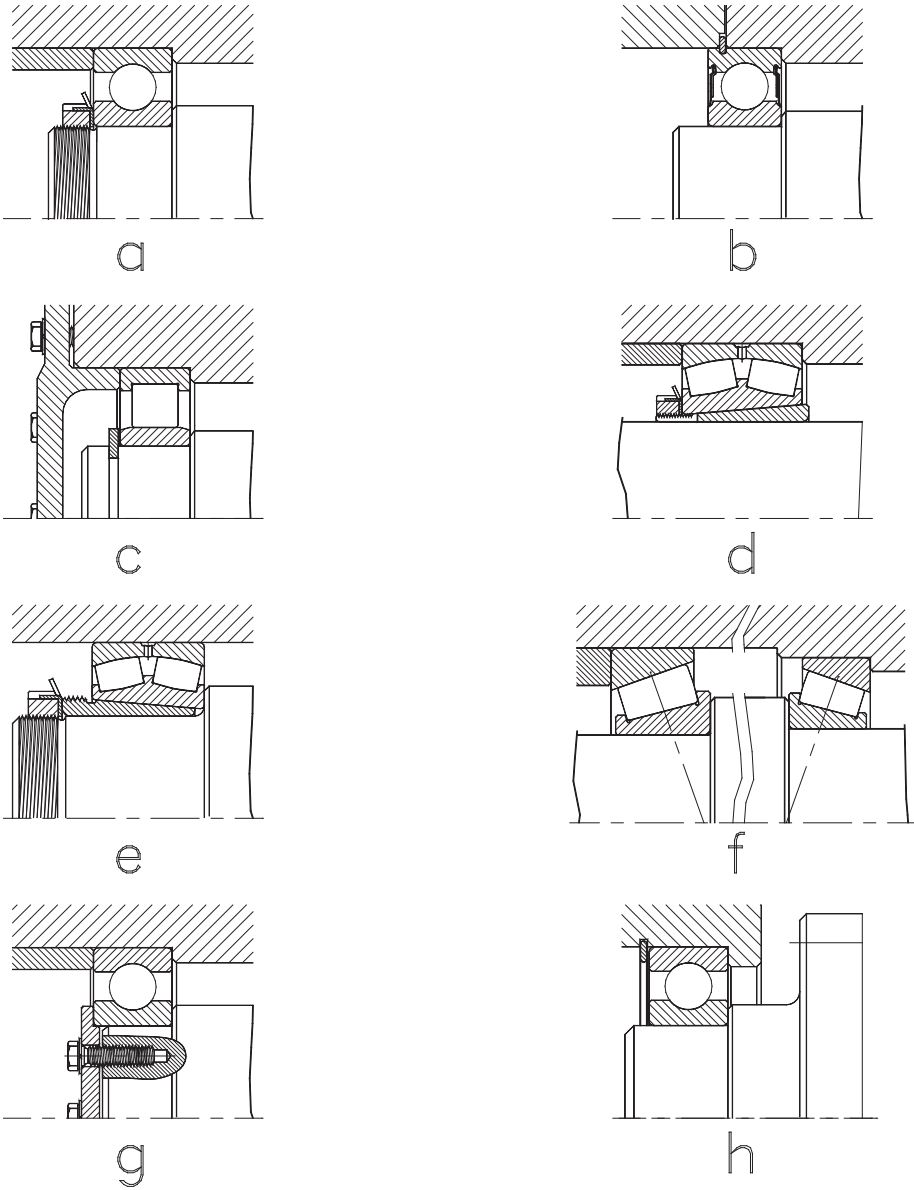


Fig. 7.4

Fig. 7.4a)

Deep groove ball bearing used as a **locating bearing**. Axial location is provided by the housing shoulder and the shaft shoulder and a lock nut, secured by a **locking washer**.

Fig. 7.4b)

Axial location of a **deep groove ball bearing** by means of a **snap ring groove** in the outer ring and housing, fitted with a snap ring.

A very simple and economic method as the bearing and the snap ring make a unit that provides a quick and easy mounting.

For such applications, however, a certain axial play will occur due to the width tolerances of snap ring groove and the snap ring.

Such a location is suitable to accommodate low thrust forces only.

Fig. 7.4c)

Axial location using **shaft snap rings** enable a quick cheap and simple mounting, for applications of mass production.

Fig. 7.4d)

Location of a spherical roller bearing with tapered bore on a plain shaft. The use of adapter sleeves allows shafts of lower class tolerances including turned or cold drawn bars to be used. Additionally the bearing mounting and arrangement construction is reduced. The maximum permissible thrust loads that may be applied to the bearing, however, is limited when using plain shafts without shaft shoulders.

In such cases the maximum applied load is limited by the friction between the contacting surfaces of adapter sleeve bore and shaft.

This is why a shaft shoulder is required when using bearings with adapter sleeves that are exposed to high thrust loads.

Fig. 7.4e)

Location of a spherical roller bearing with tapered bore, using a withdrawal sleeve.

Such a measure also enables the simplification of bearing seats and provides easier mounting and dismantling of the bearings. This type of location allows the use of lower class tolerances than for bearings mounted directly onto shafts. The bearing inner ring must be supported by an abutment face (i.e. shaft shoulder).

In cases where for strengthening reasons the shafts corner fillet clearance is larger than that of the bearing it may be necessary to fit a distance ring.

In all cases the withdrawal sleeve is secured against axial displacement by using a shaft nut or end plate.

Fig. 7.4f)

Tapered roller bearings located in face-to-face arrangement. These bearings take the thrust loads alternately, so axial location is only necessary in one direction.

At the design stage of such arrangements consideration must be taken to allow for adjustment of the bearings.

Fig. 7.4g)

Deep groove ball bearing as locating bearing. The axial location in the housing is secured by the housing shoulder and, on the shaft by the shaft shoulder and an **end plate** bolted onto the shaft end.

A relative costly arrangement.

Fig. 7.4h)

Cross-located deep groove ball bearings. The axial location in the housing is secured by each housing shoulder and a standardised **locking ring**.

Such a location is suitable for bearing arrangements without special requirements for axial guidance accuracy.

Abutment and Fillet Dimensions

The diameter of connecting parts, such as adjacent shaft collars, housing shoulders and distance rings, must be defined according to the individual guide lines relevant for each bearing type and size.

Recommendations for abutment and fillet dimensions are given in the product information tables.

The consideration of these values guarantees sufficient axial support of bearing rings enabling the bearing load ratings use in an optimum way. These values also consider salient features of each bearing type, such as cage protrusion of some tapered roller bearings.

Bearing ring forces may only contact their axial supporting surfaces.

The bearing corners must always be clear of the shaft and housing fillet radii.

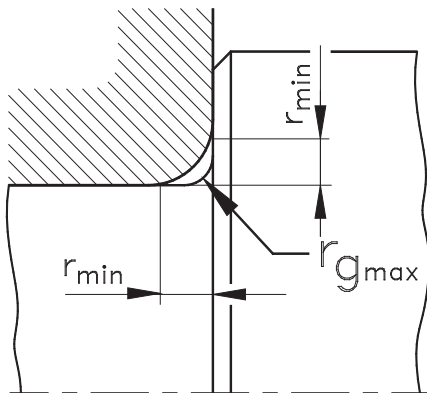


Fig. 7.5

where:

r_{\min} = minimum chamfer on bearing ring
(see product information tables)

$r_{g\max}$ = maximum fillet radius
on shaft or housing

If for strength reasons, (e.g. for a reduction of the notch effect on high loaded gearbox shafts,) larger fillet radii become necessary adequate shaped **distance rings** must be used between shaft shoulder and bearing side face, (fig. 7.6).

The diameters for these rings have to be defined in such a way, that sufficient axial support of the bearing is provided.

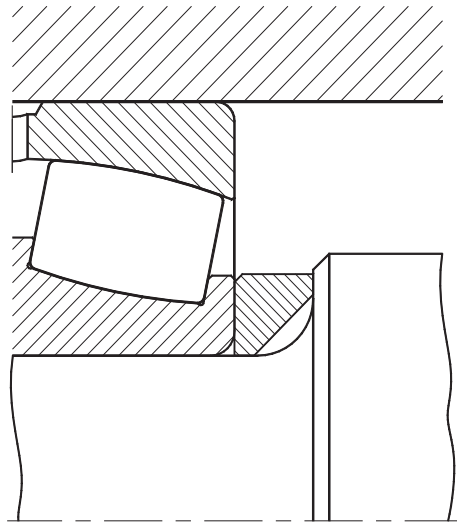


Fig. 7.6

In some cases the shaft and housing fillet corners may be “undercuts”, in each case consideration must be taken to ensure correct face abutments (fig. 7.7).

For recommended “undercut” dimensions and form values (table 7.12).

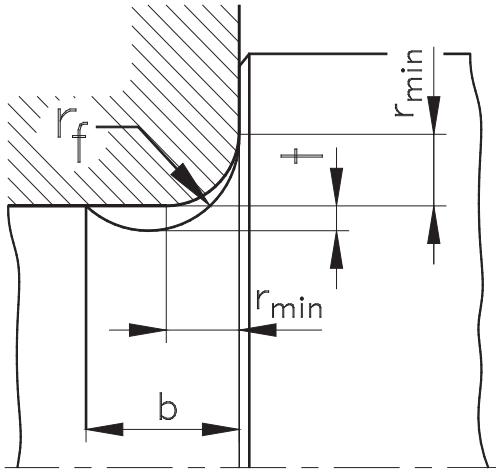


Fig. 7.7

where:

- r_{min} = minimum chamfer dimension on bearing ring (see product information tables)
- r_f = maximum undercut fillet radius on shaft or housing.
- b = width of undercut
- t = depth of undercut

Minimum chamfer dimension r_{min} [mm]	Undercut dimensions [mm]		
	b	t	r_f
1	2	0,2	1,3
1,1	2,4	0,3	1,5
1,5	3,2	0,4	2
2	4	0,5	2,5
2,1	4	0,5	2,5
3	4,7	0,5	3
4	5,9	0,5	4
5	7,4	0,6	5
6	8,6	0,6	6
7,5	10	0,6	7

Table 7.12

Design Measures for Bearing Monitoring and Dismounting

Depending upon the individual design arrangements for specific bearing applications dismounting may be more or less frequent. It is reasonable to suggest some thought on this matter at the initial design stages.

In many cases mounting or dismounting of rolling bearings may be less complicated with very simple design measures, such as **dismounting threads** or **dismounting holes** drilled into housing shoulders to push out the bearings from their housing seats, or **dismounting slots, recesses** or **undercuts** to ease bearing dismounting, using the appropriate mechanical or hydraulic tools (e.g. claw pullers etc.) in this way the machine and plant maintenance is simple and effective.

For larger machines or more important parts of the plant or machines that fulfil key functions, bearing locations sometimes are the subject of a special condition **monitoring**.

Examples for such monitoring include paper mills, power plants and steel mills.

Such monitoring may be done, according to the importance of the machine or plant, either by regular manual measurements in the simplest form or by stationary mounted sensors that have been connected on-line to a central computer that evaluates the data.

Such bearing condition monitoring records operational variations, to specific design parameters, that may indicate changes in the bearing condition arrangement or impending breakdown. These elements of a bearings condition are temperature, vibration velocity, vibration acceleration and running noise.

Irrespective of the methods, the location of measuring points should be applied as close to the bearings as possible.

This usually becomes easier when provision for, if required, threads, holes or connection facilities are already fixed.

Sealing of Bearing Arrangements

General

Rolling bearings are high precision machine elements that are produced with tolerances of close microns [μm].

For an optimum function they have super finished running surfaces featuring surface roughness of some 10th microns (**0,1 μm**).

This is why rolling bearings are very sensitive to damage caused by solid contaminations and impurities.

The efficient sealing of a bearing arrangement is thus one of the major pre-conditions for the successful performance of a rolling bearing arrangement.

Seal Types

In the field of bearing sealing there are many proven designs and design variations. To provide the optimum solution for each application and specific problems this practical experience should always be considered.

For rotary movement, **dynamic seals** are usually used for sealing bearing arrangements.

To satisfy the specific problems for each application there are in principle two main differences, namely.

- **non-contacting** seals
- **contacting (rubbing)** seals

For some applications it may become necessary to combine both types.

Non-Contacting Seals

The principle function of non-contacting seals is based on the sealing effect of narrow gaps between stationary and rotating machine components.

In their simplest form, non-contacting seals are simple, straight gaps as shown in fig. 7.9a. Their effectiveness may be increased by design improvements up to complex shaped labyrinth seals.

Gap seals do not have any contacting parts, they generate practically no friction and thus no wear which make this type suitable for high speed operations.

The **width** of sealing gap should be approximately **0,1 ÷ 0,3 mm**, according to the accuracy of shaft guidance and dependant upon the bearing size.

Some compensation of alignment errors between shaft and housing may be possible based on the seal arrangement to be used, particularly for self aligning bearing types (e.g. ball bearings and/or spherical roller bearing).

A significant improvement in the effectiveness of a gap seal may be achieved by **grease filling** of the sealing gaps. By this measure the penetration of fine dust particles may be avoided.

A higher efficiency of sealing may also be achieved by a combination of non-contacting seals with sealed or shielded bearings, (suffixes **-Z, -ZZ, -RS, -2RS, -RS2, -2RS2, -2LFS**).

For variations of non-contacting seals, (see fig 7.8).

Fig. 7.8a)

A straight gap between shaft and housing cover builds the simplest form of a **gap seal**. Suitable for grease lubricated bearing applications running under dry surroundings where less dust may occur.

Examples for Non-Contacting Seals of Bearing Arrangements

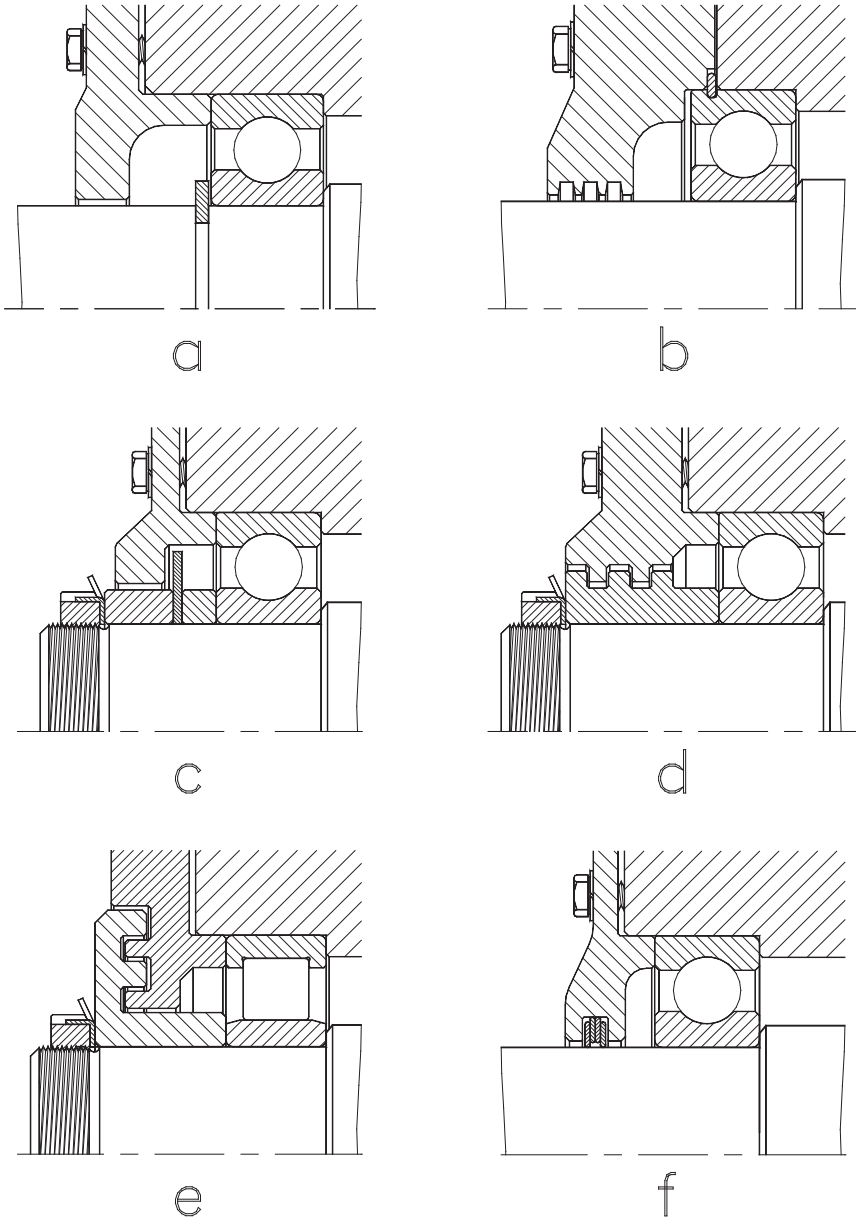


Fig. 7.8

Fig. 7.8b)

Non-contacting seal with additional concentric **grooves in housing**. A grease filling applied to these grooves prevents penetration of solid contaminations into the bearing position. The efficiency of the sealing is considerably enhanced.

In the case of oil lubrication such grooves may be applied in a helical pattern left hand or right hand depending on the direction of shaft rotation.

Due to the design of the grooves emerging oil will be circulated back into the bearing position.

Fig. 7.8c)

Simple **gap seal** with additional **washer**. These disk washers rotate with the shaft and avoid the penetration of larger impurities.

Fig. 7.8d)

Example of a **radially split labyrinth seal**. The labyrinth is filled with grease and reliably avoids contamination of the bearing position.

Generally labyrinth seals perform well where applications are exposed to contamination such as sand and dust, although they have limited success against splashed water.

To improve their efficiency in the presence of water or humidity the labyrinth should be periodically regreased with water insoluble grease.

Fig. 7.8e)

Labyrinth seal, axially split. Other features as described in fig. 7.8d).

Fig. 7.8f)

Sealing by **lamellar rings**. These are ready for use rings made from spring steel that provide good sealing properties when mounted in sets. The rings have a tension against each other to form a gap seal.

Lamellar rings provide efficient and very economic gap seals.

Contacting Seals

In the case of **contacting seals** (rubbing seals) the sealing effect is achieved by an elastic sealing element touching the mating surface under some preload.

Such contact enables a considerably higher efficiency of sealing compared to non-contacting seals. On the other hand, each contact of rotating components generate some friction and therefore causes additional heat that must be dissipated. All contacting seals depending on the material and their specific design experience wear at differing levels. This has an influence on the permissible speeds and temperature during operational performance.

Please refer to the recommendations supplied by the seal manufacturer.

Fig. 7.9 shows examples of contacting seals:

Fig. 7.9a)

Felt seals provide simple and inexpensive, efficient seals for general application purposes. Felts are commonly used in the form of **felt rings** and **strips** that are inserted into the sealing grooves of bearing housings. Before fitting felt strip seals they should be saturated with machine oil. Felt seals provide a good seal for grease lubricated bearing arrangements even in the presence of dust.

To ensure optimum seal function the mating surface must be ground to a surface roughness not exceeding Ra values of 3.2 µm.

The maximum permissible misalignment for felt seals equals approximately 0,5°.

Examples for Contacting Seals

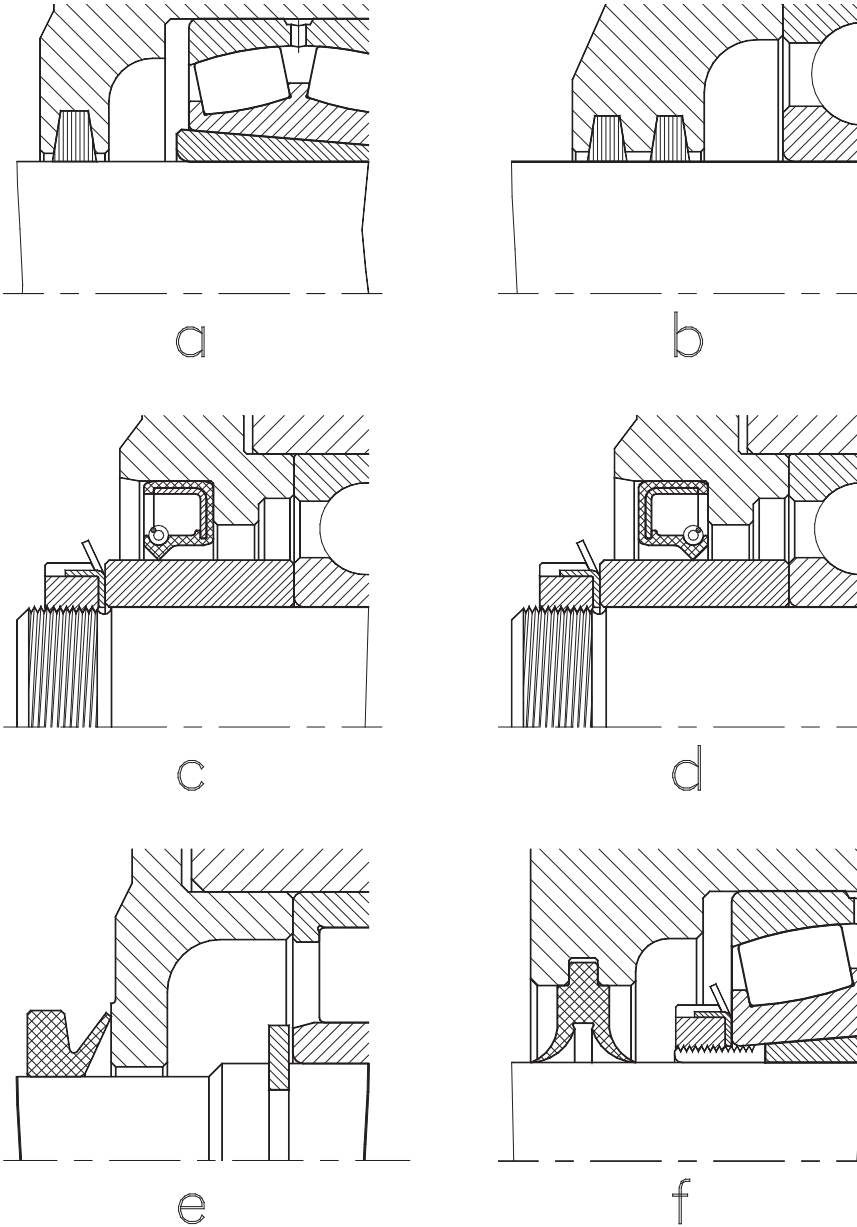


Fig. 7.9

Fig. 7.9b)

Double felt seal. For stronger contamination, especially in the presence of heavy dust, double felt seal arrangement may be used to increase the sealing effectiveness.

Fig. 7.9c) and Fig. 7.9d)

Radial oil seals are standardised machine elements. They are available in a wide variety of different designs and materials to meet the given requirements in an optimum way. In the majority of designs the radial sealing lip is pressed against the sealing surface by a garter belt.

Radial oil seals must be arranged depending on their main purpose. If the radial oil seal is used with the sealing lip facing outwards, as shown in Fig. 7.9c), the entry of contamination particles will be avoided. However, where leaking oil or grease must be avoided the radial oil seal must be mounted with its sealing lip inwards, see fig. 7.9d).

For applications where both are required either a special radial oil seal having double sealing lips may be used or two single radial oil seals located with their sealing lips arranged facing each other outwards.

Radial oil seals are suitable - depending on their individual design and material - for circumferential speeds up to 15 metres/second. They are also produced in several variations, such as special high temperature resistant materials, with garter springs in stainless steel, multiple sealing lips, etc.

For more detailed information please refer to the individual manufacturer's data sheets.

Fig. 7.9e)

V-ring seals are mounted onto the shaft which rotates whilst the long sealing lip contacts under light preload on the mating face of the stationary machine part.

In cases where the design of the housing as a mating face is not possible or uneconomical, a special sealing washer may be used.

V-ring seals provide good sealing for both oil and grease lubrication even under difficult operation conditions and feature simple mounting.

They also permit, depending on each shaft diameter, certain misalignments between bearing shaft and housing:

Shaft diameter [mm]		Maximum permissible misalignment
>	≤	
--	50	≤ 1,5°
50	150	≤ 1°

Table 7.13

V-ring seals are suitable for circumferential speeds up to 12 m/s without special measures but they should have an axial location if operating at speeds of more than 7 m/s. Such axial location may be achieved by means of locating rings etc.

Where V-ring seals have to operate at circumferential speeds exceeding 12 m/s the lifting of the ring by circumferential forces must be avoided by using supporting rings, such as pressed steel rings etc.

For special applications V-rings are also available in different materials, such as flour fluoropolymer (**FPM**) etc.

Fig. 7.9f)

Split bearing housings are frequently used with two-lip seals as shown in fig. 7.9f).

These seals are available in individual size to fit the split housings. Two-lip seals are made from polyurea and they are radially split which makes their mounting very easy.

The space between their sealing lips has to be filled with grease during mounting.

**Design
of Bearing Location**

Two-lip seals are mainly used for the sealing of grease lubricated split pillow block bearing housing.

Two-lip seals also permit certain misalignments depending on their size.

Shaft diameter [mm]		Maximum permissible misalignment
>	≤	
--	100	≤ 1°
100	--	≤ 0,5°

Table 7.14

For optimum sealing performance the mating faces should be ground. They should have a surface roughness not exceeding **Ra ≤ 3,2 µm**.

Two-lip seals are suitable for circumferential speeds not exceeding 8 metres/second.

Within the limited space of this catalogue a detailed listing of all possible sealing types and variations is not possible.

Several seal variations are available as stock items offered by specialist manufacturers. Examples for further sealing types are:

- sheet steel seals ("NILOS"-rings)
- slide ring packing
- lamellar ring seals from sheet steel
- labyrinth seals
- O-ring seals
- etc.

Combination of Different Sealing Types

In their practical use different sealing types are often combined to enhance the sealing effectiveness.

According to the existing requirements non-contacting seals are often arranged with additional contacting seals.

A very efficient improvement of the seal is provided by using sealed or shielded bearings in combination with the other seals of the bearing position.

Such bearings which incorporate shields or seals (suffixes **Z, -ZZ, RS2, -2RS2, RS, -2RS, RSR, -2RSR, -2LFS** etc.) enable maintenance-free sealed bearing arrangements that require minimum space (fig. 7.10).

The effort necessary for the sealing of bearing arrangements may be kept relatively small for high sealing efficiency.

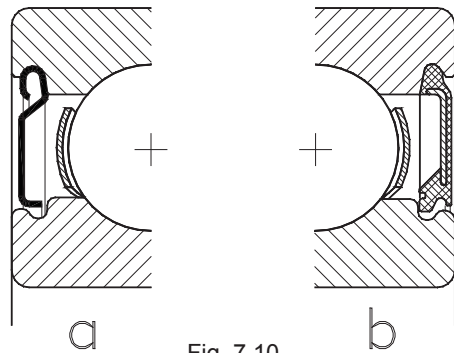


Fig. 7.10

7.10a) Deep groove ball bearing with **Z**-shield. The pressed steel shield forms a simple non contacting gap seal around the circumference of inner ring.

7.10b) Contacting **RS2**-type seal on deep groove ball bearings. In this variant the sealing lip contacts the ground inner ring around the shoulder circumference.

General

The term “clearance” is briefly described as the distance that bearing components may move relative to each other at physical extremes.

Depending upon the bearing type the bearing internal clearance is defined either in radial direction (**radial clearance**) or in **axial** direction (**axial clearance**), (fig. 8.1).

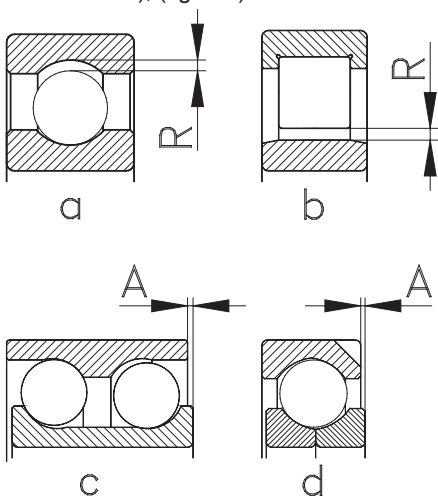


Fig. 8.1

- 8.1a) **radial clearance “R”** in the case of deep groove ball bearings.
- 8.1b) **radial clearance “R”** for NU type cylindrical roller bearing. In the case of separable cylindrical roller bearings the radial clearance is defined by the raceway diameter of their loose ring.
- 8.1c) **axial clearance “A”** of a double row angular contact ball bearing.
- 8.1d) **axial clearance “A”** of four point ball bearings.

Nominal Internal Bearing Clearance and Operational Clearance

In principle, we have to distinguish between the initial **nominal clearance** of a bearing and its **operation clearance**.

Nominal Clearance

The **nominal clearance** is the initial clearance of a new, unfitted without any external load applied.

For the most common bearing sizes clearance values are defined by DIN standard **DIN 620**.

These defined values of standard clearance (**clearance group “CN”, formerly also called “C0”**) are defined in such a way that bearings will have sufficient remaining operating clearance when “normal” operating conditions apply and the bearings are mounted with “normal” shaft and housing fits.

bearing type	bearing fits for	
	shaft	housing
ball bearing	h5, j5, k5	H6, J6, J7
roller bearing	k5, m5	H7, M7
needle bearing	k5, m5	H7, M7

Table 8.1

“Normal” operating conditions:

- temperature differences between inner and outer ring $\leq 10^\circ \text{C}$ ($\leq \text{H } 50^\circ \text{C}$)
- normal quality standard of running accuracy and precision of shaft guidance
- normal loads
- no strong vibrations or shock loads

For specific applications where it is unsuitable to use the recommendations of DIN620 for “normal” class clearances, different clearance groups may be obtained.

To meet the requirements of such applications, rolling bearings are manufactured in different clearance groups.

Clearance groups:

- C1** clearance range smaller than C2
- C2** clearance range smaller than CN

CN (C0) “normal” clearance

This clearance group is defined as the standard. Thus **CN** is not marked on the bearings. Historically the standard clearance was designated as “**C0**”.

- C3** clearance range larger than CN
- C4** clearance range larger than C3
- C5** clearance range larger than C4

Special clearance:

For applications that have specific demands not covered by the standard clearance groups or where bearings with standard clearances do not perform optimum, specific clearances may be determined and agreed.

To distinguish these special clearances from the standard ones the clearance values are stated in the bearing designation, unless it already has a special quality definition.

Examples:

- R80&150** Special **R**adial clearance of 80 to 150 microns (µm)
- A70&110** Special **A**xial clearance of 70 to 110 microns (µm)

If required, the nominal clearance may also be reduced to a certain part within a clearance group.

Such a restriction is indicated by a letter (**H**, **M** or **L**), that follows the symbol of the respective clearance group.

Examples:

- C2L** clearance range reduced to the **L**ower half of the **C2** clearance group.
- C3M** clearance range restricted to the **M**iddle half of the **C3** clearance group.
- C4H** clearance range restricted to the **U**pper half of the **C4** clearance group.

The nominal values of each clearance group are listed in the specific product data sheets in the product tables.

Operational Clearance

Unlike the manufactured **nominal clearance groups**, the operation clearance is determined by the individual operating parameters.

The term “**operational clearance**” describes the **operational play** of a mounted, loaded bearing at operating temperature.

Tight shaft fits (interference fit) may expand the inner ring diameter while interference housing fit may lead to contraction of the outer ring.

Also temperature differences between shaft (inner ring) and housing (outer ring) may result in an additional reduction of the initial clearance.

Therefore, in cases where the operational conditions differ from the standard values, the influence of these other factors on the standard value “**CN**” must be considered in detail.

Influence of Bearing Fits

Rolling bearings are located in their positions by the bearing fits. Depending upon type and size of the applied load and the individual function of the bearing either as a locating or non-locating bearing the fits may be chosen more or less tight.

For general machinery applications the most frequent bearing fits are tabulated in the chapter “**Design of Bearing Arrangements**”, pages 320 to 327 inclusive.

These tables also contain some additional information about the effect that a certain fit will probably have on a bearing.

For each tolerance both the upper and lower **dimensional limits** in microns [μm] are stated in the **left half** of each field. The **three figures** stated in the right half of each tolerance field, however, show how this tolerance field will affect the bearing seat.

As an example, for a shaft with a nominal diameter $\varnothing 75$ mm and a fit according to the tolerance field j5 the following data is shown:

	-21
+6	-12
-7	7

Bold negative figures in the each right half of a field mean interference!

The tolerance of a bearing of standard tolerance class (PN) and a bore diameter $\varnothing 75$:

$$\Delta_{\text{amp}} = 0 / -15 \mu\text{m}$$

If these both meet the following values result:

a) **Maximum interference**

The **maximum interference** occurs when the **largest permissible shaft diameter** meets the **smallest permissible bearing bore**.

In the above example the value of maximum **interference** is,

$$|(+6) + (-15)| = \mathbf{-21 \mu\text{m}}$$
 (upper value)

Note: The minus sign indicates interference!

b) **Smallest interference**

The **smallest interference** occurs when the **smallest permissible shaft** meets the **largest permissible bearing bore**.

In the above example:

$$|-7 + 0| = 7 \mu\text{m}$$
 play (lower value)

c) **Probable interference**

The **probable** interference assumes the actual dimensions to lie 1/3rd of the tolerance value from the tolerance go-side.

In the above example:

$$-12 \mu\text{m}$$
 interference (mid. value)

Bold negative figures in the each right half of a field mean interference!

Reduction of Radial Clearance due to Interference Fits

Using the values listed in the tolerance tables the reduction of clearance that must be considered is calculated as follows:

$$\Delta C = \Delta C_L + \Delta C_E \tag{Eq. 8.1}$$

where:

ΔC = total clearance loss by interference fits

ΔC_L = expansion of inner ring
as estimation ΔC_L is assumed to be approximately 80% of the probable interference of the shaft fit

ΔC_E = contraction of outer ring
as estimation ΔC_E is assumed to be approximately 75% of the probable interference of the housing fit

Smoothing of Matching Surfaces

Bearing seats usually have ground or fine turned matching surfaces.

During each bearing mounting or dismounting procedure a certain smoothing of the surface roughness of the bearing seats of shaft or housing occur (fig. 8.2).

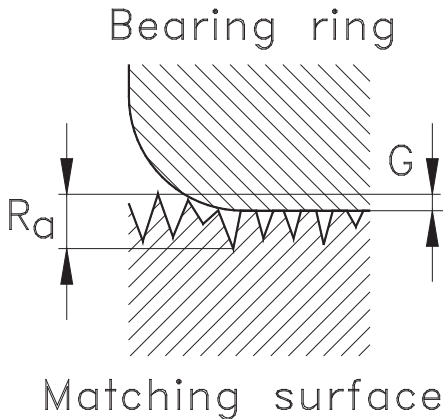


Fig. 8.2

where:

- R_a = surface roughness before mounting
- G = smoothing of roughness peaks during mounting procedure

The smoothing of surface roughness equates to approximately 40% of the initial R_a -values of the respective surface.

In cases of extremely rough surfaces this may even cause a lot of interference.

Additionally bearing fits with high surface roughness are more sensitive to damage by fretting corrosion.

The surface smoothing of the hardened and fine ground bearing surfaces, however, is negligible.

Detailed recommendations for the surface quality of bearing seats is stated in the chapter “**Design of bearing location**”, page 303.

Reduction of Clearance due to Temperature Differences

Additional to the reduction of the initial clearance due to the interference fits, the clearance also reduces due to temperature differences, which occur between inner shafts to outer housing seats.

Usually the operating temperature difference of inner to outer rings is approximately 5 to 10°C (40 to 50°F). This difference is caused mainly by the fact that the heat dissipation on the bearing outer ring is usually more effective due to the larger housing surface compared to the shaft, (fig. 8.3).

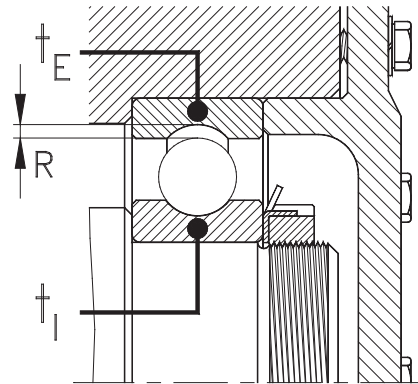


Fig. 8.3

where:

- t_E = operating temperature of outer ring
- R = operational clearance
- t_I = operating temperature of inner ring

When using steel shafts, in conjunction with either steel or cast iron housings which feature similar coefficients of thermal expansion and the temperature difference is less than 10°C (50°F), the effect of temperature on clearance reduction is negligible.

When housings are produced from steel cast steel or cast iron and higher temperature differences occur the effect on clearance reduction may be estimated using the following formula.

$$\Delta C_t = 1000 * \alpha * \frac{d + D}{2} * \Delta t \quad (\text{Eq. 8.2})$$

where:

- ΔC_t = reduction of radial clearance due to the temperature difference [μm]
- α = coefficient for thermal expansion, in the case of steel $\alpha = 12 * 10^{-6} \text{ K}^{-1}$
- d = bearing bore diameter [mm]
- D = bearing outer diameter [mm]
- Δt = difference between operating temperatures of inner and outer ring [$^{\circ}\text{C}$]

In the case of housings made from **light metal alloys**, however, a special care must be taken due to the different thermal expansion properties of light metals when compared to steel.

For such housings, every temperature change will affect the bearing fit even without large temperature differences between bearing shaft and housing seats.

Material	Coefficient of thermal expansion α [10^{-6} K^{-1}]
steel	12
light metal	22

Table 8.2

For every deviation in the real operating temperature, from the reference temperature (20°C), the diameter of housing seat will change greater than that of the steel bearing outer ring.

In the event of low temperatures the diameter of the housing seat will shrink more than the bearing outer ring. This generates a stronger interference causing the ring to contract. For the same reason the housing seat will become loose at higher temperature which eventually results in the loss of interference and, respective, increases the bearing clearance.

This may be estimated using the following formula:

$$\Delta C_t = 1000 * \Delta \alpha * D * \Delta t \quad (\text{Eq. 8.3})$$

where:

- ΔC_t = reduction of radial clearance due to the temperature difference [μm]
- $\Delta \alpha$ = $10 * 10^{-6} \text{ K}^{-1}$ difference of thermal expansion coefficients.
For steel $\alpha = 12 * 10^{-6} \text{ K}^{-1}$ and
For light metal $\alpha = 22 * 10^{-6} \text{ K}^{-1}$
- D = outer diameter of bearings [mm]
- Δt = deviation of operating temperature from the reference temperature ($20^{\circ}\text{C}/68^{\circ}\text{F}$) [$^{\circ}\text{C}$]

In general, for operating temperatures of **more than 20°C (68°F)** the housing seat will become loose, the bearing clearance will increase, i.e. Δt is **positive (+)**.

For operating temperatures **below 20°C (68°F)**, however, the housing seat will become tighter, the bearing clearance will reduce, i.e. Δt becomes **negative (-)**.

This effect may increase by the additional supply, or dissipation of heat, as in the case of cooled housings or additional heat supplied via the shaft.

Additional heat from the shaft will cause an expansion of inner ring raceway and thus a further reduction of the remaining bearing clearance.

Clearance of Bearings with Tapered Bore

Several bearing types are produced with tapered bores as a standard feature. This applies mainly to bearing types such as self-aligning ball bearings, spherical roller bearings, including some high precision cylindrical roller bearing types used in spindles of machine tools.

In the majority of applications the mounting of tapered bore bearings is by using either adapter or withdrawal sleeves.

In a few cases, such as the double row cylindrical roller bearings for machine tool spindles (**series NN 30**), the bearings are mounted directly onto tapered journals.

For such high precision spindle bearings the tapered bore is also used to adjust precisely a certain clearance (fig. 8.4).

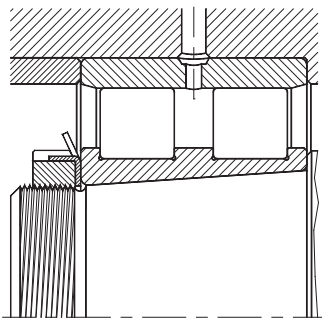


Fig. 8.4

The amount of initial clearance for tapered bore bearings is larger than that of the identical bearing with a cylindrical bore, even when belonging to the same clearance group.

This is due to the fact that during mounting the rings onto tapered journals an expansion occurs due to the axial displacement of the ring along the taper.

This results in a greater reduction of the initial clearance. In extreme cases these additional pressures can result in the premature failure of the bearing.

The amount of inner ring expansion depends upon the bearing size, the axial displacement during mounting and the taper angle itself.

This angle usually has a ratio of **1:12** (standard tapered), that means the inclination is 1 mm in a measured length of 12 mm. These tapers are designated by the suffix **K**.

Some bearing series with less section have a more flat taper, 1:30. These tapers are identified by the suffix **K30**.

To avoid any unintentional applied preload on the bearing, special attention must be taken ensuring a certain minimum clearance **R₂** (fig. 8.5) remains after mounting the bearing on the shaft.

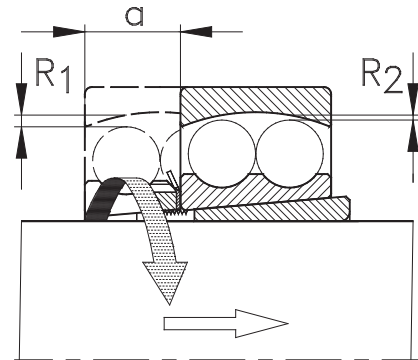


Fig. 8.5

where:

- R₁**= radial clearance before mounting
- R₂**= residual radial clearance after mounting
- a** = axial displacement

There is a simple linear ratio between taper arc, axial displacement and clearance reduction. These values are listed in Table **8.3**. (see next page).

In each case the bearing mounted onto the shaft must rotate and swivel easily.

Connection between Axial and Radial Clearance

Different bearing types have a certain relationship between their radial and axial clearance.

For example, in the case of single row deep groove ball bearings, the axial clearance a may amount to a multiple of the value of radial clearance, depending on their internal design, angle of contact and the amount of radial clearance (fig. 8.6).

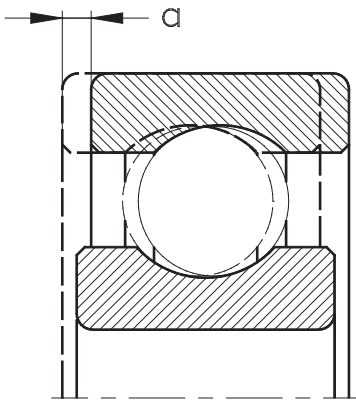


Fig. 8.6

In the vast majority of applications the axial clearance of radial bearings is usually of minor or no functional significance.

In certain cases, however, even for radial bearings certain accuracy of axial shaft guidance or for running noise levels is necessary.

This can be achieved by the selection of suitable bearing types, such as angular contact ball bearings, using adjustable bearing arrangements or by means of preloading the bearing arrangements.

For small and medium sized electric motors and generators that are frequently fitted with deep groove ball bearings, the bearings are often axially preloaded using cup springs to eliminate any axial clearance.

Table 8.3 contains approximate values to estimate the connection between radial and axial clearance of radial bearings:

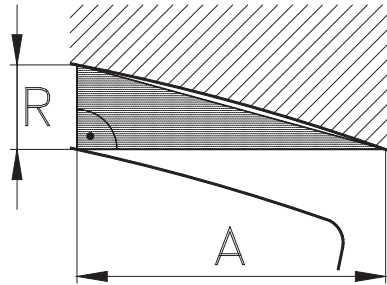


Fig. 8.7

Bearing Type	ratio A / R
Deep groove ball bearings *)	
standard clearance	≈ 9 ÷ 15
clearance group C3	≈ 7 ÷ 10
clearance group C4	≈ 6 ÷ 9
Single row angular contact ball bearing mounted in pairs, contact angle 40° (70B, 72B, 73B)	1,2
Angular contact ball bearings, double row **)	
32, 33 (contact angle 35°)	1,4
32B, 33B (contact angle 25°)	2
Four point contact ball bearings contact angle 35°	1,4
Self aligning ball bearings	2,3 * Y ₀
Spherical roller bearings	2,3 * Y ₀
Tapered roller bearings	
single row	4,6 * Y ₀
mounted in pairs	2,3 * Y ₀

Table 8.3

Remarks:

*) Depending on the individual bearing type and design, therefore, only a rough estimation possible.

***) For double row angular contact ball bearings the **axial clearance only** is stated.

Y₀ Static axial factor from product tables

Preloading of Bearings

In the majority of all applications rolling bearings are selected and mounted in such a way that they feature some clearance under operating conditions.

Other applications not requiring an operational clearance, such as machine tool spindles or truck wheel set bearings are produced and mounted with a negative operating clearance (i.e. preload). The bearing types that are most frequently used under preload, are angular contact ball bearings and tapered roller bearings. But some other bearing types like deep groove ball bearings and cylindrical roller bearings may also be used in a preloaded condition.

Depending on its type a rolling bearing may be preloaded either axially or radially.

Preloading influences the following bearing characteristics:

- **increasing the stiffness and rigidity of a bearing arrangement**
- **improved guiding accuracy**
- **reduction of running noise**
- **reduction of vibrations under service operation**
- **optimal use of bearings load rating**
- **compensation of thermal expansion**
- **avoiding sliding friction in the bearing**
- **ensuring minimum loading**

Increasing of Stiffness

Like other machine components, rolling bearings are flexible under load. In the case of rolling bearings the term **stiffness** defines the relationship between a load applied to a bearing and the resulting elastic deformation caused by this load. Depending on their internal design each bearing type features a different stiffness.

The stiffness is indicated by the force required to generate a certain deformation [**N / μm**].

As the course of bearing stiffness is not linear, bearings in a preloaded condition have less deflection under equal load than unloaded bearings.

Due to the applied preload this effect has been anticipated.

Obviously the machine arrangement enclosing the bearing and adjacent parts must be designed to ensure a optimum applied preload to the bearings or the actual bearing assembled and adjusted to a specific preload.

Enhancement of Guiding Accuracy

Due to the elimination of the bearing clearance in both radial and axial direction and the resulting higher stiffness of the bearing assembly, the shaft guidance accuracy will be improved.

This applies especially to applications like machine tools spindles, gearbox shafts and wheel bearing assemblies of vehicles.

Running Noise and Vibration Characteristics

Another feature of the preloaded bearings is less running noise, because of the clearance.

Furthermore, as the shaft guidance is more accurate the vibration characteristics of a whole spindle arrangement may be reduced and in some application totally removed by using preloaded bearings.

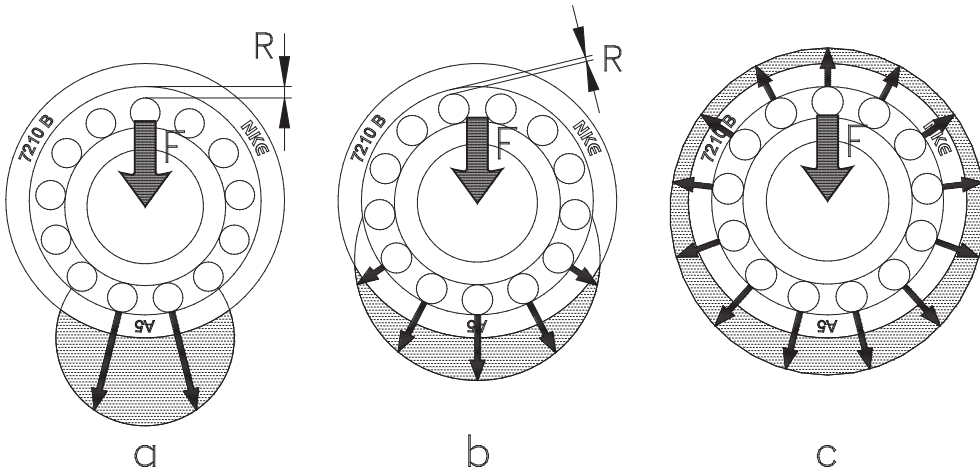


Fig. 8.8

Optimum Use of the Potential Load Rating of Rolling Bearings

The transmission of loads within a rolling bearing occurs from one bearing ring through the rolling elements to the other bearing ring.

The more rolling elements supporting in the transmission of forces, the less the specific pressure is in the small contact zone between the rolling element and raceway.

Because of this both the static load rating and the dynamic bearing life depends on the specific pressure applied to the bearing material.

There is a direct relationship between the load that the bearing is exposed to and the number of rolling elements supporting the load transmission.

Fig. 8.8 shows a schematic diagram of the affect of preloading the bearings under the influence of a constant load "F".

Fig. 8.8a:

The bearing shown in **Fig. 8.8a** has a large clearance "R" with few rolling elements supporting the load transmission.

Avoidance of Slip and Sliding Friction

Thus, the loaded zone (shaded area) is relatively small, and the specific pressures become relatively high.

Fig. 8.8b:

This bearing shows **no** or **very small** operational clearance.

Under pure radial load, the loaded zone (shaded area) surrounds approximately half the circumference, thus roughly half the number of rolling elements are supporting the load transmission. Therefore, if the load applied has the same magnitude as in Fig. 8.8a, the specific pressure is less.

Fig. 8.8c:

This bearing shows a **negative clearance (preloading)**. Due to the preloading all rolling elements are involved in the transmission of forces. Thus the specific load per rolling element is less than in either of the other cases.

Rolling bearings require a certain minimum load to be applied for an effective function. Such a minimum load forces the rolling elements to roll over the bearing raceways.

If such a minimum load is not guaranteed, high sliding friction will occur. If this reaches excessive amounts, the smooth bearing surfaces may be damaged.

Some bearing types, particularly, thrust ball and roller bearings are very sensitive to sliding friction. That is why these bearing types need a special care to ensure their minimum loading.

Also for operating conditions such as shock loads or vibrations this may cause increased amounts of sliding friction in the bearing.

In most applications the minimum loading of the bearings is already achieved by the weight of shaft and the rotating machine components, in other cases by the applied external load.

In cases where this is not possible a minimum load may be achieved by **preloading** the bearing assembly.

Such a preload may be applied by means of springs, such as recoil springs or cup spring pads.

Applied Amount of Preloading

The amount of preload applied to a bearing arrangement should be determined very carefully. Various different influences must be taken into account, such as the required stiffness of bearing assembly, bearing life, characteristic features of each bearing type and all relevant operational parameters.

Also external influences like magnitude and type of load, possible shock loads and operating temperature must be considered. Thus in such cases no general valid guidelines may be applied. Practical experiences with the same or similar applications should also be considered.

Because of the many influences accurate calculations sometimes is not possible. Therefore, in such cases it may be necessary to initiate practical run-testing of new machine design arrangement under operating conditions. In this way precise values can be determined.

Reduction of Running Noise by Preloading

The armature of small and medium sized electric motors or generators are frequently fitted with deep groove ball bearings.

As a preventive measure to avoid possible bearing failures caused by false brinelling, these bearing arrangements are often mounted with zero clearance or light preload. This is achieved by mounting a cup spring or spring pad acting against the stationary bearing ring, thereby, eliminating any axial play and assists in the reduction of running noise (fig. 8.9)

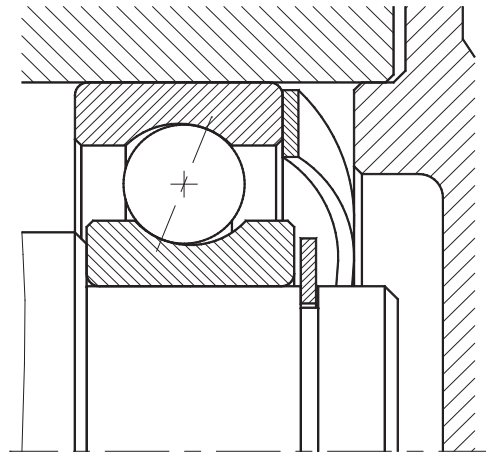


Fig. 8.9

This is also commonly applied in bearing assemblies of high speed grinding spindles to provide a quiet and smooth running.

The amount of applied preloading force depends on the bearing size and the reason for preloading:

As a rule of thumb, the following recommendations should be considered:

- to eliminate any **residual clearance**:
 $F [N] \approx 5 * d [mm]$
- to reduce the **running noise**:
 $F [N] \approx 5 \text{ to } 10 * d [mm]$
- to prevent bearing damage due to **false brinelling**:
 $F [N] \approx 15 \text{ to } 20 * d [mm]$

where:

F = spring force [N]

d = bearing bore diameter [mm]

To ensure a certain **minimum load**:

The spring force has to be adjusted according to each bearing type for recommendations (see the specific product information sheet).

Determination of Preload Force

In the case of preloaded or adjusted bearing arrangements, as shown in fig. 8.10, the load distribution is a central acting, pure radial acting load to both bearings. For bearings having contact angles $\approx 0^\circ$, such as angular contact ball bearings and tapered roller bearings, each applied external radial load generates an internal thrust force.

When additional external thrust forces (F_a) occur, as in the case of wheel bearings of motor vehicles driving around corners, this will cause, providing the external forces are larger than the internal thrust forces, the unloading of outer bearing (**B**).

The opposite bearing, located at inner position (**A**), however, has to accommodate the additional force.

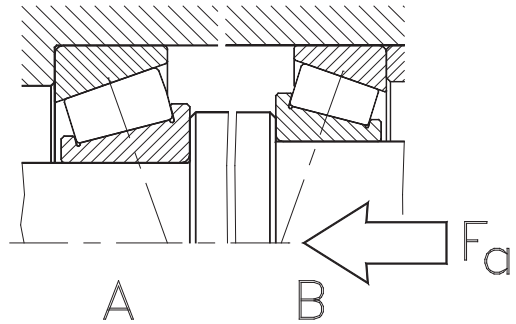


Fig. 8.10

In extreme cases this may lead to the total unloading of the bearing (**B**), whilst the opposite bearing (**A**) even may become overloaded.

In these cases the amount of preload to be applied must be defined in such a way, that the permanent unloading of one of the two bearings will be avoided, on the other hand the preload must not cause any overloading of the bearing assembly.

Preloading can also be used to increase the stiffness of a bearing arrangement. In this case the magnitude of the applied preload force must not exceed half of the external thrust loads.

A higher value of preload is no longer necessary, because excessive preloading would shorten the bearing life not increase it.

General

One of the most important elements required for the effective function of bearing arrangements is correct lubrication.

The **lubricant** separates the metallic bearing surfaces and thereby reduces friction, preserves the steel parts and acts as an additional barrier against the entry of contaminations or impurities into the bearings.

For each of these reasons the lubrication fulfils a key function in each bearing application. A malfunction of the lubrication usually causes an immediate bearing failure.

Methods of Lubrication

Normally three different lubrication methods are used:

Grease Lubrication

The vast majority of all rolling bearings, some 90%, are grease lubricated.

The main advantages of grease lubricating are:

- very simple application
- less maintenance required
- additional sealing effect
- pregreased sealed or shielded bearing
- simple sealing of bearing positions
- large number of different lubricants available
- greased "for-life" bearing arrangements possible

Oil Lubrication

Oil lubrication is generally used when oil is available normally within the respective machine, or where special operating conditions apply (e.g. high speeds and/or loads) that require effective heat dissipation at specific positions or areas.

In some high speed applications accurate applied lubrication to specific areas (e.g. guiding surfaces of

cages) may be necessary. The disadvantage of oil lubrication is the relatively high effort required to provide an effective and efficient seal at each bearing position.

Solid and Dry Lubrication

Where applications do not allow the use of oil or grease lubrication for various reasons, other materials, including some metals that are suitable in separating the bearing surfaces.

Some examples are:

Graphite

- used as a powder or press formed as a cage.

Molybdenum disulphide (MoS₂)

- in the form of powders, with additives.

Polytetrafluorethylene (PTFE)

- in the form of powders, with additives.

Metallic coatings

These are usually very thin coatings applied by a galvanising process (e.g. extremely thin layers of gold or silver).

Such metallic coatings are used for example where bearings run under vacuum, i.e. X-ray equipment or other special applications.

Sliding varnish

A solid lubricant in the form of fine powder is dissolved in a suitable solvent or other medium. After applying the mixture, the solvent will vaporise leaving the solid lubricant as a fine film on the surfaces.

Surface treatments

Such surface treatments are usually applied as a protective measure against corrosion, in addition to the normal lubrication, where bearings are exposed to extreme conditions.

The most commonly used surface treatment for rolling bearings is bonderizing.

Selection of Lubricating Method

The decision to select the most suitable lubricating method to be used for any application should be made at the early stage of design as this has an influence on the design of adjacent parts.

The lubricating method to be used for a particular application is always dependent on individual operating conditions, including the anticipated operating speeds, temperature range and environment.

The product tables list recommendations for speed ratings of each individual bearing under grease or oil lubrication.

Speed Ability of Lubricants

The speed capability of a bearing and the ability of the lubrication used to attain these specific speeds are equally important.

A significant equation to evaluate the ability of a lubricant or a certain lubricating method is provided by the so called **speed characteristics**, ($n \cdot d_m$).

$$n \cdot d_m \left[\frac{\text{mm}}{\text{min}} \right] \quad (\text{Eq. 9.1})$$

where:

- n bearing operating speed [min⁻¹]
- d_m bearing pitch diameter [mm]

Note: this may be estimated as follows:

$$d_m = \frac{d + D}{2} \quad [\text{mm}] \quad (\text{Eq. 9.2})$$

where:

- d bearing bore diameter [mm]
- D bearing outer diameter [mm]

Examples for Typical $n \cdot d_m$ -Values:

Lubricating method	$n \cdot d_m$
Grease lubrication	
standard - bearing greases	≤ 500.000
special greases	≤ 1.000.000
Oil lubrication	
oil bath lubrication	≤ 500.000
circulating oil lubrication	≤ 750.000
splash oil lubrication	≤ 800.000
oil mist lubrication *)	≤ 1.500.000
minimum quantity lubrication *)	≤ 3.000.000

Table 9.1

*) For characteristics of > 1.000.000 practical experience is also of major importance. Special appliances such as oil intercoolers, additional pumps or a separate compressed air system for oil and air lubrication may become necessary.

The values listed in table 9.1 are for as guidance only.

To obtain detailed and accurate values for a specific lubricant please contact your lubricant supplier.

Tasks of Lubricants

All lubricants used in rolling bearings have to fulfil the following main tasks:

- **separation of metallic surfaces**
- **reduction of friction in the loaded zones (i.e. both the rolling contact and in the areas having sliding friction)**

- reduction of wear
- preservation of bearings parts
- avoid the entry of pollution into the lubricating gap
- heat dissipation with oil lubrication

Significant Values of Lubricants

Viscosity

Viscosity indicates the individual layers flowing characteristics of a liquid when in motion.

It is one of the most important features when selecting oils. In the case of lubricating **greases** the viscosity of each **base oil** is indicated.

In principle, distinction is made between the **nominal viscosity** of a lubricant which is a specific reference value and the **operating viscosity** that results under given operating conditions at the bearings operating temperature.

Because the viscosity of a lubricant is highly dependant on its actual temperature, the **nominal viscosity** is always indicated together with a defined reference temperature. Usually the indicated **nominal viscosity** refers to **40°C** (V_{40}), sometimes other reference temperatures are also stated, such as (V_{50}) or (V_{100}).

Consistency

The **grade of consistency** indicates the “stiffness” of grease to defined **NLGI-scales** according to DIN 51818.

Very soft greases, used for high speeds, have low NLGI-grades; stiffer greases have higher NLGI-grades.

For lubricating rolling bearings a grease lubrication to NGLI scales 2 and 3 is normal, occasionally, grease to scales 0 and 1 are also used.

Separation of Metallic Bearing Surfaces

The most significant feature of any lubricant is to achieve a complete separation of the bearing metallic surfaces in the “loaded zone”.

Also, the standardised calculation of nominal bearing life (L10) according to **DIN ISO 281** assumes a **sufficient separation** of the metallic bearing surfaces, (fig. 9.1).

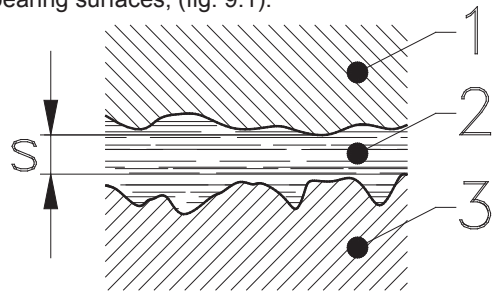


Fig. 9.1

Effective separation of the metallic bearing surfaces is reached when the thickness (**s**) of the **lubricating film** (2), which builds up in the contact area between the rolling element surfaces (1) and the bearing rings (3), is large enough to separate them completely.

Therefore the film thickness (**s**) must be larger than the total amount of surface roughness deviations of the contacting parts.

The film thickness (**s**) depends on the **operating viscosity** of the base oil and the operational speed.

Furthermore no solid pollution or foreign particles with grain sizes of more than the thickness of **lubricating film** (**s**) may be present in the lubricant.

When these pre-requisite conditions are fulfilled the so-called “**hydrodynamic**” lubrication is attained.

In practice, however, the conditions of such a hydrodynamic lubrication will not be attained on all occasions.

In many applications the so called “**limited lubrication**” occurs, where a complete separation of the metallic bearing surfaces is not always guaranteed, (see fig. 9.2).

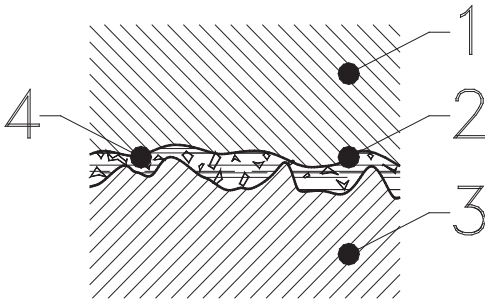


Fig. 9.2

In practice slow speeds, high temperatures, the use of lubricants with low operating viscosity, pollution in the lubricating gap or old lubricants may lead to a lower thickness of lubricating film allowing the metallic bearing surfaces to contact each other, as shown in fig. 9.2.

Selection of Viscosity of Lubricant

The actual **operating viscosity** of a lubricant is determined by the following factors:

- **nominal viscosity of lubricant**
- **bearing size**
- **operating temperature**
- **speed**

A simple and for the majority of applications accurate estimation of the operating viscosity of a lubricant under operational conditions is provided in the procedure as described in the chapter “**Selection of Bearing Type and Size**” (see page 255).

The following steps are required;

- 1) **calculation of bearing, pitch diameter, d_m**
- 2) **estimation of required operating viscosity ν_1**
- 3) **determination of actual operating viscosity ν**
- 4) **build the ratio of required to actual operating viscosity κ**

There is a close relationship between the existing lubrication situation in a bearing application and the service life that may be forecast.

This relationship is considered in the modified method of rating life of a rolling bearing by the use of several calculation factors.

See the chapter “**Selection of Bearing Type and Size**” page 267.

Additives in Lubricants

To obtain specific characteristics in lubricants one or more agents may be used, the so called “**additives**”.

The more important additives are **anti-oxidants** that lengthen the ageing behaviour of a lubricant, **EP-additives** provide better load carrying performance (**EP = Extreme Pressure**), and various other compounds and components.

These agents undergo a chemical reaction, in the case of EP-additives with the bearing steel.

Especially for applications with limited lubrication, where the lubricating film will not be of sufficient thickness under all operating conditions, a suitable lubricant additive becomes of particular importance.

In the case of lubricants having many additives the compatibility of the lubricant with materials of seals however must be clarified.

Lubricating Greases

Lubricating greases principally comprise of a base oil and thickener and activating agents, called additives.

Base oil

The base oil determines substantially the lubricating behaviours of lubricating grease. The most common base oils are mineral oils, and for special applications synthetic oils.

When determining the required operating viscosity of lubricating greases the **viscosity of the base oil** must be considered.

Thickener

The **activating agent** or **thickener** in grease holds the base oil. The thickeners are generally metallic soaps (e.g. lithium, calcium or sodium soaps), although bentonite, polyurea and some other components (i.e. PTFE) are used.

There are also **lubricating greases with mixed soaps** that have thickeners consisting of two different soaps. Commonly used are mixtures of sodium / calcium, or lithium / calcium, etc.

Another grease type is represented by the so called "**complex soap**" grease, featuring a thickening agent consisting of a metallic soap and a metal salt.

Based on which thickeners are used the grease types are commonly classified as **lithium soap**, **mixed soap** and **complex soap**.

The **thickener also** substantially determines the consistency (stiffness) of grease, its mechanical and chemical resistance, the temperature range possible and the resistance of the lubricating grease to repel moisture.

Consistency grades

The consistency of lubricating greases is determined by measuring the penetration depth of a standardised "test" cone into the grease at a temperature of 25°C (77°F) for a period of 5 seconds.

Before the penetration test begins, the grease sample is prepared to a defined procedure.

Depending on the stiffness of the grease the deeper the test cone penetration the softer the grease is, also the NLGI classification is lower.

The values obtained using these methods are called "**worked penetration**". The classification of grease values for worked penetration is defined as consistency grades: (table 9.2).

NLGI-classes consistence grade (DIN 51818)	worked penetration [0.1 mm]
000	445 to 475
00	400 to 430
0	355 to 385
1	310 to 340
2	265 to 295
3	220 to 250
4	175 to 205
5	130 to 160
6	85 to 115

Table 9.2

Depending on the bearing type, size and known individual operating conditions greases of different consistency grades may be used.

Soft greases are optimum for use in small and miniature bearings, at low temperatures or high speeds, when a central lubrication system is used.

Stiffer greases are suitable for large bearings running at low speeds or high temperature application.

Additionally, stiffer bearing grease also has a better sealing effect.

Some significant values for the more common bearing greases are listed in the table 9.3:

Thickening agent soap base	Base oil	Temperature range		Remarks
		>	≤	
Lithium	mineral oil	-30°C (-22°F)	+120°C (+122°F)	normal rolling bearing grease
	ester oil	-60°C (-76°F)	+130°C (+266°F)	low temperatures / high speed grease
	silicon oil	-40°C (-40°F)	+170°C (+338°F)	high and low temperature grease
Sodium	mineral oil	-30°C (-22°F)	+100°C (+122°F)	poor water resistance
Bentonite	mineral oil	-20°C (-4°F)	+150°C (+302°F)	high temperature grease for low speeds
Polyurea	mineral oil	-20°C (-4°F)	+150°C (+302°F)	high temperature grease for high speeds
Calcium	mineral oil	-20°C (-4°F)	+60°C (+140°F)	superior water resistance (i.e. sealing grease)
Calcium complex	mineral oil	-30°C (-22°F)	+150°C (+302°F)	high temperature grease, also for higher loads
Sodium complex	mineral oil	-20°C (-4°F)	+130°C (+266°F)	also for higher loads
Aluminium	mineral oil	-20°C (-4°F)	+70°C (+158°F)	good water resistance
Aluminium complex	mineral oil	-40°C (-40°F)	+150°C (+302°F)	high temperature grease for high speeds, also for higher loads
Barium complex	mineral oil	-20°C (-4°F)	+150°C (+302°F)	high temperature grease for high speeds, also for higher loads
	ester oil	-60°C (-76°F)	+130°C (+266°F)	low temperature grease for high speeds; good resistance against vapour

Table 9.3

Lithium soap greases

are the most common standard bearing greases. Lithium based greases are normally the standard grease in sealed or shielded bearings.

Calcium base greases

have a very good water resistance, but have limited and low temperature range.

Calcium complex greases

also have good water resistance, with higher temperatures and range.

Calcium complex greases have a tendency to harden when cooled rapidly.

Sodium base greases

enable good protection against corrosion because of their ability to emulsify with a limited amount of water. The consistency of the grease, however, becomes more liquid (i.e. thinner or flowing).

Polyurea greases

outstanding temperature resistance, suitable for low or medium loads.

PTFE-greases

special lubricant for extreme operating temperatures, very good resistance against chemical influences.

Miscibility of Greases

In general, the mixing of **different** lubricating greases should be avoided where ever possible.

Even when blending greases that have theoretically the same or similar characteristics unforeseen effects may occur caused by chemical reactions between certain components of the lubricants or their additives.

Only lubricating greases that have the same thickener and identical or similar base oils may be blended (e.g. lithium and calcium soaped greases).

In cases where change of the grease used becomes necessary, all remaining old grease must be removed. Also the remaining lubricant in housing cavities, lubrication pipes or grooves must be carefully removed.

Especially in the changer over period, special attention should be paid to the lubrication situation in the bearing arrangement.

If required, the defined relubrication intervals should be shortened during such a conversion period.

Grease Quantity

The amount of grease required for lubricating a bearing is only very small.

Following the initial grease fill and the start up period some volume of grease is expelled from the bearing by the rotating elements. This grease volume creates a reserve supply for the bearing. In this way the bearing, impart, automatically controls the correct volume of grease into the bearing.

The grease displacement during the running-in of a bearing arrangement can generate additional friction that leads to higher operating temperatures during this period; this is normal.

In extreme cases where grease displacement from the bearing is not possible, the heat generated can cause a hot-run of the bearing.

The lubricating grease fill volume is determined mainly by the bearing design and its operating speed.

The free space within the bearing itself has to be fully filled with lubricating grease in all cases.

The grease fill volume applied to the housing cavities should be determined following the recommendations given in table 9.4:

Speed ratio *)		Grease filling **)
>	≤	[%]
-	20	80 to 90
20	75	30 to 50
75		25

Table 9.4

*) in % of the speed ratings with grease lubrication

**) in % of bearing housing cavities

Under very special operating conditions, such as pulley bearings running at very low speeds, the housing cavities may be fully packed with grease to avoid any formation of condensing water (i.e. creating a seal).

Grease Service Life and Relubrication Intervals

Bearing lubricants undergo permanent mechanical stressing caused by the over rolling of the rolling elements. Additionally, lubricants change their characteristics, particularly when operating at high temperatures which generate some oxidation, the presence of humidity, pollution and other elements also bring about certain chemical reactions.

For these reasons the service life of lubricants is limited.

In the case of greased “for-life” rolling bearings, mainly bearings that have shields or seals on both sides, the service life of the lubricating grease inside the bearing is expected to be longer than the probable bearing life rating.

When maintaining bearing applications it is essential to be able to estimate the **service life** of a lubricant realistically.

This becomes evident where regular relubrication is necessary.

The duration of the grease service life depends on the individual operating conditions, particularly on the operating temperature and bearing speeds

A realistic evaluation of the **service life of lubricating grease** is possible according to the following equation:

$$t_n = \frac{a * 10^6}{n * \sqrt{d}} - b * d \quad [h] \quad (\text{Eq. 9.3})$$

where:

- a and b bearing type and series coefficients (Table 9.5)
- n bearing operating speed [min⁻¹]
- d bearing bore diameter [mm]
- t_n service time (operating hours)

For safety reasons the **relubrication intervals** of new machines or plants, where no practical experience yet exists should not exceed approximately 50 to 60% of the initial calculated **service life** of lubricant.

The duration of relubrication intervals may be adjusted to suit the criteria.

Although in the first instance very careful observation of the lubrication condition and effective monitoring of the bearing positions is recommended.

Bearing types and series	Coefficients	
	a	b
Deep groove ball bearings		
160, 60, 62	75	18
63	65	18
64	55	18
Angular contact ball bearing		
72 B	65	18
73 B	55	18
32	55	18
33	55	18
Four-point contact ball bearings		
QJ 2	65	18
QJ 3	55	18
Self aligning ball bearings		
12, 22	75	18
13, 23	65	18
Cylindrical roller bearings		
N.10, N.2, N.2.. E	75	18
N. 3, N. 3 .. E	65	18
N. 4	55	18
Taper roller bearings		
302.., 320 .., 322..,	20	7
303.., 313	18	7
323..,	15	7
Spherical roller bearings		
222..	20	7
223..	15	7

Table 9.5

Influences to the Duration of Relubrication Intervals

The relubrication intervals that are calculated according to formula eq. 9.3 may be adjusted under certain circumstances.

The values obtained are only valid for constant operating temperatures not exceeding 70°C (158°F). Above 70°C (158°F) the mineral oil based lubricants undergo extremely accelerated ageing.

When the lubricant is exposed to constant operating temperatures above 70°C (158°F) the calculated value for **relubrication intervals**, using the equation eq. 9.3 must be halved for each 15°C (59°F) increase in operating temperature.

The course of this reduction is shown graphical in fig. 9.3:

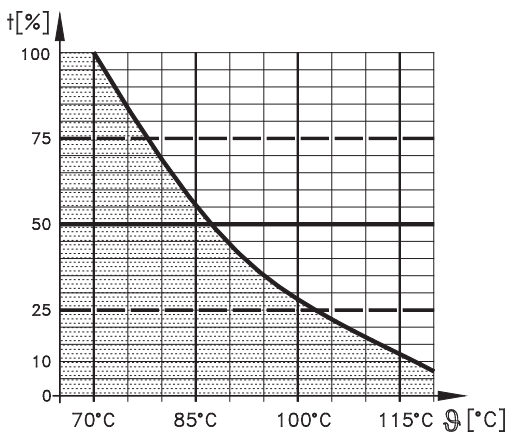


Fig. 9.3

where:

- t relubricating interval [%]
- θ constant operating temperature [°C]

If grease lubricating the bearing also acts as a seal against entry of pollution, or where the bearing outer ring rotates, the relubrication intervals must be further reduced. This also applies with the presence of moisture, dust, chemicals and vibrations etc.

Alternatively, where bearings run at low speeds and moderate operating temperatures the relubricating intervals may be extended.

In every case practical experience of relubricating intervals under known operating conditions for the same or similar machines and plant, must be considered.

Additional information on specific characteristics of lubricants, their chemical reactions with some elements and the anticipated service life of lubricant under certain operating conditions are available from the lubrication manufacturer.

Relubricating Quantity

The applied volume of new grease must be charged in such a way that a complete replacement of the old, used grease is guaranteed.

The grease volume required for **relubrication purposes** may be calculated using the following equation:

$$m = \frac{D * B}{1000} * i \quad (\text{Eq. 9.4})$$

where:

- m grease volume [g]
- D bearing outer diameter [mm]
- B bearing width [mm]
- i factor for relubricating frequency according to table 9.6

Relubricating frequency	i
weekly	2
monthly	3
yearly	4

Table 9.6

Grease Circulation

At the initial design stage the discharge of old used lubricant from the bearing position must always be considered, such as escape holes and ducts, or cavities in the underside of the housing or castings to accept and eject the old used lubricant, including the discharge of any surplus due to excessive relubrication which must be avoided.

A simple and effective method to protect the bearing against excessive lubricating is to install grease valves, as shown in fig. 9.4.

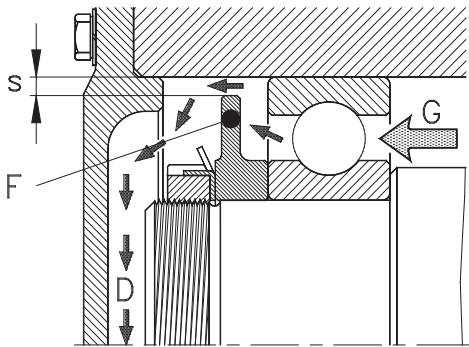


Fig. 9.4

- s gap between grease valve outer diameter and housing bore
- F grease valve
- G fresh grease supply
- D discharge of used grease

Grease valves are discs (F) that fit alongside the rolling bearings. Their outer diameter is defined in such a way that a gap (s) of approximate 1 to 3 mm between the housing bore is provided. The supply of fresh grease (G) during relubrication must be injected from the opposite side to the grease valve.

Relubrication of the bearing creates high pressure in the housing when injecting fresh grease (G).

This pressure causes the old grease (D) to discharge from the bearing position providing the pressure is maintained.

To ease the supply of fresh grease, several bearing types have lubrication holes and grooves. Typical examples are, supporting rollers, truck runner bearings, double row taper roller bearing and most spherical roller bearing and types where lubrication holes and grooves in the outer ring are a standard feature. (fig. 9.5).

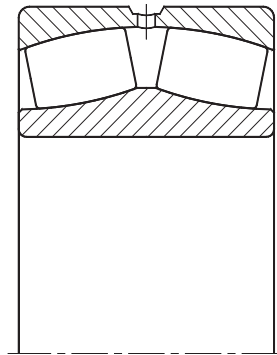


Fig. 9.5

Lubrication holes, grooves, grease valves and lubricating pipes etc. must be dimensioned in such a way that no extreme back pressure may build up during relubrication.

The supply of fresh grease should be actioned as close to the bearing as possible.

In the case of bearing housings having different or asymmetric voids the grease supply must always be in a direction from the smaller cavity towards the larger one.

Contamination of the grease channels due to dust, for example, may be avoid easily by fitting grease nipples.

Oil Lubrication

The design requirement for bearing arrangements with oil lubrication is considerably higher than for grease lubrication.

For the lubrication of rolling bearings mineral oils, with or without additives are generally used, synthetic oils are normally used for special applications.

The determination of the required oil viscosity for lubrication of a rolling bearing should be completed following the guidelines shown in chapter “**Selection of Bearing Type and Size**”, page 270.

In practice the selection of oil viscosity is often determined by other influences such as in the case of rolling bearings used in gearboxes.

Lubricating Methods

Depending on the individual application requirements the following methods of oil lubrication may be used:

Oil Bath Lubrication

This is the simplest form of oil lubrication. This method is usually used where the oil is also used for lubricating other machine components. With oil bath lubrication no additional equipment such as pumps etc. are required.

Typical applications are gear boxes, where the oil is primarily used for the lubrication of gear wheels.

In the case of oil bath lubrication the bearing usually stands directly in the lubricating oil, (fig. 9.6).

When the bearing rotates, oil is carried by both the cage and the rolling elements and is distributed by centrifugal force to all areas of the bearing to be lubricated.

On the other hand the constant displacement of oil, by the bearing, causes additional friction and thus generates heat.

This is why the maximum oil level(s) should not, where the speed exceeds 40% of the listed speed rating for oil lubrication, be higher than approximately half the diameter of the lowest rolling element (see fig. 9.6).

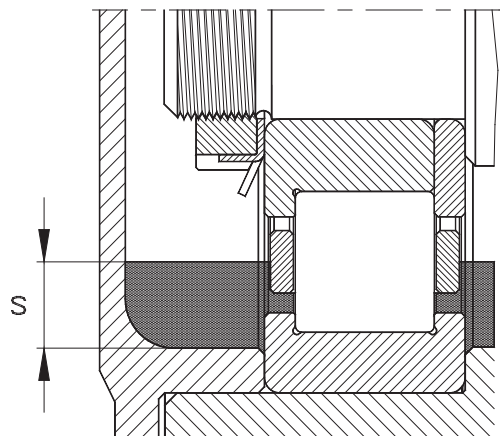


Fig. 9.6

Circulating Oil Lubrication

With this method the oil required for lubricating the bearings is collected in a sump. From this sump the oil is fed by pipes and pumps to the various bearing positions.

This method is very effective when heat dissipation is necessary. Both the oil and oil sump volumes must be adjusted to the requirements of heat dissipation

If necessary, additional oil coolers may be integrated in the oil circuit.

In every case the size of oil sump should be large enough to allow the wear particles in the lubricating oil to settle.

Before the oil recirculates in the lubrication system, it should be filtered to prevent the entry of any contaminations into the bearings.

Asymmetrical bearings, (i.e. angular contact ball bearings and taper roller bearings), generate a certain pumping action due to their internal design.

This effect may also be used to support the oil circulation in the lubricating system.

In the case of circulating oil lubrication the drain holes and the oil return pipes must be dimensioned to prevent the build-up of some back pressure.

Splash Oil Lubrication

With this method the oil splash or spray, from the rotating gear wheels immersed in the oil, is used for bearing lubrication.

Some simple gearbox applications use splash rings, which rotate loosely on the shaft, creating an oil distribution to the bearings within the gearbox casing. Where necessary, auxiliary features (i.e. oil grooves, ducts and voids) should be provided to ensure satisfactory oil volumes.

The effective lubrication of bearings must be guaranteed for all operating conditions.

Oil Injection Lubrication

This lubricating method is suitable for bearings running at high speeds, (e.g. spindle bearings).

The oil injection method provides an oil jet, via a nozzle, directly into the gaps between the outer, cage and inner ring shoulders.

The pressure of the oil jet, however, must be strong enough to penetrate the air turbulence caused by the fast rotating bearing.

This is achieved if the injection velocity is greater than 15 m/s. The nozzle bore diameter should be larger than 1 mm.

In the case of larger rolling bearings additional nozzles may be located around the bearing circumference.

Due to the relatively large oil volumes circulating all oil holes and feed pipes have to be sized correctly.

Due to the very precise lubrication system and large oil volumes circulating, this method normally attains excellent operating performance and outstanding temperature cooling and control.

Oil Mist Lubrication

This method is also suitable for bearings operating at high and very high speeds, but a compressed air system is required.

With oil mist lubrication the lubricating oil is vaporised into minute drops by an atomiser. Then the air-oil mixture is fed to the bearing position where a continuous flow lubricates and cools the bearing.

Oil Quantities, Oil Ageing

There are no valid rules or conclusive equations for the determination of the optimum oil volumes to be used in a specific application or machine.

This is due to variable influences of a number of different parameters. The optimum is only found through specific field tests and reliable practical experiences, particularly for totally new design projects where experience gained with other "similar" applications or machines etc., could be used as a base for test runs and field trials to determine optimum oil volumes.

Additionally, major changes or modifications, even small changes to the internal design may influence the oil flow and thus heat dissipation, required oil volumes, oil service life etc., it is advised practical test runs are completed.

General

NKE rolling bearings are high precision machine elements that are produced in modern plants using the latest high technology equipment, machining to close tolerances of some few microns (e.g. 1 micron = $1\mu\text{m}$ = 0.001 mm).

Extensive quality assurance procedures and systems throughout the whole manufacturing process combined with continuous inspection of product quality ensuring even the most exacting demands in operating reliability, running accuracy and bearing service life are met.

But, to guarantee the optimum function of a bearing arrangement, special care and attention must be given to simple basic rules concerning storage, handling and bearing mounting.

Bearing Storage

All NKE rolling bearings supplied are protected by a high quality preservation oil and are optimum packed either single boxed, bulk or cassette packed or to customer requirements.

The **anticorrosion agent** applied at the factory enables an effective function of the products even following long storage providing correct storage in their original undamaged packaging is maintained.

In principle bearings should always be stored in their **original packaging**. They should only be unpacked prior to their fitting.

The **storage** of bearings should be in a clean environment at normal room temperature, such temperatures being 15°C - 25°C (59°F - 77°F).

The relative air humidity must not exceed 60%. Under no circumstances should rolling bearings be stored in immediate proximity to water, humidity or any other aggressive chemical matters.

Also the storage of bearings or associated parts close to any metal removing or dust producing machines must be avoided.

Bearings also should not be exposed to any long lasting vibrations or shocks during handling or

storage, because in this way the bearings may be mechanically damaged permanently.

Bearings in a packed condition must not be exposed to strong temperature variations or direct sun light because of the danger of water condensation (i.e. humidity) in the packaging.

In principle all bearings, most particularly the larger ones must be stored **flat** (i.e. axially).

This is necessary because the individual weight of the larger bearings may deform the bearing rings if they are stored vertically (i.e. radially) additionally, storage of bearings directly on the ground or a floor must also be avoided.

Gross mishandling must be avoided at all times, particularly, shocks caused by insecure stacking and carelessness during stock utilisation and rotation. If for any reason the original packaging is damaged the product inside must be closely examined for its condition.

Shelf Life

Some bearing types, especially those having shields or seals on both sides, which are supplied grease filled (suffixes **-2RS**, **-2RSR**, **-2Z**, **-2LFS**...) a change in grease consistence must be considered during a long-term storage.

Over long storage periods the grease becomes stiffer and some grease have a tendency to secrete small amounts of their base oil. In this way the shelf life of such bearings is reduced. The duration of shelf life differs according to the grease used and the individual storage conditions.

In the case of stiffened grease a somewhat higher temperature and running noise is to be expected during the starting phase of the bearing.

Only careful consideration of all the relevant stated points is the bearing available for mounting in good condition on demand.

Presuppositions for Mounting

The correct mounting of a bearing is one of the most important basic requirements to ensure the bearing arrangement will work correctly.

Any bearing damage during mounting may have fatal consequences and cause accumulative losses. In such a case the value of the bearing is negligible when compared to the potential total consequential damage.

Cleanliness

When dealing with rolling bearings, maximum cleanliness is a paramount basic requirement.

The rolling bearing running surfaces of rings and rolling elements usually have a surface finish roughness of some tenths of microns ($1/10 \mu\text{m} = 0,0001 \text{ mm}$). Such very smooth surfaces, however, are very sensitive to damage.

Rolling bearings are able to transmit large forces via very close contact areas (fig. 10.1). In between the rolling elements (1) and the rings (3) a lubricant film (2) builds up which separates the metallic bearing parts.

Due to the applied loads, extremely high lubricant pressure develops which causes some elastic deformation in the hardened steel bearing surface.

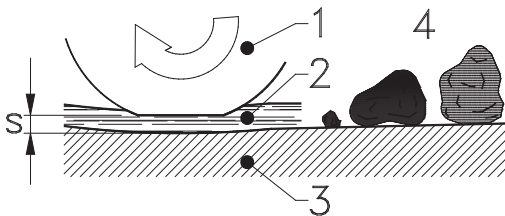


Fig. 10.1

The **thickness** (s) of such a lubricating film which builds up in the bearing depends on the operating conditions but usually amounts only to some tenth of microns ($1/10 \mu\text{m}$), up to a thickness of about 1 micron ($1 \mu\text{m}$).

Normal environment dust that surrounds us has a grain size (4) that is not visible without enlargement. The grain size of such dust particles is up to $10 \mu\text{m}$. Thus, even fine dust particles are larger than the thickness of lubricating film.

Other contaminates, such as sand or metal chips, have even larger particle sizes.

All such particles easily stick to greased or oiled surfaces, (e.g. bearing rings being prepared for mounting). In this way such impurities may enter the bearings.

When the bearing rotates these particles are over rolled and can damage the raceway surfaces seriously.

Where particles have a grain size greater than the lubricating film thickness, localised stresses will occur, causing material fatigue. This may dramatically reduce the bearing service life.

In extreme cases the bearing may be seriously damaged, even before mounting, caused by the penetration of major contaminates.

In the optimum case bearings should be fitted by experienced and qualified personnel, using the correct tools and auxiliary equipment, in a workshop which is a clean and dry environment.

The assembly area must not be located near to any metal removing or dust generating machines or plants, such as grinding, milling, drilling or wood working machines etc.

If the ideal workshop conditions are neither possible nor practical, as in the case of field installations or repair, then the mounting and assembly area must be suitably prepared.

Preparations

Prior to mounting, careful preparation is necessary.

In principle it must be distinguished between the conditions of volume mounting and the needs of repairing or maintenance works.

During volume mounting (i.e. production assembly) the conditions and environment are normally well prepared and organised. With the correct tools and auxiliary equipment provided.

In the case of repairs and maintenance the circumstances are different as each case is individual.

Furthermore, when volume mounting new parts and components are used whilst in case of repairs some used or worn parts have to be recycled. Unfavourable working conditions may apply with maintenance work, sometimes in dirty and dangerous locations that have access difficulties. Therefore, particularly in the latter cases, preparation and meticulous planning is paramount for easy work completion.

Thus the following recommendations are for guidance only and must be adjusted to every individual application or circumstance.

- Before bearing mounting commences one should be familiar with the relevant details of each application. Careful study of all available documentation such as drawings, maintenance manuals, notices, including the clarification of lubricant requirements for the specific machine.
- **All components** of the bearing arrangement, such as shafts, distance rings, spacers, housing components, cups, flanges etc. must be cleaned very carefully. The whole assembly and all adjacent areas must also be clean, dry and free from foreign bodies and contaminants. Also all lubricating facilities (i.e. grease holes, oil pipes, grooves etc.) must be carefully cleaned and clear.
- In the case of repairs any exposed machine components and housing cavities should be **covered** to protect them from pollution. Optimum suitable for this is to cover or to wrap the parts with plastic film or clean, fibre-free cloths. Also in the event of longer breakdowns or discontinuation of the mounting or dismounting sequences the machine parts should be totally covered.
- To clean adjacent parts a cleaning paper or suitable fibre-free cloth should be used. **Never use waste cotton or cleaning wool.**
- Bearing seats on shafts and housings, seals and the contacting surfaces of seals including all adjacent machine parts and components should be carefully checked for their condition, especially when dealing with repairs.
- Special attention must be paid to worn bearing seats or seals, burrs, scratches or any other damage to the machine components.
- In the case of maintenance or repair work a thorough inspection of **dimensional and geometric accuracy** of bearing seats or the adjacent parts may be necessary.
- An additional check of the **adjustment of bearing positions** may also be necessary in the case of field installations of large machines or plant. In this way undesired stresses and misalignments of the bearings can be avoided. During repairs any contacting seals such as radial oil seals or V-ring seals should in principle be exchanged.
- To avoid **fretting corrosion** the adjacent parts especially the bearing seats may be lightly oiled or be sprayed with a suitable matter. This applies particularly to loose fits.
- **The bearing should only be unpacked prior to mounting to protect it from contamination.**

Selection of Mounting Method

Rolling bearings are generally mounted to their adjacent parts by means of either sliding or interference fits.

The decision whether a bearing should be mounted either in warm or cold conditions depends mainly on the bearing type, its size and the individual fits that are used for each application.

In the event of volume mounting, some economic considerations should be undertaken. This is why there are no valid general rules to be applied.

In the majority of applications the bearing inner ring is located by a more tight fit than the outer ring. For this reason, rolling bearing **outer rings** are usually pressed into the housing bore in a cold condition. Generally, the mounting of outer rings is by means of either mechanical or hydraulic press.

In the case of very tight interference fits for housings mounting may be made easier, as far as it is practical, by heating up the housing.

To mount bearing **inner rings** onto their shaft seats there are many more possibilities:

Small bearings are normally mounted on their seats in a **cold condition**, this also includes medium-sized bearings with sliding fits or even transition fits.

A **warm mounting** is preferred in the case of large bearings, particularly if the bearings have to be mounted with heavy interference fits.

Larger and very large size rolling bearings are frequently mounted and dismounted with the help of hydraulic devices. Typical are adapter or withdrawal sleeves, frequently used featuring oil ducts. **Hydraulic nuts** are tools for mounting and dismounting larger rolling bearings.

Large-sized NKE bearings are rolling bearings having bore diameters above 250 mm.

Note:

The following basic rules are of extreme importance and must be obeyed when mounting bearings (fig. 10.2):

- 1) Never apply mounting forces via the bearing rolling elements!**

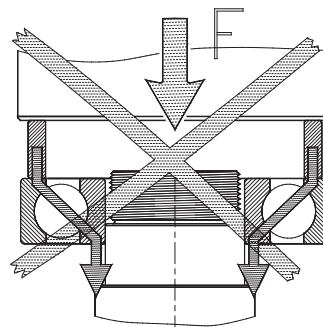


Fig. 10.2

It can easily lead to localised overloading in the contact area between the rolling elements and raceways; this overload damage is not visible and will cause premature bearing failures.

- 2) Never hit the bearing a surface directly with any hardened tools such as hammers, cotter pin drives etc.**

This can cause a breakage or fragmenting of parts of the hardened bearing rings.

For correct fitting recoil free hammers should be preferably used.

Hammers with lead or plastic heads that may split, however, are not appreciated due to the risk of particles coming off and getting into the bearing.

Mounting of Bearings in Cold Condition

Small and medium sized bearings are usually mounted in a cold condition as they do not normally have tight fits.

The bearings are mounted using either presses or by hammer strikes.

In principle the bearing that has the tighter fit must always be mounted first.

Impact sleeves and impact bushes

For mounting small and medium-sized bearings **impact sleeves** and **impact bushes** have been proven to be satisfactory tools. These are sets of discs and rings made from a special impact-proof plastic and lengths of aluminium tubes that fit to them.

These tool sets used fit the standardised bearing ring sections.

Impact bushes provide a quick and simple method of mounting small bearings, even when volume mounting bearings.

In repair shops complete sets of **impact bushes** have proven to be optimum universal devices when frequently dealing with different bearing types and sizes, particularly in electric motor rewinding shops.

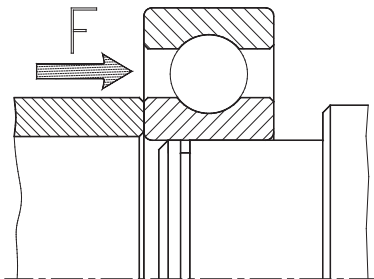


Fig. 10.3

Fig. 10.3 shows the press mounting of a radial deep groove ball bearing on a **tight shaft fit** using an appropriate **impact sleeve**.

The use of an effective **impact sleeve** enables the transfer of the mounting force via the bearing's inner ring only.

This ensures damage of the bearing or the shaft is reliably eliminated.

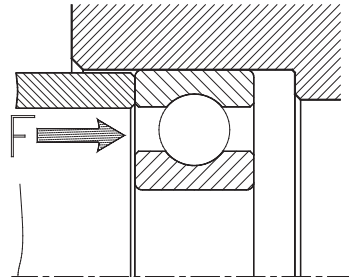


Fig. 10.4

Press mounting of the same bearing into a **tight housing fit** (fig. 10.4).

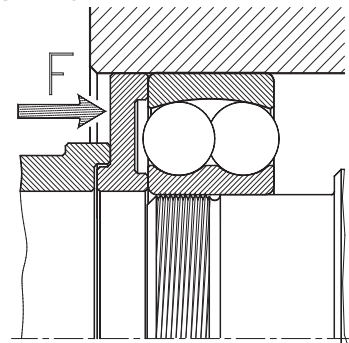


Fig. 10.5

If non-separable bearings are to be mounted simultaneously on to the shaft and into the housing seat, both bearing rings have to be supported by a satisfactory **mounting washer** (fig. 10.5).

Note:

In the case of some bearing types, certain parts such as rolling elements or cages may protrude beyond the bearing side faces. This must be carefully checked when selecting such a mounting washer.

Press Mounting of Bearings

The mounting of small and medium sized rolling bearings may be completed quickly and simply by using either mechanical or hydraulic presses.

For such cases the bearing seats of shaft and housing should be prepared by lightly oiling.

Also when applying this method the general rules that the introduction of forces via the rolling elements must be avoided. For these reason satisfactory auxiliary sleeves, washers or mounting bushes have to be used.

When using presses misalignment of parts particularly must be avoided (fig. 10.6).

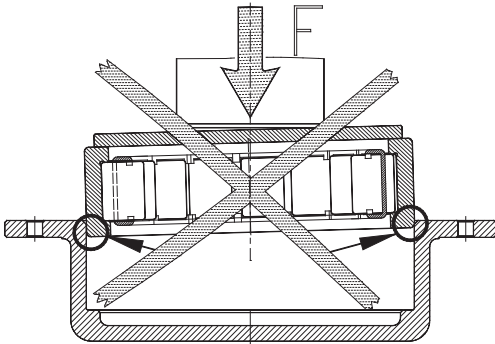


Fig. 10.6

In the case of applying mounting forces to misaligned bearing rings, localised damage to the housing seat may occur at the marked areas.

Such damage may appear as ridges and result in sheared material contaminating the bearings and causing serious damage.

Because misalignment is possible even in the case of loose bearing fits, the bearings have to be centred and aligned very carefully, for reference (fig. 10.7).

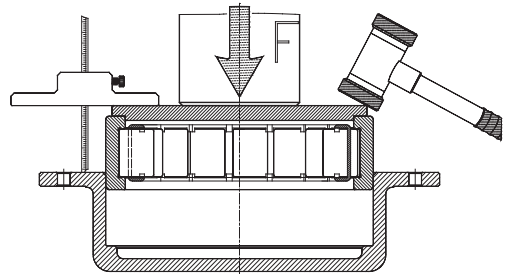


Fig. 10.7

When hydraulic presses are used, the setting of a certain pressure relief has to be recommended to avoid choking caused by defects on the bearing or in the housing.

As any additional and unnecessary dismounting and removal of the bearing from its position is time consuming, uneconomical and interrupts the mounting process, good mounting practise is paramount.

Simplification of Bearing Mounting by Constructive Measures

The mounting of bearings may be completed effectively and efficiently using good design practise.

Such measures are justified in the case of applications that only require minor maintenance.

Examples of such aids are screw threads on shafts and housings, which may also be used for mounting purposes.

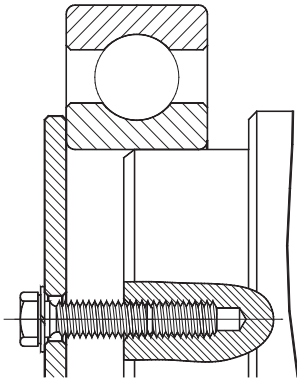


Fig. 10.8

Figure 10.8 shows how pilot holes or even other tapped holes may be used to support the mounting of bearings onto shaft seats.

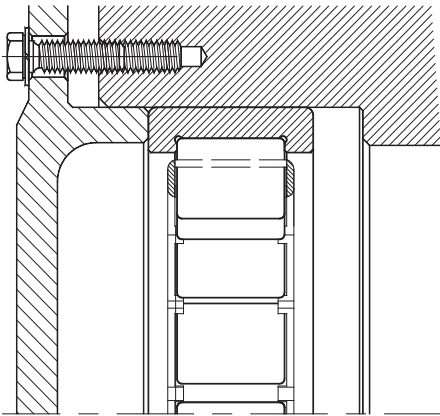


Fig. 10.9

Also necks and fastening threads of cups and housings must be used additionally to assist the mounting of bearing outer rings, (fig. 10.9).

Insertion of Shafts in the Case of Separable Bearings

When mounting separable bearing types, such as needle roller bearings, tapered roller bearings or cylindrical roller bearings, their outer and inner rings may be fitted separately.

This is a considerable advantage with volume assembly mountings. So, for example, when mounting gearboxes or electric motors, the bearing inner rings may be pressed onto the shafts or the armature, respectively, whilst the associated outer rings may be mounted in their housings later.

Although during the final assembly of the whole unit special care must be taken when the pre-assembled shaft is inserted into the housing to avoid any possible misalignments of the respective parts (fig. 10.10).

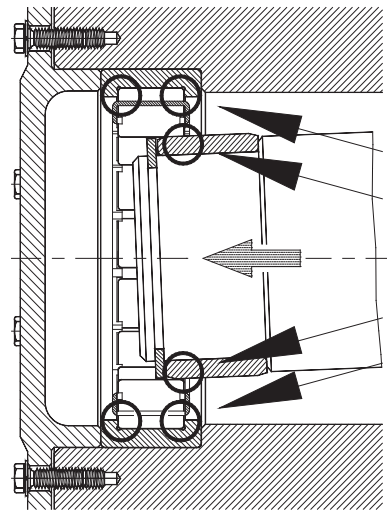


Fig. 10.10

A misaligned mounting as shown in fig. 10.10 will inevitably cause scratches, indentations and plastic deformations to the bearing raceways or their flanges; such damage is not normally visible and will result in material fatigue in the affected areas and premature bearing failure.

This damage risk can be easily avoided at mounting by rotating the shaft with care, during assembly, as shown in fig. 10.11.

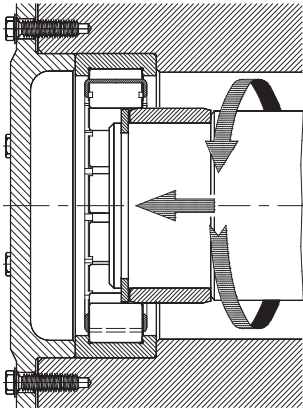


Fig. 10.11

Roller Drop in Cylindrical Roller Bearings

When mounting separable cylindrical roller bearings, fitted with cages, special attention must be paid to the looseness of the rollers. This specific behaviour is unique and is caused by the internal design of the bearing cages.

All cylindrical rollers retained by a cage require a certain clearance, the so-called “**pocket clearance**”. The pocket allows the roller to drop and hang when it is not guided by the ring. Depending on the specific cage type this pocket clearance may be large or small.

When the associated inner or outer ring is in its final position the pocket clearance is negated. But when a bearing inner ring is removed or the bearing outer ring with roller set is fitted into the housing seat separately, the upper rollers will drop and hang.

That is why special care must to be taken when assembling the shaft in this way.

The hitting of roller end faces by the shaft must be avoided at all times

A cheap, simple and very effective solution of this potential problem is provided by the use of **mounting sleeves**, as shown in fig. 10.12:

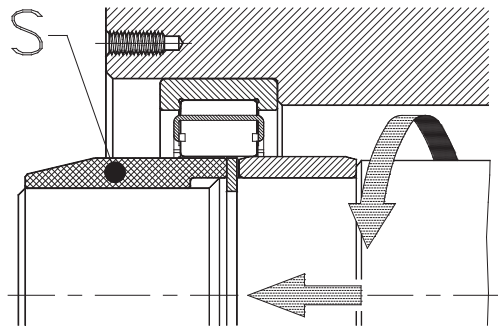


Fig. 10.12

Mounting sleeves (S) are simple-shaped hollow tubes made from various materials (e.g. plastic, nylon and card board etc.).

The sleeve has to be designed in such a way that it is able to guide and centre the shaft during assembly and to lift the loose rollers.

Mounting of Bearings Having Filling Slots

There are several bearing types which have a filling slot in one of their faces to accept the maximum amount of balls.

Examples for such types are the so-called “Max-Type” deep groove ball bearings, and some double row angular contact ball bearings fitted with cages.

In the case of these bearing types it must be noted that the direction of the major thrust load must be opposite to the side that has the filling slot.

**Mounting of Bearings
with Tapered Bore**

Several different bearing types are frequently used with tapered bores mainly self aligning ball bearings and spherical roller bearings. These bearings are mounted usually by means of adapter or withdrawal sleeves directly onto fine turned shaft seats, bright drawn bars or simple round stock.

In the case of high precision cylindrical roller bearings of the series **NN 30**, that are mounted directly onto tapered journals, the tapered shaft is also used for very accurate adjustment of the bearing operating clearance, R_2 , (fig. 10.13).

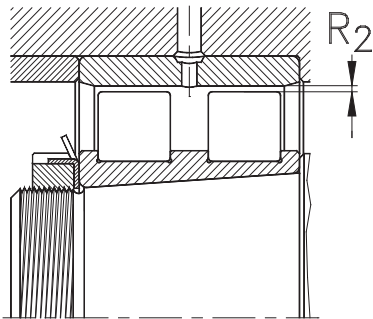


Fig. 10.13

When mounting bearings that have tapered bores on a tapered journal, considerable expansion of inner ring can occur (fig. 10.14).

Such an expansion can reduce the initial normal bearing clearance.

If this effect is overlooked, undesired radial preloading of the bearing may result. For this reason bearings with tapered bores have, in principle, a larger initial clearance compared to bearings with the same cylindrical bore, even for the same clearance group.

Example:

Self aligning ball bearing **1210**, “normal” clearance group:

- for **cylindrical** bore: 14 to 31 μm
- for **tapered** bore: 22 to 39 μm

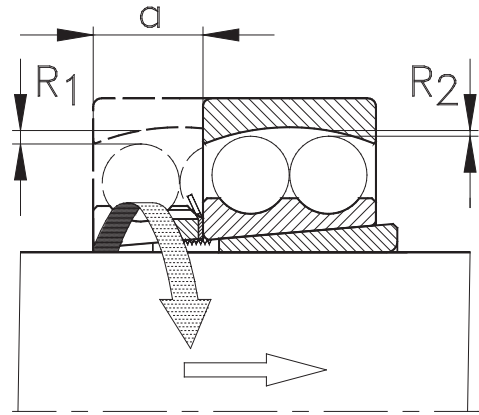


Fig. 10.14

where:

- R_1 = initial radial clearance before mounting
- R_2 = remaining radial clearance after mounting
- a = axial displacement

The magnitude of inner ring expansion depends upon the bearing size, the axial displacement during mounting (a) and the angle of the taper.

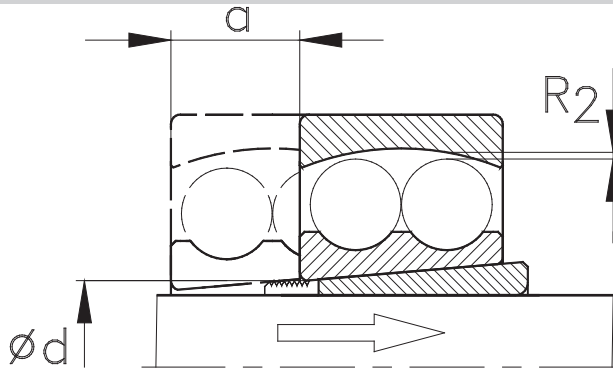
The standard taper, indicated by suffix “**K**” amounts to **1:12**, which means an inclination of 1 mm of each 12 mm gauge length.

Several bearing types with less sectional height have less taper inclination, **1:30**. These tapers are identified by the suffix “**K30**”.

To avoid any potential undesired preloading to the bearing, the remaining bearing play (R_2) after mounting must be checked.

Because of the fact that there exists a simple relationship between the taper angle, the axial displacement and the resulting clearance reduction please see the recommendations for values of remaining bearing clearance (R_2) listed on **Table 10.1** for **self aligning ball bearings** and **Table 10.2** for **spherical roller bearings**.

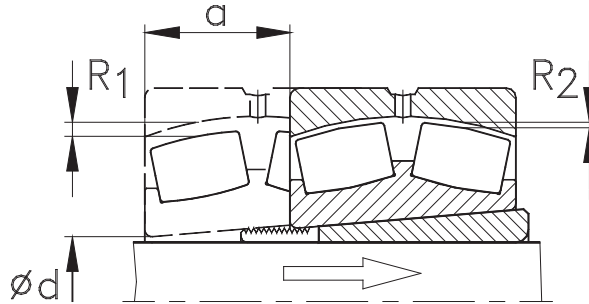
Mounting of Self Aligning Ball Bearings with Tapered Bore



Bore \varnothing d [mm]	Axial displacement a [mm] for bearings of series				Mean mounted clearance R_2 [mm] for clearance group	
	12K	22K	13K	23K	CN (normal)	C3
20	0,22	-	0,23	-	0,010	0,020
25	0,22	0,22	0,23	0,23	0,010	0,020
30	0,22	0,22	0,23	0,23	0,010	0,020
35	0,30	0,30	0,30	0,30	0,010	0,020
40	0,30	0,30	0,30	0,30	0,010	0,020
45	0,31	0,31	0,34	0,33	0,015	0,025
50	0,31	0,31	0,34	0,33	0,015	0,025
55	0,40	0,39	0,41	0,40	0,015	0,030
60	0,40	0,39	0,41	0,40	0,015	0,030
65	0,40	0,39	0,41	0,40	0,015	0,030
75	0,45	0,43	0,47	0,46	0,020	0,040
80	0,45	0,43	0,47	0,46	0,020	0,040
85	0,58	0,54	0,60	0,59	0,020	0,040
90	0,58	0,54	0,60	0,59	0,020	0,040
95	0,58	0,54	0,60	0,59	0,020	0,040
100	0,58	0,54	0,60	0,59	0,020	0,040
105	0,67	0,66	-	-	0,025	0,055
110	0,67	0,66	0,70	0,69	0,025	0,055
120	0,67	-	-	-	0,025	0,055

Table 10.1

Mounting of Spherical Roller Bearings with Tapered Bore



Bore diameter d [mm]		Clearance reduction [mm] $\Delta R (R_1 - R_2)$		Axial displacement a [mm]				Minimum mounted clearance R_2 for bearings of clearance group		
>	≤	min	max	for taper 1:12		for taper 1:30		CN (Normal)	C3	C4
				min	max	min	max			
24	30	0,015	0,020	0,3	0,35	-	-	0,015	0,020	0,035
30	40	0,020	0,025	0,35	0,40	-	-	0,015	0,025	0,040
40	50	0,025	0,030	0,4	0,45	-	-	0,020	0,030	0,050
50	65	0,030	0,040	0,45	0,6	-	-	0,025	0,035	0,055
65	80	0,040	0,050	0,6	0,75	-	-	0,025	0,040	0,070
80	100	0,045	0,060	0,7	0,90	1,7	2,2	0,035	0,050	0,080
100	120	0,050	0,070	0,75	1,1	1,9	2,7	0,050	0,065	0,100
120	140	0,065	0,090	1,1	1,4	2,7	3,5	0,055	0,080	0,110
140	160	0,075	0,100	1,2	1,6	3,0	4,0	0,055	0,090	0,130
160	180	0,080	0,110	1,3	1,7	3,2	4,2	0,060	0,100	0,150
180	200	0,090	0,130	1,4	2,0	3,5	5,0	0,070	0,100	0,160
200	225	0,100	0,140	1,6	2,2	4,0	5,5	0,080	0,120	0,180
225	250	0,110	0,150	1,7	2,4	4,2	6,0	0,090	0,130	0,200
250	280	0,120	0,170	1,9	2,7	4,7	6,7	0,100	0,140	0,220
280	315	0,130	0,190	2,0	3,0	5,0	7,5	0,110	0,150	0,240
315	355	0,150	0,210	2,4	3,3	6,0	8,2	0,120	0,170	0,260
355	400	0,170	0,230	2,6	3,6	6,5	9,0	0,130	0,190	0,290
400	450	0,200	0,260	3,1	4,0	7,7	10,0	0,130	0,200	0,310
450	500	0,210	0,280	3,3	4,4	8,2	11,0	0,160	0,230	0,350
500	560	0,240	0,320	3,7	5,0	9,2	12,5	0,170	0,250	0,360
560	630	0,260	0,350	4,0	5,4	10,0	13,5	0,200	0,290	0,410
630	710	0,300	0,400	4,6	6,2	11,5	15,5	0,210	0,310	0,450
710	800	0,340	0,450	5,3	7,0	13,3	17,5	0,230	0,350	0,510
800	900	0,370	0,500	5,7	7,8	14,3	19,5	0,270	0,390	0,570
900	1000	0,410	0,550	6,3	8,5	15,8	21,0	0,300	0,430	0,640
1000	1120	0,450	0,600	6,8	9,0	17,0	23,0	0,320	0,480	0,700
1120	1250	0,490	0,650	7,4	9,8	18,5	25,0	0,340	0,540	0,770

Table 10.2

In every case it is extremely important that after locking the shaft nut which secures the bearing, the **final bearing clearance (R_2)** must be re-checked to confirm the correct value.

Depending on the relevant mounting situation and the individual features of the specific application such inspection is completed either in a **direct** or **indirect** way. The indirect method is possible by a measurement of the **axial displacement**. A **direct** method of the final bearing clearance is completed using **dial gauges**, (fig. 10.15) or, for larger spherical roller bearings, by use of **feeler gauges**.

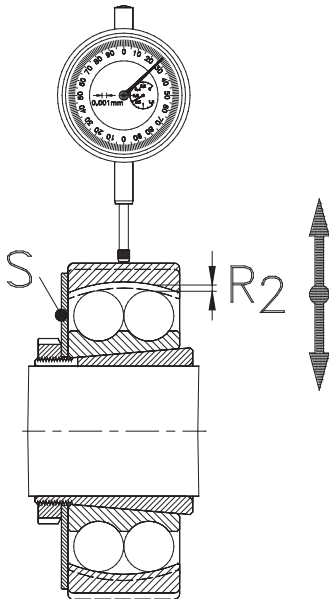


Fig. 10.15

When using dial gauges they must be adjusted to the outer ring of the mounted bearing (see fig. 10.15).

In the case of self-aligning bearings, (i.e. self-aligning ball bearings and spherical roller bearings), the use of **auxiliary supporting washers (S)** is recommended to prevent the outer ring skew (fig. 10.15).

To measure the **final bearing clearance (R_2)** the outer ring of the mounted bearing must be moved to the extremes of its position in a radial direction. For larger bearings, (e.g. large spherical roller bearings), such a procedure is normally impossible.

In these cases, however, a cross check of the remaining clearance is completed using **feeler gauges** with consideration to the recommended minimum values for the final bearing clearance (R_2 , table 10.2).

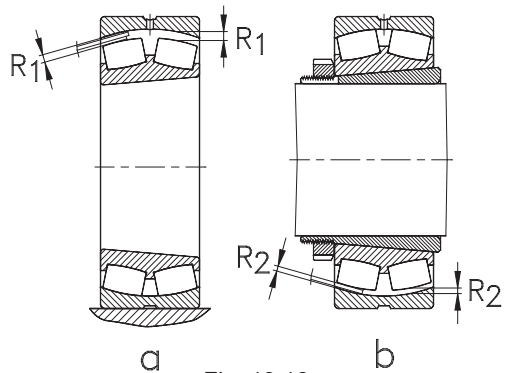


Fig. 10.16

For such a measurement the **initial clearance (R_1)** of the unmounted bearing must first be determined.

This may be done according to the specific circumstances either by using **dial gauges** or, for larger bearings using feeler gauges which are for practical purposes sufficiently accurate.

For this, place the bearing upright on a flat, clean base and rotate its inner ring by hand several times to provide an optimum contact of the rolling elements on the raceways.

When the bearing stands upright on its base, the **actual clearance R_1** (i.e. gap) between the outer ring raceway and the uppermost rolling element on a fixed axial centreline is easily measured using feeler gauges of various thickness (fig. 10.16a).

The thickest feeler gauge that can be inserted indicates the actual amount of initial bearing clearance.

The remaining bearing clearance should be frequently checked during the mounting.

Because of the fact the bearing already sits on its shaft at this stage of mounting, the actual bearing clearance is determined by measuring the final gap between the roller and the outer raceway on a fixed radial centreline (fig. 10.16b).

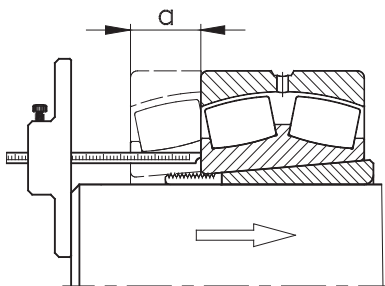
The minimum values of **final bearing clearance (R_2)** stated in table 10.2 are based on clearance values that lie on their lower limits.

The minimum values listed in table 10.2 must not be undercut.

In many cases a reliable measurement of the remaining bearing clearance using the above procedure may cause some difficulties.

Furthermore, under certain conditions of mounting this procedure may be time-consuming and impractical.

In such cases the remaining final bearing clearance (R_2) may be determined using the indirect method (i.e. axial displacement measurement "a").



The actual distance of displacement "a" is measured using effective measuring instruments such as dial gauges, depth gauges or even simple calliper rulers. This may depend on the particular application.

In this way volume production mounting may be organised in a very efficient and economic way by using the recommendations in tables 10.1 and 10.2. It must also be considered, however, that these values apply to solid steel shafts only. The mounted bearing has to allow for easy rotation and skewing of the outer ring in all cases.

**Mounting Bearings by
Using Oil Injection Method**

Larger and very large rolling bearings may be mounted in a much simpler way by using oil to force the bearing either on or off its seat.

To fit bearings by the oil injection method, called "hydraulic nuts", (fig. 10.18), are used.

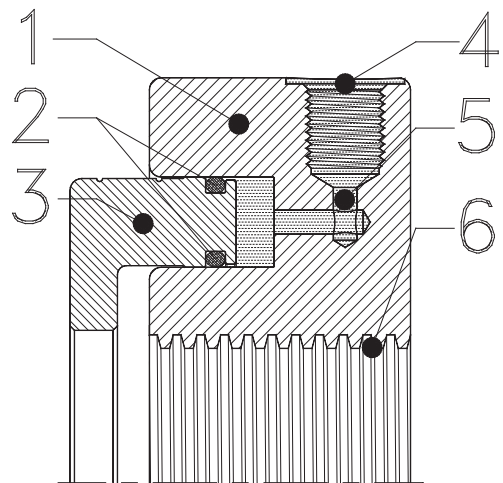


Fig. 10.18

They consist of a solid body piece (1) that features appropriate threads (6). The body piece has a circular groove in one face that accepts an annular piston ring (3).

Via the connecting threads (4) and oil ducts (5) oil is injected into the groove at a high pressure forcing the piston outwards. Two O-rings, (2) sitting in circumferential grooves on the piston effect the sealing of the oil groove against the abutting surfaces.

When mounting bearings, in conjunction with adapter and withdrawal sleeves or taper seatings, the hydraulic nut must be fully screwed and secured to the appropriate abutment face. It is important the annular piston is located correctly and secure prior to assembling the hydraulic nut.

To provide easier screw rotation, hydraulic nuts normally have 2 or 4 blind holes equally spaced in their outside face and for the larger sizes 4 to 8 blind holes around the outside circumference. These features allow the use of mechanical equipment (i.e. tools, drifts, levers, hook or impact spanners.) for securing the nuts.

The piston stroke for most hydraulic nuts is designed in such a way that the correct mounting of a bearing is completed in a single stage. To mark the maximum permissible piston stroke most hydraulic nuts have two narrow circumferential grooves formed into the piston outer diameter.

When charging the hydraulic nut with oil the piston is displaced axially and creates a considerable thrust force which presses the bearing either onto or off its seat position. Please bear in mind the clearance reduction caused by that axial displacement and check the residual clearance after each mounting.

When the bearing is located on its seat correctly the return valve on the oil pump should be opened. The pressure inside the hydraulic nut will then drop immediately.

Following mounting and rechecking the bearings final clearance the hydraulic nut must be replaced by a "normal" lock nut.

Note:

When mounting or dismounting bearings using the oil injection method huge pressures are applied, please read the operating instructions carefully and consider the recommendations and safety instructions provided by the supplier of the hydraulic equipment.

**Mounting of Bearings
by Heating**

In cases where mounting of bearings in the cold condition is not possible or where the oil injection method is not practical heating of the bearing or even individual bearing rings may be of advantage.

This method is widely used for ease of mounting the bearings or even other machine components on interference fits, particularly on tight shaft seats (i.e. heavy interference).

When heated the bearing rings expand, due to the thermal coefficients, and thus the diameters increase, which enables easier bearing mounting.

Immediately after the ring sits on its comparatively cold shaft seat it will shrink to its correct diameter by cooling down to the ambient temperature.

The following recommended methods and procedures for mounting rolling bearings are also satisfactory for other machine parts, such as cog wheels, bushes or disks which may also be mounted on interference fits.

Required Heating

The amount of heat required for a certain application depends on the actual ring sizes and shaft fit. Usually the heating of bearing rings to temperatures between 90°C to 110°C (197°F to 230°F) is sufficient for a totally problem-free mounting.

Note:

When heating rolling bearings there are some basic rules to be strictly adhered to:

- a) **Never heat standard rolling bearings above 120°C (248°F).** Higher temperatures may cause some structural changes in the ring material causing undesired dimensional and geometrical changes with no advantages for mounting the bearing.

- b) **Sealed or shielded bearings** (e.g. bearings with suffix RS, -2RS, -2Z, -2LS, LFS, -2LFS...) should never be heated by using the oil bath method.
- c) When heating bearings always ensure there is **effective temperature controls** to protect the bearing rings from excessive heat.

It is particularly important when mounting bearings that optimum planning and preparation of the work area is undertaken as prolonged handling and badly located mounting equipment and tools can result in premature cooling this obviously negates the object of mounting using the heat method.

Important:

Never heat rolling bearings or even separate bearing rings directly by means of open flames, blow and welding torches or soldering irons

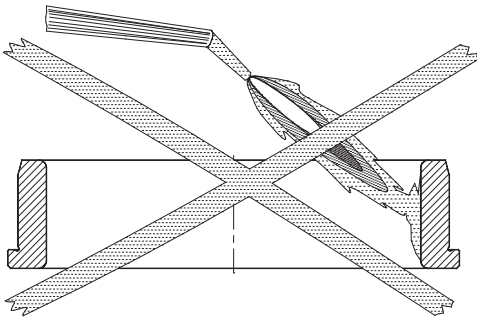


Fig. 10.19

Even with extra special care it is not possible to control the bearing or ring temperature uniformly and consequently localised overheating can never be excluded (fig. 10.19).

Approved Heating Methods

Heating in Oil Baths

The bearings are placed in an **oil bath** and heated to the required mounting temperature, (fig. 10.20).

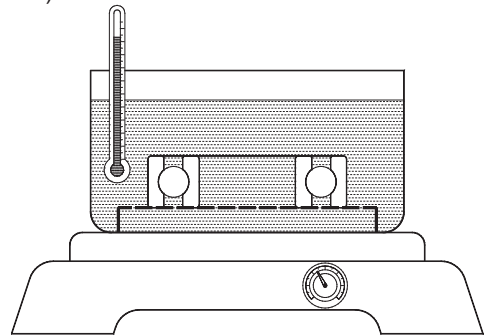


Fig. 10.20

This provides a very uniform method heating of the parts to be mounted and allows the parts to be held at specific controlled temperatures, to equalise, by means of a thermostat.

When applying the oil bath heating method some points should be carefully considered:

- Long life thin machine oils should be used.
- Only use machine oils that feature flash points above **250°C (482°F)**.
- The facility to effectively control oil temperature is paramount.
- If the oil bath is not in use for long periods, the oil tank must be covered to prevent oil contamination and pollution.

All oil undergoes an accelerated ageing due to frequent heating.

This results in the build up of oxidation particles that bind together with the dust that has entered the oil. This sediment sinks onto the oil tank bottom.

To avoid the possible entry of such particles, into the parts to be heated, tank filters should be used (fig. 10.20), or the bearings or rings should be suspended on screens or with simple hooks (fig. 10.21).

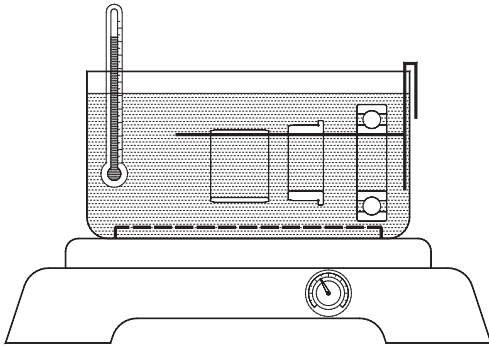


Fig. 10.21

Hot Plates and Boxes

Especially when mounting a large number of bearings or when frequently mounting numbers of bearings of different sizes **hot plates** or **heating boxes** may be satisfactory devices. In either case temperature control is very necessary.

Depending on their dimensions, **heating boxes** may also be used to heat up small housings or other different machine components.

Hot Plates

Small and medium sized bearings are frequently heated using electric powered **hot plates**.

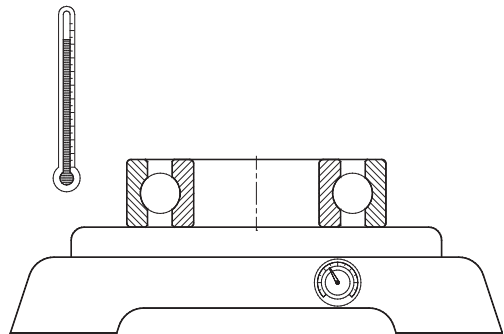


Fig. 10.22

These hot plates also require temperature control measurements, or at least the actual temperature of the heated part must be carefully checked.

Optimum devices for production mounting of bearings are special heating plates that feature temperature selection and automatic thermostatic controls.

Generally, they incorporate a cover to protect the bearings from cooling down too quickly.

Thermo Rings

Another auxiliary device for the mounting of separate needle roller or cylindrical roller bearing inner rings is represented by the so-called **thermo rings**.

Thermo rings are simple slotted rings made from solid aluminium with thermal insulated handles (fig. 10.23).

The bore diameter of the thermo rings is adjusted to the raceway diameter of the ring type which is to be heated.

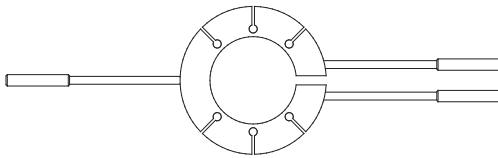


Fig. 10.23

Normally these rings are designed for dismounting bearing rings, although they can be very helpful for removing press-fitted or jammed rings.

When applying the thermo ring method, the raceway of the ring to be fitted has to be lightly oiled with thin machine oil.

The heated thermo ring must surround the bearing ring and is clamped by the handles.

The bearing ring expands due to the transfer of heat and, therefore, enables simple mounting, even with tight or interference fits.

The bearing ring must be tightly held on the contact surface until it has totally cooled down.

This cooling will occur very quickly because of the comparatively cold shaft. The thermo ring, however, should only be removed when the bearing ring sits on its shaft seat tightly.

The heating temperature of thermo rings or the heat duration has to be specified by practical experience as these parameters are influenced by the individual operational conditions such as ring section, mass of shafts and rings etc.

Induction Heating

Induction heaters (fig 10.24) are the optimum for volume production mounting (e.g. gearboxes, brake discs, electric motors etc.) where tight or interference fits apply. Additionally, they are very efficient and effective particularly when used by maintenance and repair workshop personnel (e.g. motor rewinders).

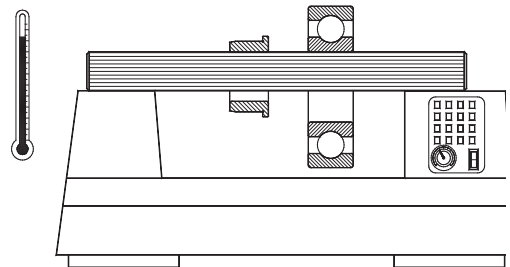


Fig. 10.24

For this method, the parts to be mounted are heated to the required temperature by using the induction effect.

This method is proven to be suitable for all types of rolling bearings providing an economic, quick and uniform heating.

Induction heaters are available in several different designs and performances.

The heater has to fulfil the following minimum requirements:

- automatic demagnetisation after heating
- temperature selection possibility and temperature control
- automatic temperature control

With more modern designs the heating may be optionally controlled either by selecting the temperature or indirectly via the time duration of heating the part.

Depending on the individual manufacturer the basic equipment supplied may vary. For the optimum utilisation of induction heaters it is recommended several yokes with different section be used.

Some types of induction heaters have yokes that allow a skewing sideways. This design feature provides a very simple method of handling the heated parts.

Warning:

All types of induction heater create a very strong magnetic field.

Please read carefully the operating instructions and consider the recommendations and safety instructions provided by the supplier of your induction equipment. Never use inductive acting equipment if you use a pace-maker!

Always wear protective gloves when working with induction heaters.

To mount the heated parts position them carefully and smoothly onto the seat up to and against the abutment face or shoulder, pressing the part firmly against the contacting surface until the part has cooled down to the ambient temperature. This is important to ensure the correct positioning of the bearing.

Mounting of Matched and Adjusted Bearings

Several bearing types, such as tapered roller bearing and angular contact ball bearing, are used in pairs.

These pre-set bearing units, (e.g. tapered roller bearing units or complete spindle bearing sets), are normally precisely matched by the manufacturer to enable a quick and simple mounting thus avoiding the time consuming and skillful adjustment of the required clearance or preload.

When a single bearing or bearings of the universal matched design are used the requisite clearance or preload must be adjusted during mounting according to the individual application and bearing position.

Values for the individual bearing clearance or preload are defined either by design or, in the case of maintenance work the instruction manuals.

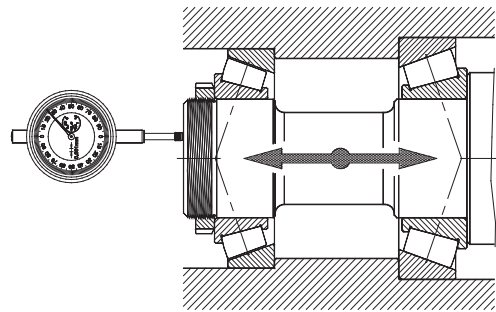


Fig. 10.25

Fig. 10.25 shows the adjustment of a defined axial clearance of a pair of tapered roller bearings.

In this example the axial clearance is adjusted by the use of a **lock nut**.

Prior to the bearing adjustment it is recommended to rotate the shaft several times by hand to ensure that the tapered rollers sit correctly in the guiding ribs of inner ring.

For a measurement of the actual axial clearance the shaft must be moved axially from one end of the stroke to the other (i.e. extremes).

An alternative method of achieving the necessary bearing assembly adjustment is the use of calibrated master spacers.

These spacers or shims are of predetermined widths which when fitted between the respective bearings determine the correct axial clearance (fig. 10.26).

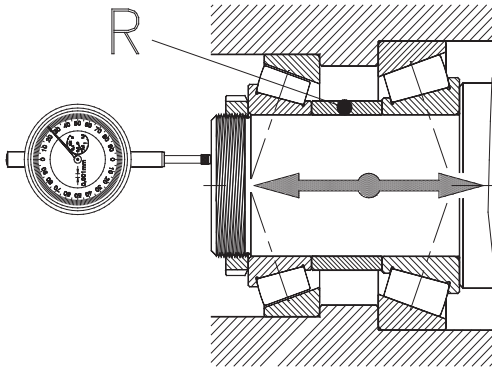


Fig. 10.26

After the determination of the actual axial clearance the master spacer is removed and replaced by an **appropriate spacer "R"** to become part of the bearing arrangement (fig. 10.26).

In the case of **face-to-face** arranged bearings and loose housing fits the axial play can be adjusted using shims to adjust the clearance, (fig. 10.27).

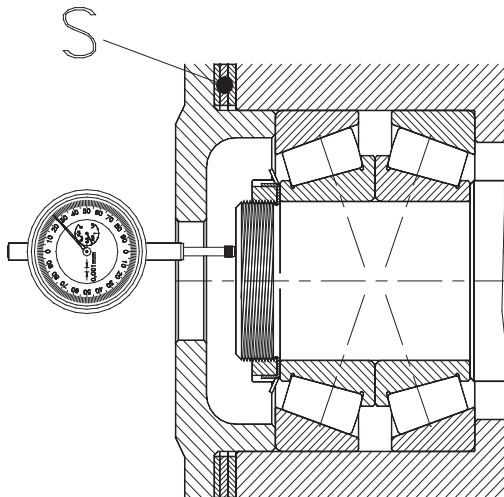


Fig. 10.27

In the initial stage of measurement the width of the required **shims (S)** has to be selected greater than required to enable a measurement of axial clearance.

With the resulting clearance value the appropriate shim width for a specific clearance is determined.

For volume **mounting** other adjusting procedures and methods are used, such as adjusting or preload bearings by estimating the angle of rotation of a hook spanner used to tighten the lock nut or tightening of the lock nut by means of a torque wrench.

In several applications, the frictional torque of a bearing unit is used as an indicator of a certain preloading condition.

All the methods commonly used, determine the optimum values empirically, this means by extended trials and field tests.

Mounting of Multi-Row Bearings

Special care and attention must be made when mounting bearing units or multi-row bearings as they can consist of several single components that may be mounted separately (Fig. 10.28).

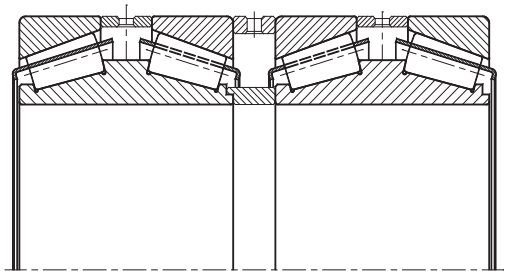


Fig. 10.28

Fig. 10.28 shows a four-row NKE tapered roller bearing for steel rolling mills.

Additional to the general guidelines and recommendations, previously stated, a certain mounting procedure may be necessary for single bearings or in the case of bearing sets and separable bearing components a specific mounting sequence.

For example, the four-row NKE tapered roller bearing shown in fig. 10.28 has rings that have been matched individually. That is why to avoid all possible confusion during mounting under no circumstances should bearings or bearings with separable parts be mixed.

Normally to assist and eliminate the mixing of bearings parts they are etched or marked, particularly in the case of bearing sets and matched tapered roller bearing when each individual separable part is clearly marked.

Greasing of Bearings

In many grease lubricated bearing arrangements their greasing is almost impossible once the bearings are mounted.

That is why the lubricating grease must be applied before inserting the bearings into their housings.

Note:

With frequent contact many people are allergic to mineral oils or greases. Please wear safety clothes and protective gloves always when dealing with lubricants and avoid any excessive skin contact to lubricating oils or greases.

Again, some basic rules must be considered when greasing rolling bearings:

- Only remove the **bearing** from its original package prior to its mounting.
- Grease them as little as possible before mounting to protect the bearings from getting contamination.

- The **preservation agent** adhering to the bearing may be left if using mineral lubricants as the preservation agent is compatible with all normal mineral lubricating oils and greases.
- When **synthetic special lubricants** are used the bearings should be washed out thoroughly prior to greasing and mounting.
- To clean the bearings of their preservation, adequate cleaning agents, such as **benzine** or **kerosene** should be used.
- Synthetic lubricants are used at very high or extremely low temperature applications, respectively.
- In general the preservation agent which adheres to the bearing bore and outside diameter, at least, should be removed prior to mounting. The use of a clean non-fibre cloth or paper is recommended to remove this preservation agent. Never use cotton waste or wool.
- **Large rolling bearings** are often preserved with a comparatively thick coating of preservation grease, the so-called **hot preservation**. This grease, however, must be removed in every case.

Note:

The preservation agent itself is not a lubricant and, therefore, it will not perform any lubricating features or behaviours!

- Bearings that are already greased must be carefully protected until they are mounted. The use of polythene film or similar material is suggested to protect the bearings from the various contaminates.
- The designated **lubricants** must always be stored in tightly closed containers to avoid any penetration of foreign matters.

- The lubricant containers, following the removal of lubricant, must always be immediately closed.
- The lubricant should always be checked for its condition prior to application with particular attention to the presence of any pollution, water or signs of ageing.
- Please be aware the use of old or contaminated lubricants may cause premature bearing failures.

The volume of lubricating grease to be applied depends mainly on the operating speed of the bearing, as already described in the chapter “**Lubrication of Rolling Bearings**”.

For general application in every case the free space within the bearing itself has to be **fully filled** with lubricating grease.

The grease filling volume applied to the housing cavities should be determined using the recommendations given in table 10.3.

Speed ratio *)		Grease volume **)
>	≤	[%]
-	20	80 ÷ 90
20	75	30 ÷ 50
75		25

Table 10.3

*) as a percentage of the speed ratings for grease lubrication given in product tables.

**) as a percentage of the bearing housing cavities.

Under very special operating conditions sheave bearings (e.g. cable car or crane pulleys etc.) which run at very low speeds the housing cavities may be fully grease filled to eliminate the formation of water condensation.

A special care must be taken at all times when dealing with lubricants. As fine particles, (e.g. dust, sand grains, small chips etc.) will adhere to greased or oiled surfaces.

All contamination that is retained by a lubricant will be brought directly into the bearings most sensitive area, its raceways.

Fitting of Seals

On completion of mounting the bearings and their associated components, seals also frequently have to be mounted.

Rubbing seals (i.e. O-rings) or radial oil seals can be difficult to fit due to the relatively high friction between **synthetic rubber (NBR)** on steel.

This is why dry mounting of such seals may lead to some fissures on the seals sensitive sealing lips. This matter is easily overcome by lightly oiling or greasing the sealing surfaces by using machine oil or standard bearing grease prior to fitting.

Many designs of contacting seals, such as the double-lip seals as used in split plummer block housings, require a grease filling of the total free space between their sealing lips to gain optimum sealing performance.

The greasing or oiling of rubbing seals reduces the amount of friction at the initial bearing rotation (i.e. start up).

Commissioning of Bearing Arrangement

Before starting up a bearing arrangement it is recommended to rotate the shaft several times manually, as far as this is possible, to ensure smooth and free running.

If **grease lubrication** is planned, the grease volume to be inserted into the housing cavities is completed after the total bearing arrangement is assembled, but prior to the mounting of enclosure, caps, etc.

In the case of oil lubrication, however, the machine must be fitted completely with all associated machine components and seals prior to applying the lubricating oil according to manufacturer's instructions.

In several cases it may be necessary to clean the oil feed pipes using flushing oil.

Appropriate information should be recorded in maintenance manuals or mounting instructions of the specific machine.

Note:

In the case of oil lubrication an adequate oil supply to the bearings must be ensured prior to rotation of the bearings or damages through lack of lubrication at the initial starting-up can occur.

Thus, the oil circulation has to commence prior to rotation of the shafts.

At the **starting-up period** the speed must only be increased slowly up to the projected operating speed.

Every bearing, ideally, requires an initial running-in period.

During this period, the micro roughness of the bearings raceways becomes well distributed.

This **running-in** process can result in a short term increase in running noise, particularly, when dealing with grease lubricated bearing and a somewhat higher operating temperature.

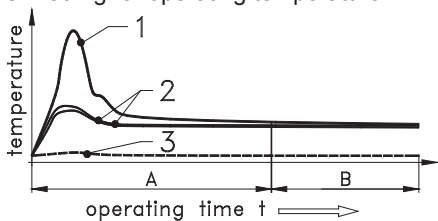


Fig. 10.29

Fig. 10.29 shows a very typical temperature pattern during the run-in period for a grease lubricated bearing arrangement:

where:

- A** duration of run-in period
- B** holding temperature
- 1** temperature course measured on a totally new bearing
- 2** temperature course of regreased bearings that are already run-in
- 3** course of ambient temperature

The duration of run-in period may vary depending on the particular application from few operating hours up to a maximum of 48 hours. Thereafter the operating temperature and the running noise should decrease to a normal level, the so-called **holding temperature**.

As the magnitude of the holding temperature is determined by a number of influencing factors there is no general rule or formula to apply.

Although practical experience gained from the same or similar equipment may be used as a base for the evaluation of the condition of the actual bearing and arrangement.

In every instance the bearing positions must be carefully checked for operating temperature, running noise and running behaviours after the machine or motor is running.

The event of considerably high temperatures or running noise may indicate some misalignment of the bearing, or contaminates in the bearings or lubricant, contacting and affecting adjacent parts.

In the event of any doubts the whole bearing arrangement must be cross checked carefully.

It has been proven that an extensive recheck is always cheaper than any bearing defect.

Condition Monitoring

Rolling bearings in many applications are functional critical parts of a machine or plant that may be vital to the process.

These rolling bearings are, generally, extremely reliable although they do not have an indefinite life.

Therefore, for more important applications and arrangements it may be sensible to incorporate at the design stage a bearing condition monitoring feature.

Such monitoring enhances considerably the operational safety of a plant providing the possibility of planned preventive maintenance by recognising potential failure sources in their very early stages.

However, the decision to effectively monitor bearing positions is dependant upon the importance of each individual bearing arrangement and a simple cost analysis.

Bearing monitoring can be applied using very rudimentary methods with some success, such as regular time controlled recording of bearing behaviours and operating temperatures usually actioned by experienced personnel who manually determine and confirm the "normal" running conditions without any sophisticated measuring equipment.

A more reliable method of condition monitoring, however, is provided with permanent supervision of specified parameters, such as operating temperature, or noise vibration levels.

There are also several complex monitoring systems available which provide continual monitoring and online computerized evaluation of the data.

Such equipment and systems are based on the detection of changes in the vibration characteristic of rolling bearings which may indicate a change of their operation conditions, too.

The vast majority of all rolling bearings consist of an outer, an inner ring, a set of rolling elements, and a cage (i.e. retainer or separator). In most applications the inner ring with cage and rolling elements rotate whilst the bearing outer ring is stationary.

In the loaded area of bearing raceways, the so called "**load zone**" shear stresses develop due to the over rolling by the loaded rolling elements.

This continuous change between loaded and unloaded condition in the loaded zone causes a fatigue process to the ring material that leads to the development of micro cracks beneath the ring surface during the course of time.

This again may result in material particles fragmenting off the bearing ring raceways.

This natural mechanism, known as "**fatigue-life**", has been researched extensively over several years and builds the base for the standardised calculation system of bearing life ratings.

When foreign particles or flaked-off particles of ring material enter the loaded zone of a rotating rolling bearing, some vibrations will occur.

In this way the change in vibration levels of a bearing arrangement may indicate the impending bearing failure.

Dismounting Bearings

The vast majority, about 90 per cent, of all rolling bearings are never removed from their locations, they stay in their machines or plants until the whole machine is scrapped.

This is why the replacement of bearings affects mainly large and larger rolling bearings, and bearings for important machinery where it is part of planned preventative maintenance programmes.

General

The ease of removal of rolling bearings is usually dependent on the dismounting possibilities considered and included in the machine design.

Particularly when dealing with machines or units that are known to require specific maintenance during their service life, including their frequent removal, quite simple and effective design features ease bearing removal significantly.

Such design measures may be pressure screws, dismounting threads and holes, or suitable slots or recesses on housings or shafts.

Preparations for Dismounting

The dismounting of bearings require some basic preparation, similar to when mounting rolling bearings, including careful study of manuals, machine plans and maintenance procedures which give appropriate information.

To ensure the successful replacement of any bearing all machine surfaces surrounding the area to be dismounted must be cleaned to eliminate the entrance of avoidable contamination, including production swarf and waste prior to any dismounting.

Also, all tools and auxiliary equipment to be used must be clean and in a good condition.

It is particularly important that when bearings are frequently dismounted and remounted special care should be taken at all times to avoid damage.

In principle, the dismounting of a bearing position is the opposite way to their mounting. This means bearings with loose fits should be dismounted first (fig. 10.30).

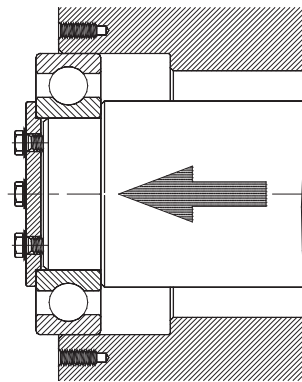


Fig. 10.30

The separable bearing types also present some advantages at removal (see fig. 10.31).

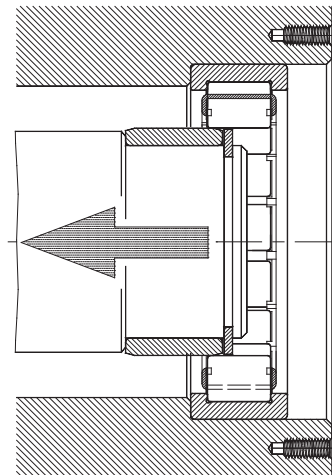


Fig. 10.31

Small size rolling bearings may be dismantled easily by mechanical means (fig. 10.32).

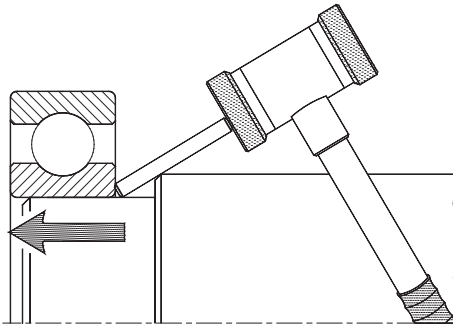


Fig. 10.32

Several special dismantling tools and systems are available to remove bearings additional to the commonly used and proven claw pullers. The claw tools, generally used for medium and large sized rolling bearings, consist of a spindle which acts either mechanically or hydraulically, in conjunction with various different sizes of claw legs and bridges which when assembled into 2 or 3 leg pullers meet the individual application requirements.

In the case of bearings located with interference fits a removal by means of **presses** may be of advantage, (fig. 10.33).

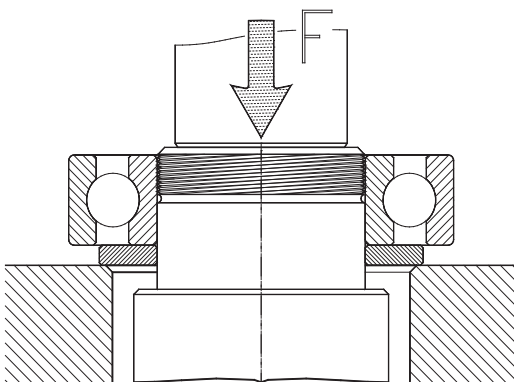


Fig. 10.33

It is restated that when bearings are planned for re-use, and removal is by the "press-method", all transmission forces via the rolling elements must be strictly avoided.

The position of bearings that are mounted on shafts by means of adapter sleeves should be **marked** on the shaft to provide an easy refitting datum.

After marking the position, the fixing tongue of the locking device must be bent up. The lock nut is loosened but not completely removed.

To dismantle the bearing totally, it is driven from the adapter sleeve by hammer blows around its circumference (fig. 10.34).

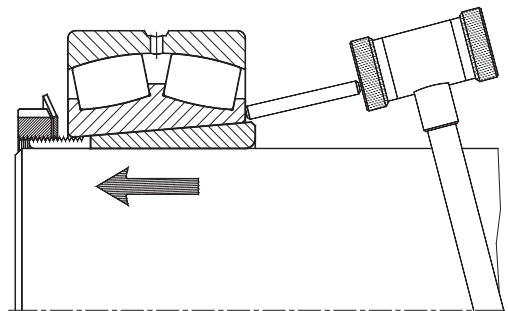


Fig. 10.34

If the bearing is located close to the end of a shaft, the loosening of the bearing may also be completed by applying impact bushings.

It is particularly important that when adapter sleeves are dismantled or mounted special care must be taken at all times to avoid damage.

The bearing can only be removed when it is loose on its seat and the locknut and lock washer is completely removed.

Following the bearing removal the adapter sleeve is easily removed.

In the case of bearings mounted on **withdrawal sleeves** the axial locking of the sleeve must be released first, only then can the removal of the bearing be completed.

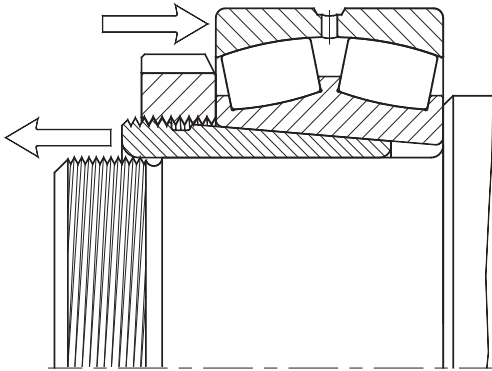


Fig. 10.35

The withdrawal sleeve is pulled from its seat using a satisfactory shaft nut, (fig. 10.35).

To minimise the friction between the bearing face and the nut side face the surfaces should be lightly lubricated using oil, bearing grease or a penetrating oil spray.

Dismounting Bearings using the Oil Injection Method

The dismounting of small and medium size rolling bearings is easily completed using simple mechanical tools and equipment.

When dismounting larger bearings, however, the forces required for their removal become large very quickly.

For such applications, the use of **hydraulic dismounting methods** has to be recommended. By applying hydraulic measures even very large and heavy bearings may be dismounted quickly, efficiently and effectively.

Furthermore dismounting bearings using hydraulic tools normally avoids the possibility of damaging either the bearing or adjacent parts, particularly, binding or jamming of heavy components.

Note:

Jammed bearings may suddenly become loose from their seats when removed using the injection oil method. This may lead in extreme cases to a literally jumping-off, even for very heavy bearings or parts.

Please careful consider the safety instructions and the recommendations provided by the manufacturer of your hydraulic tools carefully ensure all parts for dismounting by the hydraulic oil method are secured against accidental dropping or coming off. This is avoidable and for health and safety reasons the associated locknut should only be slightly loose on its thread.

The locknut should only be removed when the bearing is completely free from its locating seat.

A simple and universal tool for both mounting and dismounting of rolling bearings is provided by **hydraulic nuts**, (fig. 10.18).

An example of how this device is engaged for dismounting a large spherical roller bearing seated on a withdrawal sleeve is shown in fig. 10.36.

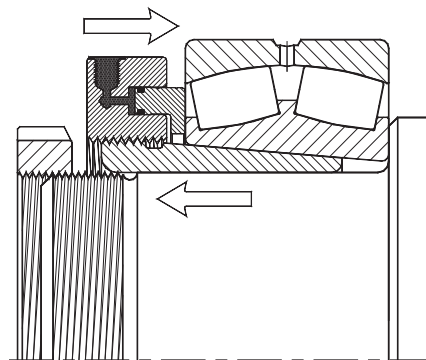


Fig. 10.36

To dismount the bearing, the same procedure as described at fig. 10.35 must be applied, but instead of the standard lock nut an appropriate **hydraulic nut** is engaged.

This is screwed onto the thread of the withdrawal sleeve as far as possible.

When the hydraulic nut is in its position, an additional axial stop (e.g. a shaft nut) is applied to prevent the bearing from coming off, the hydraulic nut is only oil pressure charged when the additional shaft nut is secure.

The withdrawal sleeve will be pulled out from its position by the axial movement of the nut piston.

The main advantage of hydraulic nuts lies in the fact, that they may also be applied to machines or bearing arrangements that are not normally supposed to being removed by hydraulic measures.

In the case of bearings that are mounted directly onto tapered shaft journals the required holes must be provided in the shaft end to allow the oil injection method to be applied (fig. 10.37).

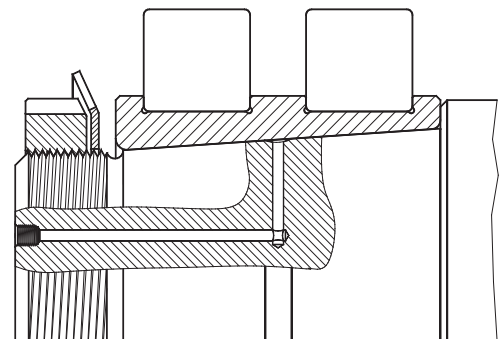


Fig. 10.37

To enable the oil pipe feed connection suitable and competent threads should be provided in the shaft end of the oil injection hole. This also allows the insertion of screw plugs to seal and prevent the entry of pollutants.

Some shallow oil grooves located around the circumference of the bearing seat allows easier distribution of the pressure oil.

To dismount such a bearing the fixing tongue of the locking device must be bend up. The lock nut is then loosened for some revolutions but for safety reasons is not completely removed.

The oil pipe may now be connected to the shaft hole and pressurised oil may be injected.

The bearings inner ring will expand, a little due to the applied pressure, enabling the build up of a very thin oil film between the bearing bore diameter and the shaft seat.

Due to the tapered bore the bearing will release from the shaft seat easily.

Larger adapter and withdrawal sleeves are often produced with oil holes and grooves to allow dismounting of the associated bearing by applying the oil injection method.

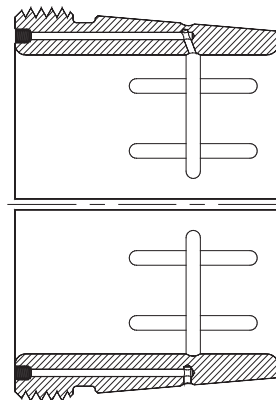


Fig. 10.38

Figure 10.38 shows a **withdrawal sleeve** of the series **AOH** . . which is produced with oil holes as standard. The connection holes and threads are located on the broad side face of the withdrawal sleeve.

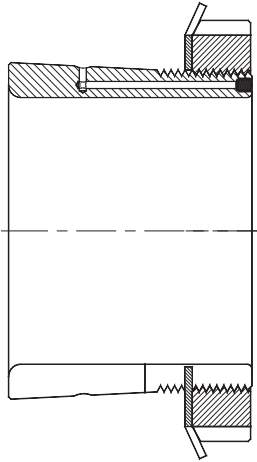


Fig. 10.39

Fig. 10.39 shows an **adapter sleeve** which is produced with oil holes as standard.

On adapter sleeves the connection of oil holes and threads is located on the narrow face side. (i.e. the lock nut is fixed).

Bearings by Heating

When removing bearings, the heating of either the bearing or the housing may ease the process somewhat.

Depending on the particularly case, heating the housings may be of advantage.

The mass removal of cylindrical roller bearing inner rings, as happens when overhauling railway axle box bearings, the appropriate tools are, **thermo rings**, see fig. 10.40

Thermo rings are slotted rings from solid aluminium with thermal insulated handles (fig. 10.40) .

The bore diameter of the ring is adjusted to the raceway diameter of the ring type that has to be removed.

Simple designed thermo rings do not have an integrated heat source and thus they need to be heated by means of hot plates or similar.

The required heating temperature and time is normally determined by practical experience.

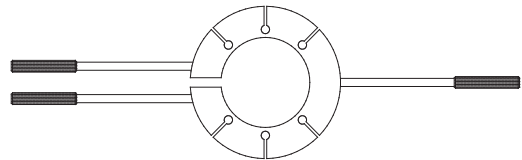


Fig. 10.40

A more advanced design of this simple but efficient tool are thermo rings that feature cast integral heating elements.

To remove bearing rings using thermo rings the ring surface has to be lightly oiled with a thin heat-resistant machine oil. The heated **thermo ring** must be placed around the bearing ring and clamped with the handles. The thin-walled bearing ring will quickly accept the heat of the thermo ring.

As soon as the ring expands due to the transferred heat it becomes loose and may be removed from its seat easily, even with heavy interference fits.

Normally it takes only a few seconds before ring removal from its seat is possible.

Because the simple thermo rings must to be reheated following each removal, the use of more than one thermo rings may become necessary.



Rillenkugellager
Deep Groove Ball Bearings

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings

Einreihige Rillenkugellager mit Ringnut und Sprengring
Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring

Einreihige Rillenkugellager

Single Row Deep Groove Ball Bearings

Normen, Hauptabmessungen

Ein- und zweireihige Rillenkugellager DIN 625

Standards, Boundary Dimensions

Single and double row deep groove ball bearings DIN 625

Allgemeines:

Einreihige Rillenkugellager sind starre, nicht zerlegbare Radiallager. Einreihige Rillenkugellager weisen die beste Drehzahleignung aller Lagerarten auf. Sie sind die mit Abstand am häufigsten verwendeten Wälzlager.

Rillenkugellager mit einem Außendurchmesser kleiner als 9,525 mm (3/8") bzw. bis zu einem maximalen Außendurchmesser von 12,7 mm (1/2") werden als „**Miniaturlager**“ bezeichnet, sofern deren Bohrungsdurchmesser größer ist als die Hälfte des Außendurchmessers.

General:

Single row deep groove ball bearings are rigid, non-separable radial bearings. **Single row deep groove ball bearings** are superior in speed rating to any other type of rolling element bearings. They are by far the most popular rolling bearing type. Deep groove ball bearings are classified as follows:

- **Miniature ball bearings** - including 3.175 mm inner bore diameter.
- **Extra small ball bearings** - over 3.175 mm including 9.525 mm inner bore diameter.
- **Deep groove ball bearings** - over 9.525 mm inner bore diameter.

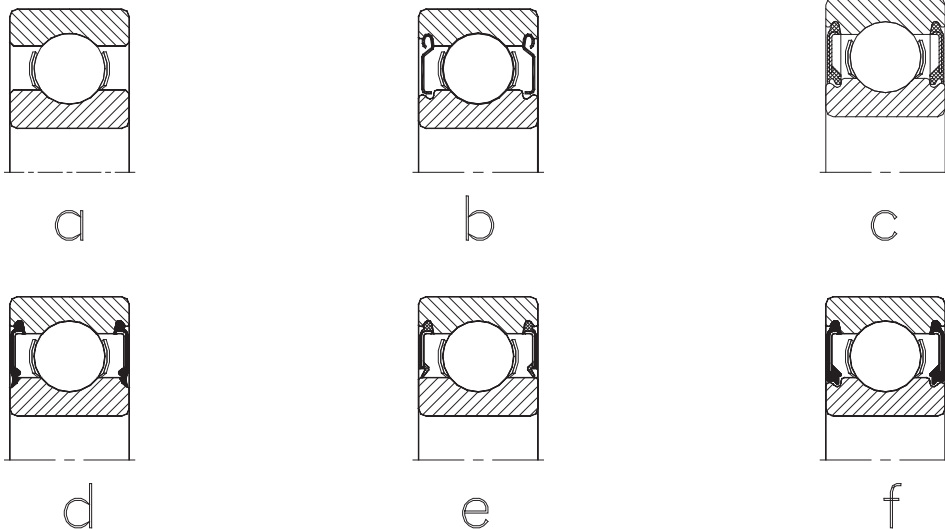


Abb. 1
 Fig. 1

Bauformen

Einreihige Rillenkugellager sind standardmäßig in einer Vielzahl unterschiedlicher Grundausführungen verfügbar.

Lager mit Dicht- und Deckscheiben

Zum Standard-Lieferprogramm gehören unterschiedliche Varianten von einreihigen Rillenkugellagern mit integrierten Dicht- oder Deckscheiben.

NKE Wälzlager in beidseitig abgedichteter Ausführung (Nachsetzzeichen **-2RS2**, **-2RS**, **-2RSR** oder **-2LFS**) bzw. Lager mit beidseitigen Deckscheiben (Ausführung **-2Z**) werden bereits werksseitig mit einem hochwertigen Wälzlagerfett befüllt.

Die standardmäßig verwendete Füllmenge beträgt **25%** bis **50%** des jeweiligen Freiraums im Lager. Für spezielle Anwendungsbereiche können alle NKE Wälzlager bereits werksseitig mit anderen Schmierstoffen bzw. auch mit anderen Füllmengen versehen werden.

Deckscheiben

Die einseitig (Nachsetzzeichen **-Z**) oder beidseitig (Nachsetzzeichen **-2Z** s.h. Abb.1b) in den Lageraußenring eingepressten Stahlblech-Deckscheiben bilden eine einfache, berührungsfreie Spaltdichtung.

Im Betrieb kann sich durch den Dichtspalt ein Fettkragen am Innenring bilden.

Bei Anwendungen mit rotierendem Außenring ist bei höheren Drehzahlen ein Fettverlust möglich.

Design Variants

Single row deep groove ball bearings are available in a wide variety of different basic designs as standard.

Sealed and Shielded Bearings

Some variations of sealed and shielded single row deep groove ball bearings also belong to the standard product range.

NKE bearings incorporating two seals or shields (suffixes **-2RS2**, **-2RS**, **-2RSR**, **-2LFS** or **-2Z**) are supplied grease filled by the factory with approved high quality rolling bearing grease.

The standard applied grease fill is approximately **25%** to **50%** of the free space within the bearing.

For special operating conditions NKE bearings can also be supplied with special grease fillings according to customer's specification or with variable grease fill quantities than the standard.

Shields

Shields represent the most simple form of sealing. The shields are sheet metal shims press fitted into the outer ring groove profile on either one side (suffix **-Z**) or both sides (suffix **-2Z**), fig. 1b respectively. During operation a collar of grease may develop around the inner ring outside diameter providing some prevention against contaminate penetration, although grease loss is possible for applications where the outer ring rotates at high speed.

Die Betriebsdrehzahl von Lagern der **Ausführung -2Z**, die mit drehendem Außenring eingesetzt werden, darf 40% der entsprechenden Grenzdrehzahlen nicht überschreiten.

Dichtscheiben

Dichtscheiben bilden berührende Dichtungen zwischen Innen- und Außenring.

Je nach Lagergröße und Lagerbauart werden abgedichtete NKE-Rillenkugellager mit Dichtscheiben der Bauform **RS2** (Abb.1c) geliefert. Berührende NKE Dichtungen werden standardmäßig aus einem besonders verschleißfesten synthetischen Elastomer (Nitril-Butadien-Kautschuk, Kurzzeichen **NBR**) hergestellt und haben zur Versteifung Stahlscheiben einvulkanisiert. Diese Dichtungen sind für Einsatztemperaturen von **-30°C bis +120°C** geeignet.

Für Sonderanwendungen sind auch Dichtungen aus **NBR** anderen Werkstoffen lieferbar.

Weitere Informationen dazu finden Sie auf Seite 41 im Abschnitt „**Lagerdaten allgemein**“.

Drehzahleinschränkungen bei Lagern mit Dicht- oder Deckscheiben

Lager mit berührenden Dichtungen (Bauformen **-RS2, -2RS2, -RSR** und **-2RSR**) weisen durch die vorgespannten Dichtlippen eine zusätzliche Wärmeentwicklung auf, wodurch die maximal zulässigen Drehzahlen für diese Lager um ein Drittel unter den für Fettschmierung empfohlenen Grenzdrehzahlen offener Lager bzw. von Lagern mit Deckscheiben liegen:

$$n_{gRS} = \frac{n_{gFett} * 2}{3}$$

wobei

- n_{gRS} = Grenzdrehzahl für das Lager in abgedichteter Ausführung [min⁻¹]
- n_{gFett} = Grenzdrehzahl laut Produkttable für das Lager bei Fettschmierung [min⁻¹]

In the case of **-2Z-shielded** bearings that operate with their outer ring rotating, the maximum operating speed must not exceed 40% of the recommended limited speed ratings.

Seals

Seals form a rubbing contact seal between the bearings inner and outer ring.

Depending upon the bearing design, type and size they are produced with **RS2**-seals (fig. 1c). These contacting seals are produced using a wear resistant synthetic rubber (**Nitrile-Butadiene-Rubber**, in short **NBR**) and are suitable for operating temperatures from **-30°C to +120 °C (-22°F to +248°F)**.

The seals have integrated steel washers to increase their rigidity.

For special applications, however, seals are also available in other materials.

For more detailed information see chapter “**General Bearing Data**” (page 226).

Speed Limitations of Sealed or Shielded Bearings

All **contacting seals** generate additional heat due to the rubbing of their preloaded sealing lips. This is why the maximum permissible speeds of bearings with contacting seals (suffix **-RS2, -2RS2, -RSR, -2RSR** etc.) is limited.

Their maximum speed must not exceed 2/3 of the limited speed ratings recommended for these bearings whether open or sealed design with grease lubrication:

$$n_{gRS} = \frac{n_{gGrease} * 2}{3}$$

where

- n_{gRS} = Limited speed ratings for the bearing, sealed version [rpm]
- $n_{gGrease}$ = Limited speed ratings for the bearing with grease lubrication [rpm]

Berührungsfreie Dichtscheiben

Für Anwendungen bei höheren Drehzahlen, in denen Rillenkugellager in abgedichteter Ausführung benötigt werden, gibt es eine berührungsfreie Sonderdichtung, **LFS** (**L**ow **F**riktion **S**eal), siehe Abb. 1f).

Bei der Bauart **LFS** liegen die Dichtlippen praktisch berührungsfrei am Innenring an. **LFS**-Dichtungen haben zwar eine erheblich bessere Dichtwirkung als Deckscheiben (Z-Deckel), sind aber berührenden Dichtungen der Bauformen **-RS**, **-2RS**, **-RSR**, **-2RSR**, **-RS2** und **-2RS2** hinsichtlich Dichtwirkung unterlegen.

LFS-Dichtungen erzeugen dafür aber auch keine Zusatzreibung. Sie erfordern daher im Gegensatz zu den berührenden Dichtungen keine Einschränkung der Grenzdrehzahlen.

Reibungsarme **LFS**-Dichtscheiben werden standardmäßig aus verschleißfestem synthetischen Kautschuk, Kurzzeichen **NBR gefertigt** und sind für Einsatztemperaturen von **-30°C bis +120°C** geeignet.

Bei allen **berührenden Dichtungen** kann es unter besonderen Betriebsbedingungen, wie beispielsweise sehr hohen Drehzahlen oder höheren Betriebstemperaturen zu einem gewissen Fettaustritt kommen. In Anwendungsfällen, in denen dies nicht zulässig ist, müssen zusätzliche Vorkehrungen getroffen werden.

Non-Contacting Seals

For high speed applications where sealed deep groove ball bearings are necessary, a special designed seal is available, the so-called **LFS**-seal (**LFS** stands for **L**ow **F**riktion **S**eal), fig. 1f.

The sealing lips of **LFS**-seals contacts the bearing inner ring without preload and forms a non-contacting seal. In respect to their sealing effectiveness **LFS**-seals perform much better than Z-shields, but less than the contacting seals of the types **-RS**, **-2RS**, **-RSR**, **-2RSR**, **-RS2** and **-2RS2**.

On the other hand, **LFS**-seals do not generate additional heat. Thus bearings that are fitted with **LFS**-seals do not have a restriction in operating speed as do the other contacting seals.

LFS-type low friction seals are also from synthetic rubber (**NBR**) and thus suitable for operating in a temperature range of **-30°C to + 120°C (-22°F to +248°F)**.

For all **contacting seals** there is the possibility of an emergence of grease during certain operating conditions such as bearings running at high speeds or high operating temperatures. In applications where this is not permissible, adequate additional design measures must be considered.

Schiefstellung

Einreihige Rillenkugellager sind zum Ausgleich von Schiefstellungen nur beschränkt geeignet. Unter normalen Betriebsverhältnissen sind – abhängig von der Radialluft – Schiefstellungen bis maximal 10 Winkelminuten aus der Mittellage zulässig.

Allerdings weisen Lager, die unter Schiefstellungen laufen, erheblich höhere Laufgeräusche auf. Weiters ist in diesen Fällen auch mit einer Verringerung der Gebrauchsdauer durch die Zusatzbelastungen zu rechnen.

Toleranzen

Einreihige NKE Rillenkugellager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese aber auch mit eingengten Toleranzen, wie beispielsweise in den Toleranzklassen **P6** und **P5** usw. gefertigt werden.

Detaillierte Werte der einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, ab Seite **52**.

Käfige

Sofern nicht anders spezifiziert, werden **NKE Rillenkugellager** der Normalausführung mit Stahlblechkäfigen gefertigt. Ausgenommen davon sind große Lager, die mit Messingmassivkäfigen erzeugt werden (Nachsetzzeichen **M**), und kleine Lager, die teilweise standardmäßig einen Messingblechkäfig aufweisen (Nachsetzzeichen **Y**).

Auf Wunsch können **NKE Rillenkugellager** auch mit anderen Käfigen geliefert werden.

Misalignment

Single row deep groove ball bearings have a very limited ability to accommodate misalignments. Under normal application conditions, misalignments may not exceed 10 angular minutes maximum from their centre position.

It must be considered, however, that bearings which run misaligned are subjected to considerable additional forces that will shorten their service life and generate high running noise.

Tolerances

NKE single row deep grooved ball bearings are produced to normal tolerance class (**PN**) as standard. Applications of higher dimensional and geometrical accuracy the bearings are produced to precision tolerance classes **P6** and **P5**.

Detailed values for the tolerance classes are listed in the chapter “**Bearing Data / Tolerances**”, page **237**.

Cages

NKE deep groove ball bearings are normally fitted with pressed steel cages as standard.

Exceptions to this are large bearings, that usually have machined solid brass cages (suffix **M**) as standard or small and miniature bearings that are frequently equipped with pressed brass cages, indicated by the suffix “**Y**”.

NKE deep groove ball bearings are also produced to other cage designs and cage materials.

Lagerluft

Einreihige NKE Rillenkugellager werden standardmäßig mit der Lagerluft „NORMAL“ (**CN**) gefertigt.

Die als Normalluft definierten Werte wurden so bemessen, daß die Lager bei Verwendung „normaler“ Passungen sowie unter „normalen“ Betriebsbedingungen eine ausreichende Betriebslagerluft erhalten.

Als „normale“ Passungen bei Kugellagern gelten:

Wellensitze: h5, j5, k5
Gehäusesitze: H6, H7, J6, J7

Auf Anfrage können alle NKE Rillenkugellager auch mit anderen Lagerluftwerten gefertigt werden.

Werte für die unterschiedlichen **Lagerluftgruppen** von **ein und zweireihigen NKE Rillenkugellagern** sind in den untenstehenden Tabellen angegeben.

Diese Werte entsprechen, soweit diese genormt sind, den Vorgaben der DIN 620/Teil 4 bzw. ISO 5753-1991.

Internal Clearance

NKE single row deep groove ball bearings are produced with **normal internal clearance (CN)** as standard.

The values of standard internal clearance are defined in such a way that bearings with **CN** clearance will have sufficient residual operating clearance when mounted using “normal” bearing fits.

“**Normal**” fits for deep groove ball bearings are considered as:

Shaft fits: h5, j5, k5
Housing fits: H6, H7, J6, J7

NKE deep groove ball bearings are also produced to other internal clearances.

Values of the different **internal clearance groups** of **single and double row NKE deep groove ball bearings** are listed in the tables below. These values are standardised and conform to the valid international standards DIN 620 part 4 and ISO 5753-1991.

Lagerluft ein- und zweireihiger **NKE** Rillenkugellager, Bohrungsdurchmesser ≤ 250 mm.
Internal clearance groups of NKE single and double row deep groove ball bearings, bore diameters up to 250 mm.

Lagerbohrung Bore diameter	[mm]	> ≤	2,5	6	10	18	24	30	40	50	65	80	100	120	140	160	180	200	225	250		
			6	10	18	24	30	40	50	65	80	100	120	140	160	180	200	225	250			
Luftgruppe Clearance group	C2	min	0	0	0	0	1	1	1	1	1	1	2	2	2	2	2	4	2			
		max	7	7	9	10	11	11	11	15	15	18	20	23	23	25	30	32	36			
Luftgruppe Clearance group (NORMAL)	CN	min	2	2	3	5	5	6	6	8	10	12	15	18	18	20	25	28	31			
		max	13	13	18	20	20	20	23	28	30	36	41	48	53	61	71	82	92			
Luftgruppe Clearance group	C3	min	8	8	11	13	13	15	18	23	25	30	36	41	46	53	63	73	87			
		max	23	23	25	28	28	33	36	43	51	58	66	81	91	102	117	132	152			
Luftgruppe Clearance group	C4	min	--	14	18	20	23	28	30	38	46	53	61	71	81	91	107	120	140			
		max	--	29	33	36	41	46	51	61	71	84	97	114	130	147	163	187	217			
Luftgruppe Clearance group	C5	min	--	20	25	28	30	40	45	55	65	75	90	105	120	135	150	175	205			
		max	--	37	45	48	53	64	73	90	105	120	140	160	180	200	230	255	290			

Lagerluft ein- und zweireihiger **NKE** Rillenkugellager, Bohrungsdurchmesser > 250 mm.
Internal clearance groups of NKE single and double row deep groove ball bearings, bore diameters over 250 mm.

Lagerbohrung Bore diameter	[mm]	> ≤	250	280	315	355	400	450	500	560	630	710	800	900	1000	1120
			280	315	355	400	450	500	560	630	710	800	900	1000	1120	1250
Luftgruppe Clearance group	C2	min	4	8	8	8	10	10	20	20	30	30	30	40	40	40
		max	39	45	50	60	70	80	90	100	120	130	150	160	170	180
Luftgruppe Clearance group (NORMAL)	CN	min	36	42	50	60	70	80	90	100	120	130	150	160	170	180
		max	97	110	120	140	160	180	200	220	250	280	310	340	370	400
Luftgruppe Clearance group	C3	min	97	110	120	140	160	180	200	220	250	280	310	340	370	400
		max	162	180	200	230	260	290	320	350	390	440	490	540	590	640
Luftgruppe Clearance group	C4	min	152	175	200	230	260	290	320	350	390	440	490	540	590	640
		max	237	260	290	330	370	410	460	510	560	620	690	760	840	910
Luftgruppe Clearance group	C5	min	225	260	290	330	370	410	460	510	560	620	690	760	840	910
		max	320	360	405	460	520	570	630	700	780	860	960	1040	1120	1220

Mindestbelastung

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE einreihige Rillenkugellager muss die Mindestbelastung 1% der dynamischen Tragzahl betragen.

Berechnungsfaktoren

Bei Rillenkugellagern hängen sowohl die **axiale Belastbarkeit** als auch die zur Berechnung der **äquivalenten dynamischen Lagerbelastung** erforderlichen **X-** und **Y-** Faktoren direkt von der **Lagerluft** ab, da sich mit zunehmender Lagerluft auch der Druckwinkel vergrößert.

Äquivalente dynamische Lagerbelastung

Für ein- und zweireihige NKE Rillenkugellager gilt bei:

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

bzw. bei

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

Die Berechnungsfaktoren X und Y werden maßgeblich durch das Verhältnis von wirkender Axialkraft zur statischen Tragzahl C_{0r} des Lagers bestimmt.

Werte für das **Grenzlastverhältnis e** sowie die **X-** und **Y-Faktoren** in Abhängigkeit von der jeweiligen Lagerluft sind in nebenstehender Tabelle angegeben. Zwischenwerte sind durch Interpolation zu ermitteln.

Minimum Load

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE single row deep groove ball bearings the minimum load must be 1% of the dynamic load rating.

Calculation Factors

In the case of deep groove ball bearings both the axial load capacity and the **X** and **Y** factors are required for the calculation of the actual dynamic equivalent load, which depends directly on the internal clearance of the bearing, because the contact angle increases along with the internal bearing clearance.

Equivalent Dynamic Bearing Load

For single and double row ball bearings the following formula should be applied:

Where

$$\frac{F_a}{F_r} \leq e, \text{ then } P = F_r$$

or, where

$$\frac{F_a}{F_r} > e, \text{ then } P = X * F_r + Y * F_a$$

The magnitude of calculation factors **X** and **Y** are mainly determined by the ratio of acting thrust force to static load rating C_{0r} of the affected bearing.

Values of the **limit value e** and the **X** and **Y factors** are given in the following table, based on the individual bearing internal clearance.

Äquivalente statische Lagerbelastung

Für ein- und zweireihige Rillenkugellager gilt:

$$P_0 = 0,6 * F_r + 0,5 * F_a$$

Wenn allerdings P_0 kleiner als F_r wird, ist der höhere Wert zur Berechnung der äquivalenten statischen Lagerbelastung zu verwenden.

Equivalent Static Bearing Load

For single and double row ball bearings:

$$P_0 = 0,6 * F_r + 0,5 * F_a$$

When P_0 is smaller than F_r , the higher value must be used for the calculation of the equivalent static bearing load.

Luftabhängige Berechnungsfaktoren ein- und zweireihiger **NKE** Rillenkugellager
Calculation factors of **NKE** single and double row deep groove ball bearings, based on individual clearances

$\frac{F_a}{C_{0r}}$	Lagerluftgruppe Internal clearance group								
	CN (NORMAL)			C3			C4		
	e	X	Y	e	X	Y	e	X	Y
0,030	0,23	0,56	1,95	0,32	0,46	1,72	0,41	0,44	1,41
0,035	0,23	0,56	1,90	0,32	0,46	1,69	0,41	0,44	1,39
0,040	0,24	0,56	1,80	0,33	0,46	1,62	0,42	0,44	1,36
0,045	0,24	0,56	1,77	0,33	0,46	1,60	0,42	0,44	1,35
0,050	0,25	0,56	1,74	0,34	0,46	1,57	0,43	0,44	1,33
0,055	0,25	0,56	1,71	0,34	0,46	1,55	0,43	0,44	1,32
0,060	0,26	0,56	1,69	0,35	0,46	1,53	0,43	0,44	1,31
0,065	0,26	0,56	1,66	0,35	0,46	1,51	0,43	0,44	1,30
0,070	0,27	0,56	1,60	0,36	0,46	1,46	0,44	0,44	1,27
0,080	0,28	0,56	1,57	0,37	0,46	1,44	0,45	0,44	1,25
0,090	0,28	0,56	1,54	0,38	0,46	1,41	0,45	0,44	1,24
0,10	0,29	0,56	1,51	0,38	0,46	1,39	0,46	0,44	1,22
0,11	0,29	0,56	1,48	0,39	0,46	1,36	0,46	0,44	1,20
0,12	0,30	0,56	1,45	0,40	0,46	1,34	0,47	0,44	1,19
0,13	0,31	0,56	1,40	0,41	0,46	1,30	0,48	0,44	1,16
0,14	0,31	0,56	1,38	0,41	0,46	1,29	0,48	0,44	1,15
0,15	0,32	0,56	1,37	0,42	0,46	1,27	0,49	0,44	1,14
0,16	0,32	0,56	1,35	0,42	0,46	1,26	0,49	0,44	1,12
0,17	0,33	0,56	1,34	0,43	0,46	1,25	0,50	0,44	1,12
0,18	0,33	0,56	1,32	0,43	0,46	1,24	0,50	0,44	1,12
0,19	0,34	0,56	1,30	0,43	0,46	1,22	0,50	0,44	1,11
0,20	0,34	0,56	1,29	0,44	0,46	1,21	0,51	0,44	1,10
0,25	0,37	0,56	1,20	0,46	0,46	1,14	0,53	0,44	1,05
0,30	0,38	0,56	1,16	0,48	0,46	1,11	0,54	0,44	1,04
0,35	0,40	0,56	1,12	0,49	0,46	1,09	0,54	0,44	1,03
0,40	0,41	0,56	1,08	0,51	0,46	1,06	0,55	0,44	1,02
0,45	0,42	0,56	1,04	0,52	0,46	1,03	0,55	0,44	1,01
0,50	0,44	0,56	1,00	0,54	0,46	1,00	0,56	0,44	1,00

Maximale axiale Belastbarkeit

Bei reiner Axialbelastung sollte die auf das Lager wirkende Kraft eine bestimmte, von der Innengeometrie der jeweiligen Lager abhängende Größe folgende Werte nicht überschreiten.

Als **Faustregel** gilt:

Bei kleinen Rillenkugellagern sowie bei Dünnringlagern und Lagern der Reihen **617, 618, 619, 160, 161** gilt:

$$F_{\text{amax}} \leq \frac{C_{0r}}{4}$$

Für andere Kugellagertypen gilt:

$$F_{\text{amax}} \leq \frac{C_{0r}}{2}$$

Weitere Varianten einreihiger Rillenkugellager

Rillenkugellager werden in einer Vielzahl unterschiedlicher Varianten hergestellt, von denen wiederum eine Anzahl zum NKE-Standard-Lieferprogramm gehört, das in diesem Katalog eingehend beschrieben wird.

Überbreite Reihen 622...2RS und 623...2RS

Dauergeschmierte Lagerungen, beispielsweise Arbeitsspindeln von Holzbearbeitungsmaschinen, erfordern abgedichtete Rillenkugellager mit vergrößerter Schmierstoffmenge.

Rillenkugellager der **überbreiten Reihen 622..-2RS2** und **623..-2RS2** weisen bei gleichem Bohrungs- und Außendurchmesser eine größere Breite und daher größere Fettreservoir als vergleichbare Lager der Baureihen **62...-2RS2** bzw. **63...-2RS2** auf.

Detaillierte Werte sind in den Produkttabellen der einreihigen Rillenkugellager enthalten.

Maximum Thrust Loads

In the case of purely axial loaded bearings the acting thrust forces must not exceed certain limits. The limits are determined by the internal bearing design.

For guidance the following formula may be applied: For **miniature** deep groove ball bearings, **thin section** bearings and bearings of the series **617, 618, 619, 160 and 161**:

where:

$$F_{\text{amax}} \leq \frac{C_{0r}}{4}$$

For all other deep groove ball bearings the following applies:

$$F_{\text{amax}} \leq \frac{C_{0r}}{2}$$

Further Design Variants of Single Row Deep Groove Ball Bearings

NKE deep groove ball bearings are produced in a wide range of different variants. Many of them are part of the NKE standard product range as listed in this technical and product catalogue.

Extra Width Series 622...2RS and 623...2RS

Several applications require sealed deep groove ball bearings with extra grease volume to ensure maximum service life. Examples are greased **"for-life"** bearing arrangements in wood working machines.

These requirements are fulfilled by extra-width bearings of the series **622..-2RS2** and **623..-2RS2**. These have the same radial cross-section section as bearings of series **62...-2RS2** or **63...-2RS2**, respectively, but feature an enlarged width.

This enables a larger grease fill volume. For detailed information please see the Product Tables.

Anschlussmaße ein- und Zweireihiger Rillenkugellager

Die Umgebungsteile der Lager müssen so gestaltet sein, dass eine ausreichende axiale Unterstützung der Lagerringe gewährleistet ist. Dazu müssen die Schulterhöhen der Anlageflächen an den Wellenbunden bzw. der Gehäuseschultern eine ausreichende Mindesthöhe aufweisen.

Allerdings dürfen die Radien der Kantenverrundung der Lagerringe nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anschlußteilen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe (siehe Zeichnung bei Tabelle auf der Folgeseite).

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert.

NKE Rillenkugellager mit Sonderbefüllung

Für spezielle Anwendungsbereiche können aber alle **NKE Wälzlager** auch mit Sonderfetten nach Kundenspezifikationen bzw. mit anderen Schmierstoffmengen geliefert werden.

Abutment and Fillet Dimensions for Single and Double Row Deep Groove Ball Bearings

The machine components surrounding the bearing must be designed in such a way that adequate axial support of bearing rings is secured under all circumstances.

To gain an adequate support both the shaft shoulders and the housing shoulders must have a certain minimum height.

On the other hand, the bearing rings must contact adjacent parts with their side faces only. The radii of bearing fillets must not touch the shoulder fillet radii of neither the shaft shoulders or the housing.

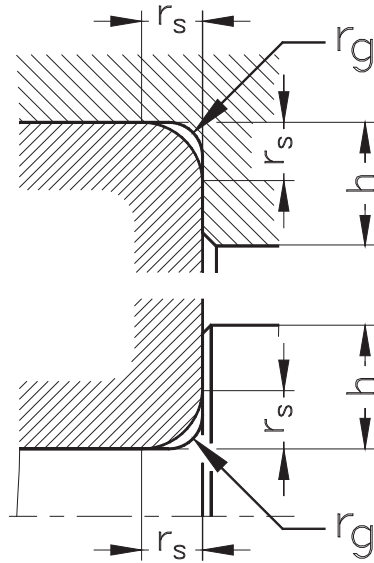
Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the bearing tables. For details please see the table on following page.

Recommendations for the dimensions of adjacent parts are given in **DIN 5418**.

NKE Deep Groove Ball Bearings with Special Grease Filling

For special operating conditions **NKE** bearings can also be supplied with special grease fillings according to customer's specification or with grease fill volumes other than the standard.

Anschlussmaße ein- und zweireihiger Rillenkugellager [mm]
Abutment and Fillet Dimensions for Single and Double Row Deep Groove Ball Bearings [mm]



$r_{s \text{ min}}$	$r_{g \text{ max}}$	h_{min} Lagerreihen Bearing series		
		618, 619 160, 60	62, 622 63, 623	64
0,08	0,08	0,26		
0,1	0,1	0,3	0,6	--
0,15	0,15	0,4	0,7	--
0,2	0,2	0,7	0,9	--
0,3	0,3	1	1,2	--
0,6	0,6	1,6	2,1	--
1	1	2,3	2,8	--
1,1	1	3	3,5	4,5
1,5	1,5	3,5	4,5	5,5
2	2	4,4	5,5	6,5
2,1	2,1	5,1	6	7
3	2,5	6,2	7	8
4	3	7,3	8,5	10
5	4	9	10	12
6	5	11,5	13	15
7,5	6	14	16	19

Das **NKE Bezeichnungsschema** für Wälzlager mit Sonderbefettung setzt sich aus folgenden Symbolen zusammen:

The **NKE designation system** for bearings containing special grease consists of the following symbols:



A) Symbol für die Temperatureignung:
LT Tieftemperaturfett
MT Mitteltemperaturfett
HT Hochtemperaturfett
LHT Sonderfett, geeignet für Hoch- und Tieftemperaturanwendungen

A) Symbol for temperature range of grease:
LT Low Temperature grease
MT Medium Temperature grease
HT High Temperature grease
LHT Special grease suitable for Low and High Temperatures

XX) Fortlaufende Numerierung

XX) Continual number

B) Symbol für Fettfüllmenge in Prozent des Lagerfreiraumes

B) Symbol for grease filling volume as % of bearings free space

A Fettfüllung 10% bis 15%
-- Fettfüllung 25% bis 50% (**Standard**)
M Fettfüllung 45% bis 60%
X Fettfüllung 70% bis 90% (Vollfettfüllung)
C Fettfüllungsgrad nach Kundenspezifikation

A Filling volume 10% ÷ 15%
-- Filling volume 25% up to 50% (**Standard**)
M Filling volume 45% up to 60%
X Filling volume 70% up to 90% (bearing is fully filled with grease)
C Filling volume according to individual customers' specifications

Montage abgedichteter Lager

Die beidseitig abgedichteten bzw. mit Deckscheiben an beiden Seiten gelieferten **NKE Rillenkugellager** (Nachsetzzeichen **-2RS**, **-2RSR**, **-2LFS** oder **-2Z**) die bereits gefettet geliefert werden, dürfen vor dem Einbau nicht ausgewaschen oder im Ölbad erwärmt werden.

Diese Lager sollten vorzugsweise in kaltem Zustand montiert werden.

Beim Einbau ist besonders darauf zu achten, dass die Dicht- oder Deckscheiben nicht beschädigt werden.

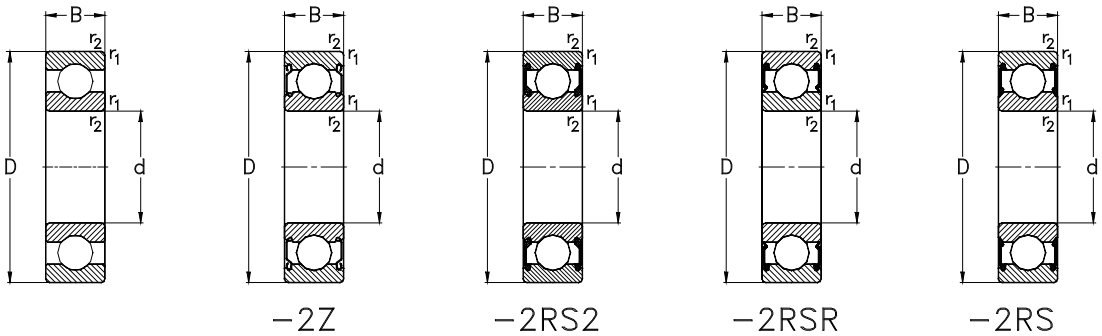
Fitting of Sealed Bearings

NKE single row deep groove ball bearings that are fitted with seals or shields on both sides (suffixes **-2RS**, **-2RSR**, **-2LFS** or **-2Z**) are supplied already grease packed. Therefore they must not be washed out or heated up by oil bath method prior to mounting.

These bearings should preferably be mounted in normal temperature conditions.

It is important that the seals or shields must not be damaged during mounting.

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



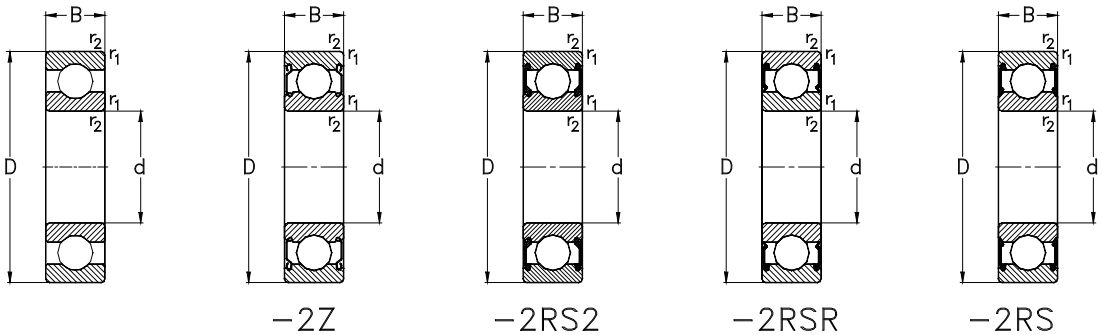
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]		Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]		Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		m	
3	10	4	0,15	623	0,6	0,3	--	56400	80000		0,001
	10	4	0,15	623-Z	0,6	0,3	--	--	52000		0,001
	10	4	0,15	623-2Z	0,6	0,3	--	--	52000		0,001
4	11	4	0,15	619/4	0,9	0,3	--	52800	80000		0,001
	12	4	0,2	604	0,8	0,3	--	49000	75000		0,002
	13	5	0,2	624	1,2	0,5	--	46600	67000		0,003
	13	5	0,2	624-Z	1,2	0,5	--	--	38000		0,003
	13	5	0,2	624-2Z	1,2	0,5	--	--	38000		0,003
	16	5	0,3	634	1,4	0,6	--	35300	67000		0,006
5	16	5	0,3	634-Z	1,4	0,6	--	--	36000		0,006
	16	5	0,3	634-2Z	1,4	0,6	--	--	36000		0,006
	13	4	0,2	619/5	1,1	0,4	--	42300	67000		0,002
6	16	5	0,3	625	1,4	0,6	--	36200	60000		0,005
	16	5	0,3	625-Z	1,4	0,6	--	--	36000		0,005
	16	5	0,3	625-2Z	1,4	0,6	--	--	36000		0,005
	19	6	0,3	635	2,2	1	--	31500	50000		0,009
	19	6	0,3	635-Z	2,2	1	--	--	32000		0,009
	19	6	0,3	635-2Z	2,2	1	--	--	32000		0,009
6	15	5	0,2	619/6	1,3	0,5	--	40100	63000		0,004
	19	6	0,3	626	2,2	1	--	32500	50000		0,009
	19	6	0,3	626-2RSR	2,2	1	--	--	21500		0,009
	19	6	0,3	626-RSR	2,2	1	--	--	21500		0,009

Anschlussmaße siehe Seite 383

Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
6	19	6	0,3	626-Z	2,2	1	--	--	32000	0,009
	19	6	0,3	626-2Z	2,2	1	--	--	32000	0,009
7	17	5	0,3	619/7	1,6	0,7	--	34200	56000	0,005
	19	6	0,3	607	2,1	0,9	--	34600	53000	0,008
	19	6	0,3	607-RSR	2,1	0,9	--	--	20000	0,008
	19	6	0,3	607-2RSR	2,1	0,9	--	--	20000	0,008
	19	6	0,3	607-Z	2,1	0,9	--	--	30000	0,008
	19	6	0,3	607-2Z	2,1	0,9	--	--	30000	0,008
	22	7	0,3	627	3,3	1,3	0,1	29900	45000	0,013
8	22	7	0,3	627-RSR	3,3	1,3	0,1	--	20000	0,013
	22	7	0,3	627-2RSR	3,3	1,3	0,1	--	20000	0,013
	22	7	0,3	627-Z	3,3	1,3	0,1	--	30000	0,013
	22	7	0,3	627-2Z	3,3	1,3	0,1	--	30000	0,013
	19	6	0,3	619/8	2,2	0,9	0	33100	50000	0,007
9	22	7	0,3	608	3,3	1,4	0,1	31800	48000	0,013
	22	7	0,3	608-RSR	3,3	1,4	0,1	--	20000	0,013
	22	7	0,3	608-2RSR	3,3	1,4	0,1	--	20000	0,013
	22	7	0,3	608-Z	3,3	1,4	0,1	--	30000	0,013
	22	7	0,3	608-2Z	3,3	1,4	0,1	--	30000	0,013
9	20	6	0,3	619/9	1,8	0,9	0,1	30300	48000	0,008
	24	7	0,3	609	3,7	1,7	0,1	28300	43000	0,015
	24	7	0,3	609-RSR	3,7	1,7	0,1	--	18000	0,015

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



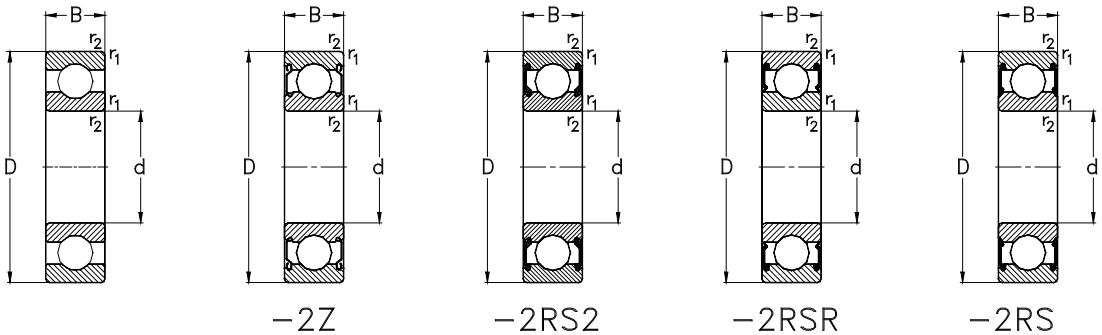
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]		Grenzdrehzahlen [min ⁻¹]		Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]		Limited speed ratings [rpm]		Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}		n _G	m	
9	24	7	0,3	609-2RSR	3,7	1,7	0,1	--		18000	0,015	
	24	7	0,3	609-Z	3,7	1,7	0,1	--		30000	0,015	
	24	7	0,3	609-2Z	3,7	1,7	0,1	--		30000	0,015	
	26	8	0,6	629	4,6	1,9	0,1	25700		38000	0,02	
26	8	0,6	629-RSR	4,6	1,9	0,1	--		18500	0,02		
26	8	0,6	629-2RSR	4,6	1,9	0,1	--		18500	0,02		
26	8	0,6	629-Z	4,6	1,9	0,1	--		28000	0,02		
26	8	0,6	629-2Z	4,6	1,9	0,1	--		28000	0,02		
10	19	5	0,3	61800	1,7	0,8	0	27500		48000	0,005	
	19	5	0,3	61800-2RSR	1,7	0,8	0	--		22000	0,005	
	19	5	0,3	61800-2Z	1,7	0,8	0	--		34000	0,005	
	22	6	0,3	61900	2,7	1,3	0,1	26900		45000	0,01	
	22	6	0,3	61900-2RSR	2,7	1,3	0,1	--		22000	0,01	
	22	6	0,3	61900-2Z	2,7	1,3	0,1	--		34000	0,01	
	26	8	0,3	6000	4,6	2	0,1	27600		40000	0,019	
	26	8	0,3	6000-RS2	4,6	2	0,1	--		17000	0,019	
	26	8	0,3	6000-2RS2	4,6	2	0,1	--		17000	0,019	
	26	8	0,3	6000-Z	4,6	2	0,1	--		28000	0,019	
26	8	0,3	6000-2Z	4,6	2	0,1	--		28000	0,019		
30	9	0,6	6200	5,1	2,4	0,1	23500		40000	0,03		
30	9	0,6	6200-RS2	5,1	2,4	0,1	--		17000	0,03		
30	9	0,6	6200-2RS2	5,1	2,4	0,1	--		17000	0,03		

Anschlussmaße siehe Seite 383

Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
10	30	9	0,6	6200-Z	5,1	2,4	0,1	--	26000	0,03
	30	9	0,6	6200-2Z	5,1	2,4	0,1	--	26000	0,03
	35	11	0,6	6300	8,2	3,5	0,2	21100	32000	0,055
	35	11	0,6	6300-RS2	8,2	3,5	0,2	--	14500	0,055
	35	11	0,6	6300-2RS2	8,2	3,5	0,2	--	14500	0,055
	35	11	0,6	6300-Z	8,2	3,5	0,2	--	22000	0,055
	35	11	0,6	6300-2Z	8,2	3,5	0,2	--	22000	0,055
	12	21	5	0,3	61801	1,8	1	0	23500	43000
21		5	0,3	61801-2RSR	1,8	1	0	--	21000	0,006
21		5	0,3	61801-2Z	1,8	1	0	--	32000	0,006
24		6	0,3	61901	2,2	1,5	0,1	23300	40000	0,011
24		6	0,3	61901-2RSR	2,2	1,5	0,1	--	20000	0,011
24		6	0,3	61901-2Z	2,2	1,5	0,1	--	30000	0,011
28		8	0,3	6001	5,1	2,4	0,1	24300	38000	0,02
28		8	0,3	6001-RS2	5,1	2,4	0,1	--	17000	0,02
28		8	0,3	6001-2RS2	5,1	2,4	0,1	--	17000	0,02
28		8	0,3	6001-Z	5,1	2,4	0,1	--	26000	0,02
28		8	0,3	6001-2Z	5,1	2,4	0,1	--	26000	0,02
32		10	0,6	6201	6,8	3,1	0,1	22200	32000	0,04
32	10	0,6	6201-RS2	6,8	3,1	0,1	--	16000	0,04	
32	10	0,6	6201-2RS2	6,8	3,1	0,1	--	16000	0,04	
32	10	0,6	6201-Z	6,8	3,1	0,1	--	24000	0,04	

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



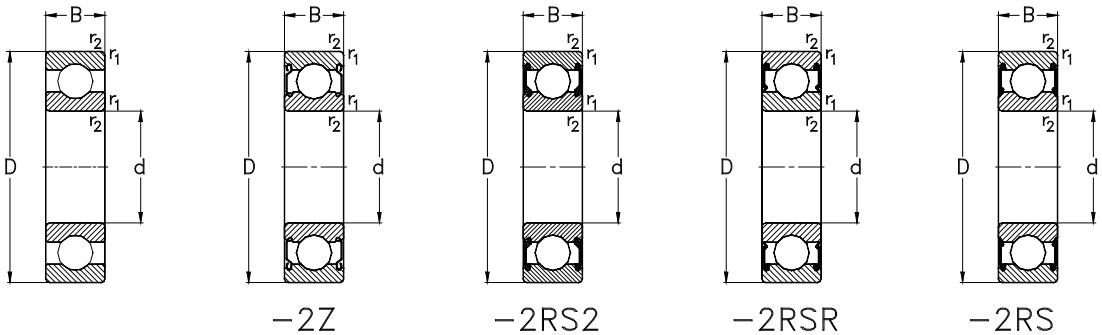
Hauptabmessungen [mm]			Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]		Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Load ratings [kN]			Thermal speed ratings [rpm]		Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		m
12	32	10	0,6	6201-2Z	6,8	3,1	0,1	--	24000	0,04
	37	12	1	6301	9,7	4,2	0,2	20000	28000	0,06
	37	12	1	6301-RS2	9,7	4,2	0,2	--	13000	0,06
	37	12	1	6301-2RS2	9,7	4,2	0,2	--	13000	0,06
	37	12	1	6301-Z	9,7	4,2	0,2	--	20000	0,06
	37	12	1	6301-2Z	9,7	4,2	0,2	--	20000	0,06
15	24	5	0,3	61802	2	1,3	0,1	19200	38000	0,007
	24	5	0,3	61802-2RSR	2	1,3	0,1	--	18500	0,007
	24	5	0,3	61802-2Z	2	1,3	0,1	--	28000	0,007
	28	7	0,3	61902	4,3	2,3	0,1	20600	34000	0,016
	28	7	0,3	61902-2RSR	4,3	2,3	0,1	--	16000	0,016
	28	7	0,3	61902-2Z	4,3	2,3	0,1	--	24000	0,016
	32	8	0,3	16002	5,6	2,8	0,1	20000	32000	0,03
	32	9	0,3	6002	5,6	2,8	0,1	21500	32000	0,029
	32	9	0,3	6002-RS2	5,6	2,8	0,1	--	15000	0,029
	32	9	0,3	6002-2RS2	5,6	2,8	0,1	--	15000	0,029
	32	9	0,3	6002-Z	5,6	2,8	0,1	--	24000	0,029
	32	9	0,3	6002-2Z	5,6	2,8	0,1	--	24000	0,029
	35	11	0,6	6202	7,6	3,7	0,2	20200	28000	0,043
	35	11	0,6	6202-RS2	7,6	3,7	0,2	--	13000	0,043
	35	11	0,6	6202-2RS2	7,6	3,7	0,2	--	13000	0,043
35	11	0,6	6202-Z	7,6	3,7	0,2	--	20000	0,043	

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Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
15	35	11	0,6	6202-ZZ	7,6	3,7	0,2	--	20000	0,043
	42	13	1	6302	11,4	5,4	0,2	17500	24000	0,08
	42	13	1	6302-RS2	11,4	5,4	0,2	--	12000	0,08
	42	13	1	6302-2RS2	11,4	5,4	0,2	--	12000	0,08
	42	13	1	6302-Z	11,4	5,4	0,2	--	18000	0,08
	42	13	1	6302-2Z	11,4	5,4	0,2	--	18000	0,08
17	26	5	0,3	61803	2,1	1,4	0,1	17100	34000	0,008
	26	5	0,3	61803-2RSR	2,1	1,4	0,1	--	16000	0,008
	26	5	0,3	61803-2Z	2,1	1,4	0,1	--	24000	0,008
	30	7	0,3	61903	4,6	2,6	0,1	18500	32000	0,018
	30	7	0,3	61903-2RSR	4,6	2,6	0,1	--	14500	0,018
	30	7	0,3	61903-2Z	4,6	2,6	0,1	--	22000	0,018
	35	8	0,3	16003	6	3,3	0,2	17700	28000	0,03
	35	10	0,3	6003	6	3,3	0,2	20300	28000	0,037
	35	10	0,3	6003-RS2	6	3,3	0,2	--	13000	0,037
	35	10	0,3	6003-2RS2	6	3,3	0,2	--	13000	0,037
	35	10	0,3	6003-Z	6	3,3	0,2	--	22000	0,037
	35	10	0,3	6003-2Z	6	3,3	0,2	--	22000	0,037
	40	12	0,6	6203	9,6	4,8	0,2	18100	24000	0,063
	40	12	0,6	6203-RS2	9,6	4,8	0,2	--	12000	0,063
40	12	0,6	6203-2RS2	9,6	4,8	0,2	--	12000	0,063	
40	12	0,6	6203-Z	9,6	4,8	0,2	--	18000	0,063	

Einreihige Rillenkugellager
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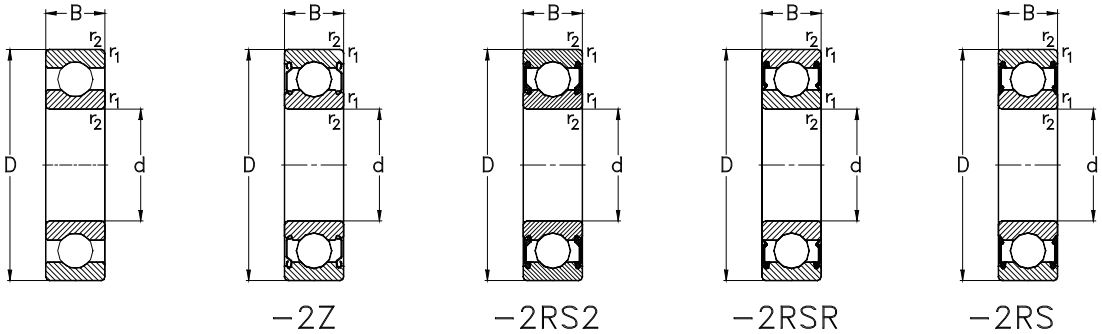
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]		Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]		Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		m	
17	40	12	0,6	6203-2Z	9,6	4,8	0,2	--	18000		0,063
	47	14	1	6303	13,6	6,6	0,3	15900	22000		0,11
	47	14	1	6303-RS2	13,6	6,6	0,3	--	10500		0,11
	47	14	1	6303-2RS2	13,6	6,6	0,3	--	10500		0,11
	47	14	1	6303-Z	13,6	6,6	0,3	--	16000		0,11
	47	14	1	6303-2Z	13,6	6,6	0,3	--	16000		0,11
20	62	17	1,1	6403	22,7	10,8	0,5	13700	18000		0,275
	32	7	0,3	61804	3,5	2,2	0,1	16600	28000		0,018
	32	7	0,3	61804-2RSR	3,5	2,2	0,1	--	12500		0,018
	32	7	0,3	61804-2Z	3,5	2,2	0,1	--	19000		0,018
	37	9	0,3	61904	6,4	3,7	0,2	17000	26000		0,038
	37	9	0,3	61904-2RSR	6,4	3,7	0,2	--	12000		0,038
	37	9	0,3	61904-2Z	6,4	3,7	0,2	--	18000		0,038
	42	8	0,3	16004	7,9	4,5	0,2	14300	24000		0,049
	42	12	0,6	6004	9,4	5	0,2	18300	24000		0,065
	42	12	0,6	6004-RS2	9,4	5	0,2	--	11000		0,065
	42	12	0,6	6004-2RS2	9,4	5	0,2	--	11000		0,065
	42	12	0,6	6004-Z	9,4	5	0,2	--	17000		0,065
	42	12	0,6	6004-2Z	9,4	5	0,2	--	17000		0,065
	47	14	1	6204	12,8	6,7	0,3	16300	20000		0,105
	47	14	1	6204-RS2	12,8	6,7	0,3	--	9900		0,105
	47	14	1	6204-2RS2	12,8	6,7	0,3	--	9900		0,105

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Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
20	47	14	1	6204-Z	12,8	6,7	0,3	--	15000	0,105
	47	14	1	6204-2Z	12,8	6,7	0,3	--	15000	0,105
	52	15	1,1	6304	15,9	7,9	0,4	14400	19000	0,148
	52	15	1,1	6304-RS2	15,9	7,9	0,4	--	9300	0,148
	52	15	1,1	6304-2RS2	15,9	7,9	0,4	--	9300	0,148
	52	15	1,1	6304-Z	15,9	7,9	0,4	--	14000	0,148
	52	15	1,1	6304-2Z	15,9	7,9	0,4	--	14000	0,148
	72	19	1,1	6404	31	15,3	0,7	12200	15000	0,412
22	50	14	1	62/22	14	7,7	0,4	14900	19000	0,11
	50	14	1	62/22-2RS2	14	7,7	0,4	--	11500	0,11
	50	14	1	62/22-2Z	14	7,7	0,4	--	15000	0,11
	56	16	1,1	63/22	18,4	9,3	0,4	13500	18000	0,16
	56	16	1,1	63/22-2RS2	18,4	9,3	0,4	--	9500	0,16
	56	16	1,1	63/22-2Z	18,4	9,3	0,4	--	14000	0,16
25	37	7	0,3	61805	3,7	2,6	0,1	13500	24000	0,022
	37	7	0,3	61805-2RSR	3,7	2,6	0,1	--	11000	0,022
	37	7	0,3	61805-2Z	3,7	2,6	0,1	--	17000	0,022
	42	9	0,3	61905	6,7	4,2	0,2	14100	22000	0,045
	42	9	0,3	61905-2RSR	6,6	4,2	0,2	--	10500	0,045
	42	9	0,3	61905-2Z	6,7	4,2	0,2	--	16000	0,045
	47	8	0,3	16005	7,2	4,7	0,3	11900	20000	0,056
	47	12	0,6	6005	10,0	5,8	0,3	15300	20000	0,078

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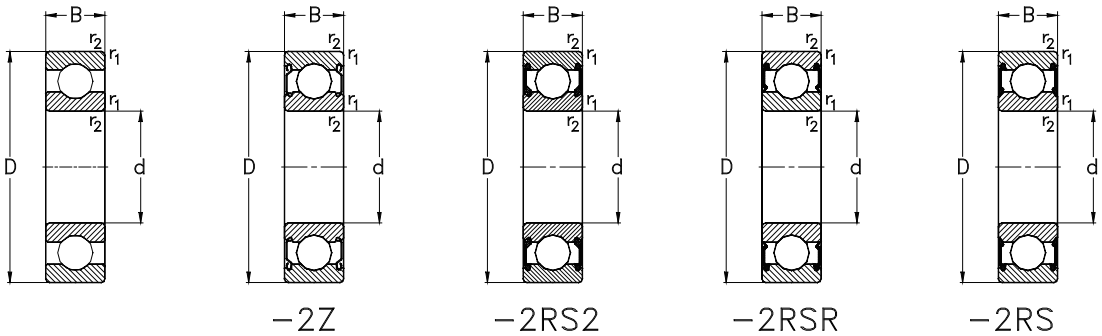
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]		
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]			
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m			
25	47	12	0,6	6005-RS2	10,1	5,9	0,3	--	10000	0,078		
	47	12	0,6	6005-2RS2	10,1	5,9	0,3	--	10000	0,078		
	47	12	0,6	6005-Z	10,1	5,9	0,3	--	15000	0,078		
	47	12	0,6	6005-2Z	10,1	5,9	0,3	--	15000	0,078		
52	15	1	6205	14	7,9	0,4	14400	18000	0,125			
	15	1	6205-RS2	14	7,9	0,4	--	9300	0,125			
	15	1	6205-2RS2	14	7,9	0,4	--	9300	0,125			
	15	1	6205-Z	14	7,9	0,4	--	14000	0,125			
52	15	1	6205-2Z	14	7,9	0,4	--	14000	0,125			
	62	17	1,1	6305	22,4	11,5	0,5	12300	16000	0,232		
		17	1,1	6305-RS2	22,4	11,5	0,5	--	7300	0,232		
		17	1,1	6305-2RS2	22,4	11,5	0,5	--	7300	0,232		
17		1,1	6305-Z	22,4	11,5	0,5	--	11000	0,232			
62	17	1,1	6305-2Z	22,4	11,5	0,5	--	11000	0,232			
	80	21	1,5	6405	38,3	19,3	0,9	11000	13000	0,543		
		28	58	16	1	62/28	16,6	9,4	0,4	13100	16000	0,17
			58	16	1	62/28-2RS2	16,6	9,4	0,4	--	9500	0,17
58			16	1	62/28-2Z	16,6	9,4	0,4	--	14000	0,17	
68	18	1,1	63/28	25	13,8	0,6	11300	14000	0,29			
	18	1,1	63/28-2RS2	25	13,8	0,6	--	6000	0,29			
	18	1,1	63/28-2Z	25	13,8	0,6	--	9000	0,29			
30	42	7	0,3	61806	4	3,2	0,1	11300	20000	0,027		

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Abutment and fillet dimensions
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Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
30	42	7	0,3	61806-2RSR	4	3,2	0,1	--	10000	0,027
	42	7	0,3	61806-2Z	4	3,2	0,1	--	15000	0,027
	47	9	0,3	61906	7,2	5	0,2	11900	19000	0,051
	47	9	0,3	61906-2RSR	7,2	5	0,2	--	9500	0,051
	47	9	0,3	61906-2Z	7,2	5	0,2	--	14000	0,051
	55	9	0,3	16006	11,2	7,4	0,3	10500	17000	0,084
	55	13	1	6006	13,2	8,3	0,4	13100	17000	0,115
	55	13	1	6006-RS2	13,2	8,3	0,4	--	8500	0,115
	55	13	1	6006-2RS2	13,2	8,3	0,4	--	8500	0,115
	55	13	1	6006-Z	13,2	8,3	0,4	--	13000	0,115
	55	13	1	6006-2Z	13,2	8,3	0,4	--	13000	0,115
	62	16	1	6206	19,5	11,3	0,5	12000	15000	0,192
	62	16	1	6206-RS2	19,5	11,3	0,5	--	7300	0,192
	62	16	1	6206-2RS2	19,5	11,3	0,5	--	7300	0,192
	62	16	1	6206-Z	19,5	11,3	0,5	--	11000	0,192
	62	16	1	6206-2Z	19,5	11,3	0,5	--	11000	0,192
	72	19	1,1	6306	27	15,2	0,7	10800	13000	0,348
	72	19	1,1	6306-RS2	27	15,2	0,7	--	6300	0,348
	72	19	1,1	6306-2RS2	27	15,2	0,7	--	6300	0,348
	72	19	1,1	6306-Z	27	15,2	0,7	--	9500	0,348
	72	19	1,1	6306-2Z	27	15,2	0,7	--	9500	0,348
	90	23	1,5	6406	47,4	24,5	1,1	9900	11000	0,746

Einreihige Rillenkugellager
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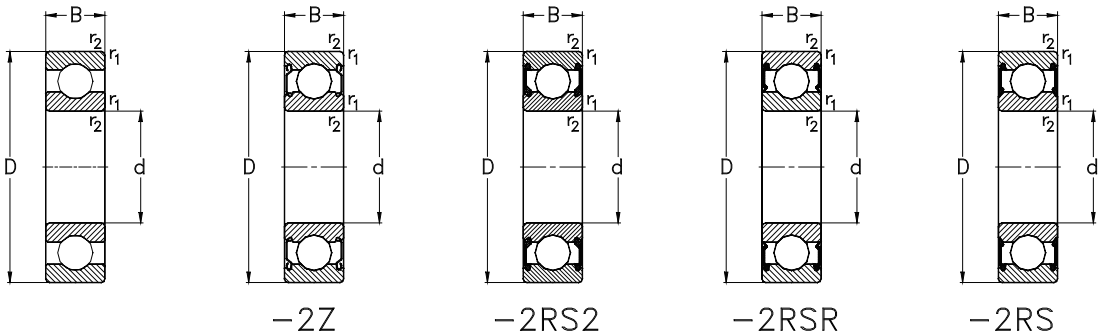
Hauptabmessungen [mm]				Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
35	47	7	0,3	61807	4,3	3,6	0,2	9600	18000	0,03
	47	7	0,3	61807-2RSR	4,3	3,6	0,2	--	8500	0,03
	47	7	0,3	61807-2Z	4,3	3,6	0,2	--	13000	0,03
	55	10	0,6	61907	10,4	7,2	0,3	10500	16000	0,08
	55	10	0,6	61907-2RSR	10,4	7,2	0,3	--	7500	0,08
	55	10	0,6	61907-2Z	10,4	7,2	0,3	--	11000	0,08
	62	9	0,3	16007	12,2	8,8	0,4	8900	15000	0,107
	62	14	1	6007	16,2	10,4	0,5	11600	15000	0,151
	62	14	1	6007-RS2	16,2	10,4	0,5	--	7300	0,151
	62	14	1	6007-2RS2	16,2	10,4	0,5	--	7300	0,151
	62	14	1	6007-Z	16,2	10,4	0,5	--	11000	0,151
	62	14	1	6007-2Z	16,2	10,4	0,5	--	11000	0,151
	72	17	1,1	6207	25,7	15,3	0,7	10300	13000	0,288
	72	17	1,1	6207-RS2	25,7	15,3	0,7	--	6300	0,288
	72	17	1,1	6207-2RS2	25,7	15,3	0,7	--	6300	0,288
	72	17	1,1	6207-Z	25,7	15,3	0,7	--	9500	0,288
	72	17	1,1	6207-2Z	25,7	15,3	0,7	--	9500	0,288
	80	21	1,5	6307	33,4	19,2	0,9	9900	12000	0,458
	80	21	1,5	6307-RS2	33,4	19,2	0,9	--	5600	0,458
	80	21	1,5	6307-2RS2	33,4	19,2	0,9	--	5600	0,458
	80	21	1,5	6307-Z	33,4	19,2	0,9	--	8500	0,458
	80	21	1,5	6307-2Z	33,4	19,2	0,9	--	8500	0,458

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Abutment and fillet dimensions
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Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
35	100	25	1,5	6407	57	30,1	1,4	9000	10000	0,928
40	52	7	0,3	61808	4,4	3,9	0,2	8400	16000	0,034
	52	7	0,3	61808-2RSR	4,4	3,9	0,2	--	7000	0,034
	52	7	0,3	61808-2Z	4,4	3,9	0,2	--	11000	0,034
	62	12	0,6	61908	12,2	8,9	0,4	10100	14000	0,12
	62	12	0,6	61908-2RSR	12,2	8,9	0,4	--	6500	0,12
	62	12	0,6	61908-2Z	12,2	8,9	0,4	--	10000	0,12
	68	9	0,3	16008	12,6	9,7	0,4	7900	14000	0,126
	68	15	1	6008	17	11,7	0,5	10700	14000	0,188
	68	15	1	6008-RS2	17	11,7	0,5	--	6600	0,188
	68	15	1	6008-2RS2	17	11,7	0,5	--	6600	0,188
	68	15	1	6008-Z	17	11,7	0,5	--	10000	0,188
	68	15	1	6008-2Z	17	11,7	0,5	--	10000	0,188
	80	18	1,1	6208	29,5	18,2	0,8	9300	11000	0,366
	80	18	1,1	6208-RS2	29,5	18,2	0,8	--	5600	0,366
	80	18	1,1	6208-2RS2	29,5	18,2	0,8	--	5600	0,366
	80	18	1,1	6208-Z	29,5	18,2	0,8	--	8500	0,366
	80	18	1,1	6208-2Z	29,5	18,2	0,8	--	8500	0,366
	90	23	1,5	6308	40,8	24	1,1	9000	11000	0,632
	90	23	1,5	6308-RS2	40,8	24	1,1	--	5000	0,632
	90	23	1,5	6308-2RS2	40,8	24	1,1	--	5000	0,632
	90	23	1,5	6308-Z	40,8	24	1,1	--	7500	0,632

Einreihige Rillenkugellager
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Hauptabmessungen [mm]				Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
40	90	23	1,5	6308-2Z	40,8	24	1,1	--	7500	0,632
	110	27	2	6408	66	37,7	1,7	8200	9000	1,18
45	58	7	0,3	61809	4,6	4,3	0,2	7300	14000	0,04
	58	7	0,3	61809-2RSR	4,6	4,3	0,2	--	6300	0,04
	58	7	0,3	61809-2Z	4,6	4,3	0,2	--	9500	0,04
	68	12	0,6	61909	14,1	10,9	0,5	9000	13000	0,14
	68	12	0,6	61909-2RSR	14,1	10,9	0,5	--	6000	0,14
	68	12	0,6	61909-2Z	14,1	10,9	0,5	--	9000	0,14
	75	10	0,6	16009	15,6	12,2	0,6	7400	12000	0,168
	75	16	1	6009	21,1	14,8	0,7	9800	12000	0,231
	75	16	1	6009-RS2	21,1	14,8	0,7	--	6000	0,231
	75	16	1	6009-2RS2	21,1	14,8	0,7	--	6000	0,231
75	16	1	1	6009-Z	21,1	14,8	0,7	--	9000	0,231
	16	1	1	6009-2Z	21,1	14,8	0,7	--	9000	0,231
	85	19	1,1	6209	31,7	20,7	0,9	8700	11000	0,405
	85	19	1,1	6209-RS2	31,7	20,7	0,9	--	5300	0,405
	85	19	1,1	6209-2RS2	31,7	20,7	0,9	--	5300	0,405
	85	19	1,1	6209-Z	31,7	20,7	0,9	--	8000	0,405
85	19	1,1	1,1	6209-2Z	31,7	20,7	0,9	--	8000	0,405
	100	25	1,5	6309	53	31,9	1,5	8300	9500	0,848
	100	25	1,5	6309-RS2	53	31,9	1,5	--	4400	0,848
100	25	1,5	6309-2RS2	53	31,9	1,5	--	4400	0,848	

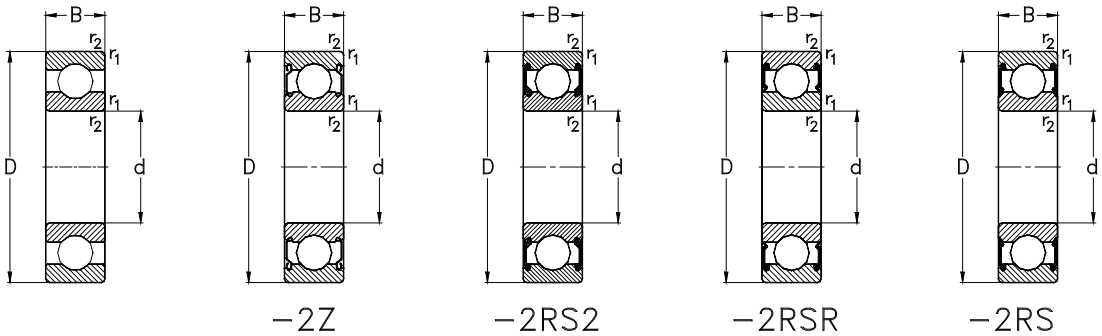
Anschlussmaße siehe Seite 383

Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
45	100	25	1,5	6309-Z	53	31,9	1,5	--	6700	0,848
	100	25	1,5	6309-2Z	53	31,9	1,5	--	6700	0,848
	120	29	2	6409	78	45,4	2,1	7600	8500	1,51
50	65	7	0,3	61810	5,5	5,3	0,2	6400	13000	0,052
	72	12	0,6	61910	13,9	11	0,5	8100	12000	0,14
	72	12	0,6	61910-2RSR	13,9	11	0,5	--	5500	0,14
	72	12	0,6	61910-2Z	13,9	11	0,5	--	8500	0,14
	80	10	0,6	6010	16,1	13,2	0,6	6700	11000	0,18
	80	16	1	6010	21,8	16,6	0,8	8900	11000	0,261
	80	16	1	6010-RS2	21,8	16,6	0,8	--	5600	0,261
	80	16	1	6010-2RS2	21,8	16,6	0,8	--	5600	0,261
	80	16	1	6010-Z	21,8	16,6	0,8	--	8500	0,261
	80	16	1	6010-2Z	21,8	16,6	0,8	--	8500	0,261
90	20	1,1		6210	35,1	23,2	1,1	8200	10000	0,453
	20	1,1		6210-RS2	35,1	23,2	1,1	--	5000	0,453
	20	1,1		6210-2RS2	35,1	23,2	1,1	--	5000	0,453
	20	1,1		6210-Z	35,1	23,2	1,1	--	7500	0,453
	20	1,1		6210-2Z	35,1	23,2	1,1	--	7500	0,453
	20	1,1		6210-2Z	35,1	23,2	1,1	--	7500	0,453
110	27	2		6310	62	38	1,7	7700	8500	1,1
	27	2		6310-RS2	62	38	1,7	--	4000	1,1
	27	2		6310-2RS2	62	38	1,7	--	4000	1,1
	27	2		6310-Z	62	38	1,7	--	6000	1,1

Einreihige Rillenkugellager
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BEARINGS



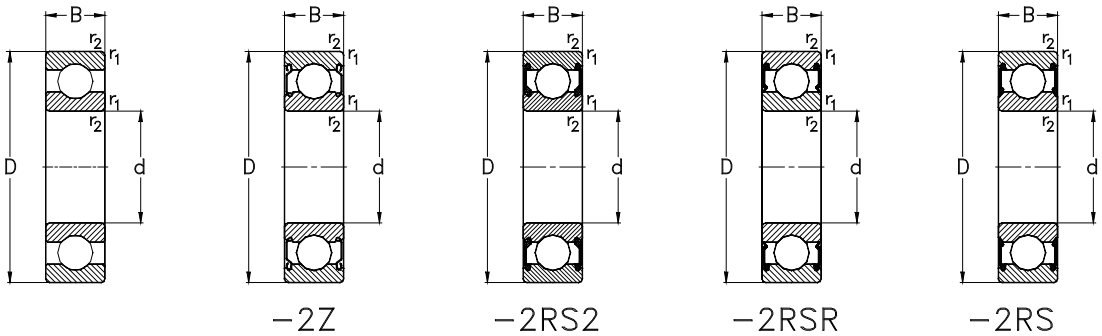
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
50	110	27	2	6310-Z	62	38	1,7	--	6000	1,1
	130	31	2,1	6410	92	55	2,5	7100	7500	1,83
55	72	9	0,3	61811	9,04	8,8	0,38	6600	12000	0,083
	80	13	1	61911	16	13,3	0,6	7500	11000	0,19
	90	11	0,6	16011	19,5	16,3	0,7	6200	10000	0,26
	90	18	1,1	6011	28,2	21,3	1	8300	10000	0,311
	90	18	1,1	6011-RS2	28,2	21,3	1	--	5000	0,311
	90	18	1,1	6011-2RS2	28,2	21,3	1	--	5000	0,311
	90	18	1,1	6011-Z	28,2	21,3	1	--	7500	0,311
	90	18	1,1	6011-2Z	28,2	21,3	1	--	7500	0,311
	100	21	1,5	6211	43,4	29,2	1,3	7500	9000	0,607
	100	21	1,5	6211-RS2	43,4	29,2	1,3	--	4400	0,607
100	21	1,5	6211-2RS2	43,4	29,2	1,3	--	4400	0,607	
100	21	1,5	6211-Z	43,4	29,2	1,3	--	6700	0,607	
100	21	1,5	6211-2Z	43,4	29,2	1,3	--	6700	0,607	
120	29	2	2	6311	72	44,8	2	7200	8000	1,39
	29	2	2	6311-RSR	72	44,8	2	--	3500	1,39
	29	2	2	6311-2RSR	72	44,8	2	--	3500	1,39
	29	2	2	6311-Z	72	44,8	2	--	5300	1,39
	29	2	2	6311-2Z	72	44,8	2	--	5300	1,39
140	33	2,1	6411	101	63	2,8	6700	7000	2,4	
60	78	10	0,3	61812	11,5	10,6	0,5	6400	11000	0,11

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Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
60	85	13	1	61912	19,5	16,3	0,7	6900	10000	0,2
	95	11	0,6	16012	19,9	17,5	0,8	5700	9500	0,28
	95	18	1,1	6012	29,4	23,2	1,1	7700	9500	0,41
	95	18	1,1	6012-RS2	29,4	23,2	1,1	--	4500	0,41
	95	18	1,1	6012-2RS2	29,4	23,2	1,1	--	4500	0,41
	95	18	1,1	6012-Z	29,4	23,2	1,1	--	7000	0,41
	95	18	1,1	6012-2Z	29,4	23,2	1,1	--	7000	0,41
	110	22	1,5	6212	47,7	33	1,5	6900	8000	0,783
	110	22	1,5	6212-RS2	47,7	33	1,5	--	4000	0,783
	110	22	1,5	6212-2RS2	47,7	33	1,5	--	4000	0,783
65	110	22	1,5	6212-Z	47,7	33	1,5	--	6000	0,783
	110	22	1,5	6212-2Z	47,7	33	1,5	--	6000	0,783
	130	31	2,1	6312	82	51,9	2,4	6800	7000	1,72
	130	31	2,1	6312-RSR	82	51,9	2,4	--	3300	1,72
	130	31	2,1	6312-2RSR	82	52	2,4	--	3300	1,72
	130	31	2,1	6312-Z	82	52	2,4	--	5000	1,72
	130	31	2,1	6312-2Z	82	52	2,4	--	5000	1,72
	150	35	2,1	6412	109	70	3,1	6400	6300	2,8
	85	10	0,6	61813	9,7	9,8	0,4	5800	10000	0,13
	90	13	1	61913	19,9	17,5	0,8	6300	9500	0,22
100	11	0,6	16013	21,2	19,7	0,9	5300	9000	0,298	
100	18	1,1	6013	30,5	25,2	1,1	7100	9000	0,436	

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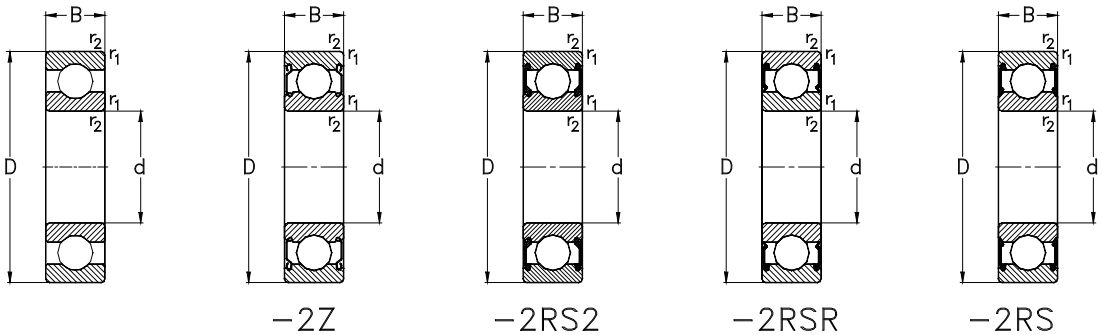
Hauptabmessungen [mm]				Lagertypen	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	Designation	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
65	100	18	1,1	6013-RSR	30,5	25,2	1,1	--	4100	0,436
	100	18	1,1	6013-2RSR	30,5	25,2	1,1	--	4100	0,436
	100	18	1,1	6013-Z	30,5	25,2	1,1	--	6300	0,436
	100	18	1,1	6013-2Z	30,5	25,2	1,1	--	6300	0,436
	120	23	1,5	6213	57	40	1,8	6400	7500	0,982
	120	23	1,5	6213-RSR	57	40	1,8	--	3500	0,982
	120	23	1,5	6213-2RSR	57	40	1,8	--	3500	0,982
	120	23	1,5	6213-Z	57	40	1,8	--	5300	0,982
	120	23	1,5	6213-2Z	57	40	1,8	--	5300	0,982
	140	33	2,1	6313	93	60	2,7	6400	6700	2,13
140	33	2,1	6313-RSR	93	60	2,7	--	3000	2,13	
140	33	2,1	6313-2RSR	93	60	2,7	--	3000	2,13	
140	33	2,1	6313-Z	93	60	2,7	--	4500	2,13	
140	33	2,1	6313-2Z	93	60	2,7	--	4500	2,13	
160	37	2,1	6413	118	79	3,4	6100	6000	3,3	
70	90	10	0,6	61814	9,8	10,1	0,5	5300	9000	0,14
	100	16	1	61914	27,1	23,3	1,1	6400	8500	0,35
	110	13	0,6	16014	27,9	25,1	1,1	5300	8000	0,43
	110	20	1,1	6014	38	30,9	1,4	6800	8000	0,6
	110	20	1,1	6014-RSR	38	30,9	1,4	--	4000	0,604
	110	20	1,1	6014-2RSR	38	30,9	1,4	--	4000	0,604
	110	20	1,1	6014-Z	38	30,9	1,4	--	6000	0,604

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Abutment and fillet dimensions
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Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
70	110	20	1,1	6014-Z	38	30,9	1,4	--	6000	0,604
	125	24	1,5	6214	61	45,1	2,1	6100	7000	1,08
	125	24	1,5	6214-RSR	61	45,1	2,1	--	3300	1,08
	125	24	1,5	6214-2RSR	61	45,1	2,1	--	3300	1,08
	125	24	1,5	6214-Z	61	45,1	2,1	--	5000	1,08
	125	24	1,5	6214-2Z	61	45,1	2,1	--	5000	1,08
	150	35	2,1	6314	104	68	3	6100	6300	2,63
	150	35	2,1	6314-RSR	104	68	3	--	2800	2,63
	150	35	2,1	6314-2RSR	104	68	3	--	2800	2,63
	150	35	2,1	6314-Z	104	68	3	--	4300	2,63
150	35	2,1	6314-2Z	104	68	3	--	4300	2,63	
180	42	3	6414	140	100	4	5700	5300	4,8	
75	95	10	0,6	61815	13,3	13,1	0,6	5000	8500	0,15
	105	16	1	61915	27,9	25,1	1,1	6000	8000	0,37
	115	13	0,6	16015	28,6	26,8	1,2	4900	7500	0,456
	115	20	1,1	6015	39,5	33,5	1,5	6400	7500	0,643
	115	20	1,1	6015-RSR	39,5	33,5	1,5	--	3700	0,643
	115	20	1,1	6015-2RSR	39,5	33,5	1,5	--	3700	0,643
	115	20	1,1	6015-Z	39,5	33,5	1,5	--	5600	0,643
	115	20	1,1	6015-2Z	39,5	33,5	1,5	--	5600	0,643
	130	25	1,5	6215	66	49,5	2,2	5900	6700	1,21
	130	25	1,5	6215-RSR	66	49,5	2,2	--	3200	1,21

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



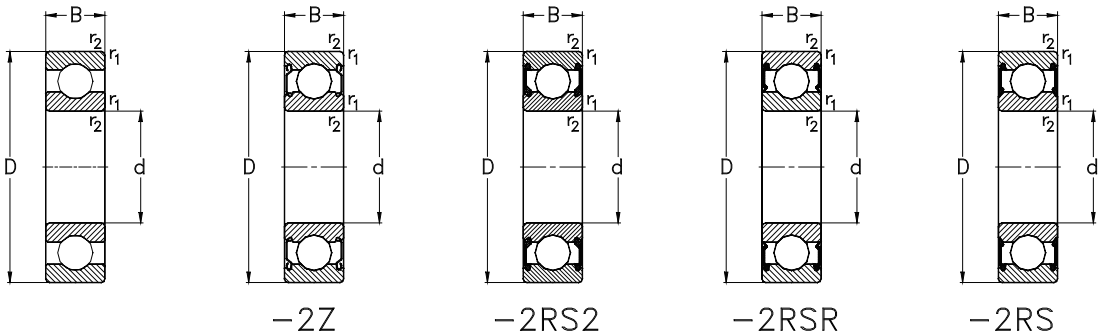
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
75	130	25	1,5	6215-2RSR	66	49,5	2,2	--	3200	1,21
	130	25	1,5	6215-Z	66	49,5	2,2	--	4800	1,21
	130	25	1,5	6215-2Z	66	49,5	2,2	--	4800	1,21
	160	37	2,1	6315	114	77	3,2	6300	5600	3,12
160	37	2,1	6315-RSR	114	77	3,2	--	2700	3,12	
160	37	2,1	6315-2RSR	114	77	3,2	--	2700	3,12	
160	37	2,1	6315-Z	114	77	3,2	--	4000	3,12	
160	37	2,1	6315-2Z	114	77	3,2	--	4000	3,12	
190	45	3	6415	154	114	4,5	5600	5000	6,75	
80	100	10	0,6	61816	15,9	16,8	0,8	4600	8000	0,15
	110	16	1	61916	27,6	25,3	1,2	5600	7500	0,4
	125	14	0,6	16016	33,1	31,4	1,4	4700	7000	0,615
	125	22	1,1	6016	51	42	1,9	6100	7000	0,85
	125	22	1,1	6016-RSR	51	42	1,9	--	3300	0,85
	125	22	1,1	6016-2RSR	51	42	1,9	--	3300	0,85
	125	22	1,1	6016-Z	51	42	1,9	--	5000	0,85
	125	22	1,1	6016-2Z	51	42	1,9	--	5000	0,85
	140	26	2	6216	72	54	2,3	5500	6000	1,42
	140	26	2	6216-RSR	72	54	2,3	--	3000	1,42
140	26	2	6216-2RSR	72	54	2,3	--	3000	1,42	
140	26	2	6216-Z	72	54	2,3	--	4500	1,42	
140	26	2	6216-2Z	72	54	2,3	--	4500	1,42	

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Abutment and fillet dimensions
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Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
80	170	39	2,1	6316	123	87	3,5	5500	5300	3,73
	170	39	2,1	6316-RSR	123	87	3,5	--	2500	3,73
	170	39	2,1	6316-2RSR	123	87	3,5	--	2500	3,73
	170	39	2,1	6316-Z	123	87	3,5	--	3800	3,73
	170	39	2,1	6316-2Z	123	87	3,5	--	3800	3,73
	200	48	3	6416	163	125	4,8	5400	4800	8
85	110	13	1	61817	15,9	16,8	0,8	4900	7500	0,27
	120	18	1,1	61917	34	29,9	1,3	5500	7000	0,55
	130	14	0,6	16017	34	33,3	1,5	4400	6700	0,641
	130	22	1,1	6017	53	45,6	2	5800	6700	0,895
	130	22	1,1	6017-RSR	53	45,6	2	--	3200	0,895
	130	22	1,1	6017-2RSR	53	45,6	2	--	3200	0,895
	130	22	1,1	6017-Z	53	45,6	2	--	4800	0,895
	130	22	1,1	6017-2Z	53	45,6	2	--	4800	0,895
	150	28	2	6217	84	62	2,6	5300	5600	1,82
	150	28	2	6217-RSR	84	62	2,6	--	2800	1,82
	150	28	2	6217-2RSR	84	62	2,6	--	2800	1,82
	150	28	2	6217-Z	84	62	2,6	--	4300	1,82
	150	28	2	6217-2Z	84	62	2,6	--	4300	1,82
180	41	3	6317	133	97	3,8	5300	5000	4,24	
180	41	3	6317-RSR	133	97	3,8	--	2300	4,24	
180	41	3	6317-2RSR	133	97	3,8	--	2300	4,24	

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



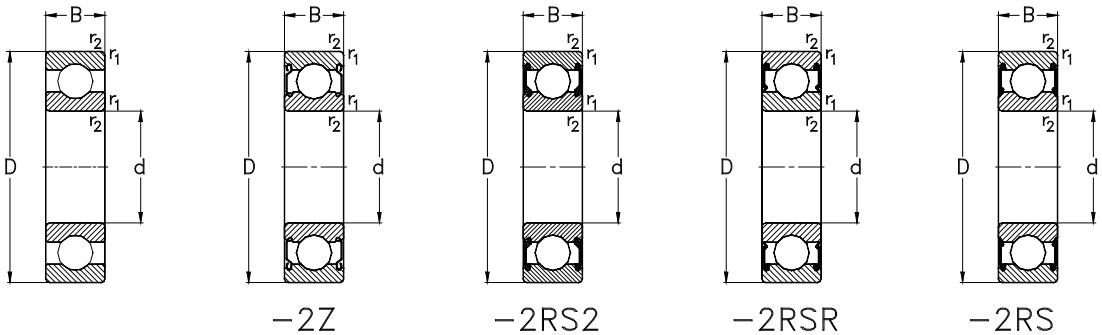
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
85	180	41	3	6317-Z	133	97	3,8	--	3400	4,24
	180	41	3	6317-2Z	133	97	3,8	--	3400	4,24
	210	52	4	6417	175	138	5,1	5300	4500	9,52
90	115	13	1	61818	19,6	20,5	0,9	4600	7000	0,28
	125	18	1,1	61918	36,5	34,2	1,5	5200	6700	0,59
	140	16	1	6018	33,6	33,3	1,4	4500	6300	0,859
	140	24	1,5	6018	58	50	2,1	5600	6300	1,18
	140	24	1,5	6018-RSR	58	50	2,1	--	3000	1,18
	140	24	1,5	6018-2RSR	58	50	2,1	--	3000	1,18
	140	24	1,5	6018-Z	58	50	2,1	--	4500	1,18
	140	24	1,5	6018-2Z	58	50	2,1	--	4500	1,18
	160	30	2	6218	96	72	2,9	5100	5300	2,2
160	30	2	6218-RSR	96	72	2,9	--	2500	2,2	
160	30	2	6218-2RSR	96	72	2,9	--	2500	2,2	
160	30	2	6218-Z	96	72	2,9	--	3800	2,2	
160	30	2	6218-2Z	96	72	2,9	--	3800	2,2	
190	43	3	6318	143	107	4,1	5100	4800	4,9	
190	43	3	6318-RSR	143	107	4,1	--	2200	4,9	
190	43	3	6318-2RSR	143	107	4,1	--	2200	4,9	
190	43	3	6318-Z	143	107	4,1	--	3400	4,9	
190	43	3	6318-2Z	143	107	4,1	--	3400	4,9	
225	54	4	6418	193	158	5,7	4900	4300	11,6	

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Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
95	120	13	1	61819	19,8	21,3	0,9	4400	6700	0,3
	130	18	1,1	61919	36,3	34,5	1,5	4900	6300	0,61
	145	16	1	16019	42,7	41,9	1,7	4200	6000	0,905
	145	24	1,5	6019	60	54	2,2	5300	6000	1,21
	145	24	1,5	6019-RSR	60	54	2,2	--	2900	1,21
	145	24	1,5	6019-2RSR	60	54	2,2	--	2900	1,21
	145	24	1,5	6019-Z	60	54	2,2	--	4300	1,21
	145	24	1,5	6019-2Z	60	54	2,2	--	4300	1,21
	170	32	2,1	6219	109	82	3,2	5000	5000	2,67
	170	32	2,1	6219-RSR	109	82	3,2	--	2400	2,67
170	32	2,1	6219-2RSR	109	82	3,2	--	2400	2,67	
170	32	2,1	6219-Z	109	82	3,2	--	3600	2,67	
170	32	2,1	6219-2Z	109	82	3,2	--	3600	2,67	
200	45	3		6319	153	119	4,4	4900	4500	5,65
	45	3		6319-RSR	153	119	4,4	--	2200	5,65
	45	3		6319-2RSR	153	119	4,4	--	2200	5,65
	45	3		6319-Z	153	119	4,4	--	3200	5,65
	45	3		6319-2Z	153	119	4,4	--	3200	5,65
100	125	13	1	61820	20,1	22	0,9	4100	6300	0,31
	140	20	1,1	61920	37,2	36,6	1,5	4900	6000	0,83
	150	16	1	16020	43,9	44,3	1,8	4000	5600	0,929
	150	24	1,5	6020	60	54	2,2	5100	5600	1,26

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



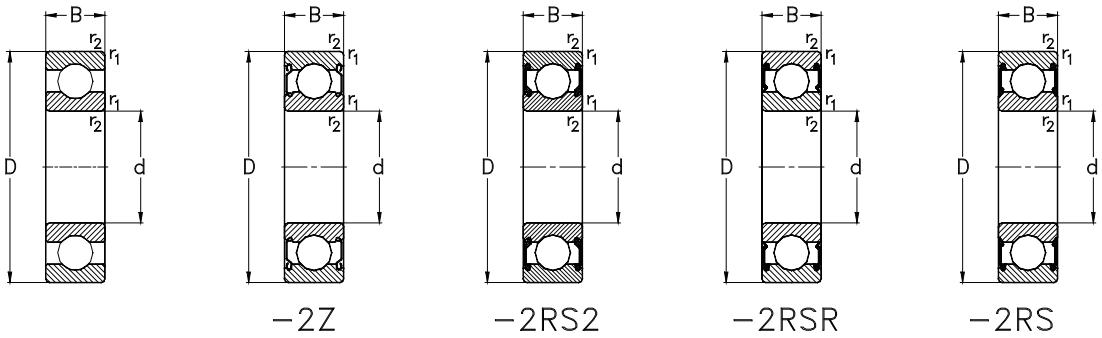
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
100	150	24	1,5	6020-RSR	60	54	2,2	--	2700	1,26
	150	24	1,5	6020-2RSR	60	54	2,2	--	2700	1,26
	150	24	1,5	6020-Z	60	54	2,2	--	4000	1,26
	150	24	1,5	6020-2Z	60	54	2,2	--	4000	1,26
	180	34	2,1	6220	122	93	3,6	4800	4800	3,22
	180	34	2,1	6220-RSR	122	93	3,6	--	2200	3,22
	180	34	2,1	6220-2RSR	122	93	3,6	--	2200	3,22
	180	34	2,1	6220-Z	122	93	3,6	--	3400	3,22
105	130	13	1	61821	17	19,7	0,8	3900	6300	0,32
	145	20	1,1	61921	43,5	42,3	1,7	4600	5600	0,87
	160	18	1	16021	52	51	2	4000	5300	1,22
	160	26	2	6021	72	66	2,6	5000	5300	1,58
	160	26	2	6021-RSR	72	66	2,6	--	2500	1,58
	160	26	2	6021-2RSR	72	66	2,6	--	2500	1,58
	160	26	2	6021-Z	72	66	2,6	--	3800	1,58
	160	26	2	6021-2Z	72	66	2,6	--	3800	1,58
190	36	2,1	6221	133	105	3,9	4700	4500	3,86	
	36	2,1	6221-RSR	133	105	3,9	--	2100	3,86	
	36	2,1	6221-2RSR	133	105	3,9	--	2100	3,86	
	36	2,1	6221-Z	133	105	3,9	--	3200	3,86	

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Abutment and fillet dimensions
see on page 383

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
105	190	36	2,1	6221-Z	133	105	3,9	--	3200	3,86
	225	49	3	6321	184	153	5,4	4500	4000	8,63
110	140	16	1	61822	28,1	30,7	1,2	4100	5600	0,6
	150	20	1,1	61922	39,2	40,5	1,6	4400	5600	0,9
	170	19	1	16022	57	57	2,2	3900	5000	1,49
	170	28	2	6022	82	73	2,8	4800	5000	1,97
	170	28	2	6022-RSR	82	73	2,8	--	2400	1,97
	170	28	2	6022-2RSR	82	73	2,8	--	2400	1,97
	170	28	2	6022-Z	82	73	2,8	--	3600	1,97
	170	28	2	6022-ZZ	82	73	2,8	--	3600	1,97
	200	38	2,1	6222	144	117	4,3	4500	4300	4,57
	200	38	2,1	6222-2RSR	144	117	4,3	--	2000	4,57
200	38	2,1	6222-ZZ	144	117	4,3	--	3000	4,57	
240	50	3	6322	195	168	5,8	4100	3800	10,3	
120	150	16	1	61824	29	32,9	1,3	3800	5300	0,65
	165	22	1,1	61924	48,6	50,5	1,9	4200	5000	1,2
	180	19	1	16024	59	60	2,2	3600	4800	1,6
	180	28	2	6024	88	80	3	4500	4800	2,11
	180	28	2	6024-2RSR	88	80	3	--	2300	2,11
	180	28	2	6024-ZZ	88	80	3	--	3400	2,11
	215	40	2,1	6224	155	131	4,6	4300	4000	5,6
215	40	2,1	6224-2RSR	155	131	4,6	--	1900	5,6	

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings

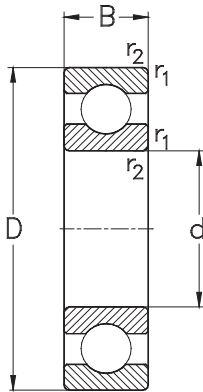


Hauptabmessungen [mm]				Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
120	215	40	2,1	6224-2Z	155	131	4,6	--	3400	5,6
	260	55	3	6324	217	196	6,5	3800	3400	12,8

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*Abutment and fillet dimensions
see on page 383*

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



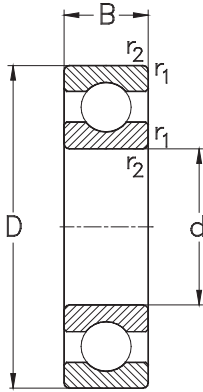
Hauptabmessungen [mm]				Lagertypen <i>Designation</i>	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
<i>Boundary dimensions [mm]</i>					<i>Load ratings [kN]</i>			<i>Thermal speed ratings [rpm]</i>	<i>Limited speed ratings [rpm]</i>	<i>Weight [kg]</i>
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
130	165	18	1,1	61826	37,9	42,9	1,6	3600	4800	0,93
	180	24	1,5	61926	65	67	2,5	4000	4500	1,6
	200	22	1,1	16026	79	81,9	2,9	3400	4300	2,42
	200	33	2	6026	106	101	3,6	4400	4300	3,27
	230	40	3	6226	167	146	5,0	3900	3600	6,22
	280	58	4	6326-M	230	215	6,8	3500	4500	18,2
140	175	18	1,1	61828	39,3	46	1,7	3300	4500	0,99
	190	24	1,5	61928	67	71	2,5	3700	5600	1,7
	210	22	1,1	16028	80	87	3,0	3200	4000	2,53
	210	33	2	6028	110	109	3,7	4100	4000	3,53
	250	42	3	6228	177	165	5,4	3600	3400	8,04
	300	62	4	6328-M	253	246	7,6	3200	4300	22
150	190	20	1,1	61830	49,1	57	2	3200	4300	1,4
	210	28	2	61930-MA	89	93	3,1	3600	5300	3,05
	225	24	1,1	16030	92	99	3,3	3100	3800	3,12
	225	35	2,1	6030	121	118	3,9	3900	3800	4,32
	270	45	3	6230-M	189	183	5,7	3300	3200	10,3
	320	65	4	6330-M	274	285	8,4	3000	4000	26,6
160	200	20	1,1	61832	49,6	59	2	3000	4000	1,45
	220	28	2	61932-MA	92	99	3,3	3400	5000	3,25
	240	25	1,5	16032	94	104	3,4	3000	3600	3,77
	240	38	2,1	6032-M	133	136	4,4	3800	3600	6,26

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*Abutment and fillet dimensions
see on page 383*

Hauptabmessungen [mm]				Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
160	290	48	3	6232-M	199	203	6,2	3100	3000	14,3
	340	68	4	6332-M	300	323	9,3	2800	3800	29,3
170	215	22	1,1	61834	62	73	2,4	3000	3600	1,9
	230	28	2	61934-MA	94	104	3,4	3200	4800	3,4
	260	28	1,5	16034	109	123	3,8	2900	3200	5,13
	260	42	2,1	6034-M	168	172	5,3	3600	4300	7,1
	310	52	4	6234-M	211	188	7,2	3000	3800	17,5
	360	72	4	6334-M	327	365	10,2	2600	3400	35,1
180	225	22	1,1	61836	62	76	2,4	2800	3400	2
	250	33	2	61936-MA	119	128	4	3200	4300	5,05
	280	31	2	16036	131	146	4,4	2800	4000	6,66
	280	46	2,1	6036-M	189	198	5,9	3300	4000	11
	320	52	4	6236-M	226	244	7,0	2800	3600	18,2
	380	75	4	6336-M	347	399	10,8	2400	3200	43,3
190	240	24	1,5	61838-MA	75	92	2,8	2700	3200	2,6
	260	33	2	61938-MA	113	126	3,8	3000	4300	5,25
	290	31	2	16038-M	149	168	4,9	2700	3000	8
	290	46	2,1	6038-M	197	215	6,3	3100	3800	10,6
	340	55	4	6238-M	255	282	7,9	2600	3400	21,8
	400	78	5	6338-M	355	416	11,0	2300	3000	50
200	250	24	1,5	61840-MA	82	101	3,1	2600	3200	2,7
	280	38	2,1	61940-MA	149	168	4,9	2900	3800	7,4

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



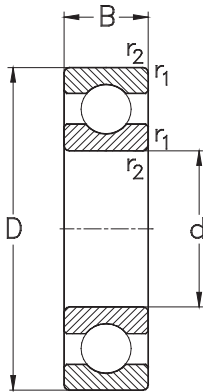
Hauptabmessungen [mm]				Lagertypen <i>Designation</i>	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
<i>Boundary dimensions [mm]</i>					<i>Load ratings [kN]</i>			<i>Thermal speed ratings [rpm]</i>	<i>Limited speed ratings [rpm]</i>	<i>Weight [kg]</i>
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
200	310	34	2	16040-M	161	180	5,1	2600	2800	9,1
	310	51	2,1	6040-M	218	243	6,9	3000	3600	13,7
	360	58	4	6240-M	269	312	8,5	2400	3200	26,2
	420	80	5	6340-M	383	463	11,9	2200	3100	56,6
220	270	24	1,5	61844	85	109	3,2	2300	2800	3
	300	38	2,1	61944-MA	152	178	5	2600	3600	8
	340	37	2,1	16044-M	174	204	5,5	2300	2400	12
	340	56	3	6044-M	247	291	7,9	2700	3200	18
	400	65	4	6244-M	296	355	9,2	2200	3000	36,9
	460	88	5	6344-M	411	518	12,8	2000	2600	74,5
240	300	28	2	61848-MA	108	139	3,8	2300	2600	4,5
	320	38	2,1	61948-MA	159	195	5,3	2400	3200	8,6
	360	37	2,1	16048-M	202	255	6,7	2100	3000	14,3
	360	56	3	6048-M	256	317	8,3	2500	3000	19,9
	440	72	4	6248-M	360	471	11,6	2000	2600	50,2
	500	95	5	6348-M	440	592	14,0	1800	2400	96
260	320	28	2	61852-MA	102	146	3,4	2100	2400	4,8
	360	46	2,1	61952-MA	197	264	5,9	2200	3000	14,5
	400	44	3	16052-MA	236	309	7,7	2000	2800	21,2
	400	65	4	6052-M	291	376	9,4	2300	2800	31,1
	480	80	5	6252-M	408	563	13,3	1800	2400	66,6
	540	102	6	6352-M	503	711	16,2	1600	2100	119

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*Abutment and fillet dimensions
see on page 383*

Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
280	350	33	2	61856-MA	147	191	4,9	2000	2200	7,4
	380	46	2,1	61956-MA	217	285	7,1	2000	2800	15,5
	420	44	3	16056-MA	242	329	8,0	1800	2600	23,1
	420	65	4	6056-M	302	408	9,9	2100	2600	33
	500	80	5	6256-M	424	599	13,8	1700	2200	70,5
	580	108	6	6356-M	568	841	18,4	1500	1900	146
300	380	38	2,1	61860-MA	147	191	4,9	1900	2600	10,5
	420	56	3	61960-MA	268	371	8,9	1900	2400	24,5
	460	50	4	16060-MA	284	405	9,4	1700	2400	32,7
	460	74	4	6060-M	375	521	12,2	1900	2400	43,2
320	400	38	2,1	61864-MA	180	243	5,8	1700	2400	11
	440	56	3	61964-MA	276	395	9,2	1800	2400	25,5
	480	50	4	16064-MA	281	406	9,2	1600	2200	34,4
	480	74	4	6064-M	370	542	12,3	1800	2200	49,4
340	420	38	2,1	61868-MA	179	253	5,9	1600	2400	11,5
	460	56	3	61968-MA	283	418	9,5	1600	2200	26,5
	520	57	4	16068-MA	340	516	11,3	1500	2000	47,3
	520	82	5	6068-M	425	642	14,1	1700	2000	61,4
360	440	38	2,1	61872-MA	161	234	5,3	1500	2200	12
	480	56	3	61972-MA	300	455	10,1	1500	2000	28
	540	57	4	16072-MA	352	552	11,8	1400	1900	49,5
	540	82	5	6072-M	460	717	15,4	1600	1900	64,4

Einreihige Rillenkugellager
Single Row Deep Groove Ball Bearings



Hauptabmessungen [mm]				Lagertypen <i>Designation</i>	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
<i>Boundary dimensions [mm]</i>					<i>Load ratings [kN]</i>			<i>Thermal speed ratings [rpm]</i>	<i>Limited speed ratings [rpm]</i>	<i>Weight [kg]</i>
d	D	B	r ₁ , r ₂ min	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
380	480	46	2,1	61876-MA	244	366	8	1400	2000	20
	520	65	4	61976-MA	352	552	11,8	1500	1900	40
	560	57	4	16076-MA	376	618	13,0	1300	1800	50,5
	560	82	5	6076-M	458	726	15,2	1500	1800	67,6
400	500	46	2,1	61880-M	248	380	8,1	1300	1900	20,5
	540	65	4	61980-MA	345	560	11,7	1400	1800	41,5
	600	90	5	6080-M	493	810	16,5	1400	1700	87,2
420	520	46	2,1	61884-MA	251	393	8,2	1300	1800	21,5
	560	65	4	61984-MA	352	586	12	1300	1800	43
	620	90	5	6084-M	535	930	18,5	1300	1600	93
440	540	46	2,1	61888-MA	255	406	8,3	1200	1800	22,5
	600	74	4	61988-MA	411	711	14,2	1200	1600	60,5
	650	94	6	6088-M	551	967	18,8	1300	1500	105
460	580	56	3	61892-MA	319	537	10,7	1200	1600	35
	620	74	4	61992-MA	407	709	13,9	1200	1600	62,5
	680	100	6	6092-M	528	946	18	1200	1500	121
480	600	56	3	61896-M	329	561	11	1100	1600	36,5
	650	78	5	61996-MA	448	808	15,5	1100	1500	74
	700	100	6	6096-M	521	951	17,8	1200	1400	126
500	620	56	3	618/500-MA	313	544	10,5	1100	1500	37,5
	670	78	5	619/500-MA	460	848	15,9	1100	1400	77
	720	100	6	60/500-M	585	1116	20,5	1100	1300	135

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*Abutment and fillet dimensions
see on page 383*

Hauptabmessungen [mm]				Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
530	650	56	3	618/530-MA	312	566	10,3	990	1400	39,5
	710	82	5	619/530-MA	484	910	16,6	1010	1300	90,5
	780	112	6	60/530-M	647	1266	22,5	1040	1200	186
560	680	56	3	618/560-MA	337	613	11,2	920	1300	42
	750	85	5	619/560-MA	490	942	16,7	950	1200	105
	820	115	6	60/560-M	615	1263	21,8	980	1200	208
600	730	60	3	618/600-MA	352	673	11,9	860	1200	52
	800	90	5	619/600-MA	583	1195	20,5	870	1100	125
	870	118	6	60/600-M	725	1515	25,4	900	1100	236
630	920	128	7,5	60/630-M	817	1769	28,9	850	1000	285
670	820	69	4	618/670-MA	446	910	15,2	770	1100	77,5
	900	103	6	619/670-MA	669	1456	23,6	780	1000	185
	980	136	7,5	60/670-M	908	2047	32,4	790	900	345
710	1030	140	7,5	60/710-M	962	2195	33,8	780	850	370
750	920	78	5	618/750-MA	525	1151	18,1	680	900	110
	1000	112	6	619/750-MA	758	1745	26,8	690	850	255

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring

NKE
BEARINGS

Einreihige Rillenkugellager mit Ringnut und Sprengring

Normen, Hauptabmessungen

Einreihige Rillenkugellager	DIN 625
Ringnuten	DIN 616
Sprengringe	DIN 5417

Allgemeines

Rillenkugellager mit Ringnut im Außenring ermöglichen eine einfache und wirtschaftliche axiale Befestigung der Lager in den Gehäusen.

Verschiedene Ausführungen gehören zum **NKE** Standardprogramm (siehe Abbildung unten).

Die Grundvariante stellen Lager der Ausführung **N** dar. Diese können auf Wunsch auch mit bereits montiertem Sprengring (Nachsetzzeichen **NR**) geliefert werden.

Diese Lager sind standardmäßig auch mit einseitiger (**-Z-N**, **-Z-NR**) oder beidseitiger Dichtscheibe (**-2Z-N** bzw. **-2Z-NR**) lieferbar.

Weitere Ausführungen sind im Rahmen des **NKE** Bedarfsprogramms gleichfalls lieferbar. Diese Typen bitten wir bei uns anzufragen.

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring

Standards, Boundary Dimensions

Single row deep groove ball bearings	DIN 625
Snap ring grooves	DIN 616
Snap rings	DIN 5417

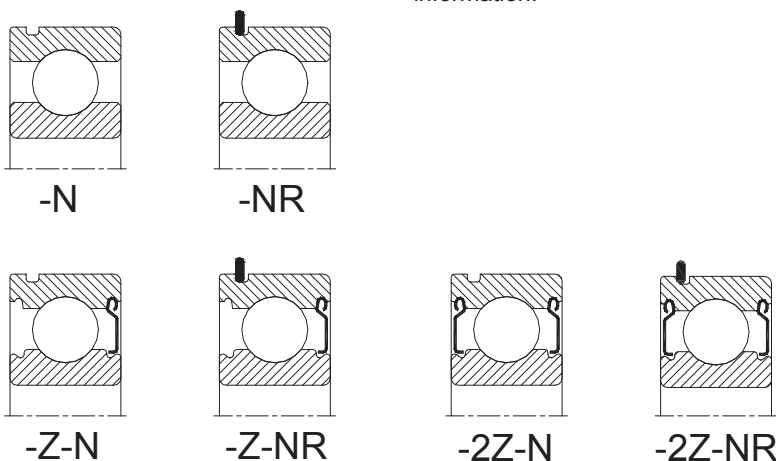
General

Deep groove ball bearings with snap ring grooves fitted provide a fast and economic axial location of bearings in their housing seats.

NKE produces several variants as part of the standard product range (see examples below). Bearings with the groove machined in the outer, (suffix **N**), form the base design. They are also available with a snap ring already fitted in this groove, i.e. suffix **NR**.

There are also deep groove ball bearings with snap ring groove features with shields fitted to either one face (i.e. suffixes **-Z-N** or **-Z-NR**) or both faces (i.e. suffixes **-2Z-N** or **-2Z-NR**)

Other variations are available within the **NKE special products range**; please contact the technical or commercial department for more information.



Sprengringe

Sprengringe bestehen zumeist aus Federstahl mit einer Härte von 450 bis 520 HV.

Sprengringe gehören zum NKE Zubehörprogramm und sind daher auch separat erhältlich.

Anschlussmaße

Neben den für Rillenkugellager üblichen Gestaltungsrichtlinien für Umgebungsteile nach **DIN 5418** (siehe Seite **383**) sind auch die in den Tabellen auf den **Seiten 420 und 421** angegebenen Maße bei der Dimensionierung der Anschlußteile zu berücksichtigen.

Weiters ist zu beachten, dass die Kantenverrundung am Außenring auf der Nutseite (**$r_{\min} = 0,5$ für alle Größen**) kleiner ist als bei Lagern ohne Sprengringnut.

Um ein Anliegen dieser Kantenverrundung an der Hohlkehlen des Gehäuses zu vermeiden, dürfen die **Hohlkehlenradien** (r_g) folgende Maße nicht überschreiten:

bei Lagern der Reihe **60**:

bis einschließlich **6007-N**: $r_g \leq 0,3$ mm
ab **6008-N**: $r_g \leq 0,5$ mm

bei Lagern der Reihe **62, 63 und 64**

für alle Lager: $r_g \leq 0,5$ mm

Snap Rings

Snap rings are usually made from spring steel with a hardness of 450 to 520 HV.

Snap rings are part of the NKE accessories product range which can be ordered separately.

Abutment and Fillet Dimensions

In addition to the values shown in the tables on pages 420 and 421, it is necessary at the design stage to consider the recommendations as defined in DIN 5418 (see table page **383**) for the design of adjacent parts.

Furthermore it is stated that the corner radius (**$r_{\min} = 0,5$ for all sizes**) is smaller, (when compared to normal bearings), on the side of the outer ring where the snap ring groove is located.

To prevent the bearing radius contacting the adjacent parts corner fillet clearance the shoulder corner fillet radius of the housing (r_g) must not exceed the following dimensions:

for bearings of series **60**:

up to type **6007-N**: $r_g \leq 0,3$ mm
from type **6008-N**: $r_g \leq 0,5$ mm

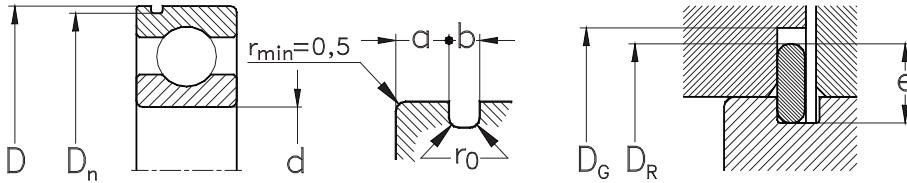
for bearings of the series **62, 63 and 64**

for all bearings: $r_g \leq 0,5$ mm

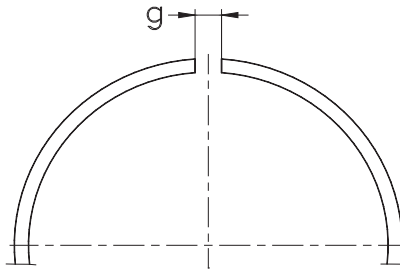
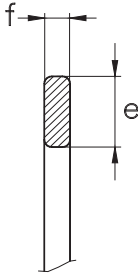
Einreihige Rillenkugellager mit Ringnut und Sprengring
Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



Alle Abmessungen in [mm]
All Dimensions are in [mm]



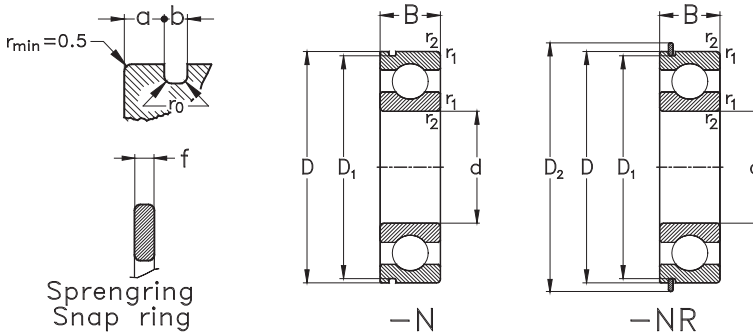
Basistype Base type Lagerreihe Bearing series				D	D _n		a Lagerreihe Bearing series				b		r ₀
60	62	63	64		min.	max.	60	62, 63, 64	max.	min.	min.	max.	max.
--	6200-N	--	--	30	27,92	28,17	--	--	1,91	2,06	1,35	1,65	0,4
6002-N	6201-N	--	--	32	29,90	30,15	1,91	2,06	1,91	2,06	1,35	1,65	0,4
6003-N	6202-N	6300-N	--	35	32,92	33,17	1,91	2,06	1,91	2,06	1,35	1,65	0,4
--	--	6301-N	--	37	34,52	34,77	--	--	1,91	2,06	1,35	1,65	0,4
--	6203-N	--	--	40	37,85	38,10	--	--	1,91	2,06	1,35	1,65	0,4
6004-N	--	6302-N	--	42	39,50	39,75	1,9	2,06	1,91	2,06	1,35	1,65	0,4
60/22-N	--	--	--	44	41,50	41,75	1,9	2,06	--	--	1,35	1,65	0,4
6005-N	6204-N	6303-N	--	47	44,35	44,60	1,9	2,06	2,31	2,46	1,35	1,65	0,4
--	62/22-N	--	--	50	47,35	47,60	--	--	2,31	2,46	1,35	1,65	0,4
60/28-N	6205-N	6304-N	6402-N	52	49,48	49,73	1,91	2,06	2,31	2,46	1,35	1,65	0,4
6006-N	--	--	--	55	52,35	52,60	1,91	2,06	--	--	1,35	1,65	0,4
--	--	63/22-N	--	56	53,35	53,60	--	--	2,31	2,46	1,35	1,65	0,4
60/32-N	62/28-N	--	--	58	55,35	55,60	1,88	2,06	2,31	2,46	1,35	1,65	0,4
6007-N	6206-N	6305-N	6403-N	62	59,11	59,61	1,86	2,06	3,08	3,28	1,9	2,2	0,6
--	62/32-N	--	--	65	62,10	62,60	--	--	3,07	3,28	1,9	2,2	0,6
6008-N	--	63/28-N	--	68	64,32	64,82	2,29	2,49	3,08	3,28	1,9	2,2	0,6
--	6207-N	6306-N	6404-N	72	68,31	68,81	--	--	3,08	3,28	1,9	2,2	0,6
6009-N	--	63/32-N	--	75	71,33	71,83	2,29	2,49	3,08	3,28	1,9	2,2	0,6
6010-N	6208-N	6307-N	6405-N	80	76,31	76,81	2,29	2,49	3,08	3,28	1,9	2,2	0,6
--	6209-N	--	--	85	81,31	81,81	--	--	3,08	3,28	1,9	2,2	0,6
6011-N	6210-N	6308-N	6406-N	90	86,29	86,79	2,67	2,87	3,08	3,28	2,7	3	0,6
6012-N	--	--	--	95	91,32	91,82	2,67	2,87	--	--	2,7	3	0,6
6013-N	6211-N	6309-N	6407-N	100	96,30	96,80	2,67	2,87	3,08	3,28	2,7	3	0,6
6014-N	6212-N	6310-N	6408-N	110	106,31	106,81	2,67	2,87	3,08	3,28	2,7	3	0,6
6015-N	--	--	--	115	111,31	111,81	2,67	2,87	--	--	2,7	3	0,6
--	6213-N	6311-N	6409-N	120	114,71	115,21	--	--	3,86	4,06	3,1	3,4	0,6
6016-N	6214-N	--	--	125	119,72	120,22	2,67	2,87	3,86	4,06	3,1	3,4	0,6
6017-N	6215-N	6312-N	6410-N	130	124,72	125,22	2,67	2,87	3,86	4,06	3,1	3,4	0,6
6018-N	6216-N	6313-N	6411-N	140	134,73	135,23	3,46	3,71	4,65	4,9	3,1	3,4	0,6
6019-N	--	--	--	145	139,73	140,23	3,44	3,71	--	--	3,1	3,4	0,6
6020-N	6217-N	6314-N	6413-N	150	144,74	145,24	3,46	3,71	4,65	4,9	3,1	3,4	0,6
6021-N	6218-N	6315-N	6413-N	160	154,72	155,22	3,46	3,71	4,65	4,9	3,1	3,4	0,6
6022-N	6219-N	6316-N	--	170	163,15	163,65	3,46	3,71	5,44	5,69	3,5	3,8	0,6
6024-N	6220-N	6317-N	6414-N	180	173,16	173,66	3,45	3,71	5,44	5,69	3,5	3,8	0,6
--	6221-N	6318-N	6415-N	190	183,13	183,64	--	--	5,44	5,69	3,5	3,8	0,6
6026-N	6222-N	6319-N	6416-N	200	193,15	193,65	5,44	5,69	5,44	5,69	3,5	3,8	0,6



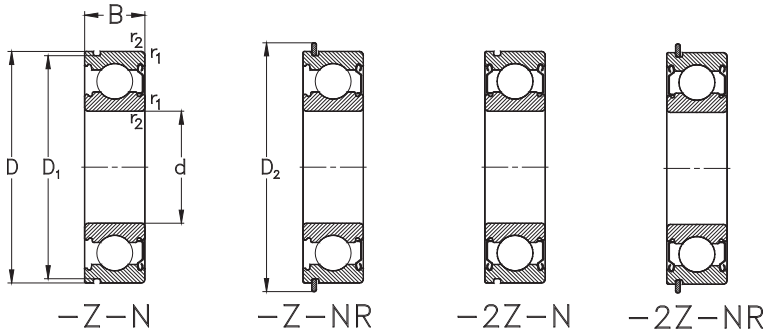
D	Sprengring								
	Bezeichnung	f		e		g	D _R	D _G	
		Designation	min.	max.	min				max.
30	SP 30	1,02	1,12	3,1	3,25	3	34,7	35,5	
32	SP 32	1,02	1,12	3,1	3,25	3	36,7	37,5	
35	SP 35	1,02	1,12	3,1	3,25	3	39,7	40,5	
37	SP 37	1,02	1,12	3,1	3,25	3	41,3	42	
40	SP 40	1,02	1,12	3,1	3,25	3	44,6	45,5	
42	SP 42	1,02	1,12	3,1	3,25	3	46,3	47	
44	SP 44	1,02	1,12	3,1	4,04	3	48,3	49	
47	SP 47	1,02	1,12	3,89	4,04	4	52,7	53,5	
50	SP 50	1,02	1,12	3,89	4,04	4	55,7	56,5	
52	SP 52	1,02	1,12	3,89	4,04	4	57,9	58,5	
55	SP 55	1,02	1,12	3,89	4,04	4	60,7	61,5	
56	SP 56	1,02	1,12	3,89	4,04	4	61,7	62,5	
58	SP 58	1,02	1,12	3,89	4,04	4	63,7	64,5	
62	SP 62	1,60	1,70	3,89	4,04	4	67,7	68,5	
65	SP 65	1,60	1,70	3,89	4,04	4	70,7	71,5	
68	SP 68	1,60	1,70	4,7	4,85	5	74,6	76	
72	SP 72	1,60	1,70	4,7	4,85	5	78,6	80	
75	SP 75	1,60	1,70	4,7	4,85	5	81,6	83	
80	SP 80	1,60	1,70	4,7	4,85	5	86,6	88	
85	SP 85	1,60	1,70	4,7	4,85	5	91,6	93	
90	SP 90	2,36	2,46	4,7	4,85	5	96,6	98	
95	SP 95	2,36	2,46	4,7	4,85	5	101,6	103	
100	SP 100	2,36	2,46	4,7	4,85	5	106,5	108	
110	SP 110	2,36	2,46	4,7	4,85	5	116,6	118	
115	SP 115	2,36	2,46	4,7	4,85	5	121,6	123	
120	SP 120	2,72	2,82	7,06	7,21	7	129,7	131,5	
125	SP 125	2,72	2,82	7,06	7,21	7	134,7	126,5	
130	SP 130	2,72	2,82	7,06	7,21	7	139,7	141,5	
140	SP 140	2,72	2,82	7,06	7,21	7	154,7	157	
145	SP 145	2,72	2,82	7,06	7,21	7	154,7	157	
150	SP 150	2,72	2,82	7,06	7,21	7	159,7	162	
160	SP 160	2,72	2,82	7,06	7,21	7	169,7	172	
170	SP 170	3	3,1	9,45	9,6	10	182,9	185	
180	SP 180	3	3,1	9,45	9,6	10	192,9	195	
190	SP 190	3	3,1	9,45	9,6	10	202,9	205	
200	SP 200	3	3,1	9,45	9,6	10	212,9	215	

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



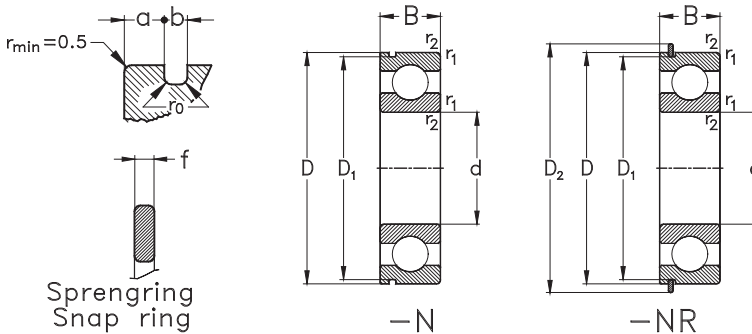
Hauptabmessungen [mm]				Lagertypen		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
10	30	9	0,6	6200-N	6200-NR	5,1	2,4	0,1	23500	40000
	30	9	0,6	6200-Z-N	6200-Z-NR	5,1	2,4	0,1	–	26000
	30	9	0,6	6200-2Z-N	6200-2Z-NR	5,1	2,4	0,1	–	26000
12	32	10	0,6	6201-N	6201-NR	6,8	3,1	0,1	22200	32000
	32	10	0,6	6201-Z-N	6201-Z-NR	6,8	3,1	0,1	–	24000
	32	10	0,6	6201-2Z-N	6201-2Z-NR	6,8	3,1	0,1	–	24000
15	35	11	0,6	6202-N	6202-NR	7,6	3,7	0,2	20200	28000
	35	11	0,6	6202-Z-N	6202-Z-NR	7,6	3,7	0,2	–	20000
	35	11	0,6	6202-2Z-N	6202-2Z-NR	7,6	3,7	0,2	–	20000
17	40	12	0,6	6203-N	6203-NR	9,6	4,8	0,2	18100	24000
	40	12	0,6	6203-Z-N	6203-Z-NR	9,6	4,8	0,2	–	24000
	40	12	0,6	6203-2Z-N	6203-2Z-NR	9,6	4,8	0,2	–	24000
20	42	12	0,6	6004-N	6004-NR	9,4	5	0,2	18300	24000
	42	12	0,6	6004-Z-N	6004-Z-NR	9,4	5	0,2	–	24000
	42	12	0,6	6004-2Z-N	6004-2Z-NR	9,4	5	0,2	–	24000
17	47	14	1	6303-N	6303-NR	13,6	6,6	0,3	15900	22000
	47	14	1	6303-Z-N	6303-Z-NR	13,6	6,6	0,3	–	22000
	47	14	1	6303-2Z-N	6303-2Z-NR	13,6	6,6	0,3	–	22000
20	47	14	1	6204-N	6204-NR	12,8	6,7	0,3	16300	20000
	47	14	1	6204-Z-N	6204-Z-NR	12,8	6,7	0,3	–	20000
	47	14	1	6204-2Z-N	6204-2Z-NR	12,8	6,7	0,3	–	20000
20	52	15	1,1	6304-N	6304-NR	15,9	7,9	0,4	14400	19000



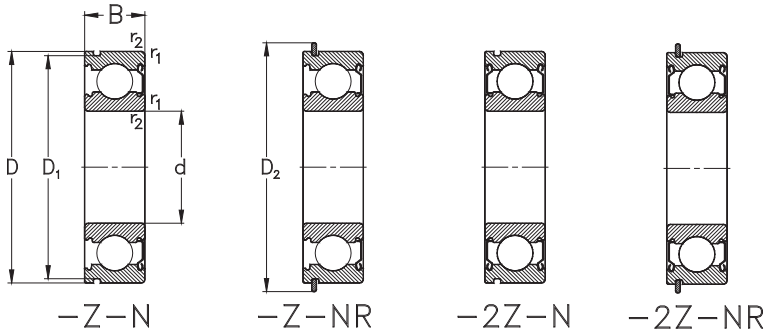
Sprengring								Gewicht
Snap Ring								[kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
10	SP30	28,17	34,7	1,35	1,12	2,06	0,4	0,03
	SP30	28,17	34,7	1,35	1,12	2,06	0,4	0,03
	SP30	28,17	34,7	1,35	1,12	2,06	0,4	0,03
12	SP32	30,15	36,7	1,35	1,12	2,06	0,4	0,04
	SP32	30,15	36,7	1,35	1,12	2,06	0,4	0,04
	SP32	30,15	36,7	1,35	1,12	2,06	0,4	0,04
15	SP35	33,17	39,7	1,35	1,12	2,06	0,4	0,043
	SP35	33,17	39,7	1,35	1,12	2,06	0,4	0,043
	SP35	33,17	39,7	1,35	1,12	2,06	0,4	0,043
17	SP40	38,1	44,6	1,35	1,12	2,06	0,4	0,063
	SP40	38,1	44,6	1,35	1,12	2,06	0,4	0,063
	SP40	38,1	44,6	1,35	1,12	2,06	0,4	0,063
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,11
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,11
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,11
20	SP42	39,75	46,3	1,35	1,12	2,06	0,4	0,065
	SP42	39,75	46,3	1,35	1,12	2,06	0,4	0,065
	SP42	39,75	46,3	1,35	1,12	2,06	0,4	0,065
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,105
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,105
	SP47	44,6	52,7	1,35	1,12	2,46	0,4	0,105
	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,148

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



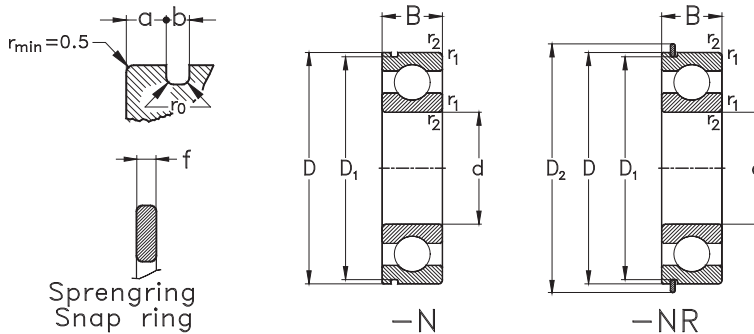
Hauptabmessungen [mm]				Lagertyp		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
20	52	15	1,1	6304-Z-N	6304-Z-NR	15,9	7,9	0,4	–	14000
	52	15	1,1	6304-2Z-N	6304-2Z-NR	15,9	7,9	0,4	–	14000
25	47	12	0,6	6005-N	6005-NR	10,1	5,9	0,3	15300	20000
	47	12	0,6	6005-Z-N	6005-Z-NR	10,1	5,9	0,3	–	15000
	47	12	0,6	6005-2Z-N	6005-2Z-NR	10,1	5,9	0,3	–	15000
52	15	1	6205-N	6205-NR	14	7,9	0,4	14400	18000	
	15	1	6205-Z-N	6205-Z-NR	14	7,9	0,4	–	14000	
	15	1	6205-2Z-N	6205-2Z-NR	14	7,9	0,4	–	14000	
62	17	1,1	6305-N	6305-NR	22,4	11,5	0,5	12300	16000	
	17	1,1	6305-Z-N	6305-Z-NR	22,4	11,5	0,5	–	11000	
	17	1,1	6305-2Z-N	6305-2Z-NR	22,4	11,5	0,5	–	11000	
30	55	13	1	6006-N	6006-NR	13,2	8,3	0,4	13100	17000
	55	13	1	6006-Z-N	6006-Z-NR	13,2	8,3	0,4	–	13000
	55	13	1	6006-2Z-N	6006-2Z-NR	13,2	8,3	0,4	–	13000
62	16	1	6206-N	6206-NR	19,5	11,3	0,5	12000	15000	
	16	1	6206-Z-N	6206-Z-NR	19,5	11,3	0,5	–	11000	
	16	1	6206-2Z-N	6206-2Z-NR	19,5	11,3	0,5	–	11000	
72	19	1,1	6306-N	6306-NR	27	15,2	0,7	10800	13000	
	19	1,1	6306-Z-N	6306-Z-NR	27	15,2	0,7	–	9500	
	19	1,1	6306-2Z-N	6306-2Z-NR	27	15,2	0,7	–	9500	
35	62	14	1	6007-N	6007-NR	16,2	10,4	0,5	11600	15000
	62	14	1	6007-Z-N	6007-Z-NR	16,2	10,4	0,5	–	11000



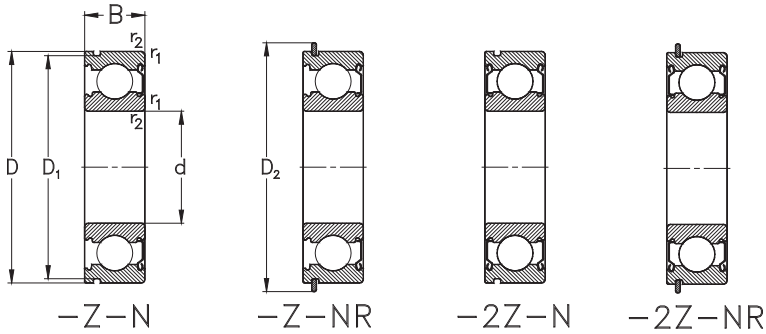
Sprengring								Gewicht [kg]
Snap Ring								Weight [kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
20	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,148
	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,148
25	SP47	44,6	52,7	1,35	1,12	2,06	0,4	0,08
	SP47	44,6	52,7	1,35	1,12	2,06	0,4	0,08
	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,125
	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,125
	SP52	49,73	57,9	1,35	1,12	2,46	0,4	0,125
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,232
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,232
30	SP55	52,6	60,7	1,35	1,12	2,06	0,4	0,115
	SP55	52,6	60,7	1,35	1,12	2,06	0,4	0,115
	SP55	52,6	60,7	1,35	1,12	2,06	0,4	0,115
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,192
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,192
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,192
	SP72	68,81	78,6	1,9	1,7	3,28	0,6	0,348
	SP72	68,81	78,6	1,9	1,7	3,28	0,6	0,348
35	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,151
	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,151

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



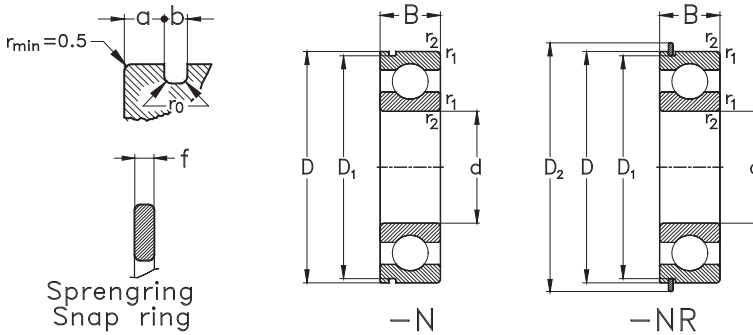
Hauptabmessungen [mm]				Lagertypen		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
35	62	14	1	6007-ZZ-N	6007-ZZ-NR	16,2	10,4	0,5	–	11000
	72	17	1,1	6207-N	6207-NR	25,7	15,3	0,7	10300	13000
	72	17	1,1	6207-Z-N	6207-Z-NR	25,7	15,3	0,7	–	9500
	72	17	1,1	6207-ZZ-N	6207-ZZ-NR	25,7	15,3	0,7	–	9500
	80	21	1,5	6307-N	6307-NR	33,4	19,2	0,9	9900	12000
	80	21	1,5	6307-Z-N	6307-Z-NR	33,4	19,2	0,9	–	8500
	80	21	1,5	6307-ZZ-N	6307-ZZ-NR	33,4	19,2	0,9	–	8500
40	100	25	1,5	6407-N	6407-NR	57	30,1	1,4	9000	10000
	68	15	1	6008-N	6008-NR	17	11,7	0,5	10700	14000
	68	15	1	6008-Z-N	6008-Z-NR	17	11,7	0,5	–	10000
	68	15	1	6008-ZZ-N	6008-ZZ-NR	17	11,7	0,5	–	10000
	80	18	1,1	6208-N	6208-NR	29,5	18,2	0,8	9300	11000
	80	18	1,1	6208-Z-N	6208-Z-NR	29,5	18,2	0,8	–	8500
	80	18	1,1	6208-ZZ-N	6208-ZZ-NR	29,5	18,2	0,8	–	8500
	90	23	1,5	6308-N	6308-NR	40,8	24	1,1	9000	11000
	90	23	1,5	6308-Z-N	6308-Z-NR	40,8	24	1,1	–	7500
90	23	1,5	6308-ZZ-N	6308-ZZ-NR	40,8	24	1,1	–	7500	
45	110	27	2	6408-N	6408-NR	66	37,7	1,7	8200	9000
	75	16	1	6009-N	6009-NR	21,1	14,8	0,7	9800	12000
	75	16	1	6009-Z-N	6009-Z-NR	21,1	14,8	0,7	–	9000
	75	16	1	6009-ZZ-N	6009-ZZ-NR	21,1	14,8	0,7	–	9000
	85	19	1,1	6209-N	6209-NR	31,7	20,7	0,9	8700	11000



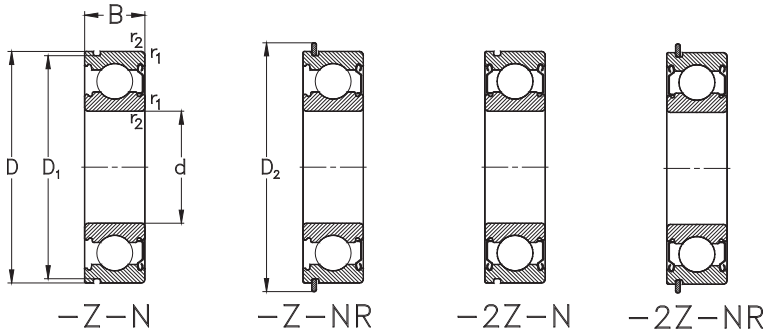
Sprengring								Gewicht [kg]
Snap Ring								Weight [kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
35	SP62	59,61	67,7	1,9	1,7	3,28	0,6	0,151
	SP72	68,81	78,6	1,9	1,7	3,28	0,6	0,288
	SP72	68,81	78,6	1,9	1,7	3,28	0,6	0,288
	SP72	68,81	78,6	1,9	1,7	3,28	0,6	0,288
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,458
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,458
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,458
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,928
40	SP68	64,82	74,6	1,9	1,7	3,28	0,6	0,188
	SP68	64,82	74,6	1,9	1,7	3,28	0,6	0,188
	SP68	64,82	74,6	1,9	1,7	3,28	0,6	0,188
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,366
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,366
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,366
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,632
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,632
45	SP75	71,83	81,6	1,9	1,7	3,28	0,6	0,231
	SP75	71,83	81,6	1,9	1,7	3,28	0,6	0,231
	SP75	71,83	81,6	1,9	1,7	3,28	0,6	0,231
	SP85	81,81	91,6	1,9	1,7	3,28	0,6	0,405

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



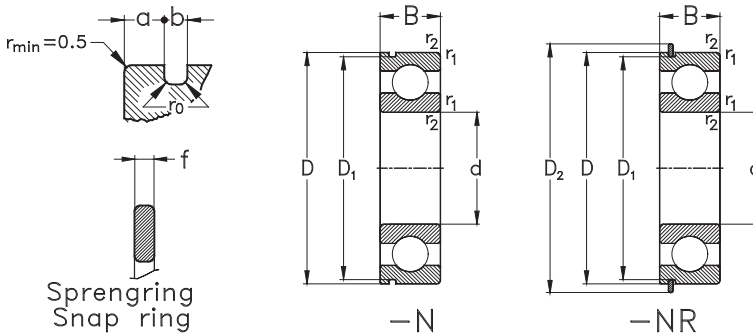
Hauptabmessungen [mm]				Lagertyp		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
45	85	19	1,1	6209-Z-N	6209-Z-NR	31,7	20,7	0,9	–	8000
	85	19	1,1	6209-2Z-N	6209-2Z-NR	31,7	20,7	0,9	–	8000
	100	25	1,5	6309-N	6309-NR	53	31,9	1,5	8300	9500
	100	25	1,5	6309-Z-N	6309-Z-NR	53	31,9	1,5	–	6700
	100	25	1,5	6309-2Z-N	6309-2Z-NR	53	31,9	1,5	–	6700
120	29	2	6409-N	6409-NR	78	45,4	2,1	7600	8500	
50	80	16	1	6010-N	6010-NR	21,8	16,6	0,8	8900	11000
	80	16	1	6010-Z-N	6010-Z-NR	21,8	16,6	0,8	–	8500
	80	16	1	6010-2Z-N	6010-2Z-NR	21,8	16,6	0,8	–	8500
	90	20	1,1	6210-N	6210-NR	35,1	23,2	1,1	8200	10000
	90	20	1,1	6210-Z-N	6210-Z-NR	35,1	23,2	1,1	–	7500
	90	20	1,1	6210-2Z-N	6210-2Z-NR	35,1	23,2	1,1	–	7500
	110	27	2	6310-N	6310-NR	62	38	1,7	7700	8500
	110	27	2	6310-Z-N	6310-Z-NR	62	38	1,7	–	6000
	110	27	2	6310-2Z-N	6310-2Z-NR	62	38	1,7	–	6000
130	31	2,1	6410-N	6410-NR	92	55	2,5	7100	7500	
55	90	18	1,1	6011-N	6011-NR	28,2	21,3	1	8300	10000
	90	18	1,1	6011-Z-N	6011-Z-NR	28,2	21,3	1	–	7500
	90	18	1,1	6011-2Z-N	6011-2Z-NR	28,2	21,3	1	–	7500
	100	21	1,5	6211-N	6211-NR	43,4	29,2	1,3	7500	9000
	100	21	1,5	6211-Z-N	6211-Z-NR	43,4	29,2	1,3	–	6700
	100	21	1,5	6211-2Z-N	6211-2Z-NR	43,4	29,2	1,3	–	6700



Sprengring								Gewicht [kg]
Snap Ring								Weight [kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
45	SP85	81,81	91,6	1,9	1,7	3,28	0,6	0,405
	SP85	81,81	91,6	1,9	1,7	3,28	0,6	0,405
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,848
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,848
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,848
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	1,51
50	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,261
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,261
	SP80	76,81	86,6	1,9	1,7	3,28	0,6	0,261
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,453
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,453
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,453
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	1,1
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	1,1
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	1,1
55	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,83
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,311
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,311
	SP90	86,79	96,5	2,7	2,46	3,28	0,6	0,311
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,607
	SP100	96,8	106,5	2,7	2,46	3,28	0,6	0,607

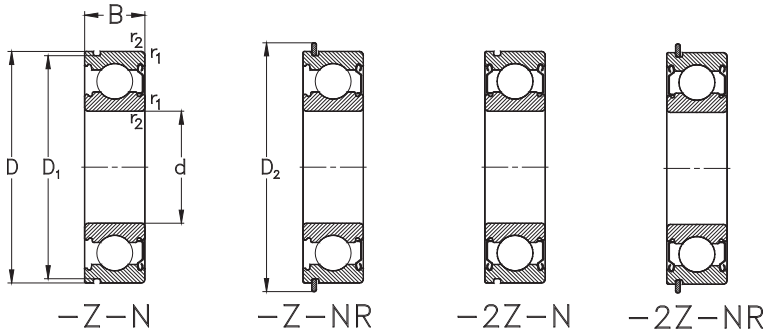
Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



Hauptabmessungen [mm]				Lagertyp		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
55	120	29	2	6311-N	6311-NR	72	44,8	2	7200	8000
	120	29	2	6311-Z-N	6311-Z-NR	72	44,8	2	–	5300
	120	29	2	6311-2Z-N	6311-2Z-NR	72	44,8	2	–	5300
	140	33	2,1	6411-N	6411-NR	101	63	2,8	6700	7000
60	95	18	1,1	6012-N	6012-NR	29,4	23,2	1,1	7700	9500
	95	18	1,1	6012-Z-N	6012-Z-NR	29,4	23,2	1,1	–	7000
	95	18	1,1	6012-2Z-N	6012-2Z-NR	29,4	23,2	1,1	–	7000
	110	22	1,5	6212-N	6212-NR	47,7	33	1,5	6900	8000
	110	22	1,5	6212-Z-N	6212-Z-NR	47,7	33	1,5	–	6000
	110	22	1,5	6212-2Z-N	6212-2Z-NR	47,7	33	1,5	–	6000
	130	31	2,1	6312-N	6312-NR	82	51,9	2,4	6800	7000
	130	31	2,1	6312-Z-N	6312-Z-NR	82	52	2,4	–	5000
	130	31	2,1	6312-2Z-N	6312-2Z-NR	82	52	2,4	–	5000
65	150	35	2,1	6412-N	6412-NR	109	70	3,1	6400	6300
	100	18	1,1	6013-N	6013-NR	30,5	25,2	1,1	7100	9000
	100	18	1,1	6013-Z-N	6013-Z-NR	30,5	25,2	1,1	–	6300
	100	18	1,1	6013-2Z-N	6013-2Z-NR	30,5	25,2	1,1	–	6300
	120	23	1,5	6213-N	6213-NR	57	40	1,8	6400	7500
	120	23	1,5	6213-Z-N	6213-Z-NR	57	40	1,8	–	5300
	120	23	1,5	6213-2Z-N	6213-2Z-NR	57	40	1,8	–	5300
	140	33	2,1	6313-N	6313-NR	93	60	2,7	6400	6700
140	33	2,1	6313-Z-N	6313-Z-NR	93	60	2,7	–	4500	

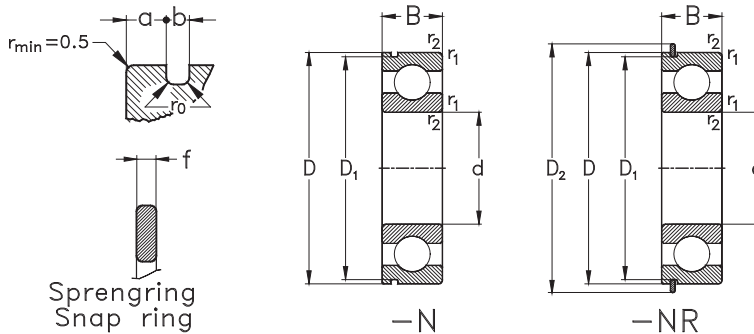
Einreihige Rillenkugellager mit Ringnut und Sprengring Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



Sprengring Snap Ring								Gewicht [kg] Weight [kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
55	SP120	115,21	129,7	3,1	2,82	4,06	0,6	1,39
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	1,39
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	1,39
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	2,4
60	SP95	91,82	101,6	2,7	2,46	2,87	0,6	0,41
	SP95	91,82	101,6	2,7	2,46	2,87	0,6	0,41
	SP95	91,82	101,6	2,7	2,46	2,87	0,6	0,41
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,783
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,783
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,783
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,72
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,72
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,72
65	SP150	145,24	159,7	3,1	2,82	4,9	0,6	2,9
	SP100	96,8	106,5	2,7	2,46	2,87	0,6	0,436
	SP100	96,8	106,5	2,7	2,46	2,87	0,6	0,436
	SP100	96,8	106,5	2,7	2,46	2,87	0,6	0,436
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	0,982
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	0,982
	SP120	115,21	129,7	3,1	2,82	4,06	0,6	0,982
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	2,13
SP140	135,23	149,7	3,1	2,82	4,9	0,6	2,13	

Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring

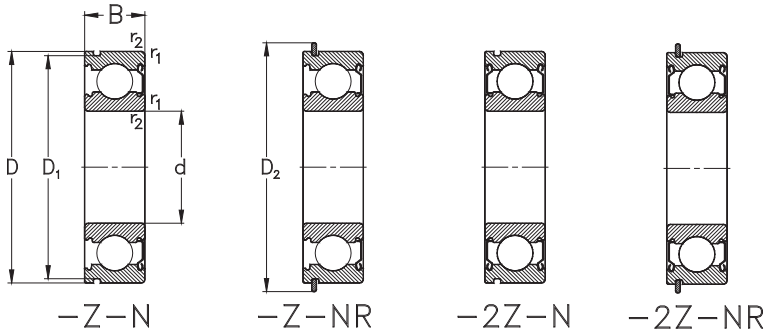


Sprengring
Snap ring

-N

-NR

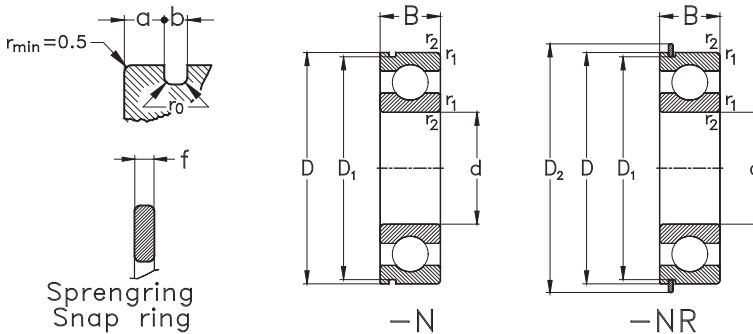
Hauptabmessungen [mm]				Lagertyp		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
65	140	33	2,1	6313-ZZ-N	6313-ZZ-NR	93	60	2,7	–	4500
	160	37	2,1	6413-N	6413-NR	118	79	3,4	6100	6000
70	110	20	1,1	6014-N	6014-NR	38	30,9	1,4	6800	8000
	110	20	1,1	6014-Z-N	6014-Z-NR	38	30,9	1,4	–	6000
	110	20	1,1	6014-ZZ-N	6014-ZZ-NR	38	30,9	1,4	–	6000
	125	24	1,5	6214-N	6214-NR	61	45,1	2,1	6100	7000
	125	24	1,5	6214-Z-N	6214-Z-NR	61	45,1	2,1	–	5000
	125	24	1,5	6214-ZZ-N	6214-ZZ-NR	61	45,1	2,1	–	5000
	150	35	2,1	6314-N	6314-NR	104	68	3	6100	6300
	150	35	2,1	6314-Z-N	6314-Z-NR	104	68	3	–	4300
75	150	35	2,1	6314-ZZ-N	6314-ZZ-NR	104	68	3	–	4300
	115	20	1,1	6015-N	6015-NR	39,5	33,5	1,5	6400	7500
	115	20	1,1	6015-Z-N	6015-Z-NR	39,5	33,5	1,5	–	5600
	115	20	1,1	6015-ZZ-N	6015-ZZ-NR	39,5	33,5	1,5	–	5600
	130	25	1,5	6215-N	6215-NR	66	49,5	2,2	5900	6700
	130	25	1,5	6215-Z-N	6215-Z-NR	66	49,5	2,2	–	4800
	130	25	1,5	6215-ZZ-N	6215-ZZ-NR	66	49,5	2,2	–	4800
	160	37	2,1	6315-N	6315-NR	114	77	3,2	6300	5600
80	160	37	2,1	6315-Z-N	6315-Z-NR	114	77	3,2	–	4000
	160	37	2,1	6315-ZZ-N	6315-ZZ-NR	114	77	3,2	–	4000
	125	22	1,1	6016-N	6016-NR	51	42	1,9	6100	7000
125	22	1,1	6016-Z-N	6016-Z-NR	51	42	1,9	–	5000	



Sprengring								Gewicht
Snap Ring								[kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
65	SP140	135,23	149,7	3,1	2,82	4,9	0,6	2,13
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	3,49
70	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,604
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,604
	SP110	106,81	116,6	2,7	2,46	3,28	0,6	0,604
	SP125	120,22	134,7	3,1	2,82	4,06	0,6	1,08
	SP125	120,22	134,7	3,1	2,82	4,06	0,6	1,08
	SP125	120,22	134,7	3,1	2,82	4,06	0,6	1,08
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	2,63
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	2,63
70	SP150	145,24	159,7	3,1	2,82	4,9	0,6	2,63
75	SP115	111,81	121,6	2,7	2,46	2,87	0,6	0,643
	SP115	111,81	121,6	2,7	2,46	2,87	0,6	0,643
	SP115	111,81	121,6	2,7	2,46	2,87	0,6	0,643
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,21
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,21
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	1,21
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	3,12
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	3,12
80	SP125	120,22	134,7	3,1	2,82	4,06	0,6	0,85
	SP125	120,22	134,7	3,1	2,82	4,06	0,6	0,85

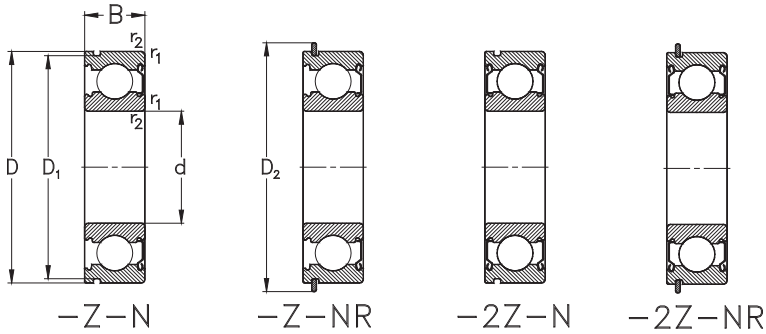
Einreihige Rillenkugellager mit Ringnut und Sprengring

Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



Sprengring
Snap ring

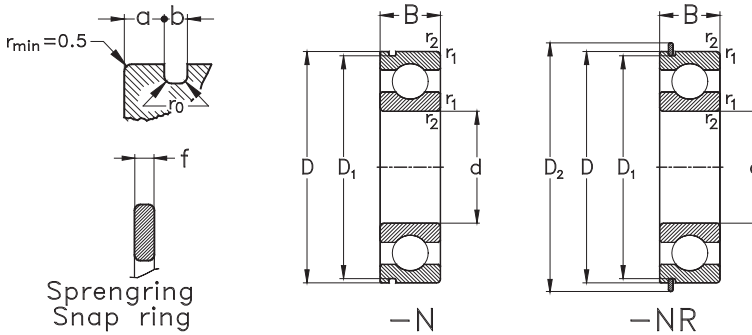
Hauptabmessungen [mm]				Lagertypen		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
80	125	22	1,1	6016-ZZ-N	6016-ZZ-NR	51	42	1,9	–	5000
	140	26	2	6216-N	6216-NR	72	54	2,3	5500	6000
	140	26	2	6216-Z-N	6216-Z-NR	72	54	2,3	–	4500
	140	26	2	6216-ZZ-N	6216-ZZ-NR	72	54	2,3	–	4500
85	130	22	1,1	6017-N	6017-NR	53	45,6	2	5800	6700
	130	22	1,1	6017-Z-N	6017-Z-NR	53	45,6	2	–	4800
	130	22	1,1	6017-ZZ-N	6017-ZZ-NR	53	45,6	2	–	4800
	150	28	2	6217-N	6217-NR	84	62	2,6	5300	5600
	150	28	2	6217-Z-N	6217-Z-NR	84	62	2,6	–	4300
	150	28	2	6217-ZZ-N	6217-ZZ-NR	84	62	2,6	–	4300
90	140	24	1,5	6018-N	6018-NR	58	50	2,1	5600	6300
	140	24	1,5	6018-Z-N	6018-Z-NR	58	50	2,1	–	4500
	140	24	1,5	6018-ZZ-N	6018-ZZ-NR	58	50	2,1	–	4500
	160	30	2	6218-N	6218-NR	96	72	2,9	5100	5300
	160	30	2	6218-Z-N	6218-Z-NR	96	72	2,9	–	3800
	160	30	2	6218-ZZ-N	6218-ZZ-NR	96	72	2,9	–	3800
95	170	32	2,1	6219-Z-N	6219-Z-NR	109	82	3,2	–	3600
	170	32	2,1	6219-ZZ-N	6219-ZZ-NR	109	82	3,2	–	3600
100	150	24	1,5	6020-N	6020-NR	60	54	2,2	5100	5600
	150	24	1,5	6020-Z-N	6020-Z-NR	60	54	2,2	–	4000
	150	24	1,5	6020-ZZ-N	6020-ZZ-NR	60	54	2,2	–	4000
	180	34	2,1	6220-Z-N	6220-Z-NR	122	93	3,6	–	3400



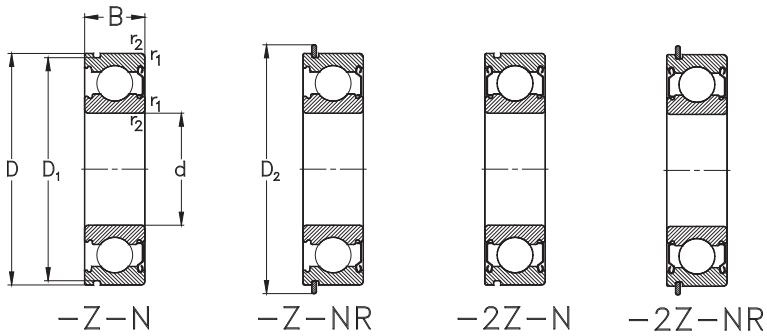
Sprengring								Gewicht
Snap Ring								[kg]
d		D ₁	D ₂ max	b	f	a	r ₀ max	m
80	SP125	120,22	134,7	3,1	2,82	4,06	0,6	0,85
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,42
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,42
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,42
85	SP130	125,22	139,7	3,1	2,82	4,06	0,6	0,895
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	0,895
	SP130	125,22	139,7	3,1	2,82	4,06	0,6	0,895
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,82
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,82
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,82
90	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,18
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,18
	SP140	135,23	149,7	3,1	2,82	4,9	0,6	1,18
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	2,2
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	2,2
	SP160	155,22	169,7	3,1	2,82	4,9	0,6	2,2
95	SP170	163,65	182,9	3,5	3,1	5,69	0,6	2,67
	SP170	163,65	182,9	3,5	3,1	5,69	0,6	2,67
100	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,26
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,26
	SP150	145,24	159,7	3,1	2,82	4,9	0,6	1,26
	SP180	173,66	192,9	3,5	3,1	5,69	0,6	3,22

Einreihige Rillenkugellager mit Ringnut und Sprengring

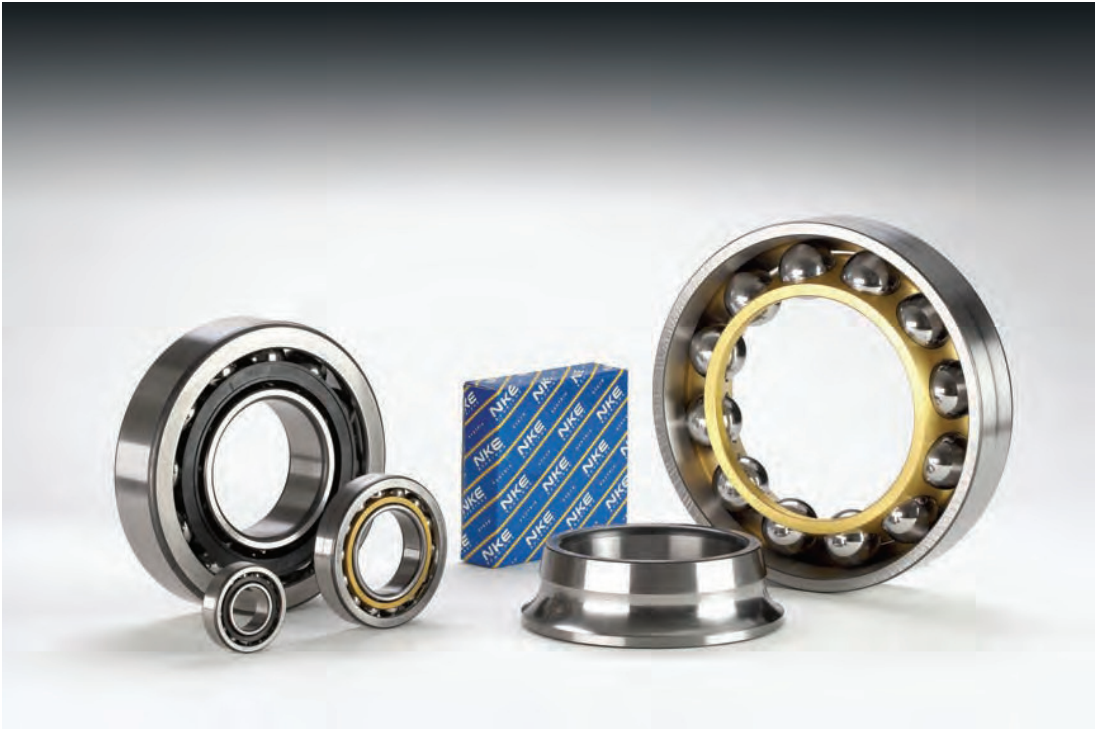
Single Row Deep Groove Ball Bearings with Snap Ring Groove and Snap Ring



Hauptabmessungen [mm]				Lagertyp		Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	N	NR	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
100	180	34	2,1	6220-ZZ-N	6220-ZZ-NR	122	93	3,6	–	3400
105	160	26	2	6021-N	6021-NR	72	66	2,6	5000	5300
	160	26	2	6021-Z-N	6021-Z-NR	72	66	2,6	–	3800
	160	26	2	6021-ZZ-N	6021-ZZ-NR	72	66	2,6	–	3800
110	170	28	2	6022-N	6022-NR	82	73	2,8	4800	5000
	170	28	2	6022-Z-N	6022-Z-NR	82	73	2,8	–	3600
	170	28	2	6022-ZZ-N	6022-ZZ-NR	82	73	2,8	–	3600
120	180	28	2	6024-N	6024-NR	88	80	3	4500	4800
	180	28	2	6024-Z-N	6024-Z-NR	88	80	4	–	3400
	180	28	2	6024-ZZ-N	6024-ZZ-NR	88	80	5	–	3400



d	Sprengring		D ₁	D ₂ max	b	f	a	r ₀ max	Gewicht
	Snap Ring								m
100	SP180		173,66	192,9	3,5	3,1	5,69	0,6	3,22
105	SP160		155,22	169,7	3,1	2,82	4,9	0,6	1,58
	SP160		155,22	169,7	3,1	2,82	4,9	0,6	1,58
	SP160		155,22	169,7	3,1	2,82	4,9	0,6	1,58
110	SP170		163,65	182,9	3,5	3,1	5,69	0,6	1,97
	SP170		163,65	182,9	3,5	3,1	5,69	0,6	1,97
	SP170		163,65	182,9	3,5	3,1	5,69	0,6	1,97
120	SP180		173,66	192,9	3,5	3,1	5,69	0,6	2,11
	SP180		173,66	192,9	3,5	3,1	5,69	0,6	2,11
	SP180		173,66	192,9	3,5	3,1	5,69	0,6	2,11



Schrägkugellager
Angular Contact Ball Bearings

Einreihige Schrägkugellager
Single Row Angular Contact Ball Bearings

Einreihige Schrägkugellager, in Universalausführung
Single Row Angular Contact Ball Bearings in Universal Design

Einreihige Schrägkugellager, abgedichtet
Single Row Angular Contact Ball Bearings with Seals and Shields

Zweireihige Schrägkugellager
Double Row Angular Contact Ball Bearings

Vierpunktlager
Four-Point Contact Ball Bearings

Einreihige NKE Schrägkugellager, metrische Abmessungen

Normen, Hauptabmessungen

Maßpläne	DIN 616
Ein- und zweireihige Schrägkugellager, metrischen Abmessungen	DIN 628

Allgemeines

Einreihige Schrägkugellager gehören zu den nicht zerlegbaren Radiallagern.

Einreihige Schrägkugellager sind auch für hohe Drehzahlen geeignet und nehmen Kräfte sowohl in **radialer** als auch in **axialer Richtung** auf. Sie sind aber auch zur Aufnahme kombinierter Belastungen und bei Kippmomenten gut geeignet.

Da einreihige Schrägkugellager Axialkräfte nur in einer Richtung aufnehmen können, müssen sie immer gegen ein zweites Lager angestellt werden, das die axiale Führung der Welle in die Gegenrichtung übernimmt.

Bei Schrägkugellagern werden die auf das Lager wirkenden Belastungen unter einem Winkel, dem so genannten **Druckwinkel α** , zur Mittelachse hin übertragen (siehe Abb. 1).

Je größer der Druckwinkel α wird, desto besser ist das Lager zur Aufnahme von Axialbelastungen geeignet.

Bauformen

Durch ihre universelle Verwendbarkeit werden **einreihige Schrägkugellager** in mehreren Konstruktionsvarianten gefertigt und auch mit unterschiedlichen Druckwinkeln angeboten.

Die spezifischen technischen Merkmale der einzelnen Konstruktionsvarianten werden durch entsprechende **Nachsetzeichen** identifiziert.

NKE Single Row Angular Contact Ball Bearings, Metric Dimensions

Standards, Boundary Dimensions

Standard plans	DIN 616
Single and double row angular contact ball bearings, metric dimensions	DIN 628

General

Single row angular contact ball bearings are rigid, non-separable radial bearings.

They are suitable for high-speed applications and can accommodate both radial and thrust forces including combined loads and tilting moments.

As single row angular contact ball bearings accept thrust loads in one direction only, they must be used in pairs where a bearing has to be adjusted against another to guide the shaft in the opposite direction.

Angular contact ball bearings transfer the loads acting on the bearing at a certain angle, the so called "**contact angle: α** " towards the shaft centre line (see Fig. 1).

The ability of single row angular contact ball bearings to accommodate thrust loads depends on their contact angle. The higher the angle the better the ability for accepting thrust loads.

Design Variants

Due to their universal feature **single row angular contact ball bearings** are produced in various designs and with different contact angles.

The individual technical features of the different design variants are clearly identified by suitable **suffixes**.

Druckwinkel α

NKE Schrägkugellager der Reihen **72** und **73** werden mit unterschiedlichen Druckwinkeln gefertigt.

Die einzelnen Druckwinkel werden durch Nachsetzzeichen unterschieden:

Contact Angle α

NKE single row angular contact ball bearings are produced with several different contact angles, these contact angles are identified by the following suffixes:

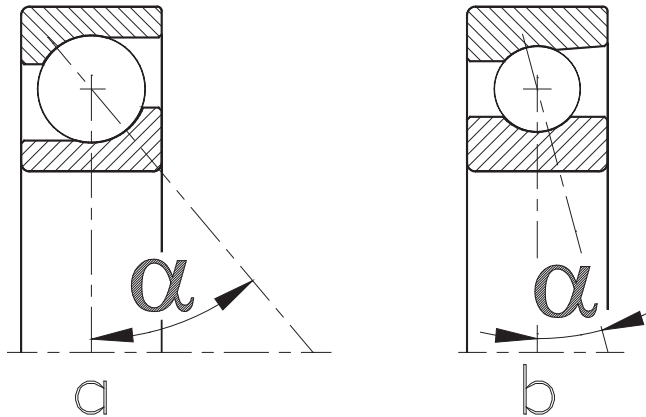


Abb. 1
Fig. 1

Nachsetzzeichen Suffix	Druckwinkel Contact angle α
A	30°
B	40°
C	15°
E	25°

Im **allgemeinen Maschinenbau** werden üblicherweise Schrägkugellager der Reihen **72** und **73** mit einem Druckwinkel von **40°** (Nachsetzzeichen **B**) verwendet.

Schrägkugellager mit anderen Druckwinkeln werden hauptsächlich zur Lagerung von Arbeitsspindeln von Werkzeugmaschinen verwendet.

Single row angular contact ball bearings of the series **72** and **73** with a contact angle of **40°** (suffix **B**) are regularly used in the general machinery industry.

Other angular contact ball bearings with different contact angles are mainly used in working spindles of machine tools.

NKE Schrägkugellager der Reihen 72 und 73 in „BE“-Ausführung

Die einreihigen **NKE Schrägkugellager** der Reihen **72** und **73** werden auch mit verstärktem Innenaufbau hergestellt, Ausführung (**BE**), siehe Abb. 2.

NKE Angular Contact Ball Bearings, Series 72 and 73 in “BE”-Design

NKE single row angular contact ball bearings, series **72** and **73** are also produced with a reinforced internal design, i.e. “**BE**”- design, see Fig. 2.

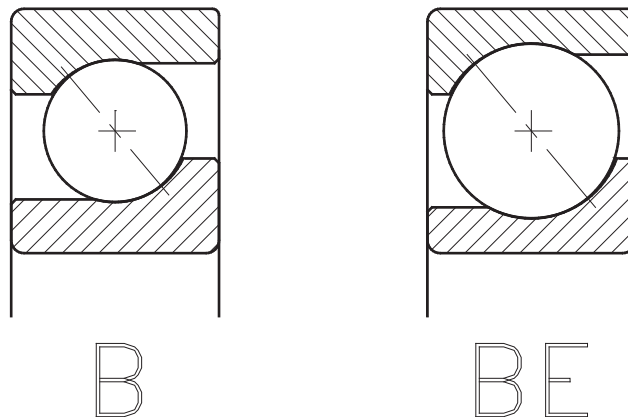


Abb. 2
Fig. 2

Durch die Verwendung größerer Kugeln bei gleichen Hauptabmessungen weisen Lager der Ausführung **BE** wesentlich höhere Tragfähigkeit als Lager der „konventionellen“ Ausführung auf.

The use of larger ball sizes in **BE**-design bearings allows for significantly higher load ratings when compared to “conventional” design bearings whilst maintaining the same overall dimensions.

Reihen 72B und 73B in Universalausführung

Einreihige Schrägkugellager werden häufig paar- oder satzweise verwendet, wobei die Lager direkt nebeneinander sitzen, siehe Seite 447.

Series 72B and 73B in Universal Design

Single row angular contact ball bearings are frequently used in pairs or sets where two or more bearings are located side by side, see page 447.

Um dabei die gewünschte Axialluft oder Vorspannung zu erhalten, müssen bereits die dafür verwendeten Einzellager sorgfältig aufeinander abgestimmt sein.

To obtain certain clearances or preloads single bearings that are used in pairs have to be matched accordingly.

Daher sind einreihige NKE Schrägkugellager der Reihen **72** und **73** mit einem Druckwinkel von **40°** sowohl in einer Ausführung zur Verwendung als **Einzellager** erhältlich (Nachsetzzeichen **B** bzw. **BE**) als auch in einer so genannten **Universalausführung**, welche einen willkürlichen paar- bzw. satzweisen Einbau dieser Lager erlaubt.

Achtung:

Schrägkugellager der Standardausführung sind für einen paar- oder satzweisen Einbau NICHT geeignet!

Lagerluft & Vorspannung

Einreihige NKE Schrägkugellager in Universalausführung sind so aufeinander abgestimmt, dass die Lagerpaare bzw. Lagersätze bei Verwendung „normaler“ Passungen eine definierte **Lagerluft**-bzw. eine definierte **Vorspannung** aufweisen.

Als „normale“ Passungen gelten :

Wellensitze <i>Shaft fits</i>	j5
Gehäusesitze <i>Housing fits</i>	J6

Lagerluft und Vorspannungsklassen

Einreihige NKE Schrägkugellager in Universalausführung werden in unterschiedlichen Lagerluft- bzw. Vorspannungsklassen hergestellt, siehe. Tabelle 1 bzw. 2.

Zur Identifikation der einzelnen Luft- bzw. Vorspannungsklassen werden folgende Nachsetzzeichen verwendet:

Die in Tabelle 2 angegebenen Werte gelten für nicht eingebaute Lagerpaare in X- oder O-Anordnung ohne Messbelastung.

For that reason NKE single row angular contact ball bearings of the series **72** and **73** featuring contact angles of **40°** are available in a variant for use as a single bearing (suffix **B** and **BE**, respectively) and in a **universal matched** variant to be used in random pairs or sets.

NOTE:

Standard design angular contact ball bearings are NOT suitable for being used as bearing pairs or sets !

Internal Clearance & Preload

NKE single row angular contact ball bearings in universal design, with normal bearing mounting fits, are matched in sets or pairs, respectively, to give a defined **axial play** or **preloading**, respectively.

The “normal” fits are:

Internal Clearance and Preload Classes

NKE single row angular contact ball bearings in universal design are produced in different internal clearance and preloading classes, see Table 1 and 2, respectively.

The individual internal clearance and preload classes are identified by following suffixes:

The values given in table 2 apply to unmounted bearing pairs arranged either back-to-back or face-to-face without external load applied.

Nachsetzzeichen Suffix		Bedeutung Meaning	
Axialluft Axial clearance	CA	geringe Axialluft <i>light axial clearance</i>	
	CB	mittlere Axialluft <i>medium axial clearance</i>	(STANDARD)
	CC	große Axialluft <i>large axial clearance</i>	
Vorspannung Preload	GA	keine / geringe Vorspannung <i>none / slight preload</i>	
	GB	mittelstarke Vorspannung <i>medium preload</i>	
	GC	starke Vorspannung <i>heavy preload</i>	

Tabelle 1
Table 1

Anmerkung:

Einreihige **NKE Schrägkugellager** der Reihen **72** und **73** in Universalausführung werden standardmäßig in Ausführung „CB“ bevorratet.

Note:

NKE single row angular contact ball bearings, Series 72 and 73 in universal design are standard stocked in “CB” design.

Für andere Ausführungen ersuchen wir die jeweilige Verfügbarkeit anzufragen.

For other design variants, please check availability.

Schiefstellung

Einreihige Schrägkugellager sind zum Ausgleich von Schiefstellungen nur sehr beschränkt geeignet.

Bei Einzellagern und Lagerpaaren in X-Anordnung mit Betriebsspiel haben unter normalen Betriebsverhältnissen Schiefstellungen von maximal 2 Winkelminuten üblicherweise noch keine negativen Auswirkungen.

Allerdings weisen Schrägkugellager, die unter Schiefstellungen laufen, erheblich höhere Laufgeräusche auf es ist auch mit einer Verringerung der Gebrauchsdauer durch die Zusatzbelastungen zu rechnen.

Lagersätze ohne Lagerluft, Lagerpaare in O- oder Tandemanordnung sowie Spindellager dürfen nicht unter Verkipfung laufen.

Misalignment

Single row angular contact ball bearings have a very limited ability to accommodate misalignments.

Therefore any operating misalignments applied to this bearing type creates additional forces subsequently reducing their service life and, additionally, generates higher running noise levels. Where individual single row angular contact bearings or pairs of bearings are arranged **face-to-face** with operating clearance, up to 2 angular minutes misalignment from the centre position does not normally affect the bearings negatively.

However, when arranged in pairs **back-to-back** or **tandem** or as **sets** without clearance, spindle bearings must not run misaligned.

Axialluftklassen bei NKE Schrägkugellagern 72 B (BE) & 73B (BE) in Universalausführung
Axial Clearance Classes of Angular Contact Ball Bearings 72 B (BE) & 73B (BE) in Universal Design

Bohrungsdurchmesser Bore diameter d [mm]		Axialluftklasse [µm] Axial internal clearance class [µm]							
		CA		CB		CC			
>	≤	min	max	min	max	min	max		
--	10	4	12	14	22	22	30		
10	18	5	13	15	23	24	32		
18	30	7	15	18	26	32	40		
30	50	9	17	22	30	40	48		
50	80	11	23	26	38	48	60		
80	120	14	26	32	44	55	67		
120	180	17	29	35	47	62	74		
180	250	21	37	45	61	74	90		
250	315	26	42	52	68	90	106		

Anmerkung: Bei Lagern mit einem Druckwinkel von 40° (Nachsetzzeichen **B**) gilt: Radialluft ≈ 0,85 Axialluft
*Note: For 40° contact angles; i.e. suffix **B** applies: radial clearance ≈ 0,85 axial clearance*

Vorspannungsklassen bei NKE Schrägkugellagern 72 B (BE) & 73B (BE) in Universalausführung
Preload Classes of NKE Angular Contact Ball Bearings 72 B (BE) & 73B (BE) in Universal Design

Bohrungs- durchmesser Bore diameter d [mm]		Vorspannungsklasse Preload class											
		GA				GB				GC			
>	≤	[µm]		[N]		[µm]		[N]		[µm]		[N]	
		min	max	min	max	min	max	min	max	min	max	min	max
10	18	+4	-4	0	80	-2	-10	30	330	-8	-16	230	660
18	30	+4	-4	0	120	-2	-10	40	480	-8	-16	340	970
30	50	+4	-4	0	160	-2	-10	60	630	-8	-16	450	1280
50	80	+6	-6	0	380	-3	-15	140	1500	-12	-24	1080	3050
80	120	+6	-6	0	410	-3	-15	150	1600	-12	-24	1150	3250
120	180	+6	-6	0	540	-3	-15	200	2150	-12	-24	1500	4300
180	250	+8	-8	0	940	-4	-20	330	3700	-16	-32	2650	7500
250	315	+8	-8	0	1080	-4	-20	380	4250	-16	-32	3000	8600

Tabelle 2
Table 2

Toleranzen

Einreihige **NKE** Schrägkugellager werden standardmäßig in Normaltoleranz (**PN**) gefertigt.

Auf Anfrage können diese auch mit eingeeengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „Lagerdaten / Toleranzen“, Seite 54.

Käfige

NKE Schrägkugellager werden mit unterschiedlichen Käfigbauarten gefertigt, wobei **Stahlblechkäfige** (Nachsetzzeichen **J**), **Polyamidkäfige** (Nachsetzzeichen **TVP**) oder **Messingmassivkäfige** (Nachsetzzeichen **MP**) verfügbar sind.

Große Schrägkugellager werden standardmäßig mit Messingmassivkäfigen (Nachsetzzeichen **MP**) gefertigt; Spindellager weisen standardmäßig einen Hartgewebekäfig (Nachsetzzeichen **TPA**) auf.

Für Sonderanwendungen können **NKE Schrägkugellager** auch mit Käfigen aus anderen Werkstoffen, wie etwa Stahlmassivkäfige (Nachsetzzeichen **FP**) oder Leichtmetall-Massivkäfigen (Nachsetzzeichen **LP**) geliefert werden.

Sofern eine bestimmte vom Standard abweichende Käfigausführung gewünscht wird, ersuchen wir die jeweilige Verfügbarkeit anzufragen.

Tolerances

NKE single row angular contact ball bearings are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 239.

Cages

NKE single row angular contact ball bearings are produced with several cage designs; such as **pressed steel cages** (Suffix **J**), **polyamide cages** (Suffix **TVP**) or **machined solid brass cages** (Suffix **MP**).

Large types and sizes have machined solid brass cages (Suffix **MP**) fitted as standard.

Bearings used in higher precision or in machine tool spindle applications are normally fitted with phenolic resin cages (suffix **TPA**).

Some special applications have machined solid steel cages (suffix **FP**) or light metal alloy cages (suffix **LP**) fitted as standard.

If a specific cage design is required, please check availability.

Sonder-Lagerluft:

Auf Anfrage liefert **NKE** auch gepaarte Schrägkugellager mit speziellen Lagerluftwerten nach Kundenspezifikationen.

Lagerpaare

Einreihige **Schrägkugellager in Universalausführung** können paar- oder satzweise in folgenden Anordnungen verwendet werden, siehe Abb. 3.

Tandem-Anordnung

Schrägkugellagerpaare in Tandemanordnung werden verwendet, wenn die auftretende Axiallast die Tragfähigkeit eines einzelnen Lagers übersteigt.

Bei dieser Anordnung werden Axialkräfte nur in einer Richtung aufgenommen und gleichmäßig auf beide Lager aufgeteilt.

Schrägkugellager in Tandem-Anordnung sind immer gegen ein weiteres, spiegelbildlich angeordnetes Lager, welches die Wellenführung in der Gegenrichtung übernimmt, anzustellen.

Special Clearances

NKE also produces paired single row angular contact ball bearings to customers' requirements and specifications on request.

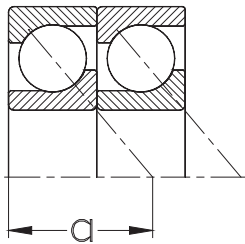
Bearing Pairs

Single row angular contact ball bearings in universal design usually used in pairs or sets. (see arrangements sketch, Fig. 3.)

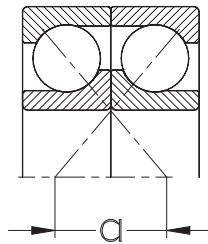
Tandem arrangement

Single row angular contact ball bearings in a tandem arrangement are used when the actual thrust force exceeds the thrust load capacity of a single angular contact ball bearing. These thrust forces are accommodated in one direction only and are distributed equally to both bearings.

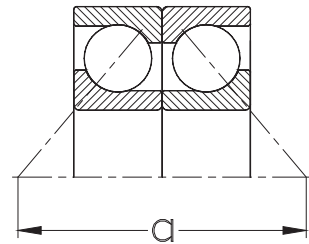
Single row angular contact ball bearings in tandem arrangement must always be adjusted against another bearing inversely arranged for shaft guidance in the opposite direction.



Tandem-Anordnung
Tandem arrangement



X-Anordnung
Face to face arrangement



O-Anordnung
Back to back arrangement

Abb. 3
Fig. 3

X-Anordnung

Axialkräfte werden beidseitig von jeweils einem der Schrägkugellager aufgenommen.

Durch ihre relativ geringe **Stützbreite (a)** stellen Lagerungen in X-Anordnung keine allzu großen Anforderungen an die Fluchtung der Lagerstellen. Allerdings können aufgrund der geringeren Starrheit dieser Anordnung Kippmomente weniger gut aufgenommen werden.

Bei Lagerpaaren in X-Anordnung führt eine Erwärmung der Welle zu einer Verminderung der Axialluft bzw. zu einer erhöhten Vorspannung.

O-Anordnung

Axialkräfte werden, wie bei der X-Anordnung, in beiden Richtungen von jeweils einem Lager aufgenommen.

Schrägkugellager in O-Anordnung weisen durch ihre **große Stützbreite (a)** eine große Starrheit auf und sind auch zur Aufnahme von Kippmomenten sehr gut geeignet.

Lagerpaare in O-Anordnung sind nicht zum Ausgleich von Schiefstellungen geeignet.

Tragfähigkeit von Lagerpaaren

In den Produkttabellen sind die für Einzellager geltenden Tragzahlen angegeben.

Für **paarweise** direkt nebeneinander eingebaute Universallager gilt:

- für die **dynamische** Tragzahl:

$$C_{r \text{ Paar}} = 1,62 * C_{r \text{ Einzellager}}$$

- für die **statische** Tragzahl des Lagerpaares:

$$C_{0r \text{ Paar}} = 2 * C_{0r \text{ Einzellager}}$$

Die Richtdrehzahlen für Lagerpaare sind gegenüber den für Einzellager angegebenen Werte um 20% zu reduzieren.

Face-to-face arrangement

Thrust forces are accommodated in both directions by each individual angular contact ball bearing.

Bearing pairs arranged face-to-face do not require a very accurate alignment of the bearing positions due to their relatively small **support width (a)**. On the other hand, these arrangements are not suitable to take tilting moments due to their less stiffness.

For bearing pairs arranged face-to-face temperature increase of the shaft causes a reduction of axial internal clearance or an increase of preloading forces, respectively.

Back-to-back arrangement

The axial forces are, similar to face-to-face arrangements, accommodated in both directions by each individual bearing.

Angular contact ball bearings arranged **back-to-back** provide a very rigid bearing arrangement due to their **large support width (a)**. They are also able to accept tilting moments.

Bearing pairs arranged back-to-back are not able to compensate for misalignments.

Load Ratings of Bearing Pairs

The basic load ratings given in the product tables apply to single bearings only.

For **bearing pairs** mounted side-by-side (i.e. universal design), the following applies:

- for the **dynamic** load rating of a bearing pair:

$$C_{r \text{ pair}} = 1,62 * C_{r \text{ single bearing}}$$

- for the **static** load rating of a bearing pair:

$$C_{0r \text{ pair}} = 2 * C_{0r \text{ single bearing}}$$

The speed ratings for bearings arranged in pairs should be reduced by 20% compared to the single bearings.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Einreihige Schrägkugellager muss die Mindestbelastung 1% der dynamischen Tragzahl betragen.

Äquivalente dynamische Lagerbelastung

Bei als **Einzellager** eingesetzten Schrägkugellagern mit einem Druckwinkel **40°** der Ausführungen **B** bzw. **BE** sowie bei in **Tandemanordnung** eingebaute Schrägkugellager in **Universalausführung** gilt:

bei

$$\frac{F_a}{F_r} \leq 1,14 \quad \text{gilt} \quad P = F_r$$

oder, wenn

$$\frac{F_a}{F_r} > 1,14 \quad \text{dann} \quad P = 0,35 \cdot F_r + 0,57 \cdot F_a$$

Achtung:

Durch den Druckwinkel verursacht bei Schrägkugellagern jede äußere Belastung eine innere Axialkraft.

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE single row angular contact ball bearings the minimum load must be 1% of the dynamic load rating.

Equivalent Dynamic Bearing Load

Where angular contact ball bearings with a contact angle **40°** are used, individually **B** or **BE** design, respectively or **universally design arranged in tandem**, the following formula should be used:

when

$$\frac{F_a}{F_r} \leq 1,14 \quad \text{then} \quad P = F_r$$

or, when

$$\frac{F_a}{F_r} > 1,14 \quad \text{then} \quad P = 0,35 \cdot F_r + 0,57 \cdot F_a$$

Note:

In the case of angular contact ball bearings, each external radial load applied generates an internal thrust force.

Zur Berechnung der resultierenden Axialkraft F_a sind daher auch die Hinweise aus Tabelle 3 zu beachten.

Bei **paarweise in X- oder O-Anordnung** eingesetzten Schrägkugellagern in Universalausführung gilt:

bei

$$\frac{F_a}{F_r} \leq 1,14 \quad \text{gilt} \quad P = F_r + 0,55 * F_a$$

bzw. wenn

$$\frac{F_a}{F_r} > 1,14 \quad \text{dann} \quad P = 0,57 * F_r + 0,93 * F_a$$

Achtung:

F_a und F_r sind die auf das **Lagerpaar** wirkenden Kräfte.

Äquivalente statische Lagerbelastung

Bei **einzel**n oder in **Tandemanordnung** paarweise eingebauten Schrägkugellagern der Ausführungen **B** und **BE** gilt:

$$P_0 = 0,5 * F_r + 0,26 * F_a$$

Wenn allerdings P_0 kleiner als F_r wird, ist F_r als statisch äquivalente Lagerbelastung zu verwenden.

Bei **paarweise in X- oder O-Anordnung** eingesetzten Schrägkugellagern in Universalausführung gilt:

$$P_0 = F_r + 0,52 * F_a$$

Achtung:

F_a und F_r sind die auf das **Lagerpaar** wirkenden Kräfte.

For the calculation of the resulting axial force F_a the information provided by table 3 should be considered.

For angular contact ball bearings in the universal design, **arranged in pairs either face-to-face or back-to-back**, the following formula should be used:

when

$$\frac{F_a}{F_r} \leq 1,14 \quad \text{then} \quad P = F_r + 0,55 * F_a$$

or, when

$$\frac{F_a}{F_r} > 1,14 \quad \text{then} \quad P = 0,57 * F_r + 0,93 * F_a$$

Note:

F_a and F_r indicate the forces acting on the **bearing pairs**.

Equivalent Static Bearing Load

For angular contact ball bearings in the **B** or **BE** design used either as **single bearings** or paired in tandem **arrangement**:

$$P_0 = 0,5 * F_r + 0,26 * F_a$$

But, when P_0 is smaller than F_r , the F_r value must be used as the equivalent static bearing load.

For angular contact ball bearings in the universal design **arranged in pairs either face-to-face or back-to-back**:

$$P_0 = F_r + 0,52 * F_a$$

Note:

F_a and F_r indicate the forces acting on the **bearing pairs**.

Axialbelastung bei einzeln verwendeten Schrägkugellagern und Schrägkugellagern in Tandem-Anordnung

Durch den Druckwinkel verursacht bei Schrägkugellagern jede Radialbelastung eine zusätzliche innere Axiallastkomponente.

Bei paarweise in **X-** oder **O-Anordnung** eingebauten Schrägkugellagern wird diese Kraftkomponente im Lagerpaar selbst aufgenommen, bei Einzellagern oder Lagerpaaren in Tandem-anordnung muss sie allerdings überprüft werden.

In Tabelle 3 (siehe Seite 452) sind Berechnungsformeln für die resultierende Axialbelastung für verschiedene Lastfälle angegeben.

Achtung:

Die in Tabelle 3 angegebenen Formeln setzen im Betriebszustand spielfrei eingestellte Lager voraus.

Die auf die Lager wirkenden Radialkräfte F_r (F_{rA} bei Lager **A**, F_{rB} bei Lager **B**) greifen in den Druckmittelpunkten (**a**) der Lager an.

Der Abstand (**a**) wird in den Lagertabellen angegeben.

Der Betrag der Radialkräfte (F_{rA} und F_{rB}) wird, unabhängig von deren Wirkungsrichtung, immer als positiv betrachtet.

Weiters wird eine auf die Lager wirkende äußere Axiallast F_a angenommen.

Thrust Loads to Angular Contact Ball Bearings and Single Mounted or Paired in Tandem Arrangement

In the case of angular contact ball bearings every radial load applied will generate an additional internal thrust load component due to the contact angle.

In the case of angular contact ball bearings arranged in pairs either **back-to-back** or **face-to-face** this thrust load component will be accommodated in the bearing pair internally. In the case of angular contact ball bearings, either as single bearings or paired in tandem arrangement, this thrust load component must be additionally considered.

The calculation formulas of the resulting thrust loads are listed on table 3, page 452.

Note:

The formulas listed in table 3 assume bearings having an operational clearance close to zero.

The radial forces applied to the bearings always act at the pressure centre (**a**) of the bearings.

The distance (**a**) is listed in the bearing tables.

The radial forces (F_{rA} and F_{rB}) which act on the bearings are always considered to be positive, irrespective from their actual direction.

Additionally an external thrust force F_a has been assumed.

**Resultierende Axialbelastung bei einreihigen Schrägkugellagern,
Ausführungen B und BE (Druckwinkel 40°)**

Resulting axial loads of single row angular contact ball bearings, B & BE design (contact angle 40°)

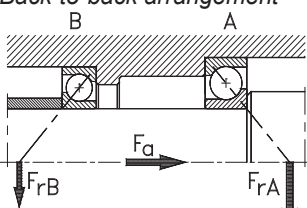
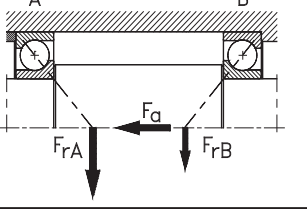
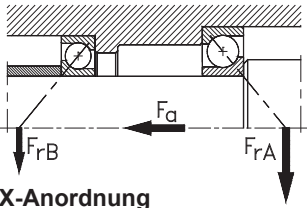
Lageranordnung <i>Bearing arrangement</i>	Belastungsfall: bei <i>Load case; if</i>	Axialbelastung / <i>Axial loads</i> an Lager / <i>on bearing</i>	
		A	B
O-Anordnung <i>Back-to-back arrangement</i> 	A $F_{rA} \geq F_{rB}$ $F_a \geq 0$	$F_{aA} = 1,14 * F_{rA}$	$F_{aB} = F_{aA} + F_a$
	B $F_{rA} < F_{rB}$ $F_a \geq 1,14 * (F_{rB} - F_{rA})$	$F_{aA} = 1,14 * F_{rA}$	$F_{aB} = F_{aA} + F_a$
X-Anordnung <i>Face-to-face arrangement</i> 	C $F_{rA} > F_{rB}$ $F_a < 1,14 * (F_{rA} - F_{rB})$ oder / or $F_a = 0$	$F_{aA} = F_{aB} - F_a$	$F_{aB} = 1,14 * F_{rB}$
	D $F_{rA} \leq F_{rB}$ $F_a \geq 0$	$F_{aA} = F_{aB} + F_a$	$F_{aB} = 1,14 * F_{rB}$
O-Anordnung <i>Back-to-back arrangement</i> 	E $F_{rA} > F_{rB}$ $F_a \geq 1,14 * (F_{rA} - F_{rB})$	$F_{aA} = F_{aB} + F_a$	$F_{aB} = 1,14 * F_{rB}$
	F $F_a < 1,14 * (F_{rA} - F_{rB})$ oder / or $F_a = 0$	$F_{aA} = 1,14 * F_{rA}$	$F_{aB} = F_{aA} - F_a$

Tabelle 3
Table 3

Anschlussmaße einreihiger Schrägkugellager der Ausführungen B und BE

Gerade bei den Schrägkugellagern ist aufgrund der entstehenden inneren Axiallastkomponente besonders auf die Einhaltung einer ausreichenden axialen Unterstützung der Lagerringe durch die Umgebungsstruktur zu achten.

Dazu müssen die Schulterhöhen der Anlageflächen an den Wellenbunden bzw. der Gehäuseschultern eine ausreichende Mindesthöhe aufweisen.

Allerdings dürfen die Radien der Kantenverrundung der Lagerringe nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muß der größte Hohlkehradius an den Anschlußteilen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius der Kantenverrundung (r_1, r_2) der Lagerringe (siehe Zeichnung bei Tabelle auf der Seite 454).

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert, die Werte der Kantenverrundung der Lagerringe sind in den Produkttabellen angegeben.

Empfehlungen zur Gestaltung der Anschlussteile sind in der Tabelle auf Seite **454** angegeben.

Förderwirkung bei Ölschmierung

Asymmetrische Lager, wozu auch Schrägkugellager gehören, weisen eine Pumpwirkung auf, die bei Ölumlaufschmierung zur zusätzlichen Unterstützung der Ölzirkulation ebenfalls herangezogen werden kann.

Bei Ölzuführung in Gegenrichtung ist allerdings mit einem erhöhten Durchflusswiderstand zu rechnen.

Abutment and Fillet Dimensions for Single Row Angular Contact Ball Bearings, Design B and BE

Especially in the case of angular contact ball bearings particular attention must be made for the optimum support of the bearing rings by the adjacent parts due to their generated internal thrust force elements.

The parts surrounding the bearing have to be designed in such a way that adequate axial support of bearing rings is secure under all circumstances.

To gain adequate support, the shaft housing shoulders require a certain minimum height.

On the other hand, the bearing rings must only contact adjacent parts with their side faces. The radii of bearing corners must not touch the corner fillet radii of either the shaft or housing shoulders.

Therefore, the largest fillet radius (r_g or r_{g1} , respectively) must always be smaller than the minimum fillet dimension of the bearing rings (r_1, r_2) refer to the details on the page **454**.

Recommendations for the dimensions of adjacent parts are listed in **DIN 5418**, the values for the bearing fillet dimensions are stated in the bearing tables.

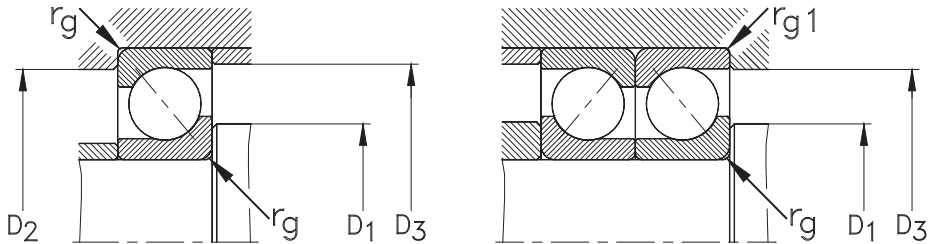
Pumping Effect with Oil Lubrication

Asymmetrical bearings, which angular contact ball bearings are, generate a certain pumping effect due to their internal design.

This effect may also be used to support the oil circulation in the lubricating circuit.

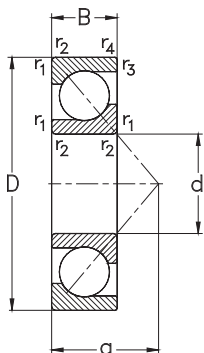
Although, in the case of oil circulation feed in the **opposite direction** an enlarged resistance against the oil flow must be taken into consideration.

Anschlussmaße Einreihiger Metrischer Schrägkugellager [mm]
Abutment and Fillet Dimensions for Metric Single Row Angular Contact Ball Bearings [mm]



ø Welle Shaft ø [mm]	Type	72...-B (-BE)					73...-B (-BE)					
		D ₁ min	D ₂ max	D ₃ max	r _g max	r _{g1} max	D ₁ min	D ₂ max	D ₃ max	r _g max	r _{g1} max	
10	7200-BE	14	26	27	0,6	0,3	--	--	--	--	--	
12	7201-BE	16	28	29	0,6	0,3	7301-BE	18	31	33	1	0,6
15	7202-BE	19	31	32	0,6	0,3	7302-BE	21	36	38	1	0,6
17	7203-BE	21	36	36	0,6	0,6	7303-BE	23	41	43	1	0,6
20	7204-BE	26	41	43	1	0,6	7304-BE	27	45	48	1	0,6
25	7205-BE	31	46	48	1	0,6	7305-BE	32	55	58	1	0,6
30	7206-BE	36	56	58	1	0,6	7306-BE	37	65	68	1	0,6
35	7207-BE	42	65	68	1	0,6	7307-BE	44	71	75	1,5	1
40	7208-BE	47	73	76	1	0,6	7308-BE	49	81	85	1,5	1
45	7209-BE	52	78	81	1	0,6	7309-BE	54	91	95	1,5	1
50	7210-BE	57	83	86	1	0,6	7310-BE	61	99	104	2	1
55	7211-BE	64	91	95	1,5	0,6	7311-BE	66	109	114	2	1
60	7212-BE	69	101	105	1,5	1	7312-BE	72	118	123	2,1	1
65	7213-BE	74	111	115	1,5	1	7313-BE	77	128	133	2,1	1
70	7214-BE	79	116	120	1,5	1	7314-BE	82	138	143	2,1	1
75	7215-BE	84	121	125	1,5	1	7315-BE	87	148	153	2,1	1
80	7216-BE	91	129	134	2	1	7316-BE	92	158	163	2,1	1
85	7217-BE	96	139	144	2	1	7317-BE	99	166	173	2,5	1
90	7218-BE	101	149	154	2	1	7318-BE	104	176	183	2,5	1
95	7219-BE	107	158	163	2,1	1	7319-BE	109	186	193	2,5	1
100	7220-BE	112	168	173	2,1	1	7320-BE	114	201	208	2,5	1
105	7221-BE	117	178	183	2,1	1	7321-BE	119	211	218	2,5	1
110	7222-BE	122	188	193	2,1	1	7322-BE	124	226	233	2,5	1
120	7224-B	132	203	208	2,1	1	7324-B	134	246	253	2,5	1
130	7226-B	144	216	223	2,5	1	7326-B	147	263	271	3	1,5
140	7228-B	154	236	243	2,5	1	7328-B	157	283	291	3	1,5
150	7230-B	164	256	263	2,5	1	7330-B	167	303	311	3	1,5
160	7232-B	174	276	283	2,5	1	7332-B	177	323	331	3	1,5
170	7234-B	187	293	301	3	1,5	7334-B	187	343	351	3	1,5

Einreihige Schrägkugellager
Single Row Angular Contact Ball Bearings



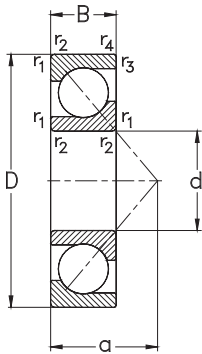
Hauptabmessungen [mm]						Lagertypen	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]							Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂	r ₃ , r ₄	a		C _r	C _{0r}	C _u	n _{0r}	n _G	m
			min	min			dyn.	stat.				
10	30	9	0,6	0,3	13	7200-BE-TVP	7	3,3	0,2	22800	30000	0,03
12	32	10	0,6	0,3	14	7201-BE-TVP	7,5	3,8	0,2	21700	26000	0,04
	37	12	1	0,6	16	7301-BE-TVP	10,5	5	0,5	16500	24000	0,06
15	35	11	0,6	0,3	16	7202-BE-TVP	8,8	4,4	0,2	19800	24000	0,05
	42	13	1	0,6	19	7302-BE-TVP	13,1	6,7	0,3	14300	20000	0,08
17	40	12	0,6	0,6	18	7203-BE-TVP	11,5	6,1	0,3	17600	22000	0,07
	40	12	0,6	0,6	18	7203-BE-MP	10,8	5,5	0,3	17800	20000	0,07
	47	14	1	0,6	20	7303-BE-TVP	16,8	8,3	0,4	13000	19000	0,11
	47	14	1	0,6	20	7303-BE-MP	15,5	7,4	0,3	13100	19000	0,11
20	47	14	1	0,6	21	7204-BE-TVP	14,8	8,3	0,4	15900	19000	0,11
	47	14	1	0,6	21	7204-BE-MP	13,9	7,6	0,3	16000	18000	0,11
	52	15	1,1	0,6	23	7304-BE-TVP	20,9	11,1	0,5	11600	18000	0,15
	52	15	1,1	0,6	23	7304-BE-MP	19,5	10,0	0,5	11700	18000	0,15
25	52	15	1	0,6	24	7205-BE-TVP	16,2	10,1	0,5	14000	17000	0,13
	52	15	1	0,6	24	7205-BE-MP	15,5	9,4	0,4	14100	15000	0,13
	62	17	1,1	0,6	27	7305-BE-TVP	27,2	15,6	0,7	9900	15000	0,23
	62	17	1,1	0,6	27	7305-BE-MP	25,5	14,1	0,6	10000	14000	0,23
30	62	16	1	0,6	27	7206-BE-TVP	24,9	15,6	0,7	11600	14000	0,2
	62	16	1	0,6	27	7206-BE-MP	23,7	14,4	0,7	11600	13000	0,2
	72	19	1,1	0,6	31	7306-BE-TVP	36,2	21,4	1,0	8700	13000	0,35
	72	19	1,1	0,6	31	7306-BE-MP	33,9	19,4	0,9	8800	12000	0,35
35	72	17	1,1	0,6	31	7207-BE-TVP	32,2	20,8	0,9	9900	12000	0,3

Empfohlene Anschlussmaße siehe Seite 454

For recommended abutment and fillet dimensions
see page 454

Hauptabmessungen [mm]						Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]							Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
35	72	17	1,1	0,6	31				7207-BE-MP	30,6	19,2	0,9
	80	21	1,5	1	35	7307-BE-TVP	40,2	24,4	1,1	8000	11000	0,46
	80	21	1,5	1	35	7307-BE-MP	37,7	22,2	1,0	8100	10000	0,46
40	80	18	1,1	0,6	34	7208-BE-TVP	36,2	25,8	1,2	8900	11000	0,37
	80	18	1,1	0,6	34	7208-BE-MP	36,1	23,9	1,1	9000	10000	0,37
	90	23	1,5	1	39	7308-BE-TVP	51	33,0	1,5	7200	10000	0,63
	90	23	1,5	1	39	7308-BE-MP	48,6	30,3	1,4	7300	9000	0,63
45	85	19	1,1	0,6	37	7209-BE-TVP	39,5	28,2	1,3	8400	10000	0,41
	85	19	1,1	0,6	37	7209-BE-MP	37,8	26,3	1,2	8400	9000	0,41
	100	25	1,5	1	43	7309-BE-TVP	61	40,1	1,8	6600	9000	0,84
	100	25	1,5	1	43	7309-BE-MP	58	36,8	1,7	6700	8000	0,84
50	90	20	1,1	0,6	39	7210-BE-TVP	40,8	30,5	1,4	7900	9000	0,47
	90	20	1,1	0,6	39	7210-BE-MP	39,2	28,6	1,3	8000	8500	0,47
	110	27	2	1	47	7310-BE-TVP	77	52	2,3	6100	8000	1,1
	110	27	2	1	47	7310-BE-MP	73	47,3	2,2	6200	7500	1,1
55	100	21	1,5	1	43	7211-BE-TVP	51	38,5	1,8	7200	8000	0,64
	100	21	1,5	1	43	7211-BE-MP	48,5	36,1	1,6	7200	7500	0,64
	120	29	2	1	51	7311-BE-TVP	88	60	2,7	5700	7000	1,4
	120	29	2	1	51	7311-BE-MP	83	55	2,5	5800	6700	1,4
60	110	22	1,5	1	47	7212-BE-TVP	59	44,4	2,0	6600	7500	0,8
	110	22	1,5	1	47	7212-BE-MP	56	41,5	1,9	6600	7000	0,8
	130	31	2,1	1,1	55	7312-BE-TVP	107	74	3,4	5300	6700	1,8

Einreihige Schrägkugellager
Single Row Angular Contact Ball Bearings



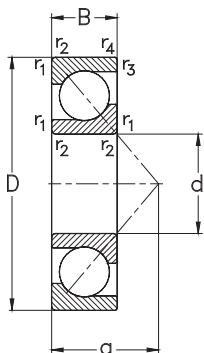
Hauptabmessungen [mm]						Lagertypen	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]							Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a			C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
60	130	31	2,1	1,1	55	7312-BE-MP	101	68	3,1	5400	6000	1,8
65	120	23	1,5	1	50	7213-BE-TVP	70	54	2,4	6000	6300	1
	120	23	1,5	1	50	7213-BE-MP	67	50	2,3	6100	6300	1
	140	33	2,1	1,1	60	7313-BE-TVP	108	80	3,6	5100	5600	2,2
	140	33	2,1	1,1	60	7313-BE-MP	102	73	3,3	5100	5600	2,2
70	125	24	1,5	1	53	7214-BE-TVP	72	58	2,6	5800	6300	1,1
	125	24	1,5	1	53	7214-BE-MP	69	54	2,5	5900	6000	1,1
	150	35	2,1	1,1	64	7314-BE-TVP	125	91	3,9	4800	5300	2,7
	150	35	2,1	1,1	64	7314-BE-MP	118	83	3,6	4900	5300	2,7
75	130	25	1,5	1	56	7215-BE-TVP	75	62	2,8	5600	5600	1,2
	130	25	1,5	1	56	7215-BE-MP	72	58	2,6	5700	5600	1,2
	160	37	2,1	1,1	68	7315-BE-J	138	106	4,4	4500	5000	3,2
	160	37	2,1	1,1	68	7315-BE-MP	130	97	4,1	4600	5000	3,2
80	140	26	2	1	59	7216-BE-TVP	88	74	3,2	5200	5600	1,5
	140	26	2	1	59	7216-BE-MP	84	69	3,0	5300	5300	1,5
	170	39	2,1	1,1	72	7316-BE-MP	141	109	4,4	4400	5000	4,3
85	150	28	2	1	63	7217-BE-TVP	105	87	3,6	5000	5300	1,9
	150	28	2	1	63	7217-BE-MP	101	81	3,4	5100	5000	1,9
	180	41	3	1,1	76	7317-BE-MP	152	122	4,8	4200	4800	4,6
90	160	30	2	1	67	7218-BE-TVP	112	94	3,8	4900	4500	2,4
	160	30	2	1	67	7218-BE-MP	107	88	3,6	4900	4500	2,4
	190	43	3	1,1	80	7318-BE-TVP	173	147	5,6	4000	4500	5,3

Empfohlene Anschlussmaße siehe Seite 454

For recommended abutment and fillet dimensions
see page 454

Hauptabmessungen [mm]						Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]							Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
90	190	43	3	1,1	80	7318-BE-MP	164	135	5,2	4000	4300	5,3
95	170	32	2,1	1,1	72	7219-BE-MP	121	101	4,0	4800	4300	3,1
	200	45	3	1,1	84	7319-BE-MP	175	149	5,6	3900	3800	6,2
100	180	34	2,1	1,1	76	7220-BE-MP	136	114	4,4	4600	4000	3,4
	215	47	3	1,1	90	7320-BE-MP	200	175	6,3	3700	3600	7,7
105	190	36	2,1	1,1	80	7221-BE-MP	149	129	4,8	4400	4000	4,4
	225	49	3	1,1	94	7321-BE-MP	211	194	6,9	3500	3400	9,5
110	200	38	2,1	1,1	84	7222-BE-MP	161	145	5,3	4300	3600	4,7
	240	50	3	1,1	98	7322-BE-TVP	236	226	7,7	3200	3200	10,4
	240	50	3	1,1	98	7322-BE-MP	223	207	7,1	3300	3400	10,4
120	215	40	2,1	1,1	90	7224-B-MP	158	151	5,3	4100	3600	6,2
	260	55	3	1,1	107	7324-B-MP	234	220	8,8	3000	3200	14,5
130	230	40	3	1,1	96	7226-B-MP	197	207	7	3600	3400	7
	280	58	4	1,5	115	7326-B-MP	250	268	8,5	2800	2800	17,5
140	250	42	3	1,1	103	7228-B-MP	195	210	6,8	3400	3000	8,9
	300	62	4	1,5	123	7328-B-MP	275	309	9,5	2500	2600	21,5
150	270	45	3	1,1	111	7230-B-MP	209	241	7,5	3100	2800	11
	320	65	4	1,5	131	7330-B-MP	303	366	10,9	2300	2400	26
160	290	48	3	1,1	118	7232-B-MP	200	237	7,2	3000	2600	13,8
	340	68	4	1,5	139	7332-B-MP	356	437	12,6	2100	2200	30
170	310	52	4	1,5	127	7234-B-MP	222	270	7,9	2800	2400	17,5
	360	72	4	1,5	147	7334-B-MP	359	548	12,8	1900	2200	36

Einreihige Schrägkugellager
Single Row Angular Contact Ball Bearings

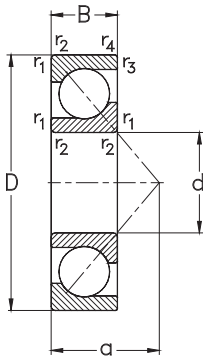


Hauptabmessungen [mm]						Lagertypen <i>Designation</i>	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
<i>Boundary dimensions [mm]</i>							<i>Load ratings [kN]</i>			<i>Thermal speed ratings [rpm]</i>	<i>Limited speed ratings [rpm]</i>	<i>Weight [kg]</i>
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
180	320	52	4	1,5	131	7236-B-MP	253	320	9,2	2600	2400	18
	380	75	4	2	156	7336-B-MP	373	489	13,3	1900	2000	42
190	340	55	4	1,5	139	7238-B-MP	273	353	9,9	2400	2200	22
	400	78	5	2	164	7338-B-MP	371	524	13,9	1800	1900	48,5
220	400	65	4	1,5	164	7244-B-MP	322	464	12	2100	1800	37
240	440	72	4	1,5	180	7248-B-MP	363	538	13,3	1900	1700	49

Empfohlene Anschlussmaße siehe Seite 454

*For recommended abutment and fillet dimensions
see page 454*

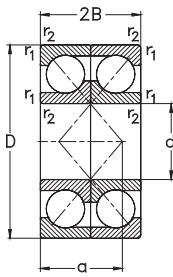
Einreihige Schrägkugellager in Universalausführung
Single Row Angular Contact Ball Bearings in Universal Design



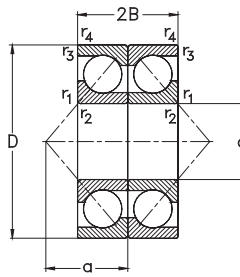
Hauptabmessungen [mm]						Lagertypen	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]							Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a		C _r dyn,	C _{0r} stat,	C _u	n _{er}	n _G	m
15	35	11	0,6	0,3	16	7202-BECB-TVP	8,8	4,4	0,2	19800	24000	0,05
17	40	12	0,6	0,6	18	7203-BECB-MP	10,8	5,5	0,3	17600	22000	0,07
	47	14	1	0,6	20	7303-BECB-MP	15,5	7,4	0,3	13100	19000	0,11
20	47	14	1	0,6	21	7204-BECB-TVP	14,8	8,3	0,4	15900	19000	0,11
	47	14	1	0,6	21	7204-BECB-MP	13,9	7,6	0,3	16000	18000	0,11
52	15	1,1	0,6	23	7304-BECB-TVP	20,9	11,1	0,5	11600	18000	0,15	
	52	15	1,1	0,6	23	7304-BECB-MP	19,5	10	0,5	11700	18000	0,15
25	52	15	1	0,6	24	7205-BECB-TVP	16,2	10,1	0,5	14000	17000	0,13
	52	15	1	0,6	24	7205-BECB-MP	15,5	9,4	0,4	14100	15000	0,13
62	17	1,1	0,6	27	7305-BECB-TVP	27,2	15,6	0,7	9900	15000	0,23	
	62	17	1,1	0,6	27	7305-BECB-MP	25,5	14,1	0,6	10000	14000	0,23
30	62	16	1	0,6	27	7206-BECB-TVP	24,9	15,6	0,7	11600	14000	0,2
	62	16	1	0,6	27	7206-BECB-MP	23,7	14,4	0,7	11600	13000	0,2
72	19	1,1	0,6	31	7306-BECB-TVP	36,2	21,4	1	8700	13000	0,35	
	72	19	1,1	0,6	31	7306-BECB-MP	33,9	19,4	0,9	8800	12000	0,35
35	72	17	1,1	0,6	31	7207-BECB-TVP	32,2	20,8	0,9	9900	12000	0,3
	72	17	1,1	0,6	31	7207-BECB-MP	30,6	19,2	0,9	10000	11000	0,3
80	21	1,5	1	35	7307-BECB-TVP	40,2	24,4	1,1	8000	11000	0,46	
	80	21	1,5	1	35	7307-BECB-MP	37,7	22,2	1	8100	10000	0,46
40	80	18	1,1	0,6	34	7208-BECB-MP	36,1	23,9	1,1	9000	10000	0,37

Empfohlene Anschlussmaße siehe Seite 454
 For recommended abutment and fillet dimensions see page 454

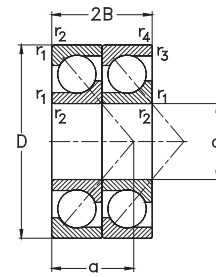
Einreihige Schrägkugellager in Universalausführung Single Row Angular Contact Ball Bearings in Universal Design



X-Anordnung
Face to face
arrangement



O-Anordnung
Back to back
arrangement

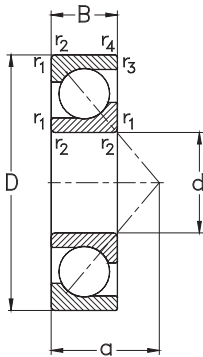


Tandem-Anordnung
Tandem
arrangement

Hauptabmessungen [mm]						Lagertyp	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Designation	Loadratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a		C _r dyn,	C _{0r} stat,	C _u	n _{er}	n _e	m
40	90	23	1,5	1	39	7308-BECB-TVP	51	33	1,5	7200	10000	0,63
	90	23	1,5	1	39	7308-BECB-MP	48,6	30,3	1,4	7300	9000	0,63
45	85	19	1,1	0,6	37	7209-BECB-MP	37,8	26,3	1,2	8400	9000	0,41
	100	25	1,5	1	43	7309-BECB-TVP	61	40,1	1,8	6600	9000	0,84
	100	25	1,5	1	43	7309-BECB-MP	58	36,8	1,7	6700	8000	0,84
50	90	20	1,1	0,6	39	7210-BECB-MP	39,2	28,6	1,3	8000	8500	0,47
	110	27	2	1	47	7310-BECB-TVP	77,0	52	2,3	6100	8000	1,1
	110	27	2	1	47	7310-BECB-MP	73	47,3	2,2	6200	7500	1,1
55	100	21	1,5	1	43	7211-BECB-MP	48,5	36,1	1,6	7200	7500	0,64
	120	29	2	1	51	7311-BECB-TVP	88,0	60	2,7	5700	7000	1,4
	120	29	2	1	51	7311-BECB-MP	83	55	2,5	5800	6700	1,4
60	110	22	1,5	1	47	7212-BECB-TVP	59	44	2	6600	7500	0,8
	110	22	1,5	1	47	7212-BECB-MP	56	41,5	1,9	6600	7000	0,8
	130	31	2,1	1,1	55	7312-BECB-TVP	107	74	3,4	5300	6700	1,8
	130	31	2,1	1,1	55	7312-BECB-MP	101	68,2	3,1	5400	6000	1,8
65	120	23	1,5	1	50	7213-BECB-MP	67	50	2,3	6100	6300	1
	140	33	2,1	1,1	60	7313-BECB-TVP	108	80	3,6	5100	5600	2,2
	140	33	2,1	1,1	60	7313-BECB-MP	102	73	3,3	5100	5600	2,2
70	125	24	1,5	1	53	7214-BECB-MP	69	54	2,5	5900	6000	1,1
	150	35	2,1	1,1	64	7314-BECB-TVP	125	91	3,9	4800	5300	2,7

Empfohlene Anschlussmaße siehe Seite 454
For recommended abutment and fillet dimensions see page 454

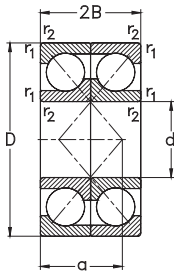
Einreihige Schrägkugellager in Universalausführung
Single Row Angular Contact Ball Bearings in Universal Design



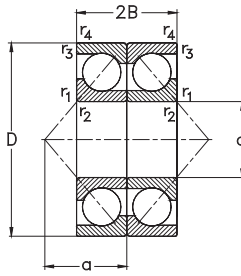
Hauptabmessungen [mm]						Lagertyp	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Designation	Loadratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a		C _r	C _{0r}	C _u	n _{er}	n _G	m
							dyn,	stat,				
70	150	35	2,1	1,1	64	7314-BECB-MP	118	83	3,6	4900	5300	2,7
75	130	25	1,5	1	56	7215-BECB-MP	72	58	2,6	5700	5600	1,2
	160	37	2,1	1,1	68	7315-BECB-MP	130	97	4,1	4600	5000	3,2
80	140	26	2	1	59	7216-BECB-TVP	88	74	3,2	5200	5600	1,5
	140	26	2	1	59	7216-BECB-MP	84	69	3	5200	5300	1,5
	170	39	2,1	1,1	72	7316-BECB-MP	141	109	4,4	4400	5000	4,3
85	150	28	2	1	63	7217-BECB-MP	101	81	3,4	5100	5000	1,9
	180	41	3	1,1	76	7317-BECB-MP	152	122	4,8	4200	4800	4,6
90	160	30	2	1	67	7218-BECB-MP	107	88	3,6	4900	4500	2,4
	190	43	3	1,1	80	7318-BECB-TVP	173	147	5,6	4000	4500	5,3
	190	43	3	1,1	80	7318-BECB-MP	164	135	5,2	4000	4300	5,3
95	170	32	2,1	1,1	72	7219-BECB-MP	121	101	4	4800	4300	3,1
	200	45	3	1,1	84	7319-BECB-MP	175	149	5,6	3900	3800	6,2
100	180	34	2,1	1,1	76	7220-BECB-MP	136	114	4,4	4600	4000	3,4
	215	47	3	1,1	90	7320-BECB-MP	200	175	6,3	3700	3600	7,7
105	190	36	2,1	1,1	80	7221-BECB-MP	149	129	4,8	4400	4000	4,4
	225	49	3	1,1	94	7321-BECB-MP	211	194	6,9	3500	3400	9,5
110	200	38	2,1	1,1	84	7222-BECB-MP	161	145	5,3	4300	3600	4,7
	240	50	3	1,1	98	7322-BECB-TVP	236	226	7,7	3200	3200	10,4
	240	50	3	1,1	98	7322-BECB-MP	223	207	7,1	3300	3200	10,4

Empfohlene Anschlussmaße siehe Seite 454
 For recommended abutment and fillet dimensions see page 454

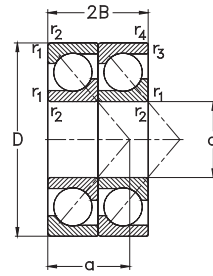
Einreihige Schrägkugellager in Universalausführung Single Row Angular Contact Ball Bearings in Universal Design



X-Anordnung
Face to face
arrangement



O-Anordnung
Back to back
arrangement



Tandem-Anordnung
Tandem
arrangement

Hauptabmessungen [mm]						Lagertyp	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Designation	Loadratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	r ₃ , r ₄ min	a		C _r	C _{0r} stat.	C _u	n _{er}	n _e	m
120	215	40	2,1	1,1	90	7224-BCB-MP	158	150	5,3	4100	3600	6,2
	260	55	3	1,1	107	7324-BCB-MP	234	220	8,8	3000	3200	14,5
130	230	40	3	1,1	96	7226-BCB-MP	197	207	7	3600	3400	7
	280	58	4	1,5	115	7326-BCB-MP	250	268	8,5	2800	2800	17,5
140	250	42	3	1,1	103	7228-BCB-MP	195	210	6,8	3400	3000	8,9
	300	62	4	1,5	123	7328-BCB-MP	275	309	9,5	2500	2600	21,5
150	270	45	3	1,1	111	7230-BCB-MP	209	241	7,5	3100	2800	11
	320	65	4	1,5	131	7330-BCB-MP	303	366	10,9	2300	2400	26
160	290	48	3	1,1	118	7232-BCB-MP	200	237	7,2	3000	2600	13,8
	340	68	4	1,5	139	7332-BCB-MP	356	437	12,6	2100	2200	30
170	310	52	4	1,5	127	7234-BCB-MP	222	270	7,9	2800	2400	17,5
	360	72	4	1,5	147	7334-BCB-MP	359	548	12,8	1900	2200	36
180	320	52	4	1,5	131	7236-BCB-MP	253	320	9,2	2600	2400	18
	380	75	4	2	156	7336-BCB-MP	373	489	13,3	1900	2000	42
190	340	55	4	1,5	139	7238-BCB-MP	273	353	9,9	2400	2200	22
	400	78	5	2	164	7338-BCB-MP	371	524	13,9	1800	1900	48,5
220	400	65	4	1,5	164	7244-BCB-MP	322	464	12	2100	1800	37
240	440	72	4	1,5	180	7248-BCB-MP	363	538	13,3	1900	1700	49

Empfohlene Anschlussmaße siehe Seite 454
For recommended abutment and fillet dimensions see page 454

Schrägkugellager, abgedichtet

Angular Contact Ball Bearings with Seals and Shields

NKE
BEARINGS

Abgedichtete einreihige NKE Schrägkugellager

Normen, Hauptabmessungen

Maßpläne DIN 616

Ein- und zweireihige
Schrägkugellager;
metrische Abmessungen DIN 628

Allgemeines

NKE fertigt einreihige Schrägkugellager der Reihen 72 und 73 mit verstärktem Innenaufbau (Nachsetzzeichen BE) auch mit berührenden Dichtungen, Bauform RSR (Nachsetzzeichen -2RSR) als auch mit Deckscheiben (Nachsetzzeichen -2Z).

Baureihen

Einreihige NKE Schrägkugellager mit Dicht- bzw. Deckscheiben basieren auf Schrägkugellagern der Reihen **72 BE** und **73 BE** und weisen daher ähnliche technische Charakteristika wie **Standard-Schrägkugellager** dieser Baureihen auf (siehe Seite 456)

Auftragsbezogen können auch **NKE Schrägkugellager** anderer Baureihen (**70, 74** etc.) mit Dicht- bzw. Deckscheiben produziert werden.

Da es sich dabei jedoch um eine ausgesprochene Sonderfertigung handelt, ersuchen wir die jeweilige Verfügbarkeit anzufragen.

NKE Sealed Single Row Angular Contact Ball Bearings

Standards, Boundary Dimensions

Standard plans DIN 616

Single and double row
Angular contact ball bearings;
metric dimensions DIN 628

General

NKE produces single row angular contact ball bearings with reinforced internal design, series 72 BE and 73 BE, also with contacting **RSR**-type seals (suffix -2RSR) and pressed steel shields (suffix -2Z).

Bearing Series Available

NKE single row angular contact ball bearings with seals or shields are based on bearing series 72 BE and 73 BE.

Therefore, these bearings feature similar technical characteristics as described for the standard type metric **single row angular contact ball bearings**; see page 456.

However, NKE also produces **single row angular contact ball bearings** with seals or shields based on alternative bearing series to customer order.

This requires special batch production, therefore please check availability.

Druckwinkel α

Einreihige NKE Schrägkugellager mit Dicht- bzw. Deckscheiben werden serienmäßig mit einem Druckwinkel von 40° (Nachsetzzeichen B) produziert.

Käfige

Abgedichtete einreihige NKE Schrägkugellager sind standardmäßig mit einem **glasfaserverstärkten Polyamid-Fensterkäfig** (Nachsetzzeichen TVP) ausgestattet.

Für Sonderanwendungen können auf Anfrage abgedichtete **NKE Schrägkugellager** auch mit Käfigen aus anderen Werkstoffen, wie etwa Stahlblechkäfigen (Nachsetzzeichen J) oder Messingblechkäfigen (Nachsetzzeichen Y) geliefert werden.

Sofern eine bestimmte vom Standard abweichende Käfigausführung gewünscht wird, ersuchen wir die jeweilige Verfügbarkeit anzufragen.

Lageranordnung

Einreihige NKE Schrägkugellager mit Dicht- bzw. Deckscheiben werden serienmäßig in der Ausführung als Einzellager produziert.

Achtung:

Einreihige NKE Schrägkugellager mit Dicht- bzw. Deckscheiben in der Standard-Ausführung sind für einen paar- oder satzweisen Einbau NICHT geeignet!

Für andere Ausführungen ersuchen wir die jeweilige Verfügbarkeit anzufragen.

Contact Angle α

NKE single row angular contact ball bearings with seals or shields are produced as standard with 40° contact angle (suffix B).

Cages

NKE single row angular contact ball bearings with seals or shields are produced with **glass fibre reinforced polyamide** cages as standard, suffix TVP.

For special applications, other cage designs are available on order request, e.g. pressed steel cages (suffix J) or pressed brass cages (suffix Y) etc.

If a specific cage design is required, please check for availability.

Bearing Arrangements

NKE single row angular contact ball bearings with seals or shields are produced for use as individual bearings.

NOTE:

Standard design NKE single row angular contact ball bearings with seals or shields are NOT suitable for use as bearing pairs or sets!

For other design variants, please check availability.

Schrägkugellager, abgedichtet

Angular Contact Ball Bearings with Seals and Shields

NKE
BEARINGS

Befettung

Abgedichtete einreihige NKE Schrägkugellager werden standardmäßig bis zu einem Bohrungsdurchmesser $d \leq 60$ mm mit einer speziellen Fettfüllung geliefert.

Dabei handelt es sich um einen speziell auf die typischen Anforderungen dieser Lager abgestimmten geräuscharmen Hochleistungsschmierstoff (**K2N-30** nach DIN 51502).

Dieser Schmierstoff ist für einen Temperaturbereich von **-50°C - +150°C** geeignet.

Bei Lagern mit einem Bohrungsdurchmesser $d > 60$ mm ist die Standardbefettung mit einem hochwertigen Schmierfett auf Lithium-Seifen-Basis (**K3K-30** nach DIN51502) für einen Temperaturbereich von **-30°C bis +120°C**.

Montagehinweise

Abgedichtete einreihige **NKE** Schrägkugellager dürfen bei der Montage nicht im Ölbad erwärmt werden.

Toleranzen

Abgedichtete einreihige NKE Schrägkugellager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 54.

Grease Filling

NKE sealed single row angular contact ball bearings are produced and supplied up to a bore diameter $d \leq 60$ mm with a specific grease filling as standard.

This is a high performance specific silent lubricant that has been specifically selected to fulfil normal application requirements. This grease fulfils the requirements of **K2N-30** according to DIN 51502. The grease is suitable for an operating temperature range from **-50°C** (or **-58°F**) up to **+150°C** (or **+302°F**).

For bearings with bore diameter $d > 60$ mm the standard grease filling is a high quality lithium-soap-grease (**K3K-30** according to DIN51502) for a temperature range of **-30°C** (**-22°F**) up to **+120°C** (**+284°F**).

Mounting Instructions

NKE sealed single row angular contact ball bearings must not be heated using hot oil baths.

Tolerances

NKE angular contact ball bearings with seals and shields are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 239.

Lagerberechnung

Einreihige NKE Schrägkugellager mit Dicht- bzw. Deckscheiben basieren auf Schrägkugellagern der Reihen **72 BE** und **73 BE**.

Für die Berechnung der Lagerlebensdauer können daher die selben Formeln und Berechnungsverfahren wie für die Standard-Schrägkugellager der Reihen **72 BE** und **73 BE** bei einer Verwendung als Einzellager verwendet werden, siehe Seite **14**.

Achtung:

Bei Dauer-Betriebstemperaturen wesentlich über **70°C** wird zusätzlich zur Abschätzung der Lagerlebensdauer auch eine Überprüfung der Schmierstoff-Gebrauchsdauer empfohlen.

Weitere Informationen dazu entnehmen Sie bitte dem Abschnitt „**Schmierung von Wälzlagern**“, ab Seite **198**.

Bearing Life Calculation

NKE single row angular contact ball bearings with seals or shields, respectively, are based on bearing series **72 BE** and **73 BE**.

Thus, the same procedures and formulas may be used for estimating the bearing life ratings as described for standard angular contact ball bearings when used as individual bearings, see page **14**.

Note:

When the actual operating temperature is constantly above **+70°C (+158 °F)**, a check of the grease service life is recommended in addition to an estimation of the bearing life rating.

For further specific information please refer to “**Lubrication of Rolling Bearings**”, page **330**.

Zweireihige Schrägkugellager

Double Row Angular Contact Ball Bearings

Normen, Hauptabmessungen

Maßpläne	DIN 616
Zweireihige Schrägkugellager	DIN 628

Standards, Boundary Dimensions

Standard plans	DIN 616
Double row angular contact bearings	DIN 628

Allgemeines

Zweireihige Schrägkugellager entsprechen in ihrer Funktion einem Paar einreihiger Schrägkugellager in O-Anordnung, weisen aber eine geringere Baubreite auf.

General

Double row angular contact ball bearings provide the function of a pair of single row angular contact ball bearings, arranged back-to-back, but requiring less space.

Zweireihige Schrägkugellager ergeben sehr starre Lagerungen und eignen sich gut zur Übertragung kombinierter Belastungen, können aber auch Kippmomente gut aufnehmen.

Double row angular contact bearings provide very stiff, rigid bearing arrangements. They are also able to accommodate combined loads and are very suitable in supporting tilting moments.

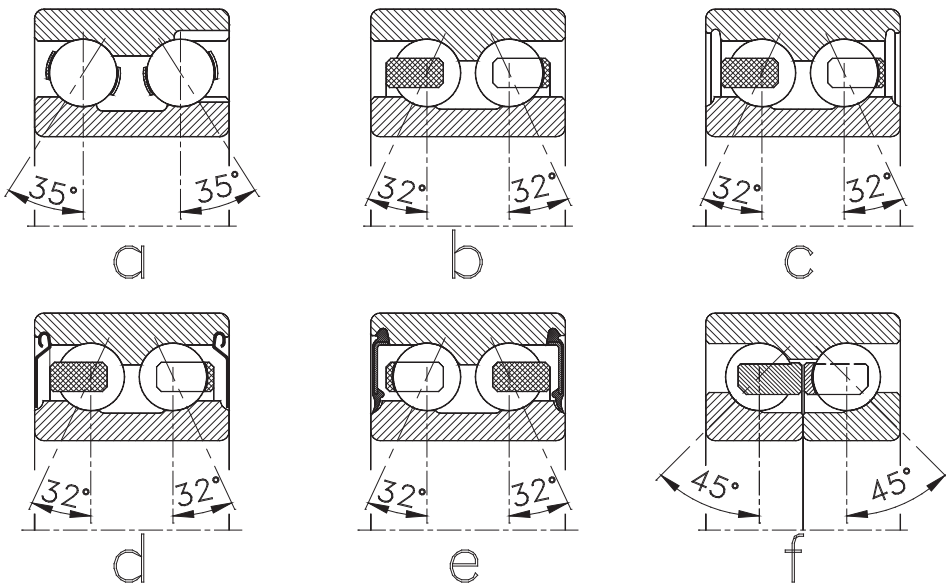


Abb. 1
 Fig. 1

Bauformen (siehe Seite 470, Abb. 1)

Zweireihige Schrägkugellager (Abb. 1a) haben einen Druckwinkel von **35°**, einen Stahlblechkäfig und weisen auf einer Seite Füllnuten auf.

Diese Lager sind so einzubauen, dass die jeweils größeren Axialkräfte in Richtung der Laufbahnen ohne Füllnuten wirken.

Neuere Konstruktionen weisen keine Füllnuten auf und sind daher in beiden Richtungen gleich gut zur Aufnahme von Axiallasten geeignet.

Die Ausführung ohne Füllnuten (siehe Abb. 1b) weist einen **Druckwinkel von 32°** auf und ist mit Kunststoffkäfigen ausgestattet.

Zweireihige NKE Schrägkugellager dieser Ausführung werden durch das Nachsetzzeichen **B-TV** identifiziert.

Aus fertigungstechnischen Gründen können auch offene Lager der Ausführung **B-TV** eingedrehte Nuten am Außenring, die normalerweise zur Befestigung von Dicht- oder Deckscheiben dienen, aufweisen (siehe Abb. 1c).

Zweireihige NKE Schrägkugellager der Ausführung **B-TV** werden auch mit beidseitigen Deckscheiben (Nachsetzzeichen **B-TV-2Z**, siehe Abb. 1d) bzw. mit zwei schleifenden Dichtungen, Nachsetzzeichen **B-TV-2RSR** (Abb. 1e) hergestellt.

Für spezielle Anwendungsfälle, wie etwa Ritzellagerungen, werden **zweireihige NKE Schrägkugellager** auftragsbezogen auch in zerlegbarer Ausführung mit geteiltem Innenring hergestellt (Nachsetzzeichen **D**, siehe Abb. 1f). Diese Lager haben einen Druckwinkel von **45°** und weisen keine Füllnuten auf, daher werden Axialkräfte in beiden Richtungen gleich gut aufgenommen.

Diese Lager sind großteils mit Messingmassivkäfigen ausgestattet und ergeben sehr starre Lagerungen.

Design Variants (see page 470, fig.1)

Double row angular contact ball bearings (fig. 1a) feature a contact angle of **35°**, a pressed steel cage and filling slots on one side.

These bearings must be mounted in such a way that the large thrust force acts towards the raceways without the filling slots.

The latest designs do not have such filling slots and are capable of accommodating thrust forces equally well in both directions.

The design without filling slots (fig. 1b) have **contact angles of 32°** and are fitted with polyamide cages; these designs are designated by the suffix (**B-TV**).

For manufacturing reasons, the open design bearings (suffix **B-TV**) may have grooves in their outer rings that are used to locate either seals or shields (fig. 1c).

NKE double row angular contact ball bearings of the **B-TV** design are available with shields suffix **B-TV-2Z** (fig. 1d) or with two contacting seals, (suffix **B-TV-2RSR**), (fig. 1e) fitted on both sides.

NKE double row angular contact ball bearings are also available as special design to meet customer order requirements. Such an application could be the bearing arrangement for pinion shafts (fig. 1f) These bearings are separable and feature a contact angle of **45°**, machined **solid brass cages**, 2-half inners and no filling slots.

These bearings provide a very rigid bearing arrangement, and are capable of accommodating thrust forces equally well in both directions. This bearing design is identified by the suffix **D**.

Schiefstellung

Zweireihige Schrägkugellager sind für einen Ausgleich von Schiefstellungen ungeeignet.

Toleranzen

Zweireihige NKE Schrägkugellager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingengten Toleranzen, wie beispielsweise in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 54.

Lager mit Dicht- und Deckscheiben

Zweireihige NKE Schrägkugellager in abgedeckter (Nachsetzzeichen **-B-TV-2Z**, siehe Abb. 1d) oder abgedichteter Ausführung (Nachsetzzeichen **B-TV-2RSR**, Abb. 1e) werden bereits werksseitig mit einem hochwertigen Wälzlagerfett befüllt.

Als **Standardfett** verwenden wir ein qualitativ hochwertiges Wälzlagerfett, das für Betriebstemperaturen von **-30°C** bis **+120°C** geeignet ist.

Für spezielle Anwendungsbereiche können zweireihige NKE Schrägkugellager auch mit Fetten nach Kundenvorgaben geliefert werden.

Zweireihige Schrägkugellager mit Deckscheiben

Die in den Außenring eingepressten Stahlblech-Deckscheiben (Nachsetzzeichen **B-TV-2Z**, siehe Abb. 1d) bilden eine einfache, berührungsfreie Spaltdichtung.

Im Betrieb kann sich durch den Dichtspalt ein Fettkragen am Innenring bilden. Bei Anwendungen mit rotierendem Außenring ist bei höheren Drehzahlen ein Fettverlust möglich.

Misalignment

Double row angular contact ball bearings must not be exposed to any misalignment.

Tolerances

NKE double row angular contact ball bearings are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data/ Tolerances**” page 237.

Sealed and Shielded Bearings

NKE double row angular contact ball bearings with shields, suffix **B-TV-2Z**, (fig. 1d), or with contacting seals, suffix **B-TV-2RSR**, (fig. 1e) are already supplied with a proven high quality bearing grease fill.

NKE uses a high quality rolling bearing grease as standard, suitable for a temperature range of **-30°C** to **+120°C**. (**-22°F** to **+248°F**)

To meet special operating conditions NKE also produces double row angular contact bearings with special grease pack according to customer's specific requests.

Shielded Double Row Angular Contact Ball Bearings

Incorporated shields (suffix **B-TV-2Z**, see fig. 1d) are steel disks that are pressed into the outer ring and form a simple gap seal to the bearing inner rings.

During operation a grease collar may develop on the inner rings. Some grease escape is possible for applications where the outer ring rotates at high speeds.

Zweireihige NKE Schrägkugellager mit Dichtscheiben

Der Standardwerkstoff der bei den mit Dichtscheiben versehenen zweireihigen Schrägkugellagern (Nachsetzzeichen **B-TV-2RSR**, Abb. 1e) verwendeten Dichtungen ist ein verschleißfester synthetischer Kautschuk, Kurzzeichen **NBR**, in den zur Versteifung Stahlscheiben einvulkanisiert sind.

NBR-Dichtscheiben sind für Einsatztemperaturen von **-30°C bis +120°C** geeignet.

Für Sonderanwendungen sind auch Dichtungen aus anderen Werkstoffen lieferbar.

Weitere Informationen dazu finden Sie im Abschnitt „**Lagerdaten allgemein**“.

Mindestbelastung

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE zweireihige Schrägkugellager muss die Mindestbelastung **1%** der dynamischen Tragzahl betragen.

Äquivalente dynamische Lagerbelastung

Bei den **zweireihigen Schrägkugellagern** hängen die zur Berechnung erforderlichen Faktoren von den Druckwinkeln der jeweils verwendeten Lagerausführung ab:

NKE Double Row Angular Contact Ball Bearings with Seals

The standard material used for the contacting seals in NKE double row angular contact ball bearings suffix **B-TV-2RSR**, (fig. 1e) is a special wear-resistant synthetic rubber (**NBR**) with an integrated steel stiffening washer.

NBR-seals are suitable for operating temperatures of **-30°C up to +120°C (-22°F to +248°F)**.

For special applications, however, seals are also available in other materials.

For more detailed information see the chapter “**General Bearing Data**”.

Minimum Load

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE double row angular contact ball bearings the minimum load must be **1%** of the dynamic load rating.

Equivalent Dynamic Bearing Load

In the case of **double row angular contact ball bearings** the calculation factors depend upon the contact angle of the selected bearing:

Zweireihige Schrägkugellager
Double Row Angular Contact Ball Bearings



Käfige

Sofern nicht anders spezifiziert, werden **Zweireihige NKE Schrägkugellager** mit den vorher beschriebenen Standardkäfigen geliefert.

Da bei den zweireihigen Schrägkugellagern ein enger Zusammenhang zwischen Innenaufbau und den verfügbaren Käfigbauarten besteht, ersuchen wir die Liefermöglichkeit von Lagern mit von der Standardausführung abweichenden Käfigen anzufragen.

Lagerluft

Bei zweireihigen Schrägkugellagern wird die **Axialluft** angegeben. **Zweireihige NKE Schrägkugellager** werden standardmäßig in der Axialluftklasse **CN (Normalluft)** gefertigt.

Auf Anfrage liefert NKE aber auch zweireihige Schrägkugellager mit größerer Axialluftklassen (**C3, C4**) oder kleinerer Axialluft (**C2**).

Werte für die axiale Lagerluft der **Zweireihige Schrägkugellager** sind in untenstehender Tabelle angegeben.

Axiale Lagerluft der **zweireihigen NKE Schrägkugellager** (Luftwerte in [µm])

Internal axial clearance of NKE double row angular contact ball bearings (Clearance in [µm])

Lagerbohrung <i>Bore diameter</i>	[mm]	>	--	10	18	24	30	40	50	65	80	100	120
		≤	10	18	24	30	40	50	65	80	100	120	140
Luftgruppe <i>Clearance group</i>	C2	min	1	1	2	2	2	2	3	3	3	4	4
		max	11	12	14	15	16	18	22	24	26	30	34
Luftgruppe <i>Clearance group(NORMAL)</i>	CN	min	5	6	7	8	9	11	13	15	18	22	25
		max	21	23	25	27	29	33	36	40	46	53	59
Luftgruppe <i>Clearance group</i>	C3	min	12	13	16	18	21	23	26	30	35	42	48
		max	28	31	34	37	40	44	48	54	63	73	82
Luftgruppe <i>Clearance group</i>	C4	min	25	27	28	30	33	36	40	46	55	65	74
		max	45	47	48	50	54	58	63	71	83	96	108

Cages

NKE double row angular contact ball bearings are, depending upon their design and size, produced and fitted with pressed steel, polyamide or solid brass cages as standard.

Because there is a close connection between the internal design of double row angular contact ball bearings and the cages available, we kindly ask to clarify this point prior to placing an order.

Internal Clearance

NKE double row angular contact ball bearings are produced to axial clearance group **CN** (Normal) as standard.

NKE also produces double row angular contact ball bearings with enlarged axial clearance (groups **C3** or **C4**) and with reduced axial clearance (**C2**) on request.

Values for these clearance groups are listed in the table below.

- für Lager der Standardausführung B mit einem Druckwinkel $\alpha = 32^\circ$:

bei

$$\frac{F_a}{F_r} \leq 0,86 \text{ gilt } P = F_r + 0,73 * F_a$$

bzw, wenn

$$\frac{F_a}{F_r} > 0,86 \text{ dann } P = 0,62 * F_r + 1,17 * F_a$$

- für Lager der alten Ausführung (Füllnuten) mit einem Druckwinkel $\alpha = 35^\circ$:

bei

$$\frac{F_a}{F_r} \leq 0,95 \text{ gilt } P = F_r + 0,66 * F_a$$

bzw, wenn

$$\frac{F_a}{F_r} > 0,95 \text{ dann } P = 0,6 * F_r + 1,07 * F_a$$

Äquivalente statische Lagerbelastung

- für Lager der Standardausführung B mit einem Druckwinkel $\alpha = 32^\circ$ gilt:

$$P_0 = F_r + 0,63 * F_a$$

- bei Lagern der alten Ausführung mit einem Druckwinkel $\alpha = 35^\circ$:

$$P_0 = F_r + 0,58 * F_a$$

- for Bearings of Standard Design B with a Contact Angle of $\alpha = 32^\circ$

when

$$\frac{F_a}{F_r} \leq 0,86, \text{ then } P = F_r + 0,73 * F_a$$

or, when

$$\frac{F_a}{F_r} > 0,86, \text{ then } P = 0,62 * F_r + 1,17 * F_a$$

- for Bearings of the Old Design (Filling Slots) with a Contact Angle of $\alpha = 35^\circ$:

when

$$\frac{F_a}{F_r} \leq 0,95, \text{ then } P = F_r + 0,66 * F_a$$

or when

$$\frac{F_a}{F_r} > 0,95, \text{ then } P = 0,6 * F_r + 1,07 * F_a$$

Equivalent Static Bearing Load

- for standard bearings B with a contact angle of $\alpha = 32^\circ$:

$$P_0 = F_r + 0,63 * F_a$$

- for bearings of the old design with a contact angle of $\alpha = 35^\circ$:

$$P_0 = F_r + 0,58 * F_a$$

Anschlussmaße

Die Radien der Kantenverrundung dürfen nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen. Daher muss der größte Hohlkehlradius an den Anschlussstellen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe.

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert, die Werte der Kantenverrundung der Lagerringe sind in den Produkttabellen angegeben.

Montagehinweise

Zweireihige Schrägkugellager mit **Füllnuten** müssen so eingebaut werden, dass die jeweils größeren Axialkräfte in Richtung der Laufbahnen ohne Füllnuten wirken.

Vorgefettete Lager, das sind alle Lager mit Dicht- oder Deckscheiben, Nachsetzzeichen **B-2Z** und **B-2RSR**, dürfen vor dem Einbau nicht ausgewaschen werden.

Abutment and Fillet Dimensions

The bearing rings, must only contact adjacent parts with their side faces.

The radii of bearing corners must not touch the corner fillet radii of either the shaft or housing shoulders. Therefore, the largest fillet radius (r_g or r_{g1} , respectively) must always be smaller than the minimum fillet dimension of the bearing rings (r_s). Recommendations for the dimensions of adjacent parts are listed in **DIN 5418**, the values for the bearing fillet dimensions are stated in the bearing tables.

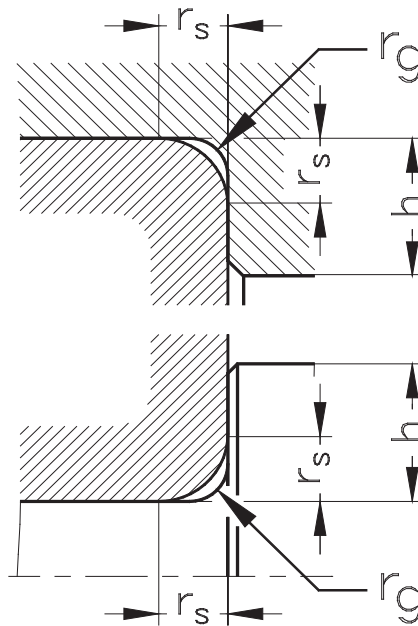
Mounting Instructions

Double row angular contact ball bearings with **filling slots** must be mounted in such a way that the larger thrust forces act towards the raceways without the filling slots.

Pre-greased bearings, such as sealed or shielded bearings (suffixes **B-2Z** and **B-2RSR**) must not be washed out prior to mounting.

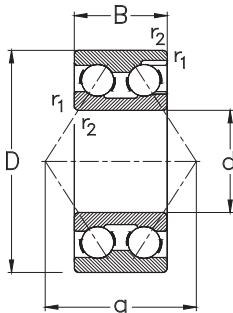
Anschlussmaße für Zweireihige Schrägkugellager
Abutment and Fillet Dimensions for Double Row Angular Contact Ball Bearings

Alle Abmessungen in [mm]
All Dimensions are in [mm]

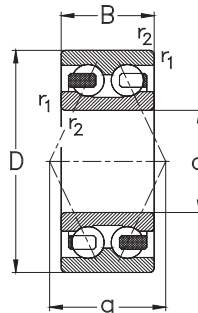


$r_{s \text{ min}}$	$r_{g \text{ max}}$	h_{min} Lagerreihen Bearing series 32 .. / 32 ..-B 33 .. / 33 ..-B
0,6	0,6	2,1
1	1	2,8
1,1	1	3,5
1,5	1,5	4,5
2	2	5,5
2,1	2,1	6
3	2,5	7
4	3	8,5

Zweireihige Schrägkugellager
Double Row Angular Contact Ball Bearings

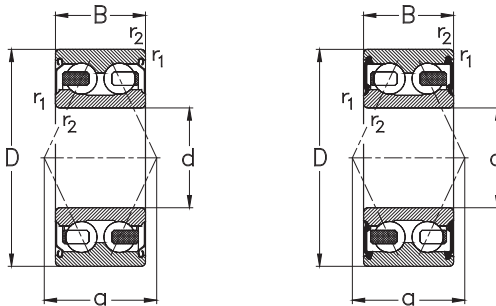


32..
33..



32..-B-TV
33..-B-TV

Hauptabmessungen [mm]					Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
10	30	14	0,6	15	3200-B-TV	7,5	4,3	0,2	17300	24000	0,05
	30	14	0,6	15	3200-B-2RSR-TV	7,5	4,3	0,2	-	17000	0,05
	30	14	0,6	15	3200-B-2Z-TV	7,5	4,3	0,2	-	24000	0,05
12	32	15,9	0,6	17	3201-B-TV	10,3	5,6	0,3	16500	22000	0,06
	32	15,9	0,6	17	3201-B-2RSR-TV	10,3	5,6	0,3	-	15000	0,06
	32	15,9	0,6	17	3201-B-2Z-TV	10,3	5,6	0,3	-	22000	0,06
15	35	15,9	0,6	18	3202-B-TV	11,3	6,8	0,3	14100	18000	0,07
	35	15,9	0,6	18	3202-B-2RSR-TV	11,3	6,8	0,3	-	14000	0,07
	35	15,9	0,6	18	3202-B-2Z-TV	11,3	6,8	0,3	-	18000	0,07
	42	19	1	22	3302-B-TV	15,5	9,4	0,4	13300	16000	0,13
17	40	17,5	0,6	20	3203-B-TV	14,0	8,7	0,4	12700	16000	0,1
	40	17,5	0,6	20	3203-B-2RSR-TV	14,0	8,7	0,4	-	12000	0,1
	40	17,5	0,6	20	3203-B-2Z-TV	14,0	8,7	0,4	-	16000	0,1
	47	22,2	1	24	3303-B-TV	20,2	11,9	0,4	10700	14000	0,2
	47	22,2	1	24	3303-B-2RSR-TV	20,2	11,9	0,5	-	11000	0,2
	47	22,2	1	24	3303-B-2Z-TV	20,2	11,9	0,5	-	14000	0,2
20	47	20,6	1	24	3204-B-TV	18,8	12,1	0,6	11500	14000	0,2
	47	20,6	1	24	3204-B-2RSR-TV	18,8	12,1	0,6	-	10000	0,2
	47	20,6	1	24	3204-B-2Z-TV	18,8	12,1	0,6	-	14000	0,2
	52	22,2	1,1	26	3304-B-TV	22,3	14,3	0,7	9100	13000	0,2
	52	22,2	1,1	26	3304-B-2RSR-TV	22,3	14,3	0,7	-	9000	0,2
	52	22,2	1,1	26	3304-B-2Z-TV	22,3	14,3	0,7	-	13000	0,2



Anschlussmaße siehe Seite 477

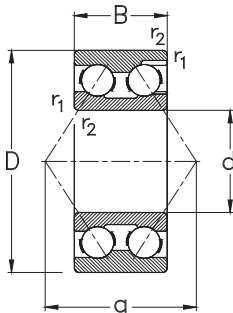
Abutment and fillet dimensions
see on page 477

32..-B-2Z-TV
33..-B-2Z-TV

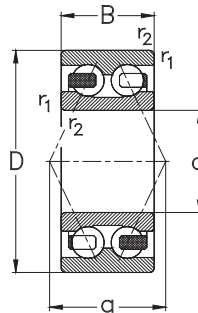
32..-B-2RSR-TV
33..-B-2RSR-TV

Hauptabmessungen [mm]					Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
25	52	20,6	1	27	3205-B-TV	20,3	14,1	0,6	9700	12000	0,2
	52	20,6	1	27	3205-B-2RSR-TV	20,3	14,1	0,6	-	8500	0,2
	52	20,6	1	27	3205-B-2Z-TV	20,3	14,1	0,6	-	12000	0,2
62	25,4	1,1	31	3305-B-TV	28,5	19,2	0,9	7900	11000	0,4	
	62	25,4	1,1	31	3305-B-2RSR-TV	28,5	19,2	0,9	-	7500	0,4
	62	25,4	1,1	31	3305-B-2Z-TV	28,5	19,2	0,9	-	11000	0,4
30	62	23,8	1	31	3206-B-TV	28,2	20,2	0,9	8500	10000	0,3
	62	23,8	1	31	3206-B-2RSR-TV	28,2	20,2	0,9	-	7500	0,3
	62	23,8	1	31	3206-B-2Z-TV	28,2	20,2	0,9	-	10000	0,3
72	30,2	1,1	36	3306-B-TV	39,5	27,5	1,2	7200	9000	0,6	
	72	30,2	1,1	36	3306-B-2RSR-TV	39,5	27,5	1,2	-	6300	0,6
	72	30,2	1,1	36	3306-B-2Z-TV	39,5	27,5	1,2	-	9000	0,6
35	72	27	1,1	36	3207-B-TV	37,2	27,4	1,2	7600	9000	0,4
	72	27	1,1	36	3207-B-2RSR-TV	37,2	27,4	1,2	-	6300	0,4
	72	27	1,1	36	3207-B-2Z-TV	37,2	27,4	1,2	-	9000	0,4
80	34,9	1,5	41	3307-B-TV	49,4	33,2	1,5	6800	8500	0,8	
	80	34,9	1,5	41	3307-B-2RSR-TV	49,4	33,2	1,5	-	6000	0,8
	80	34,9	1,5	41	3307-B-2Z-TV	49,4	33,2	1,5	-	8500	0,8
40	80	30,2	1,1	41	3208-B-TV	46	34,6	1,6	7100	8000	0,6
	80	30,2	1,1	41	3208-B-2RSR-TV	46	34,6	1,6	-	5600	0,6
	80	30,2	1,1	41	3208-B-2Z-TV	46	34,6	1,6	-	8000	0,6
90	36,5	1,5	46	3308-B-TV	59,6	43,4	2	6000	7000	1	

Zweireihige Schrägkugellager
Double Row Angular Contact Ball Bearings

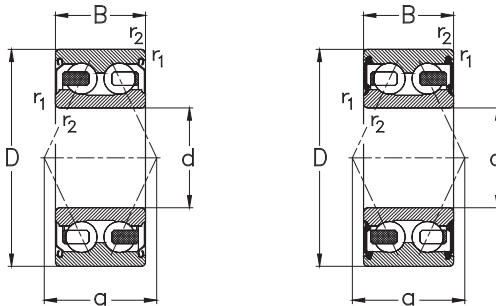


32..
33..



32..-B-TV
33..-B-TV

Hauptabmessungen [mm]					Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
d	D	B	r ₁ , r ₂ min	a		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
40	90	36,5	1,5	46	3308-B-2RSR-TV	59,6	43,4	2	-	5000	1
	90	36,5	1,5	46	3308-B-2Z-TV	59,6	43,4	2	-	7000	1
45	85	30,2	1,1	43	3209-B-TV	45,8	35,4	1,6	6500	7500	0,6
	85	30,2	1,1	43	3209-B-2RSR-TV	45,8	35,4	1,6	-	5300	0,6
	85	30,2	1,1	43	3209-B-2Z-TV	45,8	35,4	1,6	-	7500	0,6
100	100	39,7	1,5	50	3309-B-TV	65,4	48,9	2,2	5500	6300	1,4
	100	39,7	1,5	50	3309-B-2RSR-TV	65,4	48,9	2,2	-	4800	1,4
	100	39,7	1,5	50	3309-B-2Z-TV	65,4	48,9	2,2	-	6300	1,4
50	90	30,2	1,1	45	3210-B-TV	48,9	40,2	1,9	5900	7000	0,7
	90	30,2	1,1	45	3210-B-2RSR-TV	48,9	40,2	1,9	-	4800	0,7
	90	30,2	1,1	45	3210-B-2Z-TV	48,9	40,2	1,9	-	7000	0,7
	110	44,4	2	55	3310-B-TV	77,6	59,2	2,7	5200	6000	2
110	110	44,4	2	55	3310-B-2RSR-TV	77,6	59,2	2,7	-	4300	2
	110	44,4	2	55	3310-B-2Z-TV	77,6	59,2	2,7	-	6000	2
	55	100	33,3	1,5	50	3211-B-TV	55,9	47,1	2,1	5500	6300
100		33,3	1,5	50	3211-B-2RSR-TV	55,9	47,1	2,1	-	4500	1,1
100		33,3	1,5	50	3211-B-2Z-TV	55,9	47,1	2,1	-	6300	1,1
120	120	49,2	2	61	3311-B-TV	97,8	75,6	3,4	5000	4800	2,6
	120	49,2	2	61	3311-B-2RSR-TV	97,8	75,6	3,4	-	3800	2,6
	120	49,2	2	61	3311-B-2Z-TV	97,8	75,6	3,4	-	4800	2,6
60	110	36,5	1,5	55	3212-B-TV	68,5	58,6	2,7	5200	5600	1,4
	110	36,5	1,5	55	3212-B-2RSR-TV	68,5	58,6	2,7	-	4000	1,4



Anschlussmaße siehe Seite 477

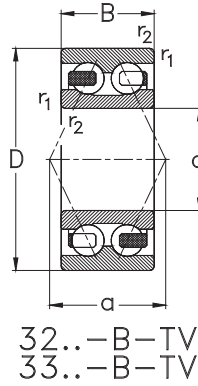
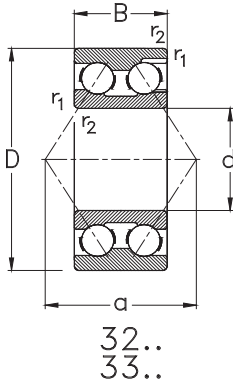
Abutment and fillet dimensions
see on page 477

32..-B-2Z-TV
33..-B-2Z-TV

32..-B-2RSR-TV
33..-B-2RSR-TV

Hauptabmessungen [mm]					Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
60	110	36,5	1,5	55	3212-B-2Z-TV	68,5	58,6	2,7	-	5600	1,4
	130	54	2,1	67	3312-B-TV	119,8	94,1	4,3	4700	5000	3,3
	130	54	2,1	67	3312-B-2RSR-TV	119,8	94,1	4,3	-	3000	3,3
	130	54	2,1	67	3312-B-2Z-TV	119,8	94,1	4,3	-	5000	3,3
65	120	38,1	1,5	60	3213-B-TV	76,1	68,8	3,1	4800	4800	1,8
	120	38,1	1,5	60	3213-B-2RSR-TV	76,1	68,8	3,1	-	3000	1,8
	120	38,1	1,5	60	3213-B-2Z-TV	76,1	68,8	3,1	-	4800	1,8
	140	58,7	2,1	71	3313-B-TV	135,7	108,3	4,9	4700	4800	4,1
	140	58,7	2,1	71	3313-B-2RSR-TV	135,7	108,3	4,9	-	3600	4,1
	140	58,7	2,1	71	3313-B-2Z-TV	135,7	108,3	4,9	-	4800	4,1
70	125	39,7	1,5	62	3214-B	79,2	72,6	3,3	4600	4500	1,9
	125	39,7	1,5	62	3214-B-2RSR-TV	79,2	72,6	3,3	-	3400	1,9
	125	39,7	1,5	62	3214-B-2Z-TV	79,2	72,6	3,3	-	4500	1,9
	150	63,5	2,1	109	3314	143,3	167,8	7,3	4200	4300	5,1
75	130	41,3	1,5	65	3215-B-TV	86,5	80,2	3,6	4400	4500	2,1
	160	68,3	2,1	117	3315	163	193	8,1	4000	4000	6,2
80	140	44,4	2	69	3216-B-TV	93,7	88,3	3,8	4300	4300	2,7
	170	68,3	2,1	123	3316	177	213	8,6	3700	3600	7
85	150	49,2	2	106	3217	112	151	6,3	4000	3800	3,4
	180	73	3	131	3317	190	228	7	3600	3400	8,3
90	160	52,4	2	113	3218	135	183	7,4	3800	3600	4,2
	190	73	3	136	3318	215	277	10,6	3200	3200	9,3

Zweireihige Schrägkugellager
Double Row Angular Contact Ball Bearings



Hauptabmessungen [mm]					Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]						Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
95	170	55,6	2,1	120	3219	140	186	4,3	4000	3400	5,1
	200	77,8	3	143	3319	219	283	10,5	3000	3000	11,1
100	180	60,3	2,1	127	3220	160	234	7,9	3500	3200	6,1
	215	82,6	3	153	3320	240	320	8,9	2900	2800	13,5
110	200	69,8	2,1	144	3222	190	260	5,6	3500	2800	8,8
	240	92,1	3	171	3322	280	400	10,6	2600	2600	19

Vierpunktlager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Vierpunktlager	DIN 628 / Teil 4

Allgemeines

Vierpunktlager sind eine Sonderform der einreihigen Schrägkugellager.

Sie weisen einen **Druckwinkel** von $\alpha = 35^\circ$ auf und können axiale Belastungen in beiden Richtungen sowie - in beschränktem Umfang - auch Radiallasten aufnehmen.

NKE Vierpunktlager der Bauform **QJ** haben zur Aufnahme einer möglichst großen Anzahl von Kugeln einen radial geteilten **Innenring** und sind somit zerlegbar.

Dadurch erleichtert sich auch deren Einbau, da der Außenring mit Kugelsatz getrennt von den Innenringhälften verbaut werden kann.

Four-Point Contact Ball Bearings

Standards, Boundary Dimensions

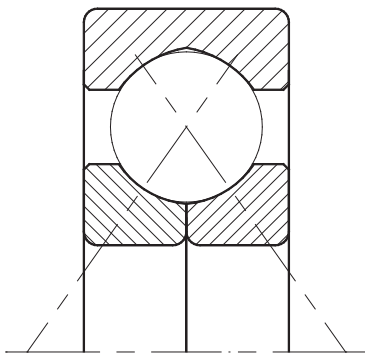
Standard plans	DIN 616
Four-point contact ball bearings	DIN 628 / part 4

General

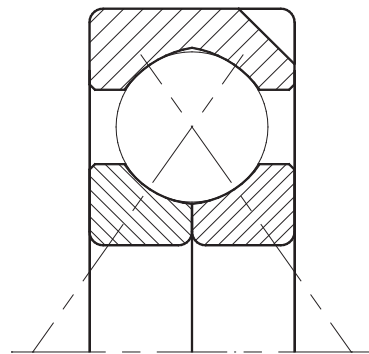
Four-point contact ball bearings, also called "**Duplex Bearings**", belong to the single row angular contact ball bearings family. But, unlike bearings of the series 7..., four-point contact bearings are able to support thrust loads in either direction including limited radial loads.

NKE four-point contact ball bearings of the QJ design feature a contact angle of $\alpha = 35^\circ$ and have **split inner rings** to allow the bearing to accept the maximum number of balls.

Due to the split inner rings, these bearings are separable. This facilitates mounting because the bearing outer ring together with cage and ball set and the inner ring halves may be mounted separately.



QJ... ..



QJ... ..-N2

Bauformen

Vierpunktlager werden häufig zur Aufnahme rein axialer Belastungen vorgesehen.

Um eine versehentliche Radiallastaufnahme aus-schließen zu können, werden solche Lager radial freigestellt. Dies geschieht üblicherweise durch eine um 1 mm größere Gehäusebohrung. Um ein Mitdrehen des Außenringes zu verhindern, werden Vierpunktlager daher häufig mit Haltenuten versehen.

NKE Vierpunktlager mit Außendurchmessern über Ø160 mm sind daher standardmäßig mit zwei in den Außenring eingefrästen Haltenuten versehen (Nachsetzzeichen **N2**).

Sonderformen der Vierpunktlager stellen Lager der Reihe **QJ 10..** sowie Vierpunktlager mit geteiltem Außenring (Bauform **Q**) dar, die wir auf Anfrage ebenfalls anbieten.

Schiefstellung

Vierpunktlager sind zum Ausgleich von Schiefstellungen grundsätzlich wenig geeignet.

Werden Vierpunktlager in Kombination mit Radiallagern als reine Axiallager verwendet, dürfen überhaupt keine Schiefstellungen auftreten.

Toleranzen

NKE Vierpunktlager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingeeengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 52.

Design Variants

Four-point contact ball bearings are frequently used to accommodate thrust loads only.

To avoid unwanted radial loading to the bearing they used to be mounted to oversized housing seats.

To prevent the outer ring from rotating in the housing, four-point contact ball bearing outer rings are often equipped with locating slots.

For this reason, **NKE four-point contact ball bearings** with outer diameters of more than Ø160 mm are produced with two locating slots in their outer ring (suffix **N2**).

Special series of four-point contact ball bearings are available on request represented by the series **QJ 10** and four-point contact ball bearings with split outer ring (series **Q**).

Misalignment

Four-point contact ball bearings are less suitable to operate with misalignments.

When they are used in combination with a radial bearing as pure thrust bearings, they must not be exposed to any misalignment.

Tolerances

NKE four-point contact bearings are produced to normal tolerance class (**PN**) as standard. On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 237.

Vierpunktlager

Four-Point Contact Ball Bearings



Käfige

Sofern nicht anders definiert, werden **NKE Vierpunktlager** standardmäßig mit Messing-Massivkäfigen (Nachsetzzeichen **MPA**) gefertigt.

Auf Wunsch können auch andere Käfige, wie etwa Massivkäfige aus Stahl (Nachsetzzeichen **FPA**), einige Typen auch mit Polyamidkäfigen (Nachsetzzeichen **TVP**) geliefert werden.

Lagerluft

Bei Vierpunktlagern wird die **Axialluft** angegeben. **NKE Vierpunktlager** werden standardmäßig in Axialluftklasse **CN (Normal)** gefertigt.

Auf Anfrage liefert **NKE** aber auch Vierpunktlager mit größerer (Axialluftklassen **C3**, **C4**) oder kleinerer Axialluft (Klasse **C2**).

Werte für die axiale Lagerluft der **NKE Vierpunktlager** sind in untenstehender Tabelle angegeben.

Cages

Unless otherwise specified, **NKE four-point contact ball bearings** are fitted with solid brass cages (suffix **MPA**) as standard.

Also, other cage types and materials are produced upon order; One-piece machined steel solid cage (suffix **FPA**) moulded polyamide cage (suffix **TVP**).

Internal Clearance

NKE four-point contact bearings are produced to axial clearance group **CN (Normal)** as standard.

NKE also produces four-point contact ball bearings with enlarged (axial clearance groups **C3** or **C4**) and/or with reduced axial clearance (Clearance group **C2**) on request.

Values for these clearance groups are listed in the table below.

Axiale Lagerluft der NKE Vierpunktlager (Luftwerte in [µm])

Internal Axial Clearance of NKE Four-Point Contact Ball Bearings (Clearances in [µm])

Lagerbohrung <i>Bore diameter</i>	[mm]	>	--	18	40	60	80	100	140	180	220
		≤	18	40	60	80	100	140	180	220	260
Luftgruppe <i>Clearance group</i>	C2	min	20	30	40	50	60	70	80	100	120
		max	60	70	90	100	120	140	160	180	200
Luftgruppe <i>Clearance group (NORMAL)</i>	CN	min	50	60	80	90	100	120	140	160	180
		max	90	110	130	140	160	180	200	220	240
Luftgruppe <i>Clearance group</i>	C3	min	80	100	120	130	140	160	180	200	220
		max	120	150	170	180	200	220	240	260	300
Luftgruppe <i>Clearance group</i>	C4	min	115	135	155	165	185	205	225	250	275
		max	165	185	205	225	245	265	295	325	355

Mindestbelastung

Vierpunktlager sind für hohe Drehzahlen geeignet. Für optimale Laufverhältnisse erfordern Vierpunktlager überwiegend **axiale Belastungen**.

Zufriedenstellende Kontaktverhältnisse liegen erst ab einem Lastverhältnis von

$$F_a \geq 1,27 * F_r$$

vor.

Wird dies nicht erreicht, ist mit einem Auftreten erhöhter Gleitreibung und daher mit hohem Laufgeräusch und Verschleiß zu rechnen.

Bei Vierpunktlagern sollte für eine zufriedenstellende Funktion unter normalen Betriebsbedingungen eine Mindestbelastung von etwa **1 bis 2%** der dynamischen Tragzahl **C_r** gegeben sein.

Äquivalente dynamische Lagerbelastung

Bei **Vierpunktlagern** gilt:

bei

$$\frac{F_a}{F_r} \leq 0,95 \quad \text{gilt} \quad P = F_r + 0,66 * F_a$$

bzw., wenn

$$\frac{F_a}{F_r} > 0,95 \quad \text{dann} \quad P = 0,6 * F_r + 1,07 * F_a$$

Äquivalente statische Lagerbelastung

$$P_0 = F_r + 0,58 * F_a$$

Minimum Load

Four-point contact ball bearings are suitable to operate at high speeds. For optimum contact behaviour, however, four-point contact ball bearings should be mainly exposed to **axial acting** loads.

An effective function is given, if

$$F_a \geq 1,27 * F_r$$

If this ratio is not attained or achieved, high sliding friction may occur in the bearing and thus generate high noise and excessive wear.

To function effectively, four-point contact ball bearings should run under a minimum bearing load of approximately **1 to 2%** of the dynamic load rating (**C_r**).

Equivalent Dynamic Bearing Load

In the case of **four-point contact ball bearings** the following formula should be used:

when

$$\frac{F_a}{F_r} \leq 0,95 \quad \text{then} \quad P = F_r + 0,66 * F_a$$

or, when

$$\frac{F_a}{F_r} > 0,95 \quad , \text{ then} \quad P = 0,6 * F_r + 1,07 * F_a$$

Equivalent static bearing load

$$P_0 = F_r + 0,58 * F_a$$

Vierpunktlager

Four-Point Contact Ball Bearings

Anschlussmaße

Vierpunktlager werden überwiegend zur Aufnahme axialer Belastungen eingesetzt. Daher ist besonders auf eine ausreichende axiale Unterstützung der Lagerringe durch die Anlageflächen an Wellenbunden bzw. Gehäuseschultern zu achten.

Die Radien der Kantenverrundung dürfen dabei nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen. Daher muss der größte Hohlkehleradius an den Anschlussstellen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_1 , r_2) der Lagerringe (siehe Zeichnung bei Tabelle auf der Folgeseite).

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert, die Werte der Kantenverrundung der Lagerringe sind in den Produkttabellen angegeben.

Empfehlungen zur Gestaltung der Anschlusssteile sind in der Tabelle auf der folgenden Seite angegeben.

Abutment and Fillet Dimensions

Four-point contact ball bearings are often used to accommodate thrust loads, so they do require optimum support of the bearing rings by the machine components surrounding the bearing. To gain adequate support the shaft and housing shoulders require a certain minimum height.

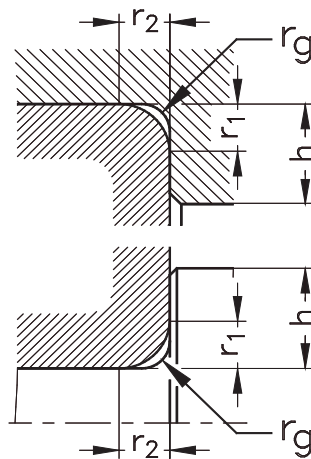
The bearing rings, however, must only contact adjacent parts with their side faces.

The radii of bearing corners must not touch the corner fillet radii of either the shaft or housing shoulders. Therefore, the largest fillet radius (r_g or r_{g1}) must always be smaller than the minimum fillet dimension of the bearing rings (r_1 , r_2).

Recommendations for the dimensions of adjacent parts listed in **DIN 5418**, the values for the bearing fillet dimensions are stated in the bearing tables, also refer to the details on the following page.

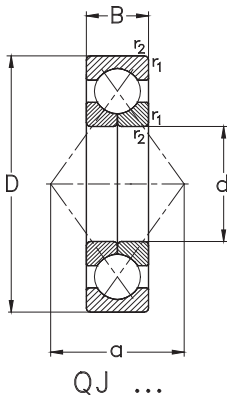
Anschlussmaße für Vierpunktlager
Abutment and Fillet Dimensions for Four-Point Contact Ball Bearings

Alle Abmessungen in [mm]
All Dimensions in [mm]



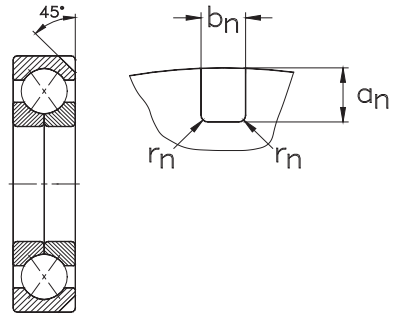
$r_1, r_2 \text{ min}$	$r_g \text{ max}$	h_{min} Lagerreihen Bearing series QJ 2 .. / QJ 3 ..
1,1	1	3,5
1,5	1,5	4,5
2	2	5,5
2,1	2,1	6
3	2,5	7
4	3	8,5
5	4	10

Vierpunktlager
Four-Point Contact Ball Bearings



Für $D \geq 160$ mm
Standardausführung
mit 2 Haltenuten im
Außenring (N2)

For $D \geq 160$ mm
standard design
with 2 location slots
in outer ring (N2)



QJ ... N2

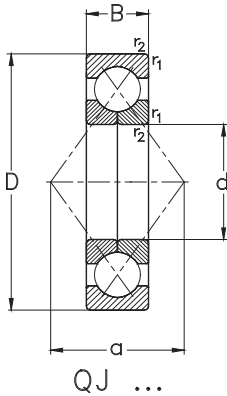
Hauptabmessungen [mm]								Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]								Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a	a _n	b _n	r _n	QJ ... MPA	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
20	47	14	1	23	--	--	--	QJ204-MPA	22,7	16,0	0,7	13800	28000	0,14
	52	15	1,1	26	--	--	--	QJ304-MPA	28,7	18,2	0,8	10800	24000	0,18
25	52	15	1	27	--	--	--	QJ205-MPA	25,3	19,8	0,9	12100	22000	0,17
	62	17	1,1	31	--	--	--	QJ305-MPA	40,7	27,8	1,3	9000	20000	0,25
30	62	16	1	32	--	--	--	QJ206-MPA	40,3	30	1,4	9800	19000	0,3
	72	19	1,1	36	--	--	--	QJ306-MPA	58	40,5	1,8	7800	17000	0,37
35	72	17	1,1	38	--	--	--	QJ207-MPA	52	40,0	1,8	8300	17000	0,46
	80	21	1,5	41	--	--	--	QJ307-MPA	64	46,5	2,1	7200	15000	0,5
40	80	18	1,1	42	--	--	--	QJ208-MPA	62	50	2,3	7300	15000	0,39
	90	23	1,5	46	--	--	--	QJ308-MPA	83	64	2,9	6400	14000	0,69
45	85	19	1,1	45	--	--	--	QJ209-MPA	65	55	2,5	6900	14000	0,48
	100	25	1,5	51	--	--	--	QJ309-MPA	98	77	3,5	5800	12000	0,95
50	90	20	1,1	49	--	--	--	QJ210-MPA	67	60	2,7	6600	13000	0,64
	110	27	2	56	--	--	--	QJ310-MPA	123	99	4,5	5300	11000	1,37
55	100	21	1,5	54	--	--	--	QJ211-MPA	83	76	3,5	5800	11000	0,68
	120	29	2	61	--	--	--	QJ311-MPA	142	116	5,3	4900	10000	1,74
60	110	22	1,5	60	--	--	--	QJ212-MPA	96	87	4,0	5400	10000	0,87
	130	31	2,1	67	--	--	--	QJ312-MPA	161	134	6,1	4600	9000	2,18
65	120	23	1,5	65	--	--	--	QJ213-MPA	114	106	4,8	4900	9500	1,24
	140	33	2,1	72	--	--	--	QJ313-MPA	182	154	6,9	4400	8500	2,69
70	125	24	1,5	68	--	--	--	QJ214-MPA	119	115	5,2	4700	9000	1,39
	150	35	2,1	77	--	--	--	QJ314-MPA	201	174	7,6	4100	8000	3,25

Anschlussmaße siehe Seite 489

*Abutment and fillet dimensions
see on page 489*

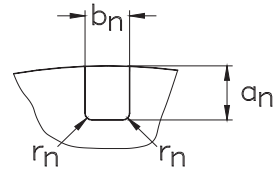
Hauptabmessungen [mm]								Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]								Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a	a _n	b _n	r _n		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
75	130	25	1,5	72	--	--	--	QJ215-MPA	124	123	5,5	4500	8500	1,77
	160	37	2,1	82	10,1	8,5	2	QJ315-N2-MPA	212	204	8,6	3900	7500	3,93
80	140	26	2	77	--	--	--	QJ216-MPA	145	146	6,3	4200	8000	1,8
	170	39	2,1	88	10,1	8,5	2	QJ316-N2-MPA	230	229	9,3	3700	7000	4,61
85	150	28	2	82	--	--	--	QJ217-MPA	160	161	6,7	4000	7500	2,25
	180	41	3	93	11,7	10,5	2	QJ317-N2-MPA	248	255	10,1	3500	6700	5,49
90	160	30	2	88	8,1	6,5	1	QJ218-N2-MPA	175	186	7,5	3900	7000	2,89
	190	43	3	98	11,7	10,5	2	QJ318-N2-MPA	267	283	10,9	3400	6300	6,34
95	170	32	2,1	93	8,1	6,5	1	QJ219-N2-MPA	199	213	8,4	3700	6700	3,37
	200	45	3	103	11,7	10,5	2	QJ319-N2-MPA	285	313	11,7	3200	6000	7,4
100	180	34	2,1	98	10,1	8,5	2	QJ220-N2-MPA	224	242	9,3	3500	6300	4,03
	215	47	3	110	11,7	10,5	2	QJ320-N2-MPA	325	368	13,3	3000	5600	8,98
105	190	36	2,1	103	10,1	8,5	2	QJ221-N2-MPA	244	272	10,2	3400	5900	6,11
	225	49	3	116	11,7	10,5	2	QJ321-N2-MPA	344	406	14,4	2900	5200	10,5
110	200	38	2,1	109	10,1	8,5	2	QJ222-N2-MPA	264	305	11,1	3300	5600	5,67
	240	50	3	123	11,7	10,5	2	QJ322-N2-MPA	363	434	14,9	2700	4800	12,2
120	215	40	2,1	117	11,7	10,5	2	QJ224-N2-MPA	284	341	12,0	3100	5000	6,74
	260	55	3	133	11,7	10,5	2	QJ324-N2-MPA	384	485	16,0	2500	4500	15,6
130	230	40	3	127	11,7	10,5	2	QJ226-N2-MPA	304	380	12,9	2800	4800	7,67
	280	58	4	144	12,7	10,5	2	QJ326-N2-MPA	426	563	17,9	2200	4000	19,2
140	250	42	3	137	11,7	10,5	2	QJ228-N2-MPA	327	436	14,2	2600	4300	9,69
	300	62	4	154	12,7	10,5	2	QJ328-N2-MPA	469	646	19,8	2000	3800	23,2

Vierpunktlager
Four-Point Contact Ball Bearings



Für $D \geq 160$ mm
Standardausführung
mit 2 Haltenuten im
Außenring (N2)

For $D \geq 160$ mm
standard design
with 2 location slots
in outer ring (N2)



QJ ...

QJ ... N2

Hauptabmessungen [mm]								Lagertyp	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]
Boundary dimensions [mm]								Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]
d	D	B	r ₁ , r ₂ min	a	a _n	b _n	r _n		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m
150	270	45	3	147	11,7	10,5	2	QJ230-N2-MPA	349	483	15,1	2400	4000	12,2
	320	65	4	165	12,7	10,5	2	QJ330-N2-MPA	514	735	21,8	1900	3600	27,8
160	290	48	3	158	12,7	10,5	2	QJ232-N2-MPA	382	544	16,5	2200	3800	20
	340	68	4	175	12,7	10,5	2	QJ332-N2-MPA	583	872	25,1	1700	3400	32,5
170	310	52	4	168	12,7	10,5	2	QJ234-N2-MPA	421	631	18,5	2000	3400	18,9
	360	72	4	186	12,7	10,5	2	QJ334-N2-MPA	589	917	25,6	1600	3200	38,4
180	320	52	4	175	12,7	10,5	2	QJ236-N2-MPA	430	670	19,26	1900	3400	23,1
	380	75	4	196	12,7	10,5	2	QJ336-N2-MPA	703	1134	30,8	1400	3000	44,9
	340	55	4	186	12,7	10,5	2	QJ238-N2-MPA	459	736	20,5	1800	3200	24
200	360	58	4	196	12,7	10,5	2	QJ240-N2-MPA	513	853	23,2	1600	3000	33,3
220	400	65	4	217	12,7	10,5	2	QJ244-N2-MPA	633	1156	28,8	1400	2800	49,3
240	440	72	4	238	15	12,5	2,5	QJ248-N2-MPA	624	1139	28,1	1300	2600	68,3

Anschlussmaße siehe Seite 489

*Abutment and fillet dimensions
see on page 489*



Pendelkugellager
Self Aligning Ball Bearings

Pendelkugellager
Self Aligning Ball Bearings

Pendelkugellager mit Spannhülsen
Self Aligning Ball Bearings with Adapter Sleeves

Pendelkugellager mit verbreitertem Innenring
Self Aligning Ball Bearings with Extended Inner Rings

Pendelkugellager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Pendelkugellager	DIN 630

Allgemeines:

Pendelkugellager sind zweireihige, nicht zerlegbare Radiallager mit einer hohlkugeligen Außenringlaufbahn. Dadurch sind sie winkeleinstellbar und gleichen Schiefstellungen durch Fluchtungsfehler oder Wellendurchbiegungen sehr gut aus.

Pendelkugellager sind nicht zerlegbar und eignen sich für geringe bis mittlere radiale und axiale Belastungen.

Self Aligning Ball Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Self Aligning Ball Bearings	DIN 630

General:

Self aligning ball bearings are non-separable double-row radial bearings. Both rows of balls rotate, in parallel, within the spherical outer ring. This allows an excellent alignment compensation, caused by machining and mounting errors, between the shaft and housing.

Self aligning ball bearings are suitable for low to medium radial loads and low amounts of thrust forces.

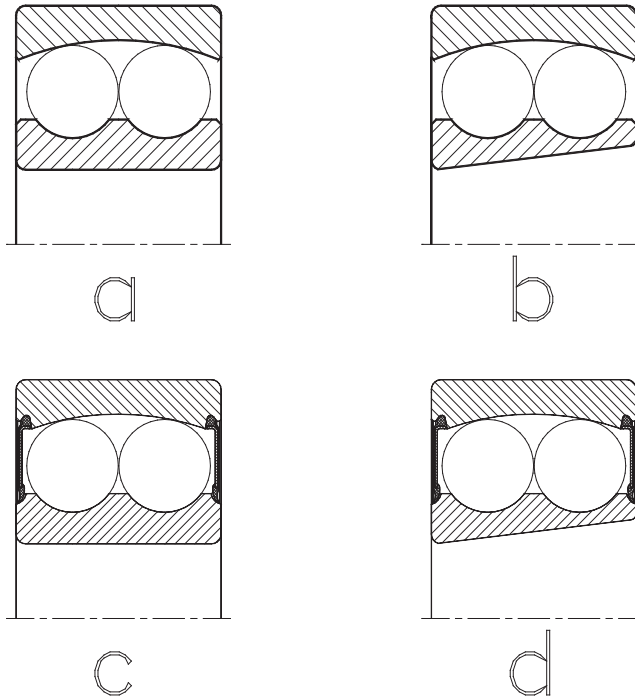


Abb. 1
Fig. 1

Bauformen

Pendelkugellager werden neben der offenen Grundausführung (siehe Abb. 1a) häufig auch mit **kegeliger Bohrung** (Kegel 1:12, Abb. 1b) zur Montage auf **Spannhülsen** eingesetzt, siehe Abb. 1b. Diese Ausführung wird durch das **Nachsetzzeichen K** identifiziert.

Durch die Montage dieser Lager auf Spannhülsen ist es möglich, bei Anwendungen ohne allzu große Ansprüche hinsichtlich Laufgenauigkeit, die Lager ohne aufwendige Bearbeitung der Lagersitze direkt auf blankgezogene Wellen bzw. auf gedrehte Wellensitze zu montieren (siehe Abb. 2).

Verschiedene Pendelkugellager sind auch mit berührenden Dichtscheiben (Nachsetzzeichen **-2RS**), sowohl mit zylindrischer (siehe Abb. 1c) als auch mit kegeliger Bohrung (Nachsetzzeichen **K-2RS**, siehe Abb. 1d bzw. 2b) verfügbar.

Bei abgedichteten Bauarten ist sowohl die Höchstdrehzahl als auch die Winkeleinstellbarkeit eingeschränkt.

Design Variants

Beside the **standard design** with cylindrical bore, (fig. 1a), **NKE self aligning ball bearings** with tapered bore, **suffix K** (i.e. taper 1:12), are available, for ease of mounting (see fig. 1b).

The possibility of mounting these bearing types, using adaptor sleeves, enables mounting directly onto drawn or fine turned shaft seats for applications where high running accuracy is not necessary (see fig 2.).

Some types of self aligning ball bearings are available with either cylindrical or tapered inner bores, with incorporated contacting seals (i.e. suffix **-2RS**, see fig. 1c, and suffix **K-2RS**, fig. 1d and fig. 2b respectively).

The standard material used for contacting seals is a wear-resistant synthetic rubber (**NBR**).

When selecting self aligning ball bearing with contacting seals fitted, consideration must be given to the reduction of their maximum operating speeds and their limited misalignment abilities.

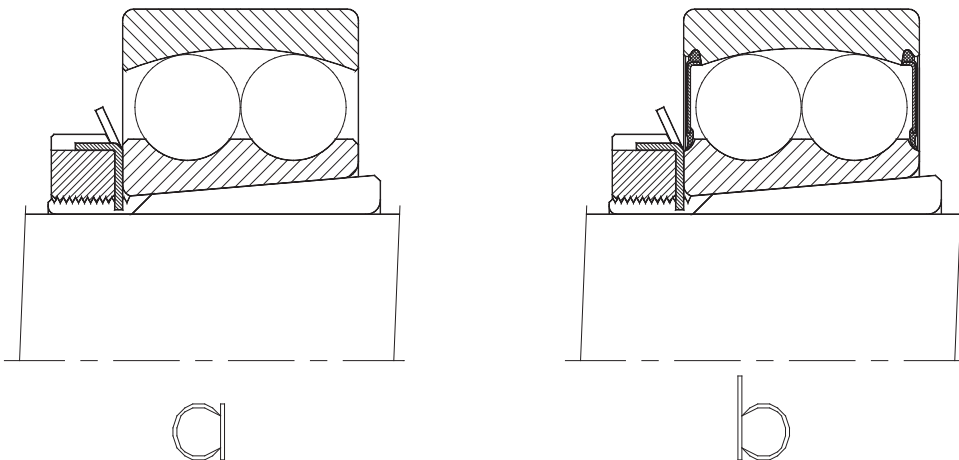


Abb. 2
Fig. 2

Eine weitere Bauform von Pendelkugellagern zur Montage auf gezogenen Wellen sind **Pendelkugellager mit verbreitertem Innenring** (Abb. 3a).

Abweichend von den für Wälzlager ansonsten üblichen Toleranzen weisen die Bohrungen von Pendelkugellagern mit verbreiterten Innenringen Toleranzen nach dem ISO-Toleranzfeld **J7** auf.

Dadurch ergibt sich ein loser Schiebesitz, wodurch die Lager sehr einfach zu montieren sind.

Da eine Fixierung der Innenringe auf den Wellensitzen nicht gegeben ist, weisen die Innenringe dieser Lager Nuten zur Aufnahme von Stiften zur Verdrehsicherung auf.

Bei Lagerungen, bei denen zwei Pendelkugellager mit verbreitertem Innenring verwendet werden, sollten die Lager so montiert werden, dass die Nuten an den Innenringen entweder beide nach innen (siehe Abb. **3b**) oder beide nach außen gerichtet sind (Abb. **3c**).

Another design variant is **self aligning ball bearings with extended inner rings** (fig. 3a).

Unlike standard bearing bores, the bore diameter of self aligning ball bearings with extended inner rings have tolerances according to ISO-tolerance field **J7**.

This tolerance **J7** provides a loose sliding fit, of inner to shaft, for ease of mounting. As this fit provides adequate location on the shaft, the inner ring features a location slot to accept locator pins to prevent the inner ring rotating on the shaft.

In the case of bearing arrangements consisting of two self aligning ball bearings with extended inner rings, the bearings must be mounted in such a way that the two location grooves on the inner rings either both face inwards (fig. **3b**) or both face outwards (fig. **3c**).

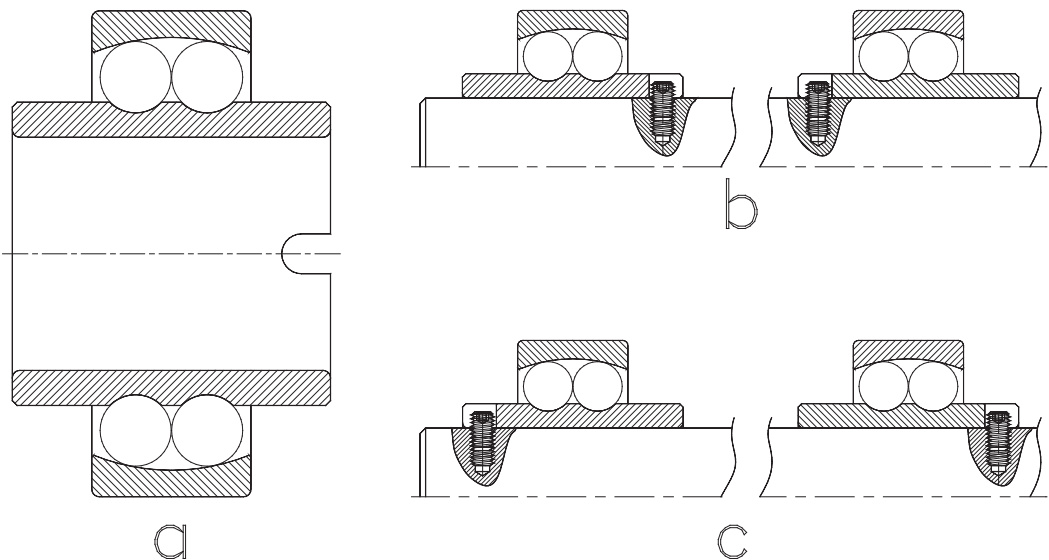


Abb. 3
Fig. 3

Schiefstellung

Pendelkugellager sind zum Ausgleich von Schiefstellungen optimal geeignet. Die jeweils zulässige **Verkipfung Ψ** um die Mittelachse hängt von der Lagerreihe sowie der Ausführung ab.

Folgende Werte sind zulässig:

- offene Lager der Reihen
112 und 113: $\Psi \leq 2,5^\circ$
- offene Lager der Reihen
12 und 22 $\Psi \leq 2,5^\circ$
- offene Lager der Reihen
13 und 23 $\Psi \leq 3^\circ$
- abgedichtete Lager (-2RS) $\Psi \leq 1,5^\circ$

Toleranzen

NKE Pendelkugellager werden in Normaltoleranz (**PN**) gefertigt.

Drehzahleinschränkungen bei Lagern mit Dichtscheiben

Abgedichtete Pendelkugellager der Bauform **-2RS** weisen durch die vorgespannten Dichtlippen eine zusätzliche Wärmeentwicklung auf, wodurch deren zulässige Höchstdrehzahl um ein Drittel unter der offener Lager liegt.

Misalignment

Self aligning ball bearings have excellent ability to compensate for misalignments. The maximum permissible **misalignment from their centre axis (Ψ)** is dependant upon the bearing design, series and actual operating conditions.

The following values are permissible:

- for bearings of series
112 and 113: $\Psi \leq 2,5^\circ$
- for open bearings of series
12 and 22 $\Psi \leq 2,5^\circ$
- for open bearings of series
13 and 23 $\Psi \leq 3^\circ$
- for sealed bearings (-2RS) $\Psi \leq 1,5^\circ$

Tolerances

NKE self aligning ball bearings are produced to normal tolerance class (**PN**) as standard.

Speed limitations for Sealed Self Aligning Ball Bearings

Sealed self aligning ball bearings with suffix **-2RS** have limited speed ratings due to the additional heat generated by the rubbing of their sealing lips.

For this reason, the maximum speed must not exceed **2/3** of the speed rating recommended for open bearings with grease lubrication.

Käfige

Kleine und mittelgroße **NKE Pendelkugellager** werden standardmäßig mit Kunststoffkäfigen bzw. Stahlblechkäfigen geliefert, größere Lager mit Messing-Massivkäfigen.

Verschiedene Pendelkugellager sind auch mit Kunststoffkäfigen verfügbar.

Lagerluft

Bei der Lagerluft von Pendelkugellagern wird grundsätzlich zwischen Lagern mit **zylindrischer** und **kegeliger** Bohrung unterschieden.

Da bei Lagern mit kegeliger Bohrung das Risiko einer unbeabsichtigten Verspannung bei der Montage besteht, weisen diese bei gleicher Luftklasse größere Luftwerte im Vergleich zu Lagern mit zylindrischer Bohrung auf.

NKE Pendelkugellager mit zylindrischer oder kegeliger Bohrung werden standardmäßig mit der Luftklasse **CN** (Normalluft) gefertigt.

Zusätzlich liefert NKE auch Pendelkugellager mit größerer (**C3**, **C4**) oder kleinerer Radialluft (Klasse **C2**).

Werte für die Lagerluft von **NKE Pendelkugellagern** mit zylindrischer und kegeliger Bohrung sind in den beiden Tabellen auf der Seite 501 angegeben.

Diese entsprechen, soweit genormt, den in DIN 620 / Teil 4 bzw. ISO 5753 - 1981 definierten Werten.

Cages

Small and medium sized **NKE self aligning ball bearings** are fitted with polyamide cages or rather pressed steel cages as standard. Larger sizes are fitted with solid brass cages.

Several types and sizes of self aligning ball bearings are also produced with polyamide cages fitted.

Internal Clearance

For the internal clearance group of self aligning ball bearings distinction is made between bearings with **cylindrical** or **tapered** bores.

Because of the risk of applying a preload force to the bearing during mounting, bearings **with tapered bore feature a larger radial internal clearance** when compared to cylindrical bore bearings of the same clearance group.

NKE self aligning ball bearings with cylindrical or tapered bores are produced with normal internal clearance (**CN**) as standard.

Other internal clearance groups are produced upon order request.

The values of clearance groups for self aligning ball bearings with cylindrical and tapered bores are given in the tables listed on page 501.

These values correspond, where standardised, to DIN 620 / part 4 and ISO 5753 - 1981.

Lagerluft der NKE Pendelkugellager
Internal Clearance for NKE Self Aligning Ball Bearings

Luftwerte in [μm]
Clearance Values are in [μm]

Lagerluft der NKE Pendelkugellager mit zylindrischer Bohrung
Internal clearance groups for NKE self aligning ball bearings with cylindrical bore

Lagerbohrung Bore diameter	[mm]	>	--	6	10	14	18	24	30	40	50	65	80	100
			\leq	6	10	14	18	24	30	40	50	65	80	100
Luftgruppe Clearance group	C2	min	1	2	2	3	4	5	6	6	7	8	9	10
		max	8	9	10	12	14	16	18	19	21	24	27	31
Luftgruppe Clearance group(NORMAL)	CN	min	5	6	6	8	10	11	13	14	16	18	22	25
		max	15	17	19	21	23	24	29	31	36	40	48	56
Luftgruppe Clearance group	C3	min	10	12	13	15	17	19	23	25	30	35	42	50
		max	20	25	26	28	30	35	40	44	50	60	70	83
Luftgruppe Clearance group	C4	min	15	19	21	23	25	29	34	37	45	54	64	75
		max	25	33	35	37	39	46	53	57	69	83	96	114

Lagerluft der NKE Pendelkugellager mit kegeliger Bohrung
Internal clearance groups for NKE self aligning ball bearings with tapered bore

Lagerbohrung Bore diameter	[mm]	>	--	24	30	40	50	65	80	100
			\leq	24	30	40	50	65	80	100
Luftgruppe Clearance group	C2	min	7	9	12	14	18	23	29	35
		max	17	20	24	27	32	39	47	56
Luftgruppe Clearance group(NORMAL)	CN	min	13	15	19	22	27	35	42	50
		max	26	28	35	39	47	57	68	81
Luftgruppe Clearance group	C3	min	20	23	29	33	41	50	62	75
		max	33	39	46	52	61	75	90	108
Luftgruppe Clearance group	C4	min	28	33	40	45	56	69	84	100
		max	42	50	59	65	80	98	116	139

Mindestbelastung:

Bei Pendelkugellagern sollte für eine zufriedenstellende Funktion unter normalen Betriebsbedingungen eine Mindestbelastung von etwa **2%** der dynamischen Tragzahl C_r gegeben sein.

Äquivalente dynamische Lagerbelastung

$$\frac{F_a}{F_r} \leq e \text{ gilt } P = F_r + Y * F_a$$

wenn

$$\frac{F_a}{F_r} > e \text{ dann } P = 0,65 * F_r + Y * F_a$$

Werte für Y und e sind in den Produkttabellen angegeben.

Äquivalente statische Lagerbelastung

$$P_0 = F_r + Y_0 * F_a$$

Werte für Y_0 sind in den Produkttabellen angegeben.

Anschlussmaße

Die Radien der Kantenverrundungen der Lageringringe dürfen nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen. Dazu muss der größte Hohlkehradius an den Anschlussstellen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lageringringe. Siehe dazu die Abweichungen auf der Seiten 504.

Minimum Load:

To perform effectively, self aligning ball bearings should run under a minimum bearing load of approximately **2%** of the dynamic load rating C_r .

Equivalent Dynamic Bearing Load

$$\frac{F_a}{F_r} \leq e \text{ then } P = F_r + Y * F_a$$

or, if

$$\frac{F_a}{F_r} > e \text{ then } P = 0,65 * F_r + Y * F_a$$

Values of Y and e are stated in the product tables.

Equivalent Static Bearing Load

$$P_0 = F_r + Y_0 * F_a$$

Values of Y_0 are stated in the product tables.

Abutment and Fillet Dimensions

The bearing ring corner profile must not contact the shaft or housing corner profiles.

Therefore the largest fillet radius (r_g) must always clear the minimum fillet dimension of the bearing (r_g) on the page 504.

Empfehlungen für Einbaumaße sind auch in ISO 5418 definiert, die Werte der Kantenverrundung der Lagerringe sind in den Produkttabellen angegeben.

Recommendations for the dimensions of adjacent parts are defined in ISO 5418, the values of the bearing fillet dimensions are given in the appropriate bearing tables.

Kugelüberstand

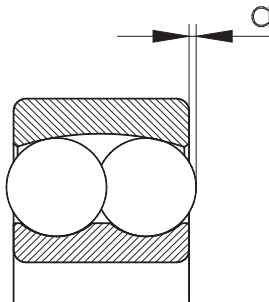
Bei einigen Typen von Pendelkugellagern stehen die Kugeln seitlich etwas über die Planfläche vor. Diese Besonderheit muß bei der Gestaltung der Anschlußteile sowie beim Einbau beachtet werden. Größere Kugelüberstände weisen folgende Lagertypen auf:

Ball Protrusion

For several self aligning ball bearings the balls protrude beyond the bearing face sides.

This feature must be considered when designing the application arrangement. Ball protrusion values are given for the following bearings:

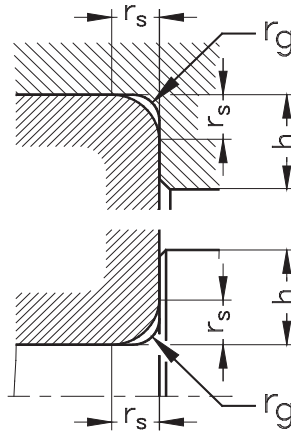
Kugelüberstand bei NKE Pendelkugellagern Ball Protrusion of NKE Self Aligning Ball Bearings



Lagertypen Bearing types	Kugelüberstand Ball protrusion [mm]
1318, 1318 K	≈ 1,1
1319, 1319 K	≈ 1,5
1320, 1320 K	≈ 2,5
1321, 1321 K	≈ 2,6
1322, 1322 K	≈ 2,6

Anschlussmaße für Pendelkugellager
Abutment and Fillet Dimensions for Self Aligning Ball Bearing

Alle Abmessungen in [mm]
All Dimensions are in [mm]



r_s min	r_g max	h_{min} Lagerreihen Bearing series	
		10	12 .. / 22.. 13 .. / 23.. 112 .. / 113..
0,3	0,3	1	1,2
0,6	0,6	--	2,1
1	1	--	2,8
1,1	1	--	3,5
1,5	1,5	--	4,5
2	2	--	5,5
2,1	2,1	--	6
3	2,5	--	7

Pendelkugellager mit kegeliger Bohrung und Spannhülse

Durch die Verwendung von Lagern mit kegeliger Bohrung (1:12) auf Spannhülsen kann bei geringen Ansprüchen an die Laufgenauigkeit der Lagerung eine aufwendige Feinbearbeitung der Lagersitze vermieden werden.

Die Pendelkugellager können damit direkt auf blankgezogene Wellen bzw. auf gedrehte Wellensitze montiert werden.

Wenn allerdings, wie in Abb. 4 dargestellt, Pendelkugellager auf Spannhülsen ohne festen seitlichen Anschlag auf glatten Wellen montiert werden, darf die auf das Lager wirkende Axialkraft eine bestimmte Höhe allerdings nicht überschreiten, da diese nur durch die Reibung zwischen Spannhülse und Welle aufgenommen wird.

Die Höhe der zulässigen Axiallast lässt sich wie folgt abschätzen:

$$F_{amax} \leq 3 \cdot d \cdot B$$

wobei:

- F_{amax}** maximal zulässige Axiallast bei Pendelkugellagern auf Spannhülse [N]
- B** Lagerbreite [mm]
- d** Bohrungsdurchmesser des Lagers [mm]

Self Aligning Ball Bearings with Tapered Bore and Adapter Sleeve

When using tapered bore bearings with adapter sleeves the time consuming and expensive fine machining of the bearing seats may be avoided for applications where less running accuracy is required.

Using adapter sleeves self aligning ball bearings may be mounted directly onto drawn or fine turned shaft seats.

In applications where self aligning ball bearings are mounted on straight shafts without additional axial supports, as shown (fig. 4) their ability to accept thrust loads is limited by the amount of friction between adapter sleeve and shaft.

The permissible thrust load may be estimated using the following formula:

$$F_{amax} \leq 3 \cdot d \cdot B$$

where:

- F_{amax}** maximum permissible thrust load for self aligning ball bearings mounted on to adapter sleeves [N]
- B** Bearing width [mm]
- d** Bearing bore diameter [mm]

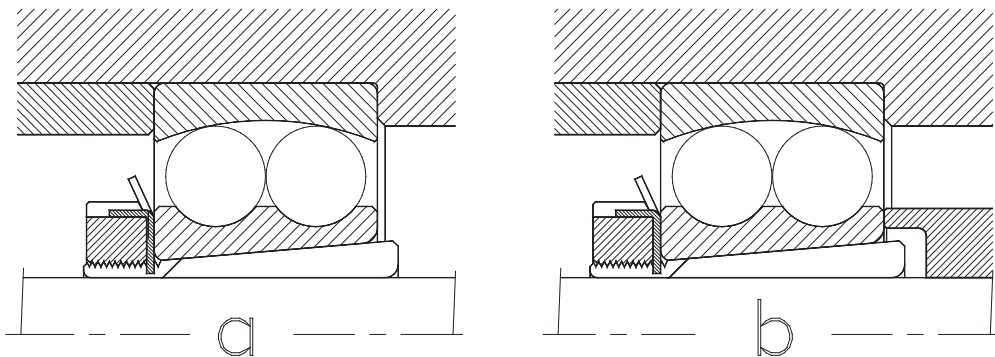


Abb. 4
Fig. 4

Montagehinweise

Speziell beim Einbau von **Pendelkugellagern mit kegelliger Bohrung** auf Spannhülsen ist besonders auf die Einhaltung einer verbleibenden Mindest-Radialluft nach der Montage zu achten. Bitte beachten Sie dazu die ausführlichen diesbezüglichen Hinweise im Abschnitt „**Handling, Ein- und Ausbau von Wälzlagern**“ ab Seite 167.

Bei einer Montage von Pendelkugellagern kann sich die Verkippung des Außenringes mitunter störend auswirken. Durch die Verwendung einfacher Hilfsmittel wie beispielsweise von **Montagescheiben** (s) wie in Abb. 5 dargestellt, kann der Einbau vereinfacht werden.

Mounting Instructions

When using self aligning ball bearings with tapered bores, in conjunction with adapter sleeves, particular attention must be paid to retain a minimum radial residual internal clearance following mounting.

Also, when mounting, outer ring tilting may cause complications. This problem may be overcome using simple methods, such as mounting disks, (s) (fig. 5).

Please see chapter “**Handling, Fitting and Dismounting Rolling Bearings**” for more detailed information.

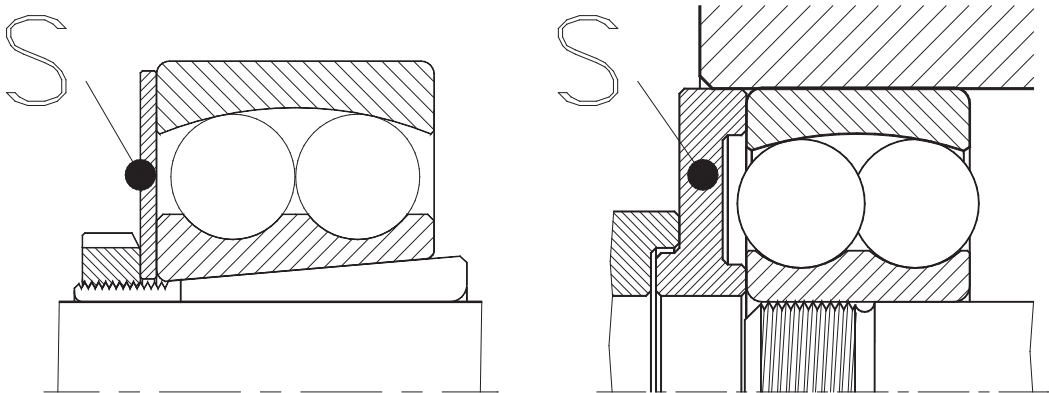
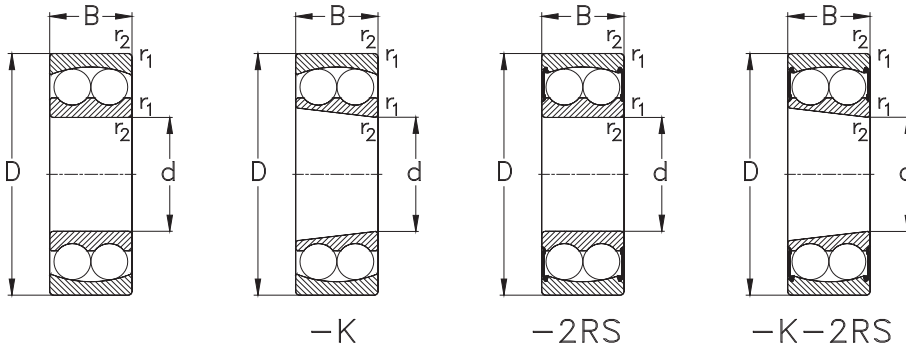


Abb. 5
Fig. 5

Pendelkugellager
Self Aligning Ball Bearings



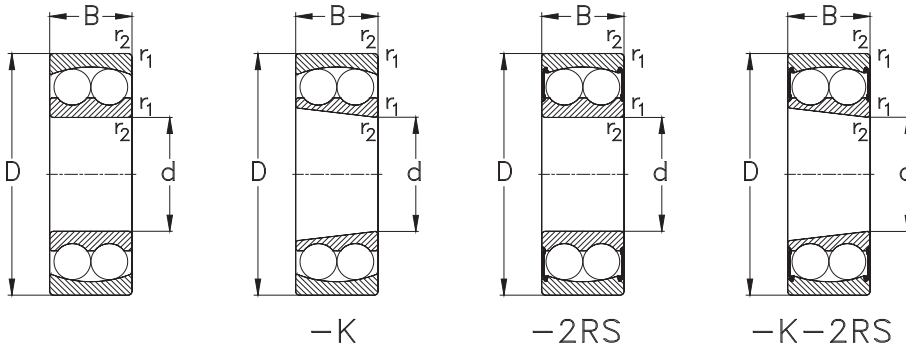
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
10	30	9	0,6	1200	5,4	1,2	0,1	21200	36000
	30	14	0,6	2200	8,1	1,8	0,1	24800	34000
	35	11	0,6	1300	7,2	1,6	0,1	17000	32000
12	32	10	0,6	1201	6,2	1,4	0,1	20200	32000
	32	14	0,6	2201	8,5	1,9	0,1	22100	30000
	32	14	0,6	2201-2RS	6,2	1,4	0,1	--	30000
	37	12	1	1301	9,7	2,2	0,01	16200	28000
15	35	11	0,6	1202	7,4	1,7	0,1	18300	28000
	35	14	0,6	2202	8,7	2	0,1	19000	26000
	35	14	0,6	2202-2RS	7,4	1,7	0,1	--	26000
	42	13	1	1302	12	2,9	0,1	14100	24000
	42	17	1	2302	11,9	2,9	0,1	15300	24000
17	40	12	0,6	1203	8,8	2,2	0,1	16500	24000
	40	16	0,6	2203	10,6	2,5	0,1	17600	24000
	40	16	0,6	2203-2RS	8,8	2,2	0,1	--	24000
	47	14	1	1303	12,8	3,4	0,2	12900	20000
	47	19	1	2303	14,5	3,6	0,2	14300	22000
	47	19	1	2303-2RS	12,8	3,4	0,2	--	22000
20	47	14	1	1204	12,7	3,4	0,2	14900	20000
	47	14	1	1204-K	12,7	3,4	0,2	14900	20000
	47	18	1	2204	14,2	3,5	0,2	15500	20000
	47	18	1	2204-2RS	12,7	3,4	0,2	--	20000

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y₀	
10	0,03	0,32	1,95	3,02	2,05	1200
	0,05	0,58	1,1	1,7	1,1	2200
	0,06	0,34	1,8	2,9	1,9	1300
12	0,04	0,37	1,69	2,62	1,77	1201
	0,05	0,53	1,2	1,9	1,3	2201
	0,05	0,37	1,7	2,6	1,8	2201-2RS
	0,07	0,35	1,8	2,8	1,9	1301
15	0,05	0,34	1,86	2,88	1,95	1202
	0,06	0,46	1,4	2,1	1,4	2202
	0,06	0,34	1,9	2,9	2	2202-2RS
	0,1	0,35	1,8	2,8	1,9	1302
	0,13	0,51	1,2	1,9	1,3	2302
17	0,08	0,33	1,93	2,99	2,03	1203
	0,09	0,46	1,4	2,1	1,4	2203
	0,09	0,33	1,9	3	2	2203-2RS
	0,14	0,32	1,9	3	2	1303
	0,18	0,53	1,2	1,9	1,3	2303
	0,18	0,32	1,9	3	2	2303-2RS
20	0,13	0,28	2,24	3,46	2,34	1204
	0,12	0,28	2,24	3,46	2,34	1204-K
	0,14	0,44	1,5	2,2	1,5	2204
	0,14	0,28	2,2	3,5	2,3	2204-2RS

Pendelkugellager
Self Aligning Ball Bearings



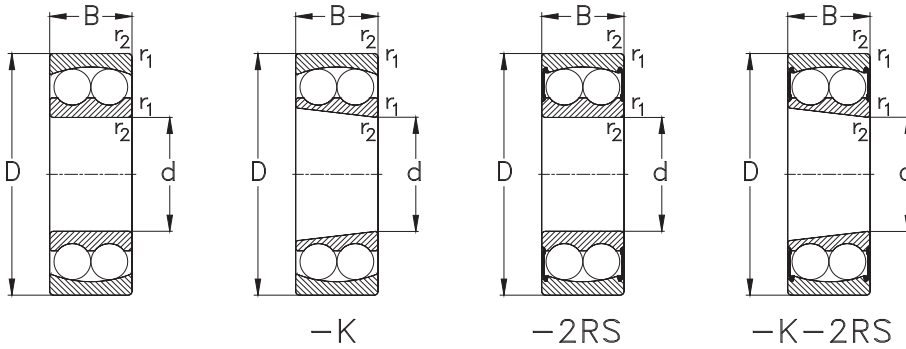
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
20	52	15	1,1	1304	14,3	4	0,2	11600	18000
	52	15	1,1	1304-K	14,3	4	0,2	11600	18000
	52	21	1,1	2304	18,2	4,7	0,2	13200	19000
	52	21	1,1	2304-2RS	14,3	4	0,2	--	19000
25	52	15	1	1205	14,3	4	0,2	13100	18000
	52	15	1	1205-K	14,3	4	0,2	13100	18000
	52	18	1	2205	16,8	4,4	0,2	13100	18000
	52	18	1	2205-K	16,8	4,4	0,2	13100	18000
	52	18	1	2205-K-2RS	14,3	4	0,2	--	18000
	52	18	1	2205-2RS	14,3	4	0,2	--	18000
	62	17	1,1	1305	18,9	5,5	0,3	10000	15000
30	62	16	1	1206	15,6	4,7	0,2	11000	15000
	62	16	1	1206-K	15,6	4,7	0,2	11000	15000
	62	20	1	2206	23,8	6,6	0,3	11300	15000
	62	20	1	2206-K	23,8	6,6	0,3	11300	15000
	62	20	1	2206-K-2RS	15,6	4,7	0,3	--	15000
30	62	20	1	2206-2RS	15,6	4,7	0,3	--	15000
	72	19	1,1	1306	21,3	6,3	0,3	8800	13000

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

d	Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>			Lagertypen <i>Designation</i>
	m	e	Y	Y	Y ₀	
			F _a /F _r ≤ e	F _a /F _r > e		
20	0,17	0,29	2,2	3,3	2,3	1304
	0,17	0,29	2,2	3,3	2,3	1304-K
	0,24	0,51	1,2	1,9	1,3	2304
	0,24	0,29	2,2	3,3	2,3	2304-2RS
25	0,14	0,27	2,37	3,66	2,48	1205
	0,14	0,27	2,37	3,66	2,48	1205-K
	0,16	0,35	1,8	2,8	1,9	2205
	0,16	0,35	1,8	2,8	1,9	2205-K
	0,16	0,27	2,4	3,7	2,5	2205-K-2RS
	0,16	0,27	2,4	3,7	2,5	2205-2RS
	0,28	0,28	2,3	3,5	2,4	1305
	0,28	0,28	2,3	3,5	2,4	1305-K
	0,37	0,48	1,3	2	1,4	2305
	0,37	0,48	1,3	2	1,4	2305-K
30	0,37	0,28	2,3	3,5	2,4	2305-2RS
	0,22	0,25	2,53	3,91	2,65	1206
	0,22	0,25	2,53	3,91	2,65	1206-K
	0,25	0,3	2,1	3,3	2,2	2206
	0,25	0,3	2,1	3,3	2,2	2206-K
	0,25	0,25	2,5	3,9	2,7	2206-K-2RS
	0,25	0,25	2,5	3,9	2,7	2206-2RS
	0,41	0,26	2,4	3,7	2,5	1306

Pendelkugellager
Self Aligning Ball Bearings



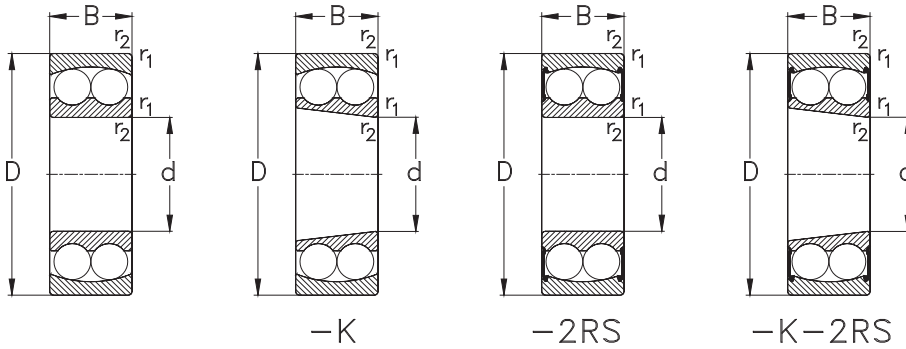
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
30	72	19	1,1	1306-K	21,3	6,3	0,3	8800	13000
	72	27	1,1	2306	31,4	8,7	0,4	10100	13000
	72	27	1,1	2306-K	31,4	8,7	0,4	10100	13000
	72	27	1,1	2306-2RS	21,3	6,3	0,3	--	13000
35	72	17	1,1	1207	18,8	5,9	0,3	9500	13000
	72	17	1,1	1207-K	18,8	5,9	0,3	9500	13000
	72	23	1,1	2207	30,5	8,7	0,4	10200	12000
	72	23	1,1	2207-K	30,5	8,7	0,4	10200	12000
	72	23	1,1	2207-K-2RS	18,8	5,9	0,3	--	12000
	72	23	1,1	2207-2RS	18,8	5,9	0,3	--	12000
80	21	1,5		1307	26,2	8,5	0,4	8100	11000
	21	1,5		1307-K	26,2	8,5	0,4	8100	11000
	31	1,5		2307	39,5	11,2	0,5	9500	12000
	31	1,5		2307-K	39,5	11,2	0,5	9500	12000
	31	1,5		2307-2RS	26,2	8,5	0,4	--	12000
40	80	18	1,1	1208	20	6,9	0,3	8600	11000
	80	18	1,1	1208-K	20	6,9	0,3	8600	11000
	80	23	1,1	2208	31,7	10	0,5	8900	11000
	80	23	1,1	2208-K	31,7	10	0,5	8900	11000
	80	23	1,1	2208-K-2RS	20	6,9	0,3	--	11000
	80	23	1,1	2208-2RS	20	6,9	0,3	--	11000
90	23	1,5		1308	33,8	11,3	0,5	7400	9500

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>			Lagertypen <i>Designation</i>	
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y₀	
30	0,41	0,26	2,4	3,7	2,5	1306-K
	0,55	0,45	1,4	2,2	1,5	2306
	0,55	0,45	1,4	2,2	1,5	2306-K
	0,55	0,26	2,4	3,7	2,5	2306-2RS
35	0,33	0,22	2,8	4,34	2,94	1207
	0,33	0,22	2,8	4,34	2,94	1207-K
	0,4	0,3	2,1	3,3	2,2	2207
	0,4	0,3	2,1	3,3	2,2	2207-K
	0,4	0,22	2,8	4,3	2,9	2207-K-2RS
	0,4	0,22	2,8	4,3	2,9	2207-2RS
	0,54	0,26	2,5	3,8	2,6	1307
	0,54	0,26	2,5	3,8	2,6	1307-K
	0,74	0,47	1,4	2,1	1,4	2307
	0,74	0,47	1,4	2,1	1,4	2307-K
40	0,42	0,22	2,9	4,49	3,04	1208
	0,42	0,22	2,9	4,49	3,04	1208-K
	0,49	0,26	2,4	3,8	2,5	2208
	0,49	0,26	2,4	3,8	2,5	2208-K
	0,49	0,22	2,9	4,5	3	2208-K-2RS
	0,49	0,22	2,9	4,5	3	2208-2RS
	0,74	0,25	2,5	3,9	2,6	1308

Pendelkugellager
Self Aligning Ball Bearings



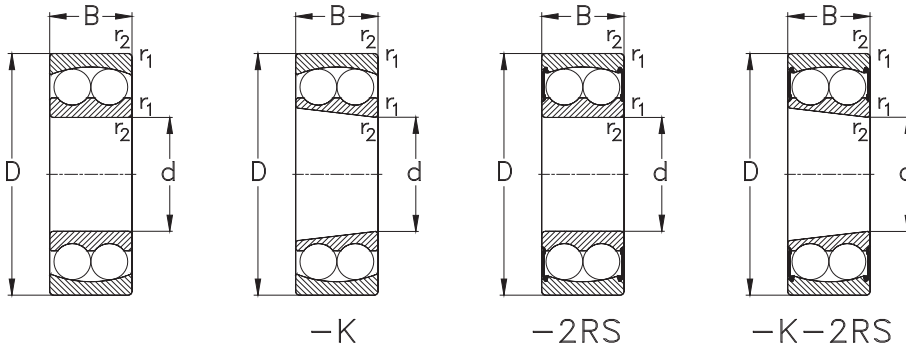
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
40	90	23	1,5	1308-K	33,8	11,3	0,5	7400	9500
	90	33	1,5	2308	54	15,9	0,7	8500	10000
	90	33	1,5	2308-K	54	15,9	0,7	8500	10000
	90	33	1,5	2308-2RS	33,8	11,3	0,5	--	10000
45	85	19	1,1	1209	23,5	8,2	0,4	8100	11000
	85	19	1,1	1209-K	23,5	8,2	0,4	8100	11000
	85	23	1,1	2209	31,7	10,6	0,5	8100	10000
	85	23	1,1	2209-K	31,7	10,6	0,5	8100	10000
	85	23	1,1	2209-K-2RS	23,5	8,2	0,4	--	10000
	85	23	1,1	2209-2RS	23,5	8,2	0,4	--	10000
100	25	1,5		1309	38,7	13,4	0,6	6800	8500
	25	1,5		1309-K	38,7	13,4	0,6	6800	8500
	36	1,5		2309	64	19,1	0,9	7800	9000
	36	1,5		2309-K	64	19,1	0,9	7800	9000
	36	1,5		2309-2RS	38,7	13,4	0,6	--	9000
50	90	20	1,1	1210	26,3	9,5	0,4	7600	10000
	90	20	1,1	1210-K	26,3	9,5	0,4	7600	10000
	90	23	1,1	2210	32,8	11,3	0,5	7400	9500
	90	23	1,1	2210-K	32,8	11,3	0,5	7400	9500
	90	23	1,1	2210-K-2RS	26,3	9,5	0,4	--	9500
	90	23	1,1	2210-2RS	26,3	9,5	0,4	--	9500
110	27	2		1310	42,5	15,3	0,7	6300	8000

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y ₀	
40	0,72	0,25	2,5	3,9	2,6	1308-K
	1	0,43	1,5	2,3	1,5	2308
	1	0,43	1,5	2,3	1,5	2308-K
	1	0,25	2,5	3,9	2,6	2308-2RS
45	0,46	0,21	3,04	4,7	3,18	1209
	0,46	0,21	3,04	4,7	3,18	1209-K
	0,53	0,26	2,4	3,8	2,5	2209
	0,53	0,26	2,4	3,8	2,5	2209-K
	0,53	0,21	3	4,7	3,2	2209-K-2RS
	0,53	0,21	3	4,7	3,2	2209-2RS
	0,99	0,25	2,5	3,9	2,6	1309
	0,99	0,25	2,5	3,9	2,6	1309-K
	1,32	0,43	1,5	2,3	1,6	2309
	1,32	0,43	1,5	2,3	1,6	2309-K
	1,32	0,25	2,5	3,9	2,6	2309-2RS
50	0,53	0,2	3,17	4,9	3,32	1210
	0,53	0,2	3,17	4,9	3,32	1210-K
	0,6	0,24	2,6	4,1	2,7	2210
	0,6	0,24	2,6	4,1	2,7	2210-K
	0,6	0,2	3,2	4,9	3,3	2210-K-2RS
	0,6	0,2	3,2	4,9	3,3	2210-2RS
	1,29	0,24	2,6	4	2,7	1310

Pendelkugellager
Self Aligning Ball Bearings



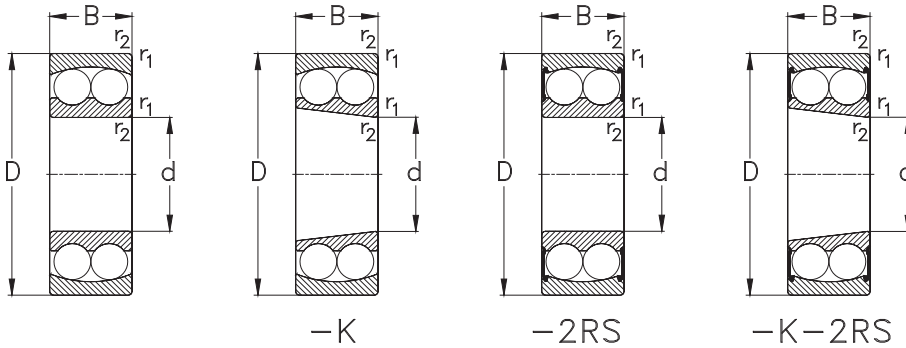
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
50	110	27	2	1310-K	42,5	15,3	0,7	6300	8000
	110	40	2	2310	65	20,1	0,9	7400	9500
	110	40	2	2310-K	65	20,1	0,9	7400	9500
	110	40	2	2310-2RS	42,5	15,3	0,7	--	9500
55	100	21	1,5	1211	27,6	10,6	0,5	6900	9000
	100	21	1,5	1211-K	27,6	10,6	0,5	6900	9000
	100	25	1,5	2211	39,2	13,3	0,6	6900	8500
	100	25	1,5	2211-K	39,2	13,3	0,6	6900	8500
	100	25	1,5	2211-K-2RS	27,6	10,6	0,5	--	8500
	100	25	1,5	2211-2RS	27,6	10,6	0,5	--	8500
	120	29	2	1311	53	18,9	0,9	5900	7500
60	110	22	1,5	1212	31,2	12,1	0,6	6400	8500
	110	22	1,5	1212-K	31,2	12,1	0,6	6400	8500
	110	28	1,5	2212	46,4	16,1	0,7	6600	8000
	110	28	1,5	2212-K	46,4	16,1	0,7	6600	8000
110	28	1,5	2212-K-2RS	31,2	12,1	0,6	--	8000	
	28	1,5	2212-2RS	31,2	12,1	0,6	--	8000	
	130	31	2,1	1312	58	21,1	1	5600	6300
	130	31	2,1	1312-K	58	21,1	1	5600	6300

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y₀	
50	1,29	0,24	2,6	4	2,7	1310-K
	1,78	0,43	1,5	2,3	1,5	2310
	1,78	0,43	1,5	2,3	1,5	2310-K
	1,78	0,24	2,6	4	2,7	2310-2RS
55	0,69	0,19	3,31	5,2	3,47	1211
	0,69	0,19	3,31	5,12	3,47	1211-K
	0,75	0,22	2,9	4,5	3,1	2211
	0,75	0,22	2,9	4,5	3,1	2211-K
	0,8	0,19	3,3	5,1	3,5	2211-K-2RS
	0,8	0,19	3,3	5,1	3,5	2211-2RS
	1,6	0,24	2,7	4,1	2,8	1311
	1,6	0,24	2,7	4,1	2,8	1311-K
	2,3	0,42	1,5	2,3	1,6	2311
	2,3	0,42	1,5	2,3	1,6	2311-K
60	0,9	0,18	3,47	5,37	3,64	1212
	0,9	0,18	3,47	5,37	3,64	1212-K
	1,1	0,23	2,7	4,2	2,8	2212
	1,1	0,23	2,7	4,2	2,8	2212-K
	1,1	0,18	3,5	5,4	3,6	2212-K-2RS
	1,1	0,18	3,5	5,4	3,6	2212-2RS
	2	0,23	2,8	4,3	2,9	1312
	2	0,23	2,8	4,3	2,9	1312-K

Pendelkugellager
Self Aligning Ball Bearings



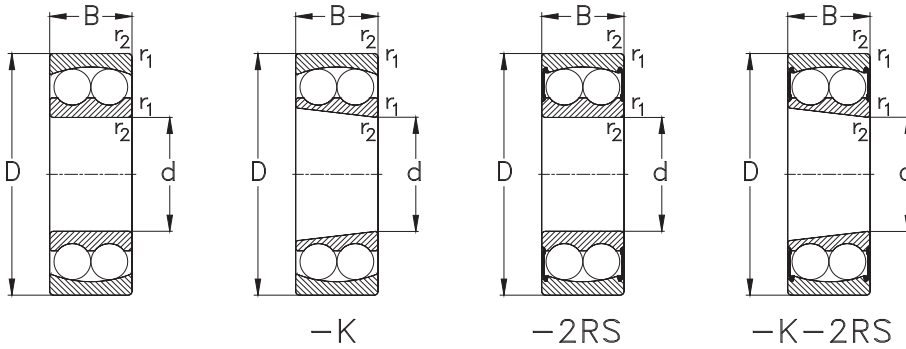
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
60	130	46	2,1	2312	86	28,6	1,3	6600	7000
	130	46	2,1	2312-K	86	28,6	1,3	6600	7000
65	120	23	1,5	1213	37,1	14,1	0,6	5900	7000
	120	23	1,5	1213-K	37,1	14,1	0,6	5900	7000
	120	31	1,5	2213	57	20,1	0,9	6300	7000
	120	31	1,5	2213-K	57	20,1	0,9	6300	7000
	140	33	2,1	1313	63	22,8	1	5300	6000
	140	33	2,1	1313-K	63	22,8	1	5300	6000
	140	48	2,1	2313	97	31,8	1,4	6100	6300
	140	48	2,1	2313-K	97	31,8	1,4	6100	6300
70	125	24	1,5	1214	34,5	13,6	0,6	5700	7000
	125	24	1,5	1214-K	34,5	14,1	0,6	5700	7000
	125	31	1,5	2214	55	19,6	0,9	6000	6700
	125	31	1,5	2214-K	55	19,6	0,9	6000	6700
	150	35	2,1	1314	75	27,7	1,2	5100	6000
	150	35	2,1	1314-K	75	27,7	1,2	5100	6000
	150	51	2,1	2314	112	37,3	1,6	5800	6000
	150	51	2,1	2314-K	112	37,3	1,6	5800	6000
75	130	25	1,5	1215	38,9	15,5	0,7	5500	6700
	130	25	1,5	1215-K	38,9	15,5	0,7	5500	6700
	130	31	1,5	2215	57	20,7	0,9	5600	6300
	130	31	1,5	2215-K	57	20,7	0,9	5600	6300

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertypen <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y ₀	
60	2,9	0,41	1,6	2,4	1,6	2312
	2,9	0,41	1,6	2,4	1,6	2312-K
65	1,2	0,18	3,57	5,52	3,74	1213
	1,2	0,18	3,57	5,52	3,74	1213-K
	1,4	0,23	2,8	4,3	2,9	2213
	1,4	0,23	2,8	4,3	2,9	2213-K
	2,5	0,23	2,8	4,3	2,9	1313
	2,5	0,23	2,8	4,3	2,9	1313-K
	3,4	0,39	1,6	2,5	1,7	2313
	3,4	0,39	1,6	2,5	1,7	2313-K
70	1,3	0,19	3,36	5,21	3,52	1214
	1,3	0,19	3,36	5,21	3,52	1214-K
	1,6	0,27	2,3	3,6	2,5	2214
	1,6	0,27	2,3	3,6	2,5	2214-K
	3,1	0,23	2,8	4,3	2,9	1314
	3,1	0,23	2,8	4,3	2,9	1314-K
	4,2	0,38	1,7	2,6	1,7	2314
	4,2	0,38	1,7	2,6	1,7	2314-K
75	1,4	0,19	3,32	5,15	3,48	1215
	1,4	0,19	3,32	5,15	3,48	1215-K
	1,7	0,26	2,5	3,8	2,6	2215
	1,7	0,26	2,5	3,8	2,6	2215-K

Pendelkugellager
Self Aligning Ball Bearings



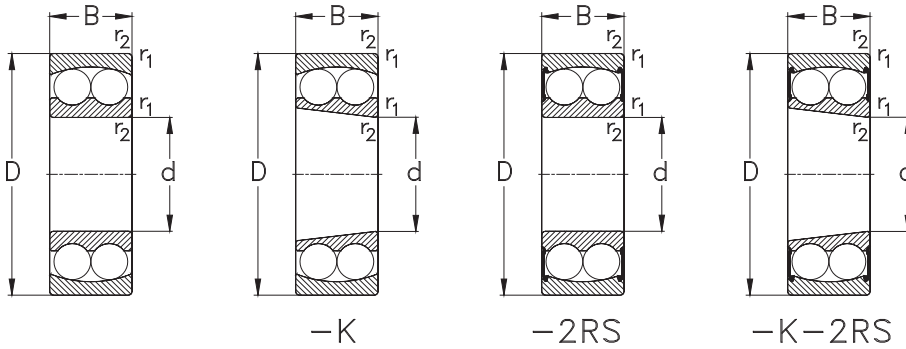
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
75	160	37	2,1	1315	79	29,9	1,2	4800	5600
	160	37	2,1	1315-K	79	29,9	1,2	4800	5600
	160	55	2,1	2315	126	42,1	1,8	5600	5600
	160	55	2,1	2315-K	126	42,1	1,8	5600	5600
80	140	26	2	1216	39,6	16,1	0,7	5200	6000
	140	26	2	1216-K	39,6	16,1	0,7	5200	6000
	140	33	2	2216	65	25,5	1,1	5300	6000
	140	33	2	2216-K	65	24,1	1	5400	6000
	170	39	2,1	1316	85	32,9	1,3	4600	5300
	170	39	2,1	1316-K	85	33,5	1,4	4600	5300
	170	58	2,1	2316	137	47,5	1,9	5400	5300
	170	58	2,1	2316-K	137	47,5	1,9	5400	5300
85	150	28	2	1217	48	19,5	0,8	5000	5600
	150	28	2	1217-K	48	19,5	0,8	5000	5600
	150	36	2	2217	66	26	1,1	5200	5600
	150	36	2	2217-K	66	24,6	1	5200	5600
	180	41	3	1317	98	38,6	1,5	4400	4800
	180	41	3	1317-K	98	38,6	1,5	4400	4800
	180	60	3	2317	139	52	2	5100	4800
	180	60	3	2317-K	139	52	2	5100	4800
90	160	30	2	1218	52	21,7	0,9	4800	5300
	160	30	2	1218-K	52	21,7	0,9	4800	5300

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y ₀	
75	3,6	0,23	2,8	4,3	2,9	1315
	3,6	0,23	2,8	4,3	2,9	1315-K
	5,2	0,38	1,6	2,5	1,7	2315
	5,2	0,38	1,6	2,5	1,7	2315-K
80	1,7	0,16	3,9	6,03	4,08	1216
	1,7	0,16	3,9	6,03	4,08	1216-K
	2,1	0,25	2,5	3,8	2,6	2216
	2,1	0,25	2,5	3,8	2,6	2216-K
	4,2	0,22	2,9	4,4	3	1316
	4,2	0,22	2,9	4,4	3	1316-K
	6,5	0,37	1,7	2,6	1,8	2316
	6,5	0,37	1,7	2,6	1,8	2316-K
85	2,2	0,17	3,73	5,78	3,91	1217
	2,2	0,17	3,73	5,78	3,91	1217-K
	2,6	0,26	2,5	3,8	2,6	2217
	2,6	0,26	2,5	3,8	2,6	2217-K
	5,1	0,22	2,8	4,5	3	1317
	5,1	0,22	2,8	4,5	3	1317-K
	7,5	0,37	1,7	2,6	1,8	2317
	7,5	0,37	1,7	2,6	1,8	2317-K
90	2,6	0,17	3,74	5,79	3,92	1218
	2,6	0,17	3,74	5,79	3,92	1218-K

Pendelkugellager
Self Aligning Ball Bearings



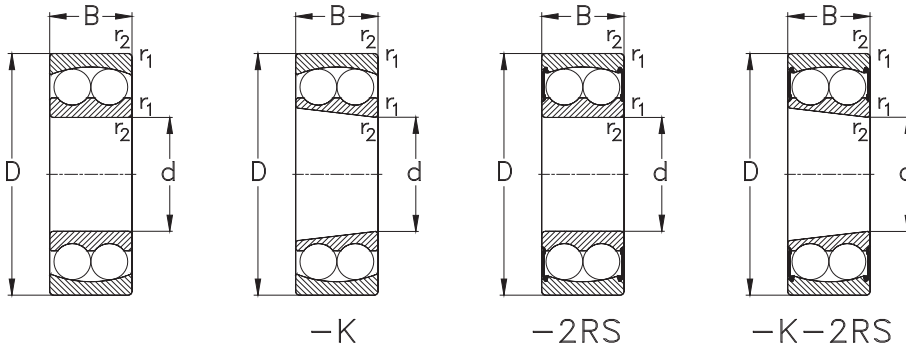
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
90	160	40	2	2218	70	28,5	1,2	5200	5300
	160	40	2	2218-K	70	28,5	1,2	5200	5300
	190	43	3	1318	116	46,2	1,8	4300	4500
	190	43	3	1318-K	116	46,2	1,8	4300	4500
	190	64	3	2318	151	58	2,2	4900	4500
	190	64	3	2318-K	151	58	2,2	4900	4500
95	170	32	2,1	1219	64	26,9	1,1	4700	5000
	170	32	2,1	1219-K	64	26,9	1,1	4700	5000
	170	43	2,1	2219	83	34,1	1,3	5000	5000
	170	43	2,1	2219-K	83	34,1	1,3	5000	5000
	200	45	3	1319	132	52	1,9	4100	4300
	200	45	3	1319-K	132	52	1,9	4100	4300
	200	67	3	2319	164	64	2,4	4600	4500
	200	67	3	2319-K	164	64	2,4	4600	4500
100	180	34	2,1	1220	69	29,4	1,1	4600	4800
	180	34	2,1	1220-K	69	29,4	1,1	4600	4800
	180	46	2,1	2220	97	40,5	1,6	4900	4800
	180	46	2,1	2220-K	97	40,5	1,6	4900	4800
	215	47	3	1320	145	59	2,1	3900	4000
	215	47	3	1320-K	145	59	2,1	3900	4000
	215	73	3	2320	191	79	2,8	4400	4000
	215	73	3	2320-K	191	79	2,8	4400	4000

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Gewicht [kg] <i>Weight [kg]</i>		Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d	m	e	Y $F_a/F_r \leq e$	Y $F_a/F_r > e$	Y₀	
90	3,3	0,27	2,3	3,6	2,4	2218
	3,3	0,27	2,3	3,6	2,4	2218-K
	6,1	0,22	2,8	4,4	3	1318
	6,1	0,22	2,8	4,4	3	1318-K
	8,8	0,39	1,6	2,5	1,7	2318
	8,8	0,39	1,6	2,5	1,7	2318-K
95	3,2	0,17	3,73	5,78	3,91	1219
	3,2	0,17	3,73	5,78	3,91	1219-K
	4,3	0,27	2,3	3,6	2,4	2219
	4,3	0,27	2,3	3,6	2,4	2219-K
	7,2	0,23	2,7	4,2	2,9	1319
	7,2	0,23	2,7	4,2	2,9	1319-K
	10,3	0,38	1,7	2,6	1,7	2319
	10,3	0,38	1,7	2,6	1,7	2319-K
100	3,8	0,18	3,58	5,53	3,75	1220
	3,8	0,18	3,58	5,53	3,75	1220-K
	5,2	0,27	2,3	3,6	2,4	2220
	5,2	0,27	2,3	3,6	2,4	2220-K
	8,8	0,23	2,7	4,2	2,8	1320
	8,8	0,23	2,7	4,2	2,8	1320-K
	13,1	0,38	1,7	2,6	1,8	2320
	13,1	0,38	1,7	2,6	1,8	2320-K

Pendelkugellager
Self Aligning Ball Bearings



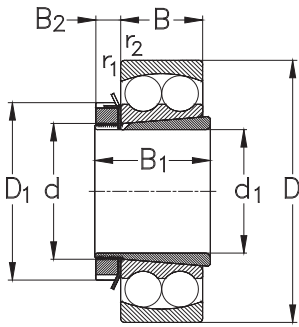
Hauptabmessungen				Lagertyp	Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Boundary dimensions				Designation	Load ratings			Thermal speed ratings	Limited speed ratings
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
[mm]					[kN]			[min ⁻¹]	[min ⁻¹]
								[rpm]	[rpm]
105	190	36	2,1	1221	75	32,1	1,2	4400	4500
	225	49	3	1321	151	64	2,2	3800	4300
110	200	38	2,1	1222	88	38,5	1,4	4300	4300
	200	38	2,1	1222-K	88	38,5	1,4	4300	4300
120	215	42	2,1	1224	119	52	1,8	4200	4000

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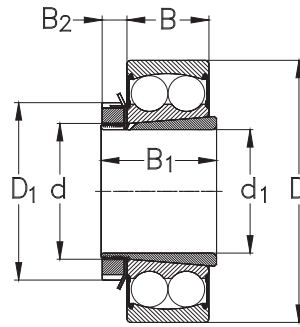
*Abutment and fillet dimensions
see on page 504*

d	Gewicht [kg]	e	Berechnungsfaktoren			Lagertyp
	Weight [kg]		Calculation factors			Designation
	m		Y F _a /F _r ≤ e	Y F _a /F _r > e	Y ₀	
105	4,5	0,18	3,54	5,48	3,71	1221
	10	0,23	2,8	4,3	2,9	1321
110	5,3	0,17	3,61	5,59	3,78	1222
	5,3	0,17	3,61	5,59	3,78	1222-K
120	7,1	0,2	3,11	4,81	3,25	1224

Pendelkugellager mit Spannhülsen
Self Aligning Ball Bearings with Adapter Sleeves



-K + H..



-K-2RS + H..

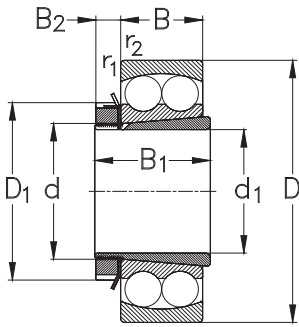
Ø Welle Ø Shaft d ₁	Hauptabmessungen Boundary dimensions [mm]				Lagertypen Designation	Spannhülse Adapter sleeve	Tragzahlen Load ratings [kN]			Referenzdrehzahlen [min ⁻¹] Thermal speed ratings [rpm]		Grenzdrehzahlen [min ⁻¹] Limited speed ratings [rpm]
	d	D	B	r ₁ , r ₂ min			C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	
20	25	52	15	1	1205-K	H205	11	4	0,2	13100	18000	
	25	52	18	1	2205-K	H305	12,9	4,4	0,2	13100	18000	
	25	52	18	1	2205-K-2RS	H305	11	4	0,2	--	9000	
25	30	62	16	1	1206-K	H206	12	4,7	0,2	11000	15000	
	30	62	20	1	2206-K	H306	18,3	6,6	0,3	11300	15000	
	30	62	20	1	2206-K-2RS	H306	12	4,7	0,2	--	7500	
	30	72	19	1,1	1306-K	H306	16,3	6,3	0,3	8800	13000	
30	35	72	17	1,1	1207-K	H207	14,5	5,9	0,3	9500	13000	
	35	72	23	1,1	2207-K	H307	23,4	8,7	0,4	10200	12000	
	35	72	23	1,1	2207-K-2RS	H307	14,5	5,9	0,3	--	6300	
	35	80	21	1,5	1307-K	H307	20,1	8,5	0,4	8100	11000	
	35	80	31	1,5	2307-K	H2307	30,4	11,4	0,5	9500	12000	
35	40	80	18	1,1	1208-K	H208	15,4	6,9	0,3	8600	11000	
	40	80	23	1,1	2208-K	H308	24,4	10	0,5	8900	11000	
	40	80	23	1,1	2208-K-2RS	H308	15,4	6,9	0,3	--	5600	
	40	90	23	1,5	1308-K	H308	26	11,3	0,5	7400	9500	
	40	90	33	1,5	2308-K	H2308	41,6	15,9	0,7	8500	10000	
40	45	85	19	1,1	1209-K	H209	18,1	8,2	0,4	8100	11000	
	45	85	23	1,1	2209-K	H309	24,9	10,6	0,5	8100	10000	
	45	85	23	1,1	2209-K-2RS	H309	18,1	8,2	0,4	--	5300	
	45	100	25	1,5	1309-K	H309	29,8	13,4	0,6	6800	8500	
	45	100	36	1,5	2309-K	H2309	49,1	19,1	0,9	7800	9000	

Anschlussmaße siehe Seite 504

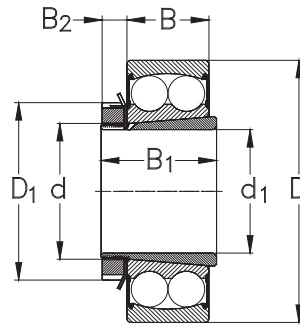
*Abutment and fillet dimensions
see on page 504*

Ø Welle Ø Shaft		Gewicht des Lagers mit Spannhülse <i>Weight of bearing with adapter sleeve</i>				Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d ₁	D ₁	B ₁	B ₂	[kg]	e	Y F _a /F _r ≤ e	Y F _a /F _r > e	Y ₀		
20	38	26	9	0,2	0,27	2,37	3,66	2,48	1205-K	
	38	29	9	0,24	0,35	1,8	2,8	1,9	2205-K	
	38	29	9	0,22	0,27	2,4	3,7	2,5	2205-K-2RS	
25	45	27	9	0,32	0,25	2,53	3,91	2,65	1206-K	
	45	31	9	0,37	0,3	2,1	3,3	2,2	2206-K	
	45	31	9	0,38	0,25	2,5	3,9	2,7	2206-K-2RS	
	45	31	9	0,51	0,26	2,4	3,7	2,5	1306-K	
30	52	29	10	0,45	0,22	2,8	4,34	2,94	1207-K	
	52	35	10	0,53	0,3	2,1	3,3	2,2	2207-K	
	52	35	10	0,58	0,22	2,8	4,3	2,9	2207-K-2RS	
	52	35	10	0,66	0,26	2,5	3,8	2,6	1307-K	
	52	43	10	0,91	0,47	1,4	2,1	1,4	2307-K	
35	58	31	11	0,6	0,22	2,9	4,49	3,04	1208-K	
	58	36	11	0,66	0,26	2,4	3,8	2,5	2208-K	
	58	36	11	0,736	0,22	2,9	4,5	3	2208-K-2RS	
	58	36	11	0,91	0,25	2,5	3,9	2,6	1308-K	
	58	46	11	1,15	0,43	1,5	2,3	1,5	2308-K	
40	65	33	12	0,7	0,21	3,04	4,7	3,18	1209-K	
	65	39	12	0,78	0,26	2,4	3,8	2,5	2209-K	
	65	39	12	0,81	0,21	3	4,7	3,2	2209-K-2RS	
	65	39	12	1,2	0,25	2,5	3,9	2,6	1309-K	
	65	50	12	1,5	0,43	1,5	2,3	1,6	2309-K	

Pendelkugellager mit Spannhülsen
Self Aligning Ball Bearings with Adapter Sleeves



-K + H..



-K-2RS + H..

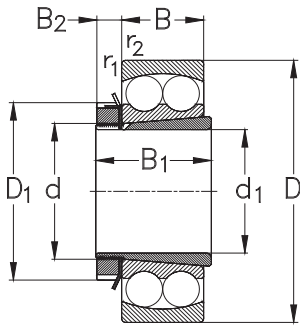
Ø Welle	Hauptabmessungen				Lagertype	Spannhülse	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Ø Shaft	Boundary dimensions [mm]				Designation	Adapter sleeve	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d ₁	d	D	B	r ₁ , r ₂ min			C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
45	50	90	20	1,1	1210-K	H210	20,2	9,5	0,4	7600	10000
	50	90	23	1,1	2210-K	H310	25,8	11,3	0,5	7400	9500
	50	90	23	1,1	2210-K-2RS	H310	20,2	9,5	0,4	--	4800
	50	110	27	2	1310-K	H310	33,6	15,3	0,7	6300	8000
	50	110	40	2	2310-K	H2310	49,7	20,1	0,9	7400	9500
50	55	100	21	1,5	1211-K	H211	21,2	10,6	0,5	6900	9000
	55	100	25	1,5	2211-K	H311	30,1	13,3	0,6	6900	8500
	55	100	25	1,5	2211-K-2RS	H311	21,2	10,6	0,5	--	8500
	55	120	29	2	1311-K	H311	40,6	18,9	0,9	5900	7500
	55	120	43	2	2311-K	H2311	58	23,9	1,1	6900	7500
55	60	110	22	1,5	1212-K	H212	24	12,1	0,6	6400	8500
	60	110	28	1,5	2212-K	H312	35,7	16,1	0,7	6600	8000
	60	130	31	2,1	1312-K	H312	44,8	21,1	1	5600	6300
	60	130	46	2,1	2312-K	H2312	68	28,6	1,3	6600	7000
60	65	120	23	1,5	1213-K	H213	28,5	14,1	0,6	5900	7000
	65	120	31	1,5	2213-K	H313	43,7	20,1	0,9	6300	7000
	70	125	24	1,5	1214-K	H214	28,5	13,6	0,6	5700	6000
	65	140	33	2,1	1313-K	H313	48,3	22,8	1	5300	6000
	65	140	48	2,1	2313-K	H2313	75	31,8	1,4	6100	6300
65	75	130	25	1,5	1215-K	H215	29,9	15,5	0,7	5500	6700
	75	130	31	1,5	2215-K	H315	43,5	20,7	0,9	5600	6300
	75	160	37	2,1	1315-K	H315	61	29,9	1,2	4800	5600

Anschlussmaße siehe Seite 504

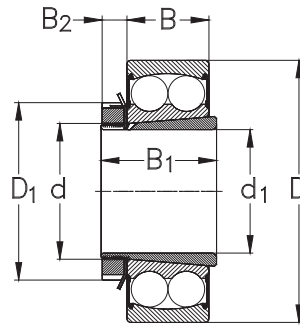
*Abutment and fillet dimensions
see on page 504*

Ø Welle Ø Shaft		Gewicht des Lagers mit Spannhülse <i>Weight of bearing with adapter sleeve</i>				Berechnungsfaktoren <i>Calculation factors</i>				Lagertyp <i>Designation</i>
d ₁	D ₁	B ₁	B ₂	[kg]	e	Y F _a /F _r ≤ e	Y F _a /F _r > e	Y ₀		
45	70	35	13	0,82	0,2	3,17	4,9	3,32	1210-K	
	70	42	13	0,88	0,24	2,6	4,1	2,7	2210-K	
	70	42	13	0,91	0,2	3,2	4,9	3,3	2210-K-2RS	
	70	42	13	1,54	0,24	2,6	4	2,7	1310-K	
	70	55	13	2	0,43	1,5	2,3	1,5	2310-K	
50	75	37	14	1	0,19	3,31	5,12	3,47	1211-K	
	75	45	14	1,1	0,22	2,9	4,5	3,1	2211-K	
	75	45	14	1,2	0,19	3,3	5,1	3,5	2211-K-2RS	
	75	45	14	1,9	0,24	2,7	4,1	2,8	1311-K	
	75	59	14	2,5	0,42	1,5	2,3	1,6	2311-K	
55	80	38	14	1,3	0,18	3,47	5,37	3,64	1212-K	
	80	47	14	1,5	0,23	2,7	4,2	2,8	2212-K	
	80	47	14	2,4	0,23	2,8	4,3	2,9	1312-K	
	80	62	14	2,7	0,41	1,6	2,4	1,6	2312-K	
60	85	40	15	1,6	0,18	3,57	5,52	3,74	1213-K	
	85	50	15	1,4	0,23	2,8	4,3	2,9	2213-K	
	92	41	14	1,9	0,19	3,36	5,21	3,52	1214-K	
	85	50	15	3	0,23	2,8	4,3	2,9	1313-K	
	85	65	15	3,9	0,39	1,6	2,5	1,7	2313-K	
65	98	43	16	2	0,19	3,32	5,15	3,48	1215-K	
	98	55	16	1,2	0,26	2,5	3,8	2,6	2215-K	
	98	55	16	3,2	0,23	2,8	4,3	2,9	1315-K	

Pendelkugellager mit Spannhülsen
Self Aligning Ball Bearings with Adapter Sleeves



-K + H..



-K-2RS + H..

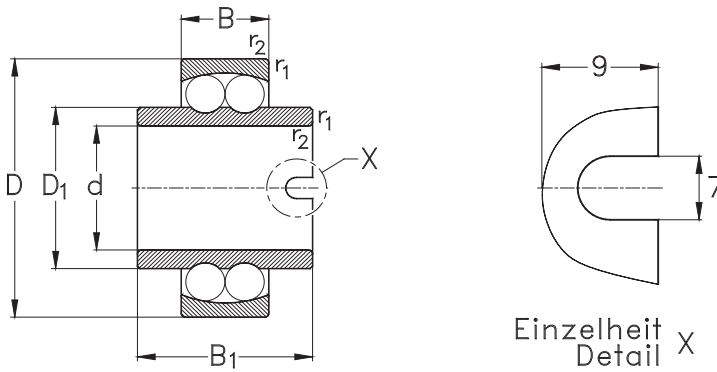
Ø Welle	Hauptabmessungen				Lagertype	Spannhülse	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Ø Shaft	Boundary dimensions [mm]				Designation	Adapter sleeve	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d ₁	d	D	B	r ₁ , r ₂ min			C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
65	75	160	55	2,1	2315-K	H2315	97	42,1	1,8	5600	5600
70	80	140	26	2	1216-K	H216	30,5	16,1	0,7	5200	6000
	80	140	33	2	2216-K	H316	48,3	24,1	1	5400	6000
	80	170	39	2,1	1316-K	H316	68	33,5	1,4	4600	5300
	80	170	58	2,1	2316-K	H2316	105	47,5	1,9	5400	5300
75	85	150	28	2	1217-K	H217	36,7	19,5	0,8	5000	5600
	85	150	36	2	2217-K	H317	49	24,6	1	5200	5600
	85	180	41	3	1317-K	H317	75	38,6	1,5	4400	4800
	85	180	60	3	2317-K	H2317	107	52	2	5200	4800
80	90	160	30	2	1218-K	H218	40,3	21,7	0,9	4800	5300
	90	160	40	2	2218-K	H318	54	28,5	1,2	5200	5300
	90	190	43	3	1318-K	H318	89	46,2	1,8	4300	4500
	90	190	64	3	2318-K	H2318	117	58	2,2	4900	4500
85	95	170	32	2,1	1219-K	H219	49	26,9	1,1	4700	5000
	95	170	43	2,1	2219-K	H319	64	34,1	1,3	5000	5000
	95	200	45	3	1319-K	H319	102	52	1,9	4100	4300
	95	200	67	3	2319-K	H2319	126	64	2,4	4600	4000
90	100	180	34	2,1	1220-K	H220	53	29,4	1,1	4600	4800
	100	180	46	2,1	2220-K	H320	75	40,5	1,6	4900	4800
	100	215	47	3	1320-K	H320	111	59	2,1	3900	4000
	100	215	73	3	2320-K	H2320	147	79	2,8	4400	4000
100	110	200	38	2,1	1222-K	H222	68	38,5	1,4	4300	4300

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

Ø Welle Ø Shaft		Gewicht des Lagers mit Spannhülse <i>Weight of bearing with adapter sleeve</i>				Berechnungsfaktoren <i>Calculation factors</i>			Lagertyp <i>Designation</i>
d ₁	D ₁	B ₁	B ₂	[kg]	e	Y F _a /F _r ≤ e	Y F _a /F _r > e	Y ₀	
65	98	73	16	6,3	0,38	1,6	2,5	1,7	2315-K
70	105	46	18	2,5	0,16	3,9	6,03	4,08	1216-K
	105	59	18	3,1	0,25	2,5	3,8	2,6	2216-K
	105	59	18	5,8	0,22	2,9	4,4	3	1316-K
	105	78	18	6,8	0,37	1,7	2,6	1,8	2316-K
75	110	50	19	3,1	0,17	3,73	5,78	3,91	1217-K
	110	63	19	3,9	0,26	2,5	3,8	2,6	2217-K
	110	63	19	6,3	0,22	2,8	4,5	3	1317-K
	110	82	19	8,4	0,37	1,7	2,6	1,8	2317-K
80	120	52	19	3,7	0,17	3,74	5,79	3,92	1218-K
	120	65	19	4,7	0,27	2,3	3,6	2,4	2218-K
	120	65	19	7,4	0,22	2,8	4,4	3	1318-K
	120	86	19	9,9	0,39	1,6	2,5	1,7	2318-K
85	125	55	20	3,5	0,17	3,73	5,78	3,91	1219-K
	125	68	20	5,6	0,27	2,3	3,6	2,4	2219-K
	125	68	19	8,5	0,23	2,7	4,2	2,9	1319-K
	125	90	20	11,6	0,38	1,7	2,6	1,7	2319-K
90	130	58	21	4,8	0,18	3,58	5,53	3,75	1220-K
	130	71	21	6,6	0,27	2,3	3,6	2,4	2220-K
	130	71	21	10,4	0,23	2,7	4,2	2,8	1320-K
	130	97	21	12,5	0,38	1,7	2,6	1,8	2320-K
100	145	63	21	7,6	0,17	3,61	5,59	3,78	1222-K

Pendelkugellager mit verbreitertem Innenring
Self Alignig Ball Bearings with Extended Inner Rings



Hauptabmessungen [mm]						Lagertyp	Tragzahlen		
Boundary dimensions [mm]						Designation	Load ratings [kN]		
d	D	B	r ₁ , r ₂ min	B ₁	D ₁		C _r dyn.	C _{0r} stat.	C _u
20	47	14	1	40	29,2	11204	12,7	3,4	0,2
25	52	15	1	44	33,3	11205	14,3	4	0,2
	62	17	1,1	48	38	11305	18,9	5,5	0,3
30	62	16	1	48	40,1	11206	15,6	4,7	0,2
	72	19	1,1	52	45	11306	21,6	6,3	0,3
35	72	17	1,1	52	47,7	11207	18,8	5,9	0,3
	80	21	1,5	56	51,7	11307	26,2	8,5	0,4
40	80	18	1,1	56	54	11208	20	6,9	0,3
	90	23	1,5	58	57,7	11308	33,8	11,3	0,5
45	85	19	1,1	58	57,7	11209	23,5	8,2	0,4
	100	25	1,5	60	63,9	11309	38,7	13,4	0,6
50	90	20	1,1	58	62,7	11210	22,9	8,1	0,4
	110	27	2	62	70,3	11310	69	30,6	1,4
55	100	21	1,5	60	69,5	11211	27,6	10,6	0,5
60	110	22	1,5	62	78	11212	31,2	12,1	0,6

Anschlussmaße siehe Seite 504

*Abutment and fillet dimensions
see on page 504*

d	Gewicht [kg]	Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Berechnungsfaktoren			Lagertyp	
	Weight [kg]	Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Calculation factors			Designation	
	m	n _{Br}	n _G	e	Y F _a /F _r ≤ e	Y F _a /F _r > e	Y ₀	
20	0,12	11700	9000	0,28	2,24	3,46	2,34	11204
25	0,2	10000	8000	0,27	2,37	3,66	2,48	11205
	0,43	9900	6700	0,28	2,3	3,5	2,4	11305
30	0,36	8200	6700	0,25	2,53	3,91	2,65	11206
	0,64	8600	5600	0,26	2,4	3,7	2,5	11306
35	0,55	6700	5600	0,22	2,8	4,34	2,94	11207
	0,85	7100	5000	0,26	2,5	3,8	2,6	11307
40	0,72	5800	5000	0,22	2,9	4,49	3,04	11208
	1,1	5800	4500	0,25	2,5	3,9	2,6	11308
45	0,78	5100	4500	0,21	3,04	4,7	3,18	11209
	1,45	5000	3800	0,25	2,5	3,9	2,6	11309
50	0,86	4900	4300	0,2	3,17	4,9	3,32	11210
	1,8	2700	3600	0,24	2,6	4	2,7	11310
55	1,13	4100	4600	0,19	3,31	5,2	3,47	11211
60	1,51	3500	3400	0,18	3,47	5,37	3,64	11212



Zylinderrollenlager
Cylindrical Roller Bearings

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings

Vollrollige Zylinderrollenlager, zweireihig, abgedichtet
Sealed Double Row Full Complement Cylindrical Roller Bearings

Einreihige Zylinderrollenlager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Einreihige Zylinderrollenlager,	
Winkelringe	DIN 5412 / Teil 1

Allgemeines:

Einreihige Zylinderrollenlager sind zerlegbare Radiallager. Eine Ausnahme bilden hierbei lediglich einige **vollrollige Zylinderrollenlager**, bei denen verschiedene Ausführungen aufgrund ihrer Innenkonstruktion nicht zerlegbar sind.

Die Möglichkeit, Innen- und Außenringe von Zylinderrollenlagern getrennt zu montieren, stellt beim Ein- und Ausbau eine wesentliche Erleichterung dar, insbesondere auch bei einem Serienverbau.

Weiters wird dadurch die Verwendung fester Passungen für beide Ringe eines Lagers ermöglicht.

Die radiale Tragfähigkeit sowie die mit einreihigen Zylinderrollenlagern erzielbaren Drehzahlen sind im Vergleich mit anderen Wälzlagerbauarten relativ hoch.

Je nach Ausführung bzw. nach Anordnung der Borde stellen einreihige Zylinderrollenlager ideale Loslager dar, verschiedene Ausführungen können aber in beschränktem Umfang auch Axialkräfte in eine oder beide Richtungen aufnehmen.

Bei Lagerungen mit beschränktem Einbauraum, wie beispielsweise in Getrieben, finden auch oftmals Zylinderrollenlager ohne lose Ringe Verwendung, bei denen die Wälzkörper direkt auf den als Laufbahnen ausgebildeten Anschlußteilen an Welle oder Gehäuse laufen (Bauformen **RN** bzw. **RNU**).

In diesen Fällen muss allerdings die Qualität der Gegenflächen dem eines Lagerringes entsprechen (z.B. gehärtet und geschliffen).

Single Row Cylindrical Roller Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Single row cylindrical roller bearings,	
thrust collars	DIN 5412 / part 1

General:

Single row cylindrical roller bearings are separable radial bearings, except for some **full complement cylindrical roller bearings** where several variations are not separable due to their internal design features.

Due to the possibility of fitting the outer and inner rings separately, the bearing mounting becomes easier and simpler even for volume assembly mounting.

Furthermore, this enables the use of tight fits where appropriate for both outer and inner rings. This is of advantage in applications where vibrations or shock loads occur.

For single row cylindrical roller bearings the radial loads and speed ratings are relatively high when compared to other roller bearings.

Depending on their particular design the single row cylindrical roller bearings are ideal non - locating radially loaded bearings, although several design variations will also accept limited magnitude of axial loading in one or both directions.

In the case of bearing arrangements with limited available space (i.e. gear boxes) cylindrical roller bearings may be used without their respective outer or inner rings (execution, **RN- RNU**, respectively). These bearing design types allow the rolling elements to run directly onto the adjacent contacting surface of either the housing or shaft. In these bearing arrangements the adjacent contacting surface parts must be designed as for bearing raceways (i.e. hardened and ground etc).

**Bauformen
einreihiger Zylinderrollenlager**

Einreihige Zylinderrollenlager sind standardmäßig in mehreren Grundausführungen verfügbar, die sich in Anzahl und Anordnung der Borde unterscheiden. Die wichtigsten Bauformen sind in **Abb. 1** dargestellt.

Die Bauform **N** hat zwei Borde am Innenring und einen bordlosen Außenring. Bei der Bauform **NU** hat der Außenring zwei Borde, der Innenring ist bordlos.

Zylinderrollenlager der Ausführung **N** bzw. **NU** können keine axialen Kräfte aufnehmen, erlauben aber einen Längenausgleich innerhalb des Lagers, wodurch sie ideale Loslager darstellen.

Beide Ringe können daher mit Preßpassungen befestigt werden.

**Design Variants of
Single Row Cylindrical Roller Bearings**

Single row cylindrical roller bearings are available in several basic designs that differ from each other in the number and arrangement of their flanges, as standard. The most important design variants are shown below (see **Fig. 1**).

The **N**-design features two integral flanges on the inner ring and a plain outer ring. In the case of **NU**-type bearings, however, the inner ring is plain whilst the outer ring features two integral flanges.

Cylindrical roller bearings of the **N** and **NU** design allow a compensation of length changes within the bearing and thus are ideal non-locating bearings.

These bearings are not able to accommodate any axial loads.

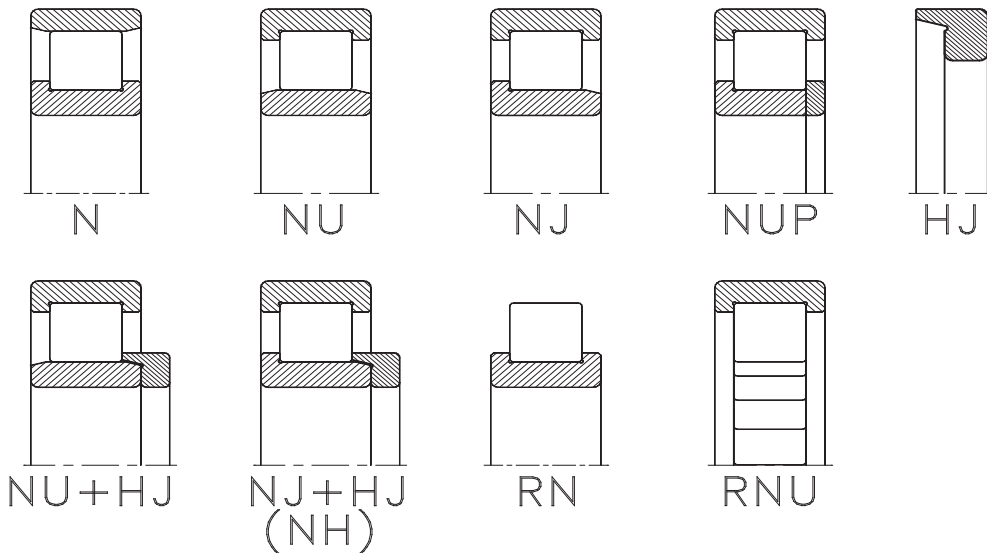


Abb. 1
Fig. 1

Zylinderrollenlager der Bauform **NJ** haben zwei Borde am Außenring und einen Bord am Innenring. Axialkräfte können dadurch in einer Richtung aufgenommen werden.

Typische Festlager sind hingegen Zylinderrollenlager der Bauform **NUP**. Diese weisen neben zwei festen Borden am Außenring auch einen festen Bord und eine Bordscheibe am Innenring auf. Dadurch können Axialkräfte in beiden Richtungen aufgenommen werden.

Winkelringe (**HJ**) dienen der axialen Führung einer Welle bei Verwendung von Zylinderrollenlagern.

Ergänzt mit einem Winkelring **HJ** bilden auch Zylinderrollenlager der Bauform **NJ** Festlager (**NJ + HJ = NH**) und führen die Welle axial in beiden Richtungen.

Standard-Zylinderrollenlager der Bauform **NU** dürfen allerdings nur mit einem Winkelring **HJ** ergänzt werden, um ein Klemmen der Rollen zu vermeiden.

Die Lager können dann Axialkräfte in einer Richtung übertragen.

Verstärkte Ausführungen

NKE liefert den Großteil der Zylinderrollenlager standardmäßig mit verstärktem Innenaufbau, Nachsetzzeichen „**E**“.

Diese Lager weisen bei gleichen Außenabmessungen durch optimierte Innenkonstruktionen eine höhere radiale Tragfähigkeit auf und haben sich daher in weiten Bereichen des Maschinenbaus als Standard durchgesetzt.

Ausnahmen davon sind beispielsweise Zylinderrollenlager der Reihen **10** und **4** sowie bei großen Zylinderrollenlagern, die nur in Standardausführung verfügbar sind.

Für bestimmte Anwendungsfälle, speziell im Reparaturbedarf, sind Zylinderrollenlager in der alten, nicht „**E**“ Ausführung erforderlich.

Auf Anfrage liefert NKE Zylinderrollenlager sowohl in „**E**“ als auch in **nicht „E**“-Ausführung.

Cylindrical roller bearings of **NJ**-design have two integral flanges on their outer ring and one integral flange on the inner ring. This allows them to accommodate axial loads in one direction only. Typical locating bearings are **NUP**-design cylindrical roller bearings. These have two integral flanges on their outer ring, one integral flange on the inner ring and a loose rib. **NUP**-type bearings are able to accept axial loads in either direction.

Separate thrust collars, type **HJ**, are designed to guide shafts when used in conjunction with cylindrical roller bearings.

NJ-type cylindrical roller bearings in conjunction with thrust collars, locating bearings, are that provide shaft guidance in both directions (**NJ + HJ = NH**).

When standard cylindrical roller bearings of the **NU**-type, are used in conjunction with a separate **HJ**-separate thrust collar, care must be taken to avoid the possibility of clamping the rollers in error.

These bearing types are able to accommodate axial forces acting in one direction only.

Reinforced Internal Design

NKE single row cylindrical roller bearings are normally produced with reinforced internal design (suffix **E**), as standard.

This incorporates an optimised internal design providing increased load carrying capabilities.

The exception to this “standard” are some of the larger cylindrical roller bearings and bearing types of the **10** and **4** series for which the **NON-E**-design remains the standard.

However, in certain applications, particularly in the “**aftermarket**” the historic **NON-E**-design remains, therefore, for all sizes these are produced on customer order request.

Schiefstellung

Zylinderrollenlager sind durch die Linienberührung grundsätzlich nur beschränkt zum Ausgleich von Schiefstellungen geeignet.

NKE Zylinderrollenlager haben Rollen mit optimierter Rollengeometrie, um schädliche Kantenspannungen zwischen Rollen und Laufbahnen zu minimieren. Unter normalen Betriebsverhältnissen sind daher Schiefstellungen bis maximal 2 Winkelminuten aus der Mittellage zulässig.

Allerdings weisen Lager, die unter Schiefstellungen laufen, erheblich höhere Laufgeräusche auf. Weiters ist in diesen Fällen auch mit einer Verringerung der Gebrauchsdauer durch die Zusatzbelastungen zu rechnen.

Für Anwendungsfälle, in denen mit größeren Schiefstellungen im Betrieb zu rechnen ist, fertigt **NKE** auch Zylinderrollenlager mit speziell balliger Innenringlaufbahn, Nachsetzzeichen „**B**“.

Toleranzen

NKE Zylinderrollenlager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 52.

Käfige

Sofern nicht anders spezifiziert, werden **NKE** Zylinderrollenlager der **E-Ausführung** mit Polyamidkäfigen (Nachsetzzeichen „**TVP**“) gefertigt.

Misalignment

Due to the line contact cylindrical roller bearings have limited capacity to cope with misalignment.

NKE single row cylindrical roller bearings feature rolling elements with modified contact geometry to minimise edge loading stresses between the rollers and contacting raceways. For applications operating under normal conditions the misalignment must not exceed 2 angular minutes from their centre position. It must be accepted that when bearings run misaligned they are subjected to additional forces which result in a reduced service life and additionally generate higher noise.

For applications where higher misalignments occur, (e.g. vibrating screens or compactors for road rollers), **NKE** also produces cylindrical roller bearings with special crowned inner ring raceways, (suffix “**B**”).

Tolerances

NKE cylindrical roller bearings are produced to normal tolerance class (**PN**) as standard. On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 237.

Cages

NKE single row cylindrical roller bearings of the **E** design are normally equipped with polyamide cages (suffix “**TVP**”) as standard.

Zylinderrollenlager

Cylindrical Roller Bearings



Ausgenommen davon sind große Zylinderrollenlager sowie Lager der Reihe **4**, die standardmäßig mit **Messingmassivkäfigen** erzeugt werden (Nachsetzzeichen **M**).

Auf Anfrage können **NKE** Zylinderrollenlager auch mit einer Vielzahl anderer Käfigbauformen und Käfigwerkstoffe geliefert werden.

Lagerluft

Einreihige NKE Zylinderrollenlager werden standardmäßig in **Normalluft** (Luftgruppe **CN**) geliefert.

Auf Anfrage werden NKE Zylinderrollenlager auch mit anderen Lagerluftwerten gefertigt.

Werte für die unterschiedlichen **Lagerluftgruppen** von **ein- und zweireihigen NKE Zylinderrollenlagern** sind in den untenstehenden Tabellen (1-4) angegeben.

Diese Werte entsprechen, soweit diese genormt sind, den Vorgaben der DIN 620/Teil 4 bzw. der ISO 5753-1991.

Sonder - Lagerluft:

Für Anwendungsfälle, die mit diesen Luftklassen nicht oder nicht optimal abgedeckt werden können, können **NKE** Zylinderrollenlager auftragsbezogen auch mit speziell definierten Luftwerten erzeugt werden.

Beispiel:

R100&180 Spezielle **R**adialluft.
Luft zwischen **100** und **180 µm**

Falls erforderlich kann auch der Bereich einer Lagerluftklasse eingeschränkt werden.

Diese Halbierung der Lagerluft wird durch einen dem Symbol der Lagerluftklasse folgenden Buchstaben **H**, **M** oder **L** angezeigt.

Beispiel:

C4H Lagerluft auf die **obere Hälfte** der Luftklasse **C4** eingeschränkt.

Exceptions to this standard are the larger cylindrical roller bearings and bearings of the **4** series which are produced with machined **solid brass cages** (suffix **M**) as standard.

NKE cylindrical roller bearings are also available with other cage designs and cage materials on order request.

Internal Clearance

NKE single row cylindrical roller bearings are produced to the **normal internal clearance** group (**CN**), as standard.

On request NKE cylindrical roller bearings are produced with other internal clearances. Values of **internal clearance groups** are listed in the tables (1-4), below.

These values are standardised and conform to both DIN 620/part 4 and ISO 5753-1991, respectively.

Special Clearance:

For bearing applications where the standard internal clearances and ranges do not satisfy optimum performance **NKE** cylindrical roller bearings are produced with either individual or special internal clearance groups on order request.

Example:

R100&180 Special **R**adial clearance between **100** and **180 µm** (microns)

If required, the values of an internal clearance may be halved and controlled within a part of a standard. Such a restriction is indicated by a letter (**H**, **M** or **L**), that follows the symbol of the bearing clearance group.

Example:

C4H Clearance controlled within the **upper half** of clearance group **C4**.

Lagerluft ein- und zweireihiger NKE Zylinderrollenlager, Bohrungsdurchmesser ≤ 250 mm
Clearance Groups of NKE Single and Double Row Cylindrical Roller Bearings; Bore Diameters ≤ 250 mm.

Zylinderrollenlager mit zylindrischer Bohrung (Luftwerte in µm)
Cylindrical roller bearings with cylindrical bore (clearance values in µm)

Lagerbohrung Bore diameter	[mm]	> ≤	--	24	30	40	50	65	80	100	120	140	160	180	200	225	
			24	30	40	50	65	80	100	120	140	160	180	200	225	250	
Luftgruppe Clearance group	C1	min	5	5	5	5	5	10	10	10	10	10	10	10	15	15	15
		max	15	15	15	18	20	25	30	30	35	35	40	45	50	50	
Luftgruppe Clearance group	C2	min	0	0	5	5	10	10	15	15	15	20	25	35	45	45	
		max	25	25	30	35	40	45	50	55	60	70	75	90	105	110	
Luftgruppe Clearance group (NORMAL)	CN	min	20	20	25	30	40	40	50	50	60	70	75	90	105	110	
		max	45	45	50	60	70	75	85	90	105	120	125	145	165	175	
Luftgruppe Clearance group	C3	min	35	35	45	50	60	65	75	85	100	115	120	140	160	170	
		max	60	60	70	80	90	100	110	125	145	165	170	195	220	235	
Luftgruppe Clearance group	C4	min	50	50	60	70	80	90	105	125	145	165	170	195	220	235	
		max	75	75	85	100	110	125	140	165	190	215	220	250	280	300	
Luftgruppe Clearance group	C5	min	75	75	85	100	110	125	140	165	190	215	220	250	280	300	
		max	100	100	110	130	140	160	175	205	235	265	270	305	340	365	

Tabelle 1 / Table 1

Zylinderrollenlager mit kegeliger Bohrung (Luftwerte in µm)
Cylindrical roller bearings with tapered bore (clearance values in µm)

Luftgruppe Clearance group	C1	min	10	15	15	17	20	25	35	40	45	50	55	60	60	65
		max	20	25	25	30	35	40	55	60	70	75	85	90	95	100
Luftgruppe Clearance group	C2	min	15	20	20	25	30	35	40	50	55	60	75	85	95	105
		max	40	45	45	55	60	70	75	90	100	110	125	140	155	170
Luftgruppe Clearance group (NORMAL)	CN	min	30	35	40	45	50	60	70	90	100	110	125	140	155	170
		max	55	60	65	75	80	95	105	130	145	160	175	195	215	235
Luftgruppe Clearance group	C3	min	40	45	55	60	70	85	95	115	130	145	160	180	200	220
		max	65	70	80	90	100	120	130	155	175	195	210	235	260	285
Luftgruppe Clearance group	C4	min	50	55	70	75	90	110	120	140	160	180	195	220	245	270
		max	75	80	95	105	120	145	155	180	205	230	245	275	305	335
Luftgruppe Clearance group	C5	min	75	80	95	105	120	145	155	180	205	230	245	275	305	335
		max	100	105	120	135	150	180	190	220	250	280	295	330	365	400

Tabelle 2 / Table 2

Lagerluft ein- und zweireihiger NKE Zylinderrollenlager, Bohrungsdurchmesser > 250 mm
Clearance Groups of NKE Single and Double Row Cylindrical Roller Bearings; Bore Diameters > 250 mm.

Zylinderrollenlager mit **zylindrischer** Bohrung (Luftwerte in μm)
Cylindrical roller bearings with **cylindrical** bore (clearance values in μm)

Lagerbohrung Bore diameter	[mm]	> ≤	250	280	315	355	400	450	500	560	630	710	800	900	1000
			280	315	355	400	450	500	560	630	710	800	900	1000	1120
Luftgruppe Clearance group	C1	min	20	20	20	25	25	25	25	30	30	35	35	35	50
		max	55	60	65	75	85	95	100	110	130	140	160	180	200
Luftgruppe Clearance group	C2	min	55	55	65	100	110	110	120	140	145	150	180	200	220
		max	125	130	145	190	210	220	240	260	285	310	350	390	430
Luftgruppe Clearance group (NORMAL)	CN	min	125	130	145	190	210	220	240	260	285	310	350	390	430
		max	195	205	225	280	310	330	360	380	425	470	520	580	640
Luftgruppe Clearance group	C3	min	190	200	225	280	310	330	360	380	425	470	520	580	640
		max	260	275	305	370	410	440	480	500	565	630	690	770	850
Luftgruppe Clearance group	C4	min	260	275	305	370	410	440	480	500	565	630	690	770	850
		max	330	350	385	460	510	550	600	620	705	790	860	960	1060
Luftgruppe Clearance group	C5	min	330	350	385	460	510	550	600	620	705	790	860	960	1060
		max	400	425	465	550	610	660	720	740	845	950	1030	1150	1270

Tabelle 3 / Table 3

Zylinderrollenlager mit **kegeliger** Bohrung (Luftwerte in μm)
Cylindrical roller bearings with **tapered** bore (clearance values in μm)

Luftgruppe Clearance group	C1	min	75	80	90	100	110	120	130	140	160	170	190	210	230
		max	110	120	135	150	170	190	210	230	260	290	330	360	400
Luftgruppe Clearance group	C2	min	115	130	145	165	185	205	230	260	295	325	370	410	455
		max	185	205	225	255	285	315	350	380	435	485	540	600	665
Luftgruppe Clearance group (NORMAL)	CN	min	185	205	225	255	285	315	350	380	435	485	540	600	665
		max	255	280	305	345	385	425	470	500	575	645	710	790	875
Luftgruppe Clearance group	C3	min	240	265	290	330	370	410	455	500	565	630	700	780	865
		max	310	340	370	420	470	520	575	620	705	790	870	970	1075
Luftgruppe Clearance group	C4	min	295	325	355	405	455	505	560	620	695	775	860	960	1065
		max	365	400	435	495	555	615	680	740	835	935	1030	1150	1275
Luftgruppe Clearance group	C5	min	365	400	435	495	555	615	680	740	835	935	1030	1150	1275
		max	435	475	515	585	655	725	800	860	975	1095	1200	1340	1485

Tabelle 4 / Table 4

Achtung:

Bei ein- und zweireihigen Zylinderrollenlagern der Luftgruppe C1 dürfen die Komponenten verschiedener Lager untereinander nicht vertauscht werden!

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für **NKE** Zylinderrollenlager muss die Mindestradialbelastung **2%** der dynamischen Tragzahl betragen.

Maximale axiale Belastbarkeit

Zylinderrollenlager sind primär zur Aufnahme radialer Belastungen vorgesehen, jedoch können verschiedene Bauformen auch zusätzlich einseitige oder in beide Richtungen wirkende Axialkräfte in begrenzter Höhe aufnehmen.

Bei Zylinderrollenlagern entsteht durch eine axiale Belastung Gleitreibung zwischen den Rollenstirnflächen und den Führungsborden, wodurch eine optimale Schmierung erforderlich ist.

Die Höhe der Axialbelastung sollte auch unter optimalen Betriebsbedingungen folgende Werte nicht überschreiten:

$$F_{amax} \leq 0,4 * F_r$$

sowie

$$F_{amax} \leq 0,1 * C_r$$

Note:

The individual components of single and double row cylindrical roller bearings of the internal clearance group (C1) are not interchangeable.

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For **NKE** cylindrical roller bearings the minimum radial load must be **2%** of the dynamic load rating.

Maximum Thrust Loads

Although cylindrical roller bearings are primarily designed to accommodate radial loads there are several designs which are suitable to accept additionally thrust forces of limited magnitude acting in either one or both directions.

Every thrust force applied to a cylindrical roller bearing will generate sliding friction between the roller end faces and the guiding flanges which make optimum lubrication essential.

The magnitude of thrust forces applied to the bearing must not exceed the following ratio even with optimum operating conditions:

$$F_{amax} \leq 0,4 * F_r$$

and

$$F_{amax} \leq 0,1 * C_r$$

Voraussetzungen dafür sind allerdings:

- optimale Schmierung
- keine stoßartigen Belastungen
- optimale Wärmeabfuhr
- ausreichende axiale Unterstützung der Borde

This only applies under the following conditions:

- optimum lubrication
- no shock loads
- optimum heat dissipation
- adequate axial support of the bearing flanges

Äquivalente dynamische Lagerbelastung

Zylinderrollenlager der Bauformen **N, NU, NN, NNU** usw., die als reine **Loslager** eingesetzt werden, können keine Axialkräfte aufnehmen, daher gilt:

$$P = F_r$$

Für ein- und zweireihige Zylinderrollenlager mit Borden an Innen- und Außenringen gilt:

wenn

$$\frac{F_a}{F_r} \leq e \text{ gilt } P = F_r$$

bzw. , bei

$$\frac{F_a}{F_r} > e \text{ dann } P = X * F_r + Y * F_a$$

Equivalent Dynamic Bearing Load

Cylindrical roller bearings of the types **N, NU, NN, NNU** etc are to be used as **non-locating bearings** only as they are unable to accommodate any thrust loads. For these bearings applies:

$$P = F_r$$

In the case of single and double row cylindrical roller bearings with flanges on inner or their outer rings, the following formate must be applied:

where

$$\frac{F_a}{F_r} \leq e , \text{ then } P = F_r$$

or, where

$$\frac{F_a}{F_r} > e , \text{ then } P = X * F_r + Y * F_a$$

Lagerreihe Bearing series	Berechnungsfaktoren Calculation factors		
	e	X	Y
10, 18, 19, 2, 3, 4	0,2	0,92	0,6
22, 23	0,3	0,92	0,4

Äquivalente statische Lagerbelastung

Für ein- und zweireihige Zylinderrollenlager gilt:

$$P_0 = F_r$$

Anschlussmaße ein- und zweireihiger Zylinderrollenlager

Die Umgebungsteile der Lager müssen so gestaltet sein, dass eine ausreichende axiale Unterstützung der Lagerringe gewährleistet ist. Dazu müssen die Schulterhöhen der Anlageflächen an den Wellenbunden bzw. der Gehäuseschultern eine ausreichende Mindesthöhe aufweisen.

Die Radien der Kantenverrundung der Lagerringe dürfen nicht an Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anschlußteilen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe (siehe Zeichnung bei Tabelle auf der Folgeseite).

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert.

Bei **axial hoch belasteten** Zylinderrollenlagern müssen die Lager darüber hinaus mindestens bis zur halben Bordhöhe unterstützt werden. Die Anschlußmaße errechnen sich dabei wie folgt:

für den Wellen-Schulter-Durchmesser:

$$dw_{\min} = \frac{F + d_1}{2}$$

und den bei Gehäuse-Schulter-Durchmesser:

$$DG_{\max} = \frac{E + D_1}{2}$$

Equivalent Static Bearing Load

For single and double row cylindrical roller bearings:

$$P_0 = F_r$$

Abutment and Fillet Dimensions for Single and Double Row Cylindrical Roller Bearings

The machine components surrounding the bearing must be designed in such a way that adequate axial support of bearing rings is secured under all circumstances. To gain adequate support both the shoulders on shaft and the housing must have a certain minimum height.

The bearing rings must contact adjacent parts with their side faces only. The radii of bearing corners must not touch the shoulder fillet radii of either the shaft or the housing shoulders.

Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the bearing tables.

Recommendations for the dimensions of adjacent parts are given in **DIN 5418**.

In the case of cylindrical roller bearings exposed to **high thrust loads** the bearing flanges must be supported by 50% of their radial section or greater.

Thus the adjacent dimensions are to be calculated as follows:

for shaft shoulder diameter:

$$dw_{\min} = \frac{F + d_1}{2}$$

and, housing shoulder diameter:

$$DG_{\max} = \frac{E + D_1}{2}$$

wobei:

- d_{wmin} = erforderlicher Mindest-Wellen-Schulterdurchmesser
- F = Innenring-Laufbahndurchmesser (siehe Produkttabellen)
- d_1 = Innenring-Schulterdurchmesser (siehe Produkttabellen)
- DG_{max} = erforderlicher Maximaldurchmesser der Gehäuseschulter
- E = Außenring-Laufbahndurchmesser (siehe Produkttabellen)
- D_1 = Außenring-Schulterdurchmesser (siehe Produkttabellen)

where:

- d_{wmin} = recommended minimum diameter of shaft shoulder
- F = diameter of inner ring raceway (see product tables)
- d_1 = outer diameter of inner ring shoulder, (see product tables)
- DG_{max} = recommended maximum diameter of housing shoulder
- E = diameter of outer ring raceway (see product tables)
- D_1 = inner diameter of outer ring shoulder, (see product tables)

Ausführung der Lagersitze als Laufbahnen bei Direktlagerungen

In verschiedenen Anwendungsfällen kann es aus Platzgründen zweckmäßig sein anstatt kompletter Zylinderrollenlager nur einen Lagerring mit Wälzkörpersatz zu verwenden.

In diesen Fällen laufen die Rollen direkt auf den als Laufbahnen ausgeführten, also gehärteten und geschliffenen Gegenflächen an Welle oder Gehäuse.

Beispiele dafür sind etwa Zylinderrollenlager ohne Innenring (Bauform **RNU**) bzw. ohne Außenring (Bauform **RN**).

Die Laufflächen an Wellen (Maß F) müssen dabei nach **g6**, Gehäusebohrungen (Maß E) nach **K6** bearbeitet werden.

Die Durchmesser der seitlichen Führungsflächen der Wälzkörper an Wellen- oder Gehäuseschultern müssen der für diese Lager üblichen Schulterhöhen **d_1** bzw. **D_1** entsprechen (siehe Produkttabellen).

Weitere Informationen zur allgemeinen Gestaltung von Direktlagerungen finden Sie im Abschnitt „**Gestaltung der Lagerstelle**“, ab Seite 97.

Design of Bearing Seats as Raceways

In several applications with limited space availability it may be beneficial to use a cage-and-roller assembly with outer (or inner ring) only, as an alternative to a complete cylindrical roller bearing.

In these arrangements the rolling elements run directly onto the contacting surfaces of either shaft or housing. These contacting surfaces must be designed and produced as bearing raceways (hardened and ground etc).

Typical bearing types for these applications are **RNU** series (without inner rings) or **RN** series (without outer rings).

The contacting surface (raceway) of the shaft (dimension F) or housing (dimension E) must be produced to ISO tolerance field **g6** and **K6** respectively.

The roller guiding flange diameters of shaft or housing must be in accordance with the respective shoulder diameters **d_1** or **D_1** , (see product tables)

For further information of the design of raceways see chapter “**Design of Bearing Location**”, on page 282.

Anschlussmaße einreihiger Zylinderrollenlager [mm]

Abutment and Fillet Dimensions for Single Row Cylindrical Roller Bearings [mm]



Lagerbohrung Bearing bore		Für Lagerreihe / for bearing series												
Ø [mm]	Kennzahl Reference number	10		2, 2-E, 22, 22-E					3, 3-E, 23, 23-E					
		D ₁ max	D ₂ min	D ₁ max	D ₂ min	D ₃ min	D ₅ min	D ₆ max	D ₁ max	D ₂ min	D ₃ min	D ₅ min	D ₆ max	
15	02	--	--	18,5	21	23				--	--	--	--	--
17	03	--	--	21	24	27	37	33		23	26	29	42	38
20	04	25	27	25	28	31	43	40		26	29	33	47	44
25	05	29	32	30	33	36	48	45		32	36	40	56	52
30	06	35	38	36	39	43	57	54		39	39	47	64	60
35	07	41	44	42	46	50	66	62		44	48	53	72	68
40	08	45	49	48	51	56	73	69		50	54	60	82	78
45	09	51	54	53	56	61	78	74		56	61	67	91	86
50	10	56	60	57	57	66	83	79		63	67	73	99	95
55	11	63	67	64	68	73	92	88		68	73	80	109	104
60	12	68	72	70	74	80	101	98		74	79	87	118	112
65	13	72	77	76	81	87	111	106		80	85	93	127	122
70	14	78	82	81	86	92	116	111		86	91	100	136	130
75	15	83	87	86	91	97	121	116		92	97	107	146	140
80	16	90	94	93	98	104	129	125		98	104	113	154	148
85	17	95	99	98	103	110	139	134		105	111	120	163	157
90	18	101	106	104	110	117	148	142		110	116	127	173	166
95	19	106	111	110	115	123	157	152		118	124	135	181	174
100	20	111	116	116	122	130	166	160		124	130	142	195	188
105	21	117	122	122	128	137	176	170		130	136	148	205	198
110	22	123	128	130	135	145	183	177		139	146	159	215	208
120	24	133	138	140	146	156	199	192		150	157	171	233	226
130	26	145	151	150	156	167	213	206		163	170	185	251	243
140	28	155	161	166	172	183	228	219		176	183	199	268	256
150	30	167	173	178	185	197	245	236		189	196	213	287	273
160	32	177	183	191	198	210	263	255		200	207	225	302	298
170	34	190	196	203	210	224	284	269		214	221	241	323	313
180	36	202	208	213	220	234	294	279		223	235	255	332	323
190	38	212	218	226	234	248	311	296		240	249	268	--	--
200	40	225	233	239	247	262	328	313		253	264	280	--	--
220	44	246	254	264	270	288	--	--		277	288	311	--	--
240	48	266	274	288	299	317	--	--		302	314	339	--	--
260	52	291	300	313	324	344	--	--		330	341	343	--	--
280	56	311	320	333	344	364	--	--		347	366	364	--	--

Tabelle 5 / Table 5

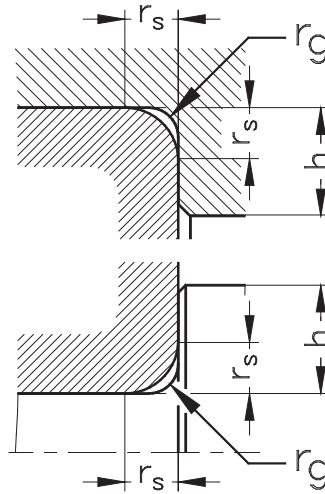
Anschlussmaße einreihiger Zylinderrollenlager [mm]
Abutment and Fillet Dimensions for Single Row Cylindrical Roller Bearings [mm]



Lagerbohrung Bearing bore		Für Lagerreihe / for bearing series								
Ø [mm]	Kennzahl Reference number	10		19		2, 2-E, 22, 22-E				
		D ₁ max	D ₂ min	D ₁ max	D ₂ min	D ₁ max	D ₂ min	D ₃ min	D ₅ min	D ₆ max
300	60	335	344	--	--	358	368	391	--	--
320	64	355	364	--	--	383	394	429	--	--
340	68	380	389	--	--	401	421	448	--	--
360	72	400	410	--	--	--	--	--	--	--
380	76	420	430	--	--	--	--	--	--	--
400	80	446	455	--	--	--	--	--	--	--
420	84	466	475	--	--	--	--	--	--	--
440	88	488	498	--	--	--	--	--	--	--
460	92	511	521	--	--	--	--	--	--	--
480	96	531	541	517	530	--	--	--	--	--
500	/500	550	561	537	549	--	--	--	--	--
530	/530	585	598	547	582	--	--	--	--	--
560	/560	617	630	599	613	--	--	--	--	--
630	/630	--	--	681	694	--	--	--	--	--
710	/710	--	--	769	779	--	--	--	--	--

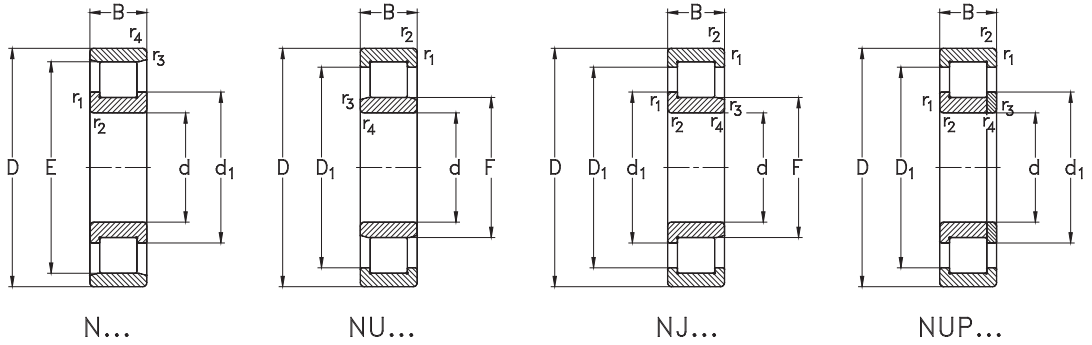
Tabelle 6 / Table 6

Anschlussmaße einreihiger Zylinderrollenlager – Radien der Anschlusssteile [mm]
Abutment and Fillet Dimensions for Single Row Cylindrical Roller Bearings [mm]

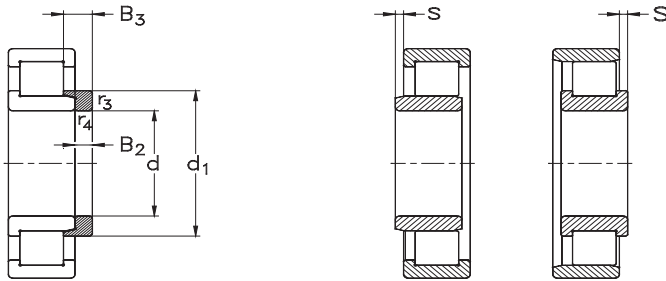


$r_{s \text{ min}}$	$r_{g \text{ max}}$	h_{min} Lagerreihen Bearing series		
		18 19 10	2, 2-E 22, 22-E 3, 3-E 23, 23-E	4
0,3	0,3	1	1,2	--
0,6	0,6	1,6	2,1	--
1	1	2,3	2,8	--
1,1	1	3	3,5	4,5
1,5	1,5	3,5	4,5	5,5
2	2	4,4	5,5	6,5
2,1	2,1	5,1	6	7
3	2,5	6,2	7	8
4	3	7,3	8,5	10
5	4	9	10	12
6	5	11,5	13	15

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
15	35	11	12,9	10,5	1,3	17600	26000	NU202-E-TVP3	--
	35	11	12,9	10,5	1,3	17600	26000	NJ202-E-TVP3	--
17	40	12	17,7	14,7	1,8	15400	22000	NU203-E-TVP3	--
	40	12	17,7	14,7	1,8	15400	22000	NJ203-E-TVP3	--
	40	12	17,7	14,7	1,8	15400	22000	NUP203-E-TVP3	--
	40	16	23,6	22	2,7	13400	22000	NU2203-E-TVP3	--
	40	16	23,6	22	2,7	13400	22000	NJ2203-E-TVP3	--
	40	16	23,6	22	2,7	13400	22000	NUP2203-E-TVP3	--
47	14	25,5	21,3	2,6	13600	20000	NU303-E-TVP3	--	
	14	25,5	21,3	2,6	13600	20000	NJ303-E-TVP3	--	
	14	25,5	21,3	2,6	13600	20000	NUP303-E-TVP3	--	
20	47	14	27,6	24,9	3	13100	19000	NU204-E-TVP3	--
	47	14	27,6	24,9	3	13100	19000	NJ204-E-TVP3	--
	47	14	27,6	24,9	3	13100	19000	NUP204-E-TVP3	--
	47	18	32,8	31,1	3,8	11400	19000	NU2204-E-TVP3	--
	47	18	32,8	31,1	3,8	11400	19000	NJ2204-E-TVP3	--
	47	18	32,8	31,1	3,8	11400	19000	NUP2204-E-TVP3	--
	52	15	34,7	26,5	3,2	12200	18000	NU304-E-TVP3	--
52	15	34,7	26,5	3,2	12200	18000	NJ304-E-TVP3	--	
	15	34,7	26,5	3,2	12200	18000	NUP304-E-TVP3	--	
	21	46,4	38,4	4,7	10000	18000	NU2304-E-TVP3	--	
	21	46,4	38,4	4,7	10000	18000	NJ2304-E-TVP3	--	



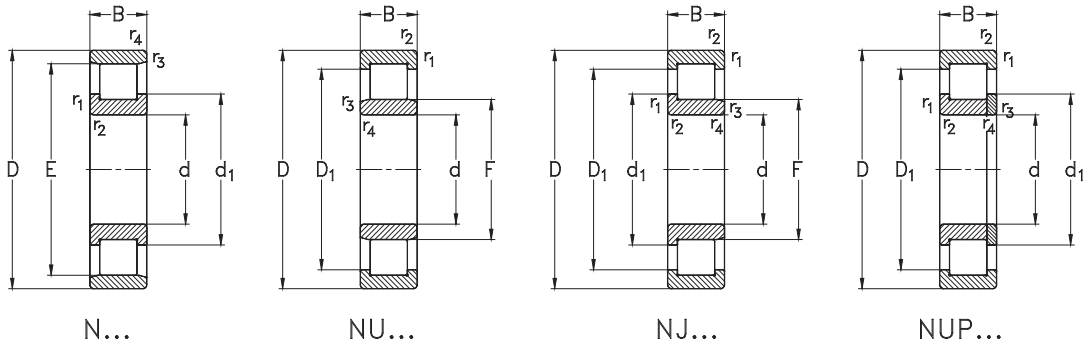
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

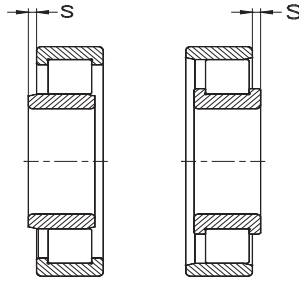
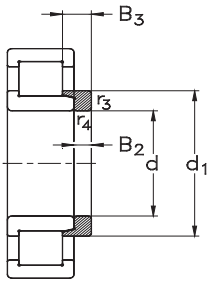
NJ...+ HJ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]		
	E,F	Bearing dimensions [mm]		r ₁ , r ₂		r ₃ , r ₄	s	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
		d ₁ ≈	D ₁ ≈	min		min	≈					
15	19,3	--	27,8	0,6	0,3	1	--	--	--	0,047	--	
	19,3	21,8	27,8	0,6	0,3	1	HJ202-E	2,5	5	0,047	0,007	
17	22,1	--	32	0,6	0,3	1,2	--	--	--	0,068	--	
	22,1	24,7	32	0,6	0,3	1,2	HJ203-E	3	5,5	0,068	0,009	
	22,1	24,7	32	0,6	0,3	--	--	--	--	0,068	--	
	22,1	--	32	0,6	0,3	1	--	--	--	0,091	--	
	22,1	24,7	32	0,6	0,3		HJ2203-E	3	6	0,091	0,01	
	22,1	24,7	32	0,6	0,3		--	--	--	0,091	--	
	24,2	--	36,8	1,1	0,6	1,1	--	--	--	0,12	--	
20	24,2	27,6	36,8	1,1	0,6	1	HJ303-E	4	6,5	0,12	0,012	
	24,2	27,6	36,8	1,1	0,6	--	--	--	--	0,12	--	
	26,5	--	38,8	1	0,6	1	--	--	--	0,132	--	
20	26,5	29,9	38,8	1	0,6	1	HJ204-E	3	5,5	0,132	0,011	
	26,5	29,9	38,8	1	0,6	--	--	--	--	0,132	--	
	26,5	--	38,8	1	0,6	2	--	--	--	0,142	--	
	26,5	29,9	38,8	1	0,6	2	HJ2204-E	3	6,5	0,142	0,012	
	26,5	29,9	38,8	1	0,6	--	--	--	--	0,142	--	
	27,5	--	42	1,1	0,6	1,1	--	--	--	0,151	--	
	27,5	31,4	42	1,1	0,6	1,1	HJ304-E	4	6,5	0,151	0,017	
20	27,5	31,4	42	1,1	0,6	--	--	--	--	0,151	--	
	27,5	--	42	1,1	0,6	2	--	--	--	0,21	--	
	27,5	31,4	42	1,1	0,6	2	HJ2304-E	4	7,5	0,21	0,019	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
20	52	21	46,4	38,4	4,7	10000	18000	NUP2304-E-TVP3	--
25	47	12	18	16,8	2	12700	18000	NU1005-E-MPA	--
	52	15	29,5	28	3,4	11800	16000	NU205-E-TVP3	MPA
	52	15	29,5	28	3,4	11800	16000	NJ205-E-TVP3	MPA
	52	15	29,5	28	3,4	11800	16000	NUP205-E-TVP3	MPA
	52	18	35,1	34,9	4,3	9800	16000	NU2205-E-TVP3	MPA
	52	18	35,1	34,9	4,3	9800	16000	NJ2205-E-TVP3	MPA
	52	18	35,1	34,9	4,3	9800	16000	NUP2205-E-TVP3	MPA
	62	17	45,7	36,9	4,5	10300	15000	NU305-E-TVP3	MPA
62	17	45,7	36,9	4,5	10300	15000	NJ305-E-TVP3	MPA	
62	17	45,7	36,9	4,5	10300	15000	NUP305-E-TVP3	MPA	
62	24	63	55,6	6,8	8400	15000	NU2305-E-TVP3	MPA	
62	24	63	55,6	6,8	8400	15000	NJ2305-E-TVP3	MPA	
62	24	63	55,6	6,8	8400	15000	NUP2305-E-TVP3	MPA	
80	21	46,2	39,4	4,8	9600	14000	NU405-M	--	
80	21	46,2	39,4	4,8	9600	14000	NJ405-M	--	
30	55	13	24,4	23,5	2,9	10800	15000	NU1006-E-MPA	--
	62	16	46,7	41	5	9500	14000	NU206-E-TVP3	MPA
	62	16	46,7	41	5	9500	14000	NJ206-E-TVP3	MPA
	62	16	46,7	41	5	9500	14000	NUP206-E-TVP3	MPA
	62	20	54	49,3	6	8200	14000	NU2206-E-TVP3	MPA
	62	20	54	49,3	6	8200	14000	NJ2206-E-TVP3	MPA



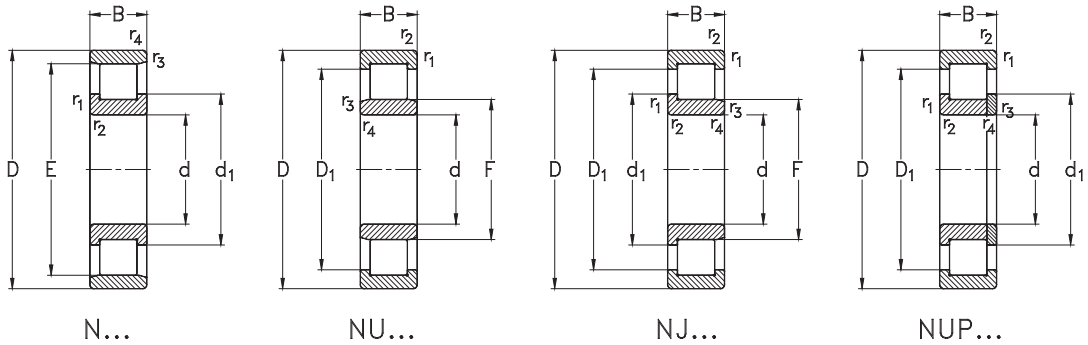
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

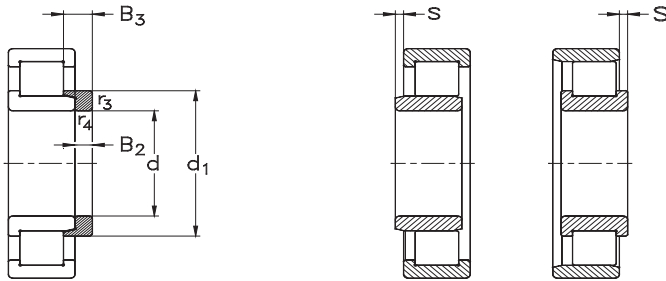
NJ...+ HJ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]		
	E,F	Bearing dimensions [mm]		r ₁ , r ₂		r ₃ , r ₄	s	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
		d ₁ ≈	D ₁ ≈	min		min	≈					
20	27,5	31,4	42	1,1	0,6	--	--	--	--	--	0,21	--
25	30,5	--	38,9	0,6	0,3	1,2	--	--	--	--	0,9	--
	31,5	--	43,5	1	0,6	1,3	--	--	--	--	0,14	--
	31,5	34,9	43,5	1	0,6	1,3	HJ205-E	3	6	0,14	0,015	
	31,5	34,9	43,5	1	0,6	--	--	--	--	--	0,14	--
	31,5	--	43,5	1	0,6	1,7	--	--	--	--	0,16	--
	31,5	34,9	43,5	1	0,6	1,7	HJ2205-E	3	6,5	0,16	0,015	
	31,5	34,9	43,5	1	0,6	--	--	--	--	--	0,16	--
34	--	50,1	1,1	1,1	1,5	--	--	--	--	0,245	--	
34	38,3	50,1	1,1	1,1	1,5	HJ305-E	4	7	0,245	0,025		
34	38,3	50,1	1,1	1,1	--	--	--	--	--	0,245	--	
34	--	50,1	1,1	1,1	1,9	--	--	--	--	0,35	--	
34	38,3	50,1	1,1	1,1	1,9	HJ2305-E	4	8	0,35	0,027		
34	38,3	50,1	1,1	1,1	--	--	--	--	--	0,35	--	
38,8	--	58,4	1,5	1,5	2,2	--	--	--	--	0,625	--	
38,8	43,6	58,4	1,5	1,5	2,2	HJ405	6	10,5	0,625	0,057		
30	36	--	47,3	1	0,6	1,2	--	--	--	--	0,134	--
	37,5	--	52	1	0,6	1,4	--	--	--	--	0,21	--
	37,5	41,4	52	1	0,6	1,4	HJ206-E	4	7	0,21	0,025	
	37,5	41,4	52	1	0,6	--	--	--	--	--	0,21	--
	37,5	--	52	1	0,6	1,6	--	--	--	--	0,26	--
	37,5	41,4	52	1	0,6	1,6	HJ2206-E	4	7,5	0,26	0,025	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
30	62	20	54	49,3	6	8200	14000	NUP2206-E-TVP3	MPA
	72	19	59	49,6	6	8900	12000	NU306-E-TVP3	MPA
	72	19	59	49,6	6	8900	12000	NJ306-E-TVP3	MPA
	72	19	59	49,6	6	8900	12000	NUP306-E-TVP3	MPA
	72	27	83	77	9,4	7200	12000	NU2306-E-TVP3	MPA
	72	27	83	77	9,4	7200	12000	NJ2306-E-TVP3	MPA
	72	27	83	77	9,4	7200	12000	NUP2306-E-TVP3	MPA
90	23	62	54	6,5	8400	11000	NU406-M	--	
	23	62	54	6,5	8400	11000	NJ406-M	--	
	23	62	54	6,5	8400	11000	NUP406-M	--	
35	62	14	34,3	36,1	4,4	9300	13000	NU1007-E-MPA	--
	72	17	55,3	49,5	6	8300	12000	NU207-E-TVP3	MPA
	72	17	55,3	49,5	6	8300	12000	NJ207-E-TVP3	MPA
	72	17	55,3	49,5	6	8300	12000	NUP207-E-TVP3	MPA
	72	23	68	65	7,9	7400	12000	NU2207-E-TVP3	MPA
	72	23	68	65	7,9	7400	12000	NJ2207-E-TVP3	MPA
	72	23	68	65	7,9	7400	12000	NUP2207-E-TVP3	MPA
	80	21	74	65	7,9	8000	11000	NU307-E-TVP3	MPA
	80	21	74	65	7,9	8000	11000	NJ307-E-TVP3	MPA
	80	21	74	65	7,9	8000	11000	NUP307-E-TVP3	MPA
80	31	103	100	12,2	6700	11000	NU2307-E-TVP3	MPA	
	31	103	100	12,2	6700	11000	NJ2307-E-TVP3	MPA	



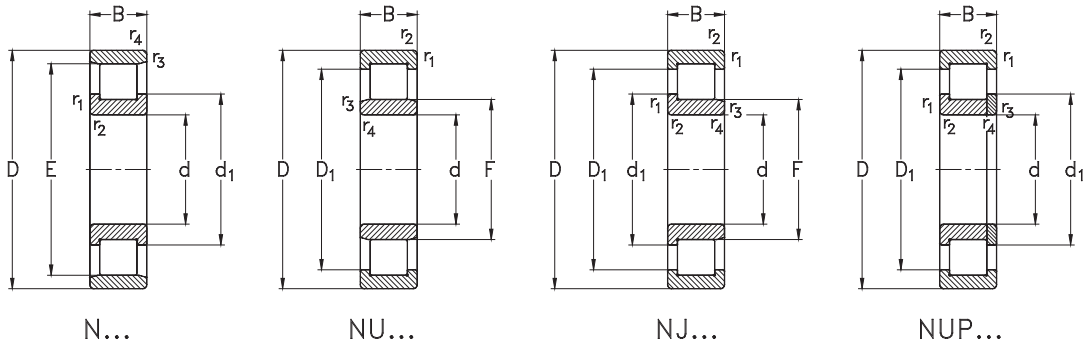
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

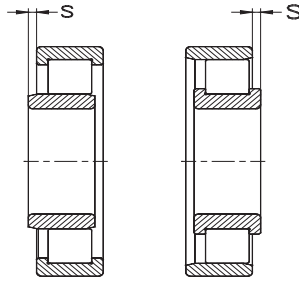
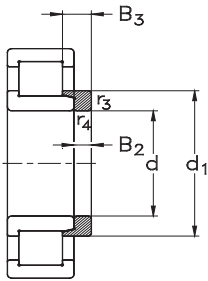
NJ...+ HJ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]	
	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
30	37,5	41,4	52	1	0,6	--	--	--	--	0,26	--
	40,5	--	58,3	1,1	1,1	1,9	--	--	--	0,37	--
	40,5	45,1	58,3	1,1	1,1	1,9	HJ306-E	5	8,5	0,37	0,043
	40,5	45,1	58,3	1,1	1,1	--	--	--	--	0,37	--
	40,5	--	58,3	1,1	1,1	2,5	--	--	--	0,528	--
	40,5	45,1	58,3	1,1	1,1	2,5	HJ2306-E	5	9,5	0,528	0,045
	40,5	45,1	58,3	1,1	1,1	--	--	--	--	0,528	--
	45	--	67,8	1,5	1,5	2,3	--	--	--	0,87	--
	45	50,5	67,8	1,5	1,5	2,3	HJ406	7	11,5	0,87	0,09
	45	50,5	67,8	1,5	1,5	--	--	--	--	0,87	--
35	41,5	--	54	1	0,6	1,1	--	--	--	0,18	--
	44	--	61	1,1	0,6	1,7	--	--	--	0,305	--
	44	48	61	1,1	0,6	1,7	HJ207-E	4	7	0,305	0,033
	44	48	61	1,1	0,6	--	--	--	--	0,305	--
	44	--	61	1,1	0,6	2,9	--	--	--	0,395	--
	44	48	61	1,1	0,6	2,9	HJ2207-E	4	8,5	0,395	0,035
	44	48	61	1,1	0,6	--	--	--	--	0,395	--
	46,2	--	65,7	1,5	1,1	1	--	--	--	0,485	--
	46,2	51,2	65,7	1,5	1,1	1	HJ307-E	6	9,5	0,485	0,062
	46,2	51,2	65,7	1,5	1,1	--	--	--	--	0,485	--
46,2	--	65,7	1,5	1,1	3	--	--	--	0,715	--	
46,2	51,2	65,7	1,5	1,1	3	HJ2307-E	6	11	0,715	0,065	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
35	80	31	103	100	12,2	6700	11000	NUP2307-E-TVP3	MPA
	100	25	76	70	8,6	7400	9500	NU407-M	--
	100	25	76	70	8,6	7400	9500	NJ407-M	--
	100	25	76	70	8,6	7400	9500	NUP407-M	--
40	68	15	37,2	41,3	5	8500	18000	NU1008-E-MPA	--
	80	18	61	55	6,7	7600	11000	NU208-E-TVP3	MPA
	80	18	61	55	6,7	7600	11000	NJ208-E-TVP3	MPA
	80	18	61	55	6,7	7600	11000	NUP208-E-TVP3	MPA
	80	23	80	77	9,4	6300	11000	NU2208-E-TVP3	MPA
	80	23	80	77	9,4	6300	11000	NJ2208-E-TVP3	MPA
	80	23	80	77	9,4	6300	11000	NUP2208-E-TVP3	MPA
	90	23	91	80	9,7	7200	9500	NU308-E-TVP3	MPA
	90	23	91	80	9,7	7200	9500	NJ308-E-TVP3	MPA
	90	23	91	80	9,7	7200	9500	NUP308-E-TVP3	MPA
	90	33	134	127	15,4	5800	9500	NU2308-E-TVP3	MPA
	90	33	134	127	15,4	5800	9500	NJ2308-E-TVP3	MPA
90	33	134	127	15,4	5800	9500	NUP2308-E-TVP3	MPA	
110	27	96	89	10,9	6700	8500	NU408-M	--	
	27	96	89	10,9	6700	8500	NJ408-M	--	
	27	96	89	10,9	6700	8500	NUP408-M	--	
45	75	16	43	49,7	6,1	7800	11000	NU1009-E-MPA	--
	85	19	70	66	8	7000	9500	NU209-E-TVP3	MPA



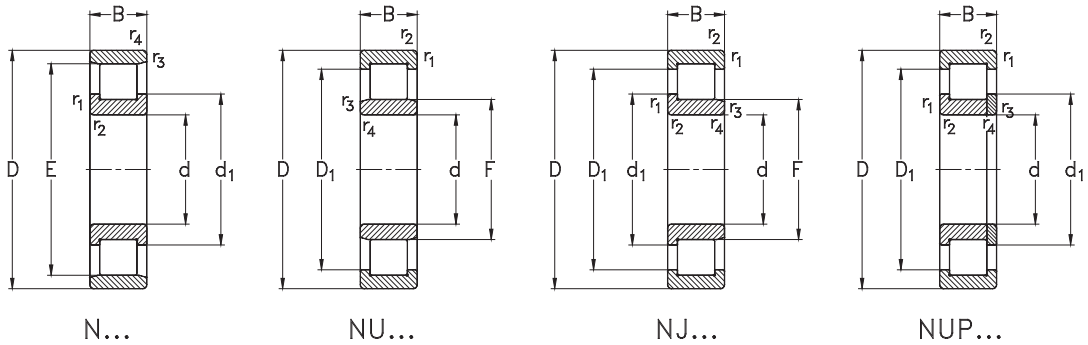
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

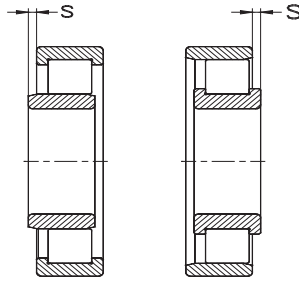
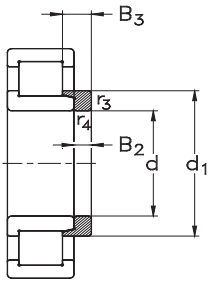
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
35	46,2	51,2	65,7	1,5	1,1	--	--	--	--	0,715	--
	53	--	77,6	1,5	1,5	2,6	--	--	--	1,05	--
	53	59	77,6	1,5	1,5	2,6	HJ407	8	13	1,05	0,13
	53	59	77,6	1,5	1,5	--	--	--	--	1,05	--
40	47	--	59	1	0,6	1,2	--	--	--	0,23	--
	49,5	--	67,3	1,1	1,1	1,9	--	--	--	0,38	--
	49,5	54,1	67,3	1,1	1,1	1,9	HJ208-E	5	8,5	0,38	0,05
	49,5	54,1	67,3	1,1	1,1	--	--	--	--	0,38	--
	49,5	--	67,3	1,1	1,1	2,3	--	--	--	0,49	--
	49,5	54,1	67,3	1,1	1,1	2,3	HJ2208-E	5	9	0,49	0,05
	49,5	54,1	67,3	1,1	1,1	--	--	--	--	0,49	--
	52	--	74,9	1,5	1,5	2,5	--	--	--	0,66	--
	52	57,7	74,9	1,5	1,5	--	HJ308-E	7	11	0,66	0,088
	52	57,7	74,9	1,5	1,5	--	--	--	--	0,66	--
	52	--	74,9	1,5	1,5	3,5	--	--	--	0,95	--
52	57,7	74,9	1,5	1,5	--	HJ2308-E	7	12,5	0,95	0,092	
	57,7	74,9	1,5	1,5	--	--	--	--	0,95	--	
	58	--	85,8	2	2	2,6	--	--	--	1,3	--
	58	64,8	85,8	2	2	2,6	HJ408	8	13	1,3	0,15
	58	64,8	85,8	2	2	--	--	--	--	1,3	--
	45	52,5	--	65	1	0,6	1,1	--	--	--	0,29
54,5		--	72,4	1,1	1,1	1,9	--	--	--	0,5	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
45	85	19	70	66	8	7000	9500	NJ209-E-TVP3	MPA
	85	19	70	66	8	7000	9500	NUP209-E-TVP3	MPA
	85	23	84	84	10,2	5800	9500	NU2209-E-TVP3	MPA
	85	23	84	84	10,2	5800	9500	NJ2209-E-TVP3	MPA
	85	23	84	84	10,2	5800	9500	NUP2209-E-TVP3	MPA
	100	25	110	100	12,2	6500	8500	NU309-E-TVP3	MPA
	100	25	110	100	12,2	6500	8500	NJ309-E-TVP3	MPA
	100	25	110	100	12,2	6500	8500	NUP309-E-TVP3	MPA
	100	36	154	155	18,9	5300	8500	NU2309-E-TVP3	MPA
	100	36	154	155	18,9	5300	8500	NJ2309-E-TVP3	MPA
	100	36	154	155	18,9	5300	8500	NUP2309-E-TVP3	MPA
	120	29	107	102	12,4	6200	7500	NU409-M	--
120	29	107	102	12,4	6200	7500	NJ409-M	--	
120	29	107	102	12,4	6200	7500	NUP409-M	--	
50	80	16	44,7	53	6,5	7100	9500	NU1010-E-MPA	M6
	90	20	73	71	8,7	6700	9000	N210-E-M6	--
	90	20	73	71	8,7	6700	9000	NU210-E-TVP3	M6, MA6, MPA
	90	20	73	71	8,7	6700	9000	NJ210-E-TVP3	M6, MA6, MPA
	90	20	73	71	8,7	6700	9000	NUP210-E-TVP3	M6, MA6, MPA
	90	23	88	91	11	5300	9000	NU2210-E-TVP3	M6, MA6, MPA
	90	23	88	91	11	5300	9000	NJ2210-E-TVP3	M6, MA6, MPA
	90	23	88	91	11	5300	9000	NUP2210-E-TVP3	M6, MA6, MPA



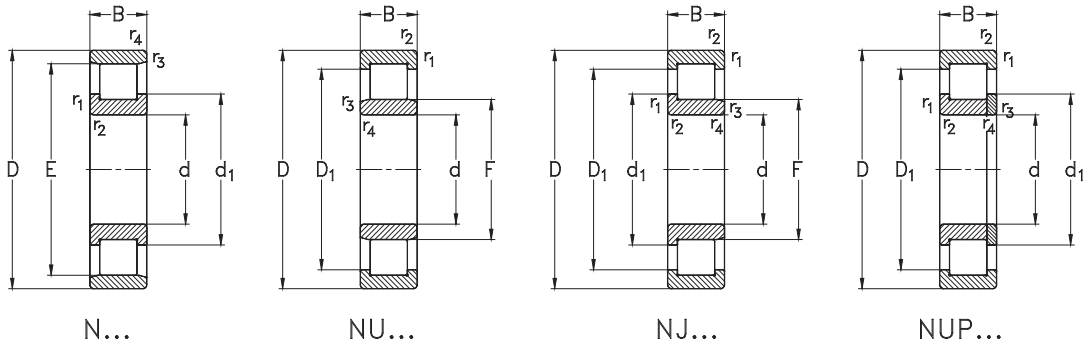
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

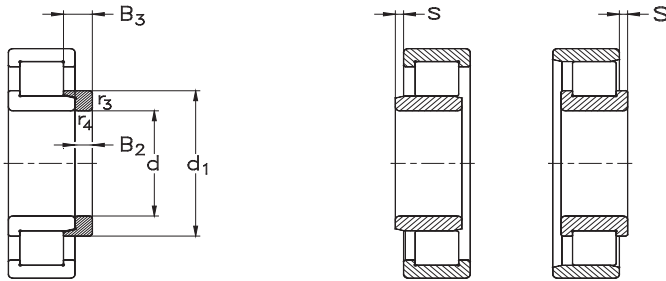
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
45	54,5	59,1	72,4	1,1	1,1	1,9	HJ209-E	5	8,5	0,5	0,055
	54,5	59,1	72,4	1,1	1,1	--	--	--	--	0,5	--
	54,5	--	72,4	1,1	1,1	2,3	--	--	--	0,6	--
	54,5	59,1	72,4	1,1	1,1	2,3	HJ2209-E	5	9	0,6	0,057
	54,5	59,1	72,4	1,1	1,1	--	--	--	--	0,6	--
	58,5	--	83,1	1,5	1,5	2,9	--	--	--	1	--
	58,5	64,6	83,1	1,5	1,5	2,9	HJ309-E	7	11,5	1	0,11
	58,5	64,6	83,1	1,5	1,5	--	--	--	--	1	--
	58,5	--	83,1	1,5	1,5	3,5	--	--	--	1,3	--
	58,5	64,6	83,1	1,5	1,5	3,5	HJ2309-E	7	13	1,3	0,12
50	58,5	64,6	83,1	1,5	1,5	--	--	--	--	1,3	--
	64,5	--	93,9	2	2	2,9	--	--	--	1,7	--
	64,5	71,8	93,9	2	2	--	HJ409	8	13,5	1,7	0,19
	64,5	71,8	93,9	2	2	--	--	--	--	1,7	--
	57,5	--	69,4	1	0,6	1,1	--	--	--	0,3	--
	81,5	64,1	78	1,1	1,1	1,3	--	--	--	0,6	--
	59,5	--	78	1,1	1,1	1,3	--	--	--	0,6	--
	59,5	64,1	78	1,1	1,1	1,3	HJ210-E	5	9	0,6	0,06
	59,5	64,1	78	1,1	1,1	--	--	--	--	0,6	--
	59,5	--	78	1,1	1,1	1,3	--	--	--	0,65	--
59,5	64,1	78	1,1	1,1	1,3	HJ2210-E	5	9	0,65	0,06	
59,5	64,1	78	1,1	1,1	--	--	--	--	0,65	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
50	110	27	124	115	14	6100	8000	N310-E-M6	--
	110	27	124	115	14	6100	8000	NU310-E-TVP3	M6, MA6, MPA
	110	27	124	115	14	6100	8000	NJ310-E-TVP3	M6, MA6, MPA
	110	27	124	115	14	6100	8000	NUP310-E-TVP3	M6, MA6, MPA
	110	40	182	189	23	5000	8000	NU2310-E-TVP3	M6, MA6, MPA
	110	40	182	189	23	5000	8000	NJ2310-E-TVP3	M6, MA6, MPA
	110	40	182	189	23	5000	8000	NUP2310-E-TVP3	M6, MA6, MPA
130	31	141	139	16,9	5500	7000	NU410-M	--	
	31	141	139	16,9	5500	7000	NJ410-M	--	
	31	141	139	16,9	5500	7000	NUP410-M	--	
55	90	18	52	62	7,5	6700	8500	NU1011-E-MPA	M6
	100	21	95	98	11,9	5800	8000	N211-E-M6	--
	100	21	95	98	11,9	5800	8000	NU211-E-TVP3	M6, MA6, MPA
	100	21	95	98	11,9	5800	8000	NJ211-E-TVP3	M6, MA6, MPA
	100	21	95	98	11,9	5800	8000	NUP211-E-TVP3	M6, MA6, MPA
	100	25	112	121	14,7	4700	8000	NU2211-E-TVP3	M6, MA6, MPA
	100	25	112	121	14,7	4700	8000	NJ2211-E-TVP3	M6, MA6, MPA
	100	25	112	121	14,7	4700	8000	NUP2211-E-TVP3	M6, MA6, MPA
	120	29	153	143	17,4	5500	7000	N311-E-M6	--
	120	29	153	143	17,4	5500	7000	NU311-E-TVP3	M6, MA6, MPA
120	29	153	143	17,4	5500	7000	NJ311-E-TVP3	M6, MA6, MPA	
	29	153	143	17,4	5500	7000	NUP311-E-TVP3	M6, MA6, MPA	



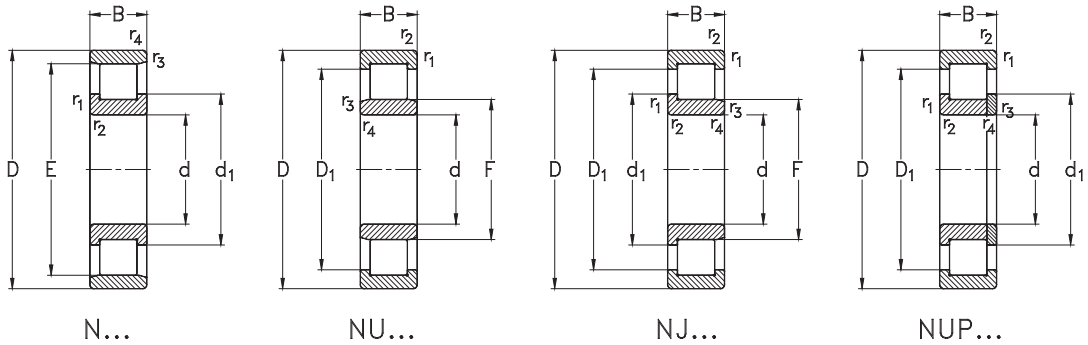
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*Abutment and fillet dimensions
see on page 547*

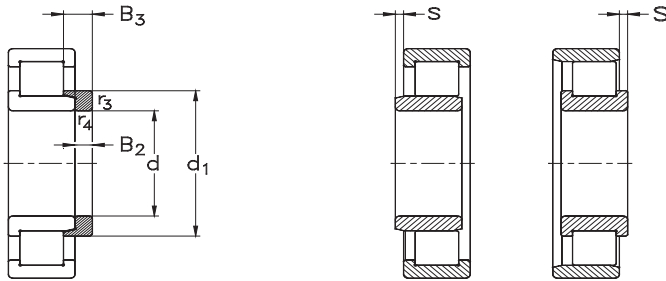
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
50	97	71,4	--	2	2	1,7	--	--	--	1,2	--
	65	--	92	2	2	1,7	--	--	--	1,2	--
	65	71,2	92	2	2	1,7	HJ310-E	8	13	1,2	0,15
	65	71,2	92	2	2	--	--	--	--	1,2	--
	65	--	92	2	2	3,2	--	--	--	1,9	--
	65	71,2	92	2	2	3,2	HJ2310-E	8	14,5	1,9	0,16
	65	71,2	92	2	2	--	--	--	--	1,9	--
	70,8	78,8	103,5	2,1	2,1	2	--	--	--	2,1	--
	70,8	78,8	103,5	2,1	2,1	2	HJ410	9	14,5	2,1	0,24
70,8	78,8	103,5	2,1	2,1	--	--	--	--	2,2	--	
55	64	--	78	1,1	1	1,5	--	--	--	0,47	--
	90	71	86,2	1,5	1,1	0,8	--	--	--	0,75	--
	66	--	86,2	1,5	1,1	0,8	--	--	--	0,75	--
	66	71	86,2	1,5	1,1	0,8	HJ211-E	6	9,5	0,75	0,09
	66	71	86,2	1,5	1,1	--	--	--	--	0,75	--
	66	--	86,2	1,5	1,1	1,3	--	--	--	0,9	--
	66	71	86,2	1,5	1,1	1,3	HJ2211-E	6	10	0,9	0,09
	66	71	86,2	1,5	1,1	--	--	--	--	0,9	--
	106,5	77,7	--	2	2	1,8	--	--	--	1,6	--
	70,5	77,7	101	2	2	1,8	--	--	--	1,6	--
	70,5	77,7	101	2	2	1,8	HJ311-E	9	14	1,6	0,2
	70,5	77,7	101	2	2	--	--	--	--	1,6	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
55	120	43	224	233	28,4	4600	7000	NU2311-E-TVP3	M6, MA6, MPA
	120	43	224	233	28,4	4600	7000	NJ2311-E-TVP3	M6, MA6, MPA
	120	43	224	233	28,4	4600	7000	NUP2311-E-TVP3	M6, MA6, MPA
140	33	142	142	17,3	5400	6300	NU411-M	--	
	33	142	142	17,3	5400	6300	NJ411-M	--	
	33	142	142	17,3	5400	6300	NUP411-M	--	
60	95	18	56	68	8,3	6200	11000	NU1012-E-MPA	M6
	110	22	106	105	12,7	5400	7500	N212-E-M6	--
	110	22	106	105	12,7	5400	7500	NU212-E-TVP3	M6, MA6, MPA
	110	22	106	105	12,7	5400	7500	NJ212-E-TVP3	M6, MA6, MPA
	110	22	106	105	12,7	5400	7500	NUP212-E-TVP3	M6, MA6, MPA
	110	28	144	154	18,8	4400	7500	NU2212-E-TVP3	M6, MA6, MPA
	110	28	144	154	18,8	4400	7500	NJ2212-E-TVP3	M6, MA6, MPA
	110	28	144	154	18,8	4400	7500	NUP2212-E-TVP3	M6, MA6, MPA
	130	31	169	160	19,6	5300	6700	N312-E-M6	--
	130	31	169	160	19,6	5300	6700	NU312-E-TVP3	M6, MA6, MPA
	130	31	169	160	19,6	5300	6700	NJ312-E-TVP3	M6, MA6, MPA
	130	31	169	160	19,6	5300	6700	NUP312-E-TVP3	M6, MA6, MPA
130	46	250	265	32,3	4300	6700	NU2312-E-TVP3	M6, MA6, MPA	
	46	250	265	32,3	4300	6700	NJ2312-E-TVP3	M6, MA6, MPA	
	46	250	265	32,3	4300	6700	NUP2312-E-TVP3	M6, MA6, MPA	
150	35	169	170	20,4	5000	6000	NU412-M	--	



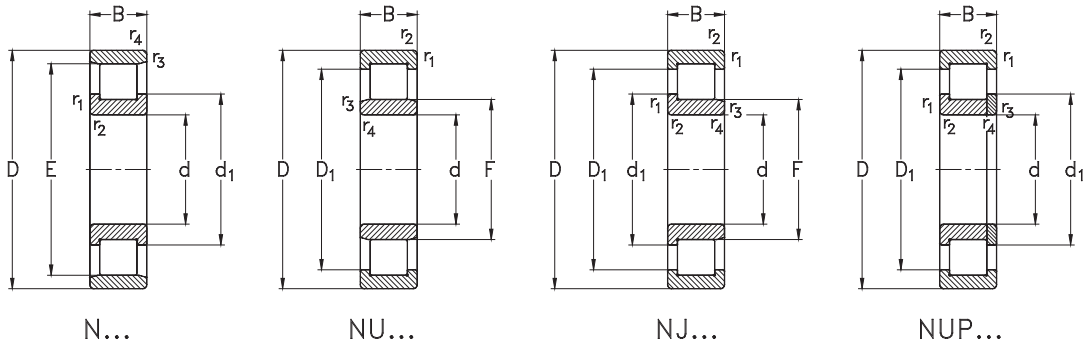
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

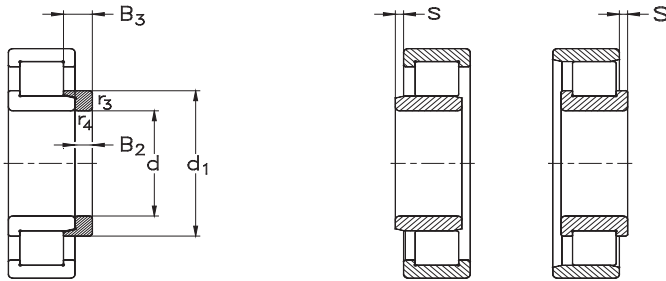
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
55	70,5	--	101	2	2	3,3	--	--	--	2,3	--
	70,5	77,7	101	2	2	3,3	HJ2311-E	9	15,5	2,3	0,2
	70,5	77,7	101	2	2	--	--	--	--	2,3	--
	77,2	--	110	2,1	2,1	2,5	--	--	--	2,5	--
	77,2	85,2	110	2,1	2,1	2,5	HJ411	10	16,5	2,5	0,31
	77,2	85,2	110	2,1	2,1	--	--	--	--	2,5	--
60	69	--	83	1,1	1	1,5	--	--	--	0,48	--
	100	77,7	--	1,5	1,5	1,6	--	--	--	1	--
	72	--	95,7	1,5	1,5	1,6	--	--	--	1	--
	72	77,7	95,7	1,5	1,5	1,6	HJ212-E	6	10	1	0,11
	72	77,7	95,7	1,5	1,5	--	--	--	--	1	--
	72	--	95,7	1,5	1,5	1,6	--	--	--	1,2	--
	72	77,7	95,7	1,5	1,5	1,6	HJ2212-E	6	10	1,2	0,11
	72	77,7	95,7	1,5	1,5	--	--	--	--	1,2	--
	115	84,5	--	2,1	2,1	1,8	--	--	--	1,9	--
	77	84,5	110	2,1	2,1	1,8	--	--	--	1,9	--
	77	84,5	110	2,1	2,1	1,8	HJ312-E	9	14,5	1,9	0,24
	77	84,5	110	2,1	2,1	--	--	--	--	1,9	--
	77	--	110	2,1	2,1	3,5	--	--	--	2,9	--
	77	84,5	110	2,1	2,1	3,5	HJ2312-E	9	16	2,9	0,24
	77	84,5	110	2,1	2,1	--	--	--	--	2,9	--
83	--	119	2,1	2,1	2	--	--	--	3,1	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
60	150	35	169	170	20,4	5000	6000	NJ412-M	--
	150	35	169	170	20,4	5000	6000	NUP412-M	--
65	100	18	57	72	8,8	5700	7500	NU1013-E-MPA	M6
	120	23	121	121	14,8	5000	6700	N213-E-M6	--
	120	23	121	121	14,8	5000	6700	NU213-E-TVP3	M6, MA6, MPA
	120	23	121	121	14,8	5000	6700	NJ213-E-TVP3	M6, MA6, MPA
	120	23	121	121	14,8	5000	6700	NUP213-E-TVP3	M6, MA6, MPA
	120	31	168	183	22,3	4200	6700	NU2213-E-TVP3	M6, MA6, MPA
	120	31	168	183	22,3	4200	6700	NJ2213-E-TVP3	M6, MA6, MPA
	120	31	168	183	22,3	4200	6700	NUP2213-E-TVP3	M6, MA6, MPA
	140	33	203	193	23,3	4800	6000	N313-E-M6	--
	140	33	203	193	23,3	4800	6000	NU313-E-TVP3	M6, MA6, MPA
140	33	203	193	23,3	4800	6000	NJ313-E-TVP3	M6, MA6, MPA	
	33	203	193	23,3	4800	6000	NUP313-E-TVP3	M6, MA6, MPA	
	48	277	289	34,9	4100	6000	NU2313-E-TVP3	M6, MA6, MPA	
	48	277	289	34,9	4100	6000	NJ2313-E-TVP3	M6, MA6, MPA	
	48	277	289	34,9	4100	6000	NUP2313-E-TVP3	M6, MA6, MPA	
	160	37	196	205	24,1	4600	5600	NU413-M	--
		37	196	205	24,1	4600	5600	NJ413-M	--
		37	196	205	24,1	4600	5600	NUP413-M	--
70	110	20	76	92	11,3	5400	7000	NU1014-E-MPA	M6
	125	24	134	140	17	4700	6300	N214-E-M6	--



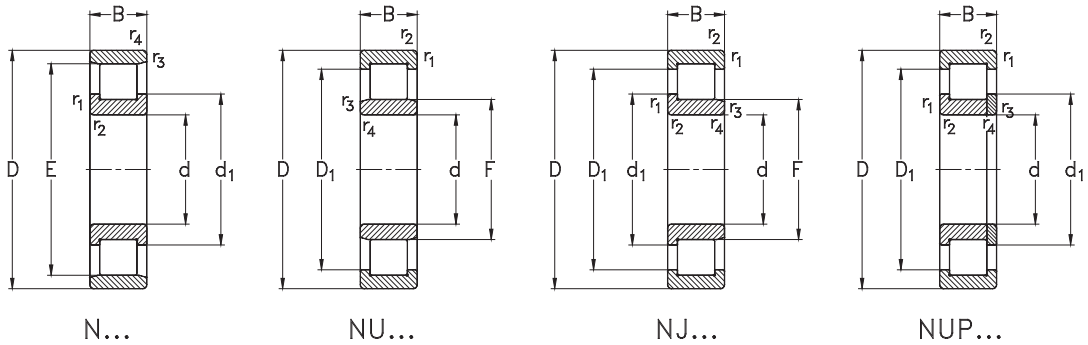
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

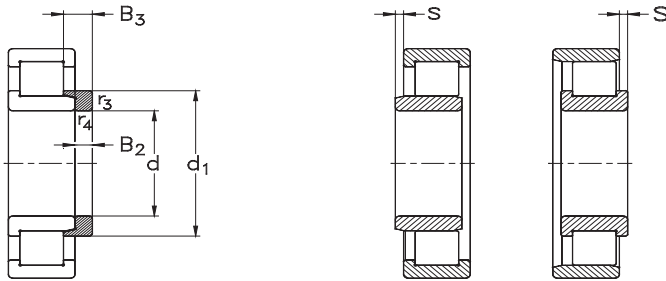
NJ...+ HJ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]	
	E,F	Bearing dimensions [mm]		r ₁ , r ₂ min		r ₃ , r ₄ min	s	Bezeichnung Designation	B ₂	B ₃	Lager Bearing
60	83	d ₁ ≈ 91,8	D ₁ ≈ 119	2,1	2,1	2	HJ412	10	16,5	3,1	0,35
	83	91,8	119	2,1	2,1	--	--	--	--	3,1	--
65	74	--	88	1,1	1	1,5	--	--	--	0,52	--
	108,5	84,6	104	1,5	1,5	1,4	--	--	--	1,05	--
	78,5	--	104	1,5	1,5	1,4	--	--	--	1,05	--
	78,5	84,6	104	1,5	1,5	1,4	HJ213-E	6	10	1,05	0,13
	78,5	84,6	104	1,5	1,5	--	--	--	--	1,2	--
	78,5	--	104	1,5	1,5	1,9	--	--	--	1,6	--
	78,5	84,6	104	1,5	1,5	1,9	HJ2213-E	6	10,5	1,6	0,13
	78,5	84,6	104	1,5	1,5	--	--	--	--	1,6	--
	124,5	90,7	--	2,1	2,1	1,5	--	--	--	2,3	--
	82,5	--	118,5	2,1	2,1	1,5	--	--	--	2,3	--
70	82,5	90,7	118,5	2,1	2,1	1,5	HJ313-E	10	15,5	2,3	0,29
	82,5	90,7	118,5	2,1	2,1	--	--	--	--	2,3	--
	82,5	--	118,5	2,1	2,1	4	--	--	--	3,3	--
	82,5	90,7	118,5	2,1	2,1	4	HJ2313-E	10	18	3,3	0,3
	82,5	90,7	118,5	2,1	2,1	--	--	--	--	3,3	--
	89,3	--	127	2,1	2,1	2	--	--	--	3,8	--
	89,3	98,5	127	2,1	2,1	2	HJ413	11	18	3,8	0,43
	89,3	98,5	127	2,1	2,1	--	--	--	--	3,8	--
70	79,5	--	97	1,1	1	1,7	--	--	--	0,7	--
	113,5	--	108,7	1,5	1,5	1,6	--	--	--	1,15	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
70	125	24	134	140	17	4700	6300	NU214-E-TVP3	M6, MA6, MPA
	125	24	134	140	17	4700	6300	NJ214-E-TVP3	M6, MA6, MPA
	125	24	134	140	17	4700	6300	NUP214-E-TVP3	M6, MA6, MPA
	125	31	175	197	24	3900	6300	NU2214-E-TVP3	M6, MA6, MPA
	125	31	175	197	24	3900	6300	NJ2214-E-TVP3	M6, MA6, MPA
	125	31	175	197	24	3900	6300	NUP2214-E-TVP3	M6, MA6, MPA
	150	35	229	224	26,5	4500	5600	N314-E-M6	--
	150	35	229	224	26,5	4500	5600	NU314-E-TVP3	M6, MA6, MPA
	150	35	229	224	26,5	4500	5600	NJ314-E-TVP3	M6, MA6, MPA
	150	35	229	224	26,5	4500	5600	NUP314-E-TVP3	M6, MA6, MPA
	150	51	306	325	38,4	3800	5600	NU2314-E-TVP3	M6, MA6, MPA
	150	51	306	325	38,4	3800	5600	NJ2314-E-TVP3	M6, MA6, MPA
150	51	306	325	38,4	3800	5600	NUP2314-E-TVP3	M6, MA6, MPA	
180	42	248	264	30	4200	5000	NU414-M	--	
	42	248	264	30	4200	5000	NJ414-M	--	
	42	248	264	30	4200	5000	NUP414-M	--	
75	115	20	78	98	11,9	5100	10000	NU1015-E-MPA	M6
	130	25	147	159	19,2	4500	6000	N215-E-M6	--
	130	25	147	159	19,2	4500	6000	NU215-E-TVP3	M6, MA6, MPA
	130	25	147	159	19,2	4500	6000	NJ215-E-TVP3	M6, MA6, MPA
	130	25	147	159	19,2	4500	6000	NUP215-E-TVP3	M6, MA6, MPA
	130	31	182	210	25,3	3700	6000	NU2215-E-TVP3	M6, MA6, MPA



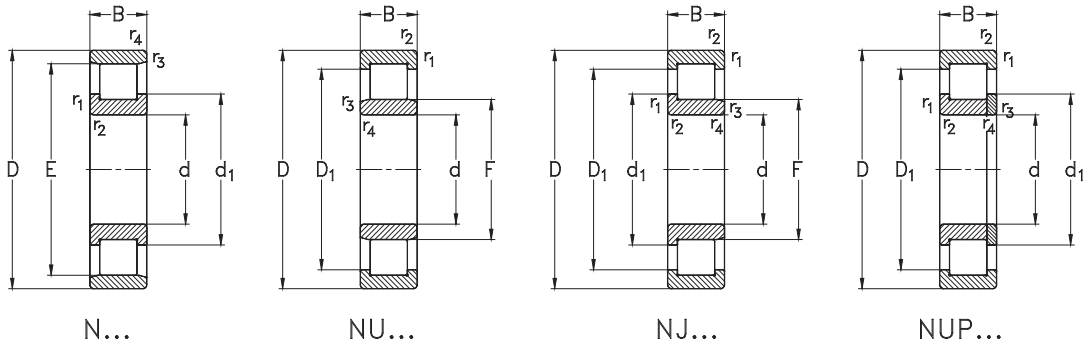
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

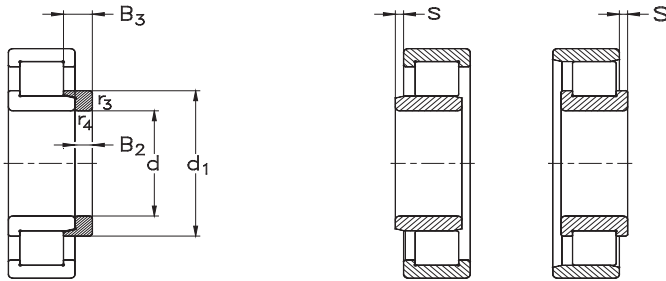
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
70	83,5	--	108,7	1,5	1,5	1,6	--	--	--	1,15	--
	83,5	89,6	108,7	1,5	1,5	1,6	HJ214-E	7	11	1,15	0,16
	83,5	89,6	108,7	1,5	1,5	--	--	--	--	1,3	--
	83,5	--	108,7	1,5	1,5	1,6	--	--	--	1,7	--
	83,5	89,6	108,7	1,5	1,5	1,6	HJ2214-E	7	11,5	1,7	0,15
	83,5	89,6	108,7	1,5	1,5	--	--	--	--	1,7	--
	133	97,5	--	2,1	2,1	1,7	--	--	--	2,8	--
	89	--	126,4	2,1	2,1	1,7	--	--	--	2,8	--
	89	97,5	126,4	2,1	2,1	1,7	HJ314-E	10	15,5	2,8	0,34
	89	97,5	126,4	2,1	2,1	--	--	--	--	2,8	--
75	89	--	126,4	2,1	2,1	4,7	--	--	--	4	--
	89	97,5	126,4	2,1	2,1	4,7	HJ2314-E	10	18,5	4	0,35
	89	97,5	126,4	2,1	2,1	--	--	--	--	4	--
	100	--	142,5	3	3	2	--	--	--	5,5	--
	100	110,3	142,5	3	3	2	HJ414	12	20	5,5	0,61
	100	110,3	142,5	3	3	--	--	--	--	5,5	--
	84,5	--	102	1,1	1	1,7	--	--	--	0,75	--
	118,5	94,5	--	1,5	1,5	1,2	--	--	--	1,25	--
	88,5	--	113,5	1,5	1,5	1,2	--	--	--	1,25	--
	88,5	94,5	133,5	1,5	1,5	1,2	HJ215-E	7	11	1,25	0,17
88,5	94,5	133,5	1,5	1,5	--	--	--	--	1,25	--	
88,5	--	113,5	1,5	1,5	1,6	--	--	--	1,6	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
75	130	31	182	210	25,3	3700	6000	NJ2215-E-TVP3	M6, MA6, MPA
	130	31	182	210	25,3	3700	6000	NUP2215-E-TVP3	M6, MA6, MPA
	160	37	269	265	30,7	4200	5300	N315-E-M6	--
	160	37	269	265	30,7	4200	5300	NU315-E-TVP3	M6, MA6, MPA
	160	37	269	265	30,7	4200	5300	NJ315-E-TVP3	M6, MA6, MPA
	160	37	269	265	30,7	4200	5300	NUP315-E-TVP3	M6, MA6, MPA
	160	55	368	397	45,9	3600	5300	NU2315-E-TVP3	M6, MA6, MPA
	160	55	368	397	45,9	3600	5300	NJ2315-E-TVP3	M6, MA6, MPA
	160	55	368	397	45,9	3600	5300	NUP2315-E-TVP3	M6, MA6, MPA
	190	45	281	300	33,6	4000	4800	NU415-M	--
190	45	281	300	33,6	4000	4800	NJ415-M	--	
190	45	281	300	33,6	4000	4800	NUP415-M	--	
80	125	22	101	132	16	4800	6300	NU1016-E-MPA	M6
	140	26	157	170	20,1	4200	5600	N216-E-M6	--
	140	26	157	170	20,1	4200	5600	NU216-E-TVP3	M6, MA6, MPA
	140	26	157	170	20,1	4200	5600	NJ216-E-TVP3	M6, MA6, MPA
	140	26	157	170	20,1	4200	5600	NUP216-E-TVP3	M6, MA6, MPA
	140	33	209	246	29	3400	5600	NU2216-E-TVP3	M6, MA6, MPA
	140	33	209	246	29	3400	5600	NJ2216-E-TVP3	M6, MA6, MPA
	140	33	209	246	29	3400	5600	NUP2216-E-TVP3	M6, MA6, MPA
	170	39	290	289	32,9	4100	5000	N316-E-M6	--
	170	39	290	289	32,9	4100	5000	NU316-E-TVP3	M6, MA6, MPA



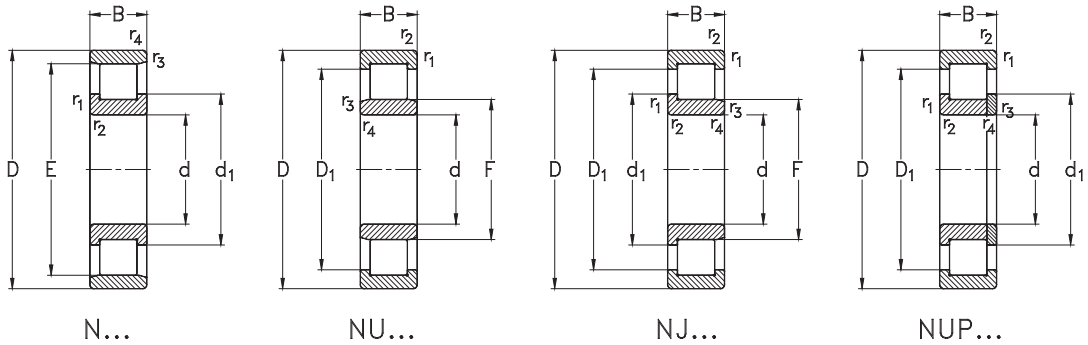
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*Abutment and fillet dimensions
see on page 547*

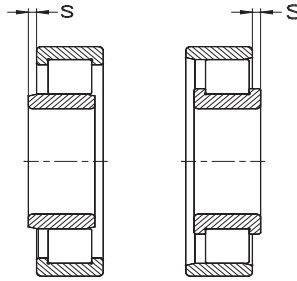
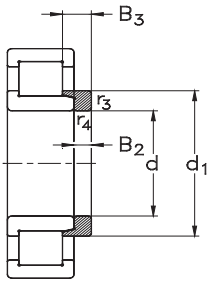
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
75	88,5	94,5	113,5	1,5	1,5	1,6	HJ2215-E	7	11,5	1,6	0,17
	88,5	94,5	113,5	1,5	1,5	--	--	--	--	1,6	--
	143	104,3	--	2,1	2,1	1,2	--	--	--	3,4	--
	95	--	136	2,1	2,1	1,2	--	--	--	3,4	--
	95	104,3	136	2,1	2,1	1,2	HJ315-E	11	16,5	3,4	0,42
	95	104,3	136	2,1	2,1	--	--	--	--	3,4	--
	95	--	136	2,1	2,1	4,2	--	--	--	5	--
	95	104,3	136	2,1	2,1	4,2	HJ2315-E	11	19,5	5	0,43
	95	104,3	136	2,1	2,1	--	--	--	--	5	--
	104,5	--	150,5	3	3	2,5	--	--	--	6,45	--
104,5	116	150,5	3	3	2,5	HJ415	13	21,5	6,45	0,71	
104,5	116	150,5	3	3	--	--	--	--	6,45	--	
80	91	--	110	1,1	1	1,7	--	--	--	1,03	--
	127,3	101,7	--	2	2	1,3	--	--	--	1,54	--
	95,3	--	122,3	2	2	1,3	--	--	--	1,54	--
	95,3	101,7	122,3	2	2	1,3	HJ216-E	8	12,5	1,54	0,22
	95,3	101,7	122,3	2	2	--	--	--	--	1,54	--
	95,3	--	122,3	2	2	1,3	--	--	--	2,1	--
	95,3	101,7	122,3	2	2	1,3	HJ2216-E	8	12,5	2,1	0,22
	95,3	101,7	122,3	2	2	--	--	--	--	2,1	--
	151	110,6	--	2,1	2,1	0,7	--	--	--	3,95	--
	101	--	143,7	2,1	2,1	0,7	--	--	--	3,95	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
80	170	39	290	289	32,9	4100	5000	NJ316-E-TVP3	M6, MA6, MPA
	170	39	290	289	32,9	4100	5000	NUP316-E-TVP3	M6, MA6, MPA
	170	58	401	438	49,8	3400	5000	NU2316-E-TVP3	M6, MA6, MPA
	170	58	401	438	49,8	3400	5000	NJ2316-E-TVP3	M6, MA6, MPA
	170	58	401	438	49,8	3400	5000	NUP2316-E-TVP3	M6, MA6, MPA
	200	48	321	345	38,1	3900	4500	NU416-M	--
	200	48	321	345	38,1	3900	4500	NJ416-M	--
200	48	321	345	38,1	3900	4500	NUP416-M	--	
85	130	22	104	139	16,6	4500	9000	NU1017-E-MPA	M6
	150	28	186	199	23	4000	5300	N217-E-M6	--
	150	28	186	199	23	4000	5300	NU217-E-TVP3	M6, MA6, MPA
	150	28	186	199	23	4000	5300	NJ217-E-TVP3	M6, MA6, MPA
	150	28	186	199	23	4000	5300	NUP217-E-TVP3	M6, MA6, MPA
	150	36	242	279	32,3	3300	5300	NU2217-E-TVP3	M6, MA6, MPA
	150	36	242	279	32,3	3300	5300	NJ2217-E-TVP3	M6, MA6, MPA
	150	36	242	279	32,3	3300	5300	NUP2217-E-TVP3	M6, MA6, MPA
	180	41	340	351	39,2	3700	4800	N317-E-M6	--
	180	41	340	351	39,2	3700	4800	NU317-E-TVP3	M6, MA6, MPA
	180	41	340	351	39,2	3700	4800	NJ317-E-TVP3	M6, MA6, MPA
180	41	340	351	39,2	3700	4800	NUP317-E-TVP3	M6, MA6, MPA	
180	60	443	493	55	3200	4800	NU2317-E-TVP3	M6, MA6, MPA	
180	60	443	493	55	3200	4800	NJ2317-E-TVP3	M6, MA6, MPA	



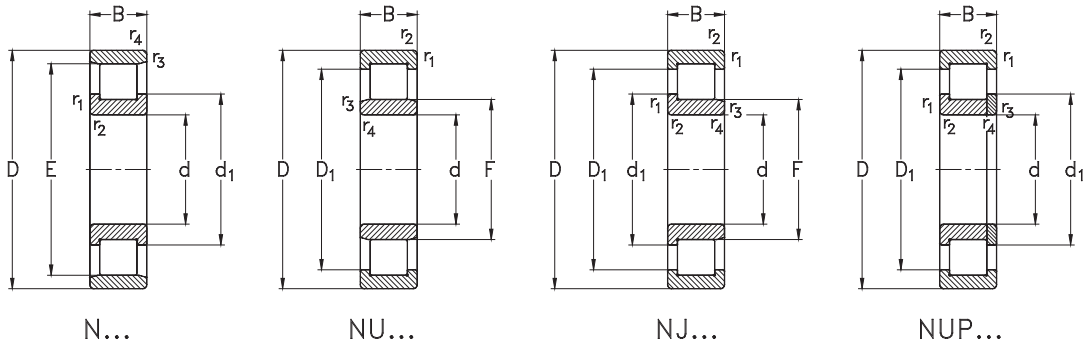
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Abutment and fillet dimensions
see on page 547

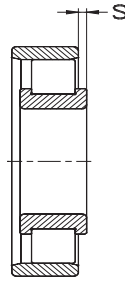
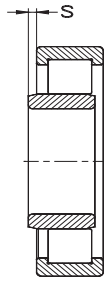
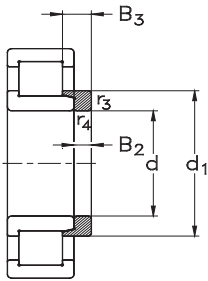
NJ...+ HJ...

d	Lagerabmessungen [mm] Bearing dimensions [mm]						Winkelring Thrust collar			Gewicht [kg] Weight [kg]	
	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
80	101	110,6	143,7	2,1	2,1	0,7	HJ316-E	11	17	3,95	0,47
	101	110,6	143,7	2,1	2,1	--	--	--	--	3,95	--
	101	--	143,7	2,1	2,1	3,7	--	--	--	5,9	--
	101	110,6	143,7	2,1	2,1	3,7	HJ2316-E	11	20	5,9	0,5
	101	110,6	143,7	2,1	2,1	--	--	--	--	5,9	--
	110	--	159	3	3	2,5	--	--	--	8,3	--
	110	122	159	3	3	2,5	HJ416	13	22	8,3	0,79
	110	122	159	3	3	--	--	--	--	8,3	--
85	96	--	115	1,1	1	1,7	--	--	--	1,1	--
	136,5	107,6	--	2	2	0,8	--	--	--	1,9	--
	100,5	--	131	2	2	0,8	--	--	--	1,9	--
	100,5	107,6	131	2	2	0,8	HJ217-E	8	12,5	1,9	0,25
	100,5	107,6	131	2	2	--	--	--	--	1,9	--
	100,5	--	131	2	2	1,3	--	--	--	2,6	--
	100,5	107,6	131	2	2	1,3	HJ2217-E	8	13	2,6	0,25
	100,5	107,6	131	2	2	--	--	--	--	2,6	--
	160	118	--	3	3	1,3	--	--	--	5,3	--
	108	--	152,4	3	3	1,3	--	--	--	5,3	--
	108	118	152,4	3	3	1,3	HJ317-E	12	18,5	5,3	0,58
	108	118	152,4	3	3	--	--	--	--	5,3	--
108	--	152,4	3	3	4,7	--	--	--	6,9	--	
108	118	152,4	3	3	4,7	HJ2317-E	12	22	6,9	0,6	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
85	180	60	443	493	55	3200	4800	NUP2317-E-TVP3	M6, MA6, MPA
	210	52	362	392	42,7	3700	4300	NU417-M	--
	210	52	362	392	42,7	3700	4300	NJ417-M	--
	210	52	362	392	42,7	3700	4300	NUP417-M	--
90	140	24	121	156	18,1	4400	8500	NU1018-E-MPA	M6
	160	30	206	222	25,3	3900	5000	N218-E-M6	--
	160	30	206	222	25,3	3900	5000	NU218-E-TVP3	M6, MA6, MPA
	160	30	206	222	25,3	3900	5000	NJ218-E-TVP3	M6, MA6, MPA
	160	30	206	222	25,3	3900	5000	NUP218-E-TVP3	M6, MA6, MPA
	160	40	273	319	36,3	3300	5000	NU2218-E-TVP3	M6, MA6, MPA
	160	40	273	319	36,3	3300	5000	NJ2218-E-TVP3	M6, MA6, MPA
	160	40	273	319	36,3	3300	5000	NUP2218-E-TVP3	M6, MA6, MPA
	190	43	353	356	39,2	3700	4500	N318-E-M6	--
	190	43	353	356	39,2	3700	4500	NU318-E-TVP3	M6, MA6, MPA
	190	43	353	356	39,2	3700	4500	NJ318-E-TVP3	M6, MA6, MPA
	190	43	353	356	39,2	3700	4500	NUP318-E-TVP3	M6, MA6, MPA
	190	64	486	536	59	3000	4500	NU2318-E-TVP3	M6, MA6, MPA
	190	64	486	536	59	3000	4500	NJ2318-E-TVP3	M6, MA6, MPA
	190	64	486	536	59	3000	4500	NUP2318-E-TVP3	M6, MA6, MPA
	225	54	407	447	47,5	3400	4000	NU418-M	--
225	54	407	447	47,5	3400	4000	NJ418-M	--	
225	54	407	447	47,5	3400	4000	NUP418-M	--	



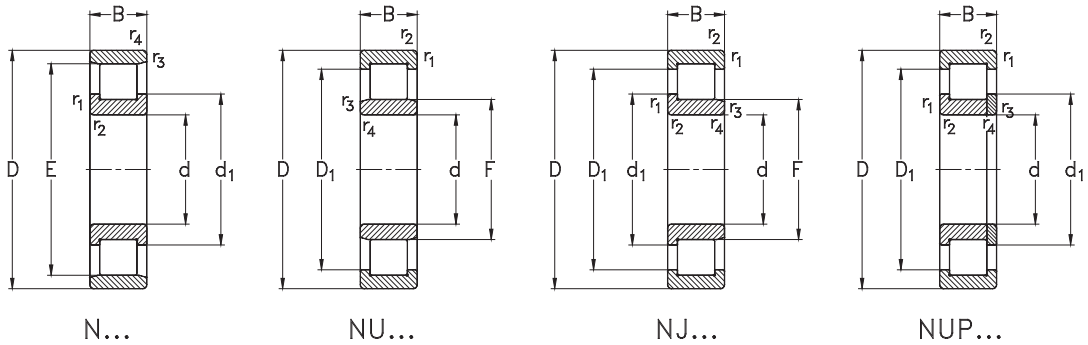
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

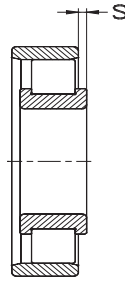
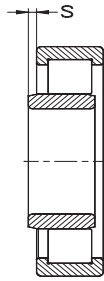
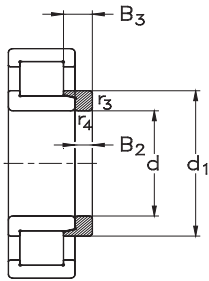
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
85	108	118	152,4	3	3	--	--	--	--	6,9	--
	113	--	165	4	4	2,8	--	--	--	9,8	--
	113	126	165	4	4	2,8	HJ417	14	24	9,8	0,92
	113	126	165	4	4	--	--	--	--	9,8	--
90	102	--	125	1,5	1,1	1,9	--	--	--	1,4	--
	145	114,5	--	2	2	1,5	--	--	--	2,4	--
	107	--	139,5	2	2	1,5	--	--	--	2,4	--
	107	114,5	139,5	2	2	1,5	HJ218-E	9	14	2,7	0,33
	107	114,5	139,5	2	2	--	--	--	--	2,7	--
	107	--	139,5	2	2	2,5	--	--	--	3,2	--
	107	114,5	139,5	2	2	2,5	HJ2218-E	9	15	3,2	0,32
	107	114,5	139,5	2	2	--	--	--	--	3,2	--
	169,5	124	--	3	3	1,5	--	--	--	5,4	--
	113,5	--	161,4	3	3	1,5	--	--	--	5,4	--
	113,5	124	161,4	3	3	1,5	HJ318-E	12	18,5	5,4	0,63
	113,5	124	161,4	3	3	--	--	--	--	5,4	--
	113,5	--	161,4	3	3	5	--	--	--	8,1	--
	113,5	124	161,4	3	3	5	HJ2318-E	12	22	8,1	0,68
	113,5	124	161,4	3	3	--	--	--	--	8,1	--
	123,5	--	179	4	4	3,3	--	--	--	11,5	--
123,5	137	179	4	4	3,3	HJ418	14	24	11,5	1,1	
123,5	137	179	4	4	--	--	--	--	11,5	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
95	145	24	125	164	18,9	4200	8000	NU1019-E-MPA	M6
	170	32	247	267	29,9	3700	4800	N219-E-M6	--
	170	32	247	267	29,9	3700	4800	NU219-E-TVP3	M6, MA6, MPA
	170	32	247	267	29,9	3700	4800	NJ219-E-TVP3	M6, MA6, MPA
	170	32	247	267	29,9	3700	4800	NUP219-E-TVP3	M6, MA6, MPA
	170	43	320	373	41,7	3100	4800	NU2219-E-TVP3	M6, MA6, MPA
	170	43	320	373	41,7	3100	4800	NJ2219-E-TVP3	M6, MA6, MPA
	170	43	320	373	41,7	3100	4800	NUP2219-E-TVP3	M6, MA6, MPA
	200	45	374	389	42	3600	4300	N319-E-M6	--
	200	45	374	389	42	3600	4300	NU319-E-TVP3	M6, MA6, MPA
200	45	374	389	42	3600	4300	NJ319-E-TVP3	M6, MA6, MPA	
	45	374	389	42	3600	4300	NUP319-E-TVP3	M6, MA6, MPA	
	67	514	585	63	2900	4300	NU2319-E-TVP3	M6, MA6, MPA	
	67	514	585	63	2900	4300	NJ2319-E-TVP3	M6, MA6, MPA	
	67	514	585	63	2900	4300	NUP2319-E-TVP3	M6, MA6, MPA	
	240	55	434	492	51,4	3100	3600	NU419-M	--
55		434	492	51,4	3100	3600	NJ419-M	--	
55		434	492	51,4	3100	3600	NUP419-M	--	
100	150	24	129	172	19,6	--	7500	NU1020-E-MPA	M6
	180	34	279	308	33,9	--	4500	N220-E-M6	--
	180	34	279	308	33,9	--	4500	NU220-E-TVP3	M6, MA6, MPA
	180	34	279	308	33,9	--	4500	NJ220-E-TVP3	M6, MA6, MPA



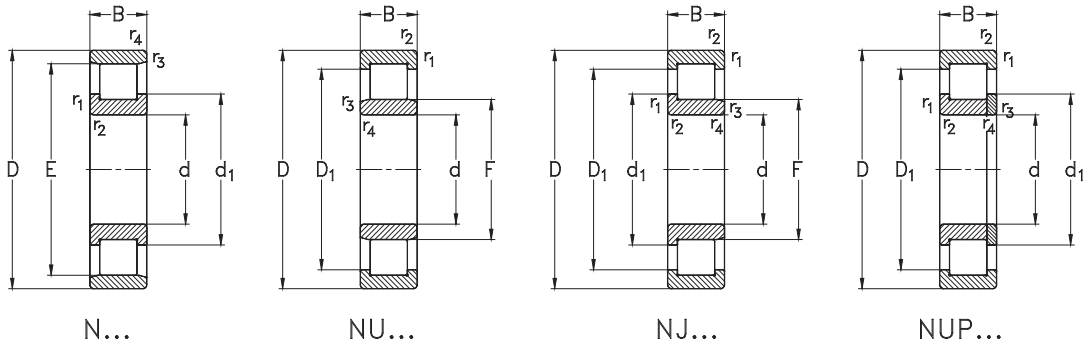
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

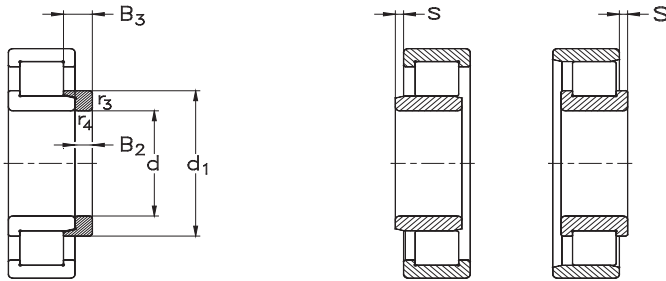
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
95	107	--	130	1,5	1,1	1,9	--	--	--	1,4	--
	154,5	120,7	--	2,1	2,1	1,7	--	--	--	2,8	--
	112,5	--	148,5	2,1	2,1	1,7	--	--	--	2,8	--
	112,5	120,7	148,5	2,1	2,1	1,7	HJ219-E	9	14	2,8	0,35
	112,5	120,7	148,5	2,1	2,1	--	--	--	--	2,8	--
	112,5	--	148,5	2,1	2,1	2,2	--	--	--	3,8	--
	112,5	120,7	148,5	2,1	2,1	2,2	HJ2219-E	9	15,5	3,8	0,37
	112,5	120,7	148,5	2,1	2,1	--	--	--	--	3,8	--
	177,5	132,2	--	3	3	1,4	--	--	--	6,3	--
	121,5	--	169,3	3	3	1,4	--	--	--	6,3	--
	121,5	132,5	169,3	3	3	1,4	HJ319-E	13	20,5	6,3	0,8
	121,5	132,5	169,3	3	3	--	--	--	--	6,3	--
	121,5	--	169,3	3	3	5,6	--	--	--	9,3	--
	121,5	132,2	169,3	3	3	5,6	HJ2319-E	13	24,5	9,3	0,83
	121,5	132,2	169,3	3	3	--	--	--	--	9,3	--
	133,5	--	189	4	4	3,3	--	--	--	13,8	--
133,5	147	189	4	4	3,3	HJ419	15	25,5	13,8	1,3	
133,5	147	189	4	4	--	--	--	--	13,8	--	
100	112	--	135	1,5	1,1	1,9	--	--	--	1,5	--
	163	127,3	--	2,1	2,1	1,5	--	--	--	3,44	--
	119	--	154,8	2,1	2,1	1,5	--	--	--	3,44	--
	119	127,3	154,8	2,1	2,1	1,5	HJ220-E	10	15	3,44	0,44

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages	
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G			
100	180	34	279	308	33,9	--	4500	NUP220-E-TVP3	M6, MA6, MPA	
	180	46	382	461	51	--	4500	NU2220-E-TVP3	M6, MA6, MPA	
	180	46	382	461	51	--	4500	NJ2220-E-TVP3	M6, MA6, MPA	
	180	46	382	461	51	--	4500	NUP2220-E-TVP3	M6, MA6, MPA	
	215	47	430	435	46,1	3400	3800	N320-E-M6	--	
	215	47	430	435	46,1	3400	3800	NU320-E-TVP3	M6, MA6, MPA	
	215	47	430	435	46,1	3400	3800	NJ320-E-TVP3	M6, MA6, MPA	
	215	47	430	435	46,1	3400	3800	NUP320-E-TVP3	M6, MA6, MPA	
	215	73	642	728	77,1	2500	3800	NU2320-E-TVP3	M6, MA6, MPA	
	215	73	642	728	77,1	2500	3800	NJ2320-E-TVP3	M6, MA6, MPA	
215	73	642	728	77,1	2500	3800	NUP2320-E-TVP3	M6, MA6, MPA		
250	58	58	450	502	52	3100	3600	NU420-M	--	
	58	58	450	502	52	3100	3600	NJ420-M	--	
	58	58	450	502	52	3100	3600	NUP420-M	--	
	105	160	26	149	194	21,6	3900	7500	NU1021-E-MPA	M6
		190	36	294	315	34,1	3500	4300	N221-E-M6	--
		190	36	294	315	34,1	3500	4300	NU221-E-TVP3	M6, MA6, MPA
		190	36	294	315	34,1	3500	4300	NJ221-E-TVP3	M6, MA6, MPA
190	36	294	315	34,1	3500	4300	NUP221-E-TVP3	M6, MA6, MPA		
225	49	483	492	51,4	3200	3800	N321-E-M6	--		
225	49	483	492	51,4	3200	3800	NU321-E-TVP3	M6, MA6, MPA		
225	49	483	492	51,4	3200	3800	NJ321-E-TVP3	M6, MA6, MPA		



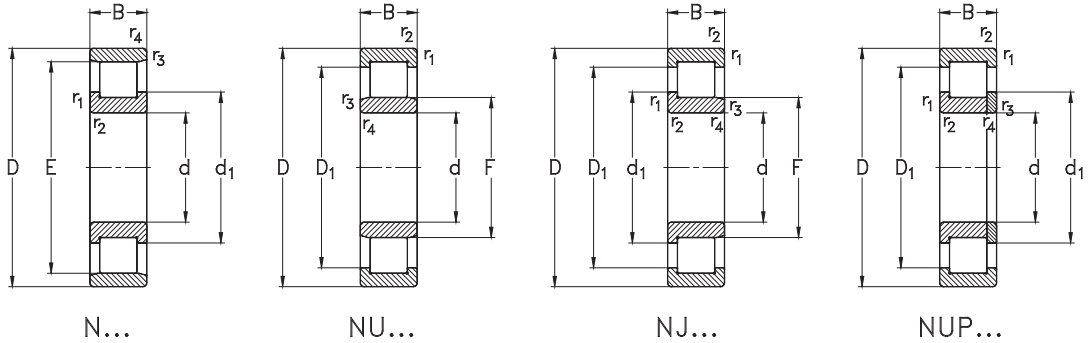
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

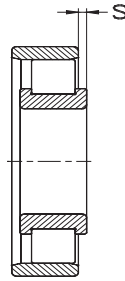
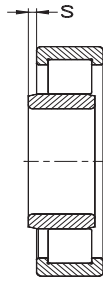
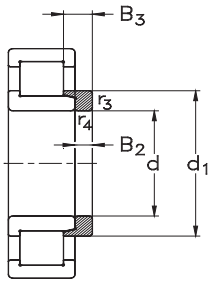
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
100	119	127,3	154,8	2,1	2,1	--	--	--	--	3,44	--
	119	--	154,8	2,1	2,1	2,5	--	--	--	5,5	--
	119	127,3	154,8	2,1	2,1	2,5	HJ2220-E	10	16	5,5	0,45
	119	127,3	154,8	2,1	2,1	--	--	--	--	5,5	--
	191,5	139,6	--	3	3	1,2	--	--	--	7,7	--
	127,5	--	182,5	3	3	1,2	--	--	--	7,7	--
	127,5	139,6	182,5	3	3	1,2	HJ320-E	13	20,5	7,7	0,9
	127,5	139,6	182,5	3	3	--	--	--	--	7,7	--
	127,5	--	182,5	3	3	4,2	--	--	--	12	--
	127,5	139,6	182,5	3	3	4,2	HJ2320-E	13	23,5	12	0,95
127,5	139,6	182,5	3	3	--	--	--	--	12	--	
139	--	198	4	4	3,3	--	--	--	15,8	--	
139	153,5	198	4	4	3,3	HJ420	16	27	15,8	1,6	
139	153,5	198	4	4	--	--	--	--	15,8	--	
105	119,5	124,7	140,3	2	1,1	3,8	--	--	--	1,9	--
	173	134,2	--	2,1	2,1	1,3	--	--	--	4,1	--
	125	--	163,7	2,1	2,1	1,3	--	--	--	4,1	--
	125	134,2	163,7	2,1	2,1	1,3	HJ221-E	10	16	4,1	0,52
	125	134,2	163,7	2,1	2,1	--	--	--	--	4,1	--
	201	145	--	3	3	3,4	--	--	--	9,1	--
	133	--	191	3	3	3,4	--	--	--	9,1	--
	133	145	191	3	3	3,4	HJ321-E	13	20,5	9,1	1

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{tr}	n _G		
105	225	49	483	492	51	3200	3800	NUP321-E-TVP3	M6, MA6, MPA
	260	60	499	560	57	2800	3400	NU421-M	--
	260	60	499	560	57	2800	3400	NJ421-M	--
	260	60	499	560	57	2800	3400	NUP421-M	--
110	170	28	160	215	23,7	3800	7000	NU1022-E-MPA	M6
	200	38	328	368	39,2	3300	4000	N222-E-M6	--
	200	38	328	368	39,2	3300	4000	NU222-E-TVP3	M6, MA6, MPA
	200	38	328	368	39,2	3300	4000	NJ222-E-TVP3	M6, MA6, MPA
	200	38	328	368	39,2	3300	4000	NUP222-E-TVP3	M6, MA6, MPA
	200	53	429	520	55	2800	4000	NU2222-E-TVP3	M6, MA6, MPA
	200	53	429	520	55	2800	4000	NJ2222-E-TVP3	M6, MA6, MPA
	200	53	429	520	55	2800	4000	NUP2222-E-TVP3	M6, MA6, MPA
	240	50	511	537	55	2900	3400	N322-E-M6	--
	240	50	511	537	55	2900	3400	NU322-E-TVP3	M6, MA6, MPA
	240	50	511	537	55	2900	3400	NJ322-E-TVP3	M6, MA6, MPA
	240	50	511	537	55	2900	3400	NUP322-E-TVP3	M6, MA6, MPA
	240	80	759	892	92	2200	3400	NU2322-E-TVP3	M6, MA6, MPA
	240	80	759	892	92	2200	3400	NJ2322-E-TVP3	M6, MA6, MPA
	240	80	759	892	92	2200	3400	NUP2322-E-TVP3	M6, MA6, MPA
	280	65	551	626	62	2600	3200	NU422-M	--
280	65	551	626	62	2600	3200	NJ422-M	--	
280	65	551	626	62	2600	3200	NUP422-M	--	



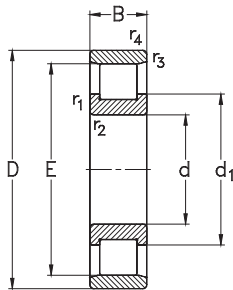
Anschlussmaße siehe Seite 547

Abutment and fillet dimensions
see on page 547

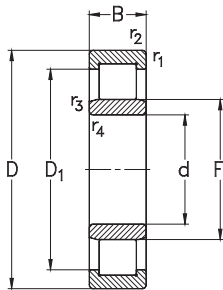
NJ...+ HJ...

Lagerabmessungen [mm] Bearing dimensions [mm]							Winkelring Thrust collar			Gewicht [kg] Weight [kg]	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
105	133	145	191	3	3	--	--	--	--	9,1	--
	144,5	--	207	4	4	3,2	--	--	--	17,5	--
	144,5	159,5	207	4	4	3,2	HJ421	16	27	17,5	1,7
	144,5	159,5	207	4	4	--	--	--	--	17,5	--
110	125	--	149,5	2	1,1	2,1	--	--	--	2,4	--
	180,5	141,6	--	2,1	2,1	1,5	--	--	--	4,9	--
	132,5	--	174,6	2,1	2,1	1,5	--	--	--	4,9	--
	132,5	141,6	174,6	2,1	2,1	1,5	HJ222-E	11	17	4,9	0,62
	132,5	141,6	174,6	2,1	2,1	--	--	--	--	4,9	--
	132,5	--	174,6	2,1	2,1	4	--	--	--	6,7	--
	132,5	141,6	174,6	2,1	2,1	4	HJ2222-E	11	19,5	6,7	0,65
	132,5	141,6	174,6	2,1	2,1	--	--	--	--	6,7	--
	211	155,9	--	3	3	1,3	--	--	--	10,5	--
	143	--	201,7	3	3	1,3	--	--	--	10,5	--
	143	155,9	201,7	3	3	1,3	HJ322-E	14	22	10,5	1,2
	143	155,9	201,7	3	3	--	--	--	--	10,5	--
	143	--	201,7	3	3	5,8	--	--	--	17	--
	143	155,9	201,7	3	3	5,8	HJ322-E	14	26,5	17	1,3
143	155,9	201,7	3	3	--	--	--	--	17	--	
155	--	220,5	4	4	3,3	--	--	--	20,8	--	
155	171	220,5	4	4	3,3	HJ422	17	29,5	20,8	2,1	
155	171	220,5	4	4	--	--	--	--	20,8	--	

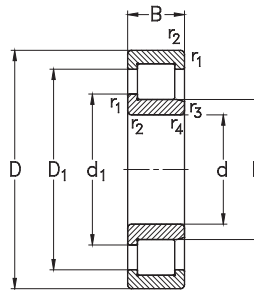
Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



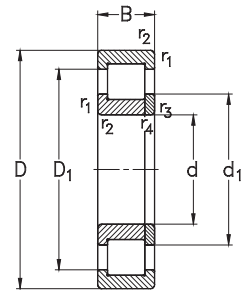
N...



NU...

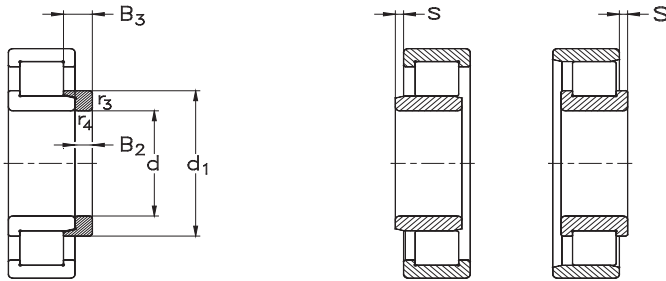


NJ...



NUP...

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
120	180	28	169	237	25,5	3500	6300	NU1024-E-MPA	M6
	215	40	380	431	44,9	3000	3600	N224-E-M6	--
	215	40	380	431	44,9	3000	3600	NU224-E-TVP3	M6, MA6, MPA
	215	40	380	431	44,9	3000	3600	NJ224-E-TVP3	M6, MA6, MPA
	215	40	380	431	44,9	3000	3600	NUP224-E-TVP3	M6, MA6, MPA
	215	58	509	629	66	2500	3600	NU2224-E-TVP3	M6, MA6, MPA
	215	58	509	629	66	2500	3600	NJ2224-E-TVP3	M6, MA6, MPA
	215	58	509	629	66	2500	3600	NUP2224-E-TVP3	M6, MA6, MPA
	260	55	591	615	62	2700	3200	N324-E-M6	--
	260	55	591	615	62	2700	3200	NU324-E-TVP3	M6, MA6, MPA
	260	55	591	615	62	2700	3200	NJ324-E-TVP3	M6, MA6, MPA
	260	55	591	615	62	2700	3200	NUP324-E-TVP3	M6, MA6, MPA
	260	86	885	1033	104	2000	4300	NU2324-E-TVP3	M6, MA6, MPA
	260	86	885	1033	104	2000	4300	NJ2324-E-TVP3	M6, MA6, MPA
	260	86	885	1033	104	2000	4300	NUP2324-E-TVP3	M6, MA6, MPA
130	310	72	680	780	76	2300	3000	NU424-M	--
	310	72	680	780	76	2300	3000	NJ424-M	--
	200	33	218	300	31,4	3400	5600	NU1026-E-MPA	M6
	230	40	406	456	46,5	2800	3400	N226-E-M6	--
	230	40	406	456	46,5	2800	3400	NU226-E-TVP3	M6, MA6, MPA
	230	40	406	456	46,5	2800	3400	NJ226-E-TVP3	M6, MA6, MPA
230	40	406	456	46,5	2800	3400	NUP226-E-TVP3	M6, MA6, MPA	



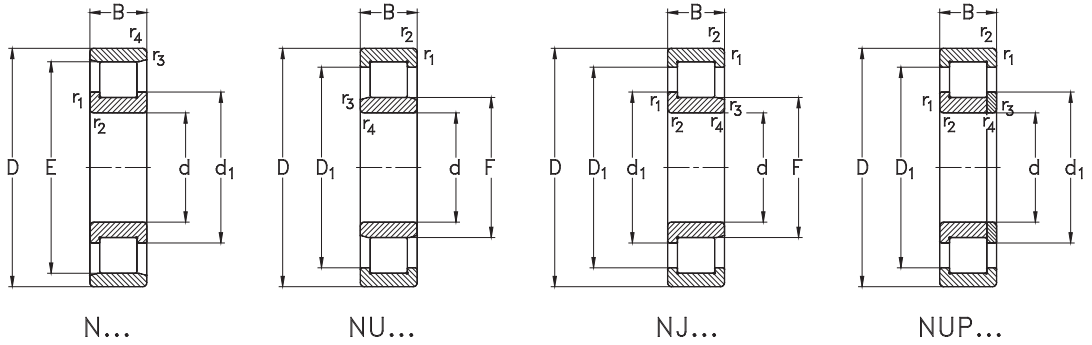
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

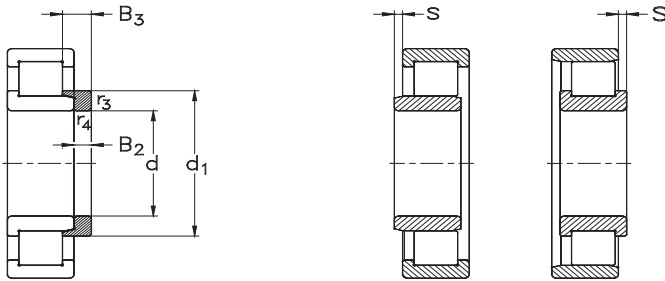
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
120	135	--	159,5	2	1,1	0,9	--	--	--	2,5	--
	195,5	153,5	--	2,1	2,1	1,4	--	--	--	5,7	--
	143,5	--	188	2,1	2,1	1,4	--	--	--	5,7	--
	143,5	153,5	188	2,1	2,1	1,4	HJ224-E	11	17	5,7	0,72
	143,5	153,5	188	2,1	2,1	--	--	--	--	5,7	--
	143,5	--	188	2,1	2,1	4,5	--	--	--	8,3	--
	143,5	153,5	188	2,1	2,1	4,5	HJ2224-E	11	20	8,3	0,75
	143,5	153,5	188	2,1	2,1	--	--	--	--	8,3	--
	230	168,7	--	3	3	3,5	--	--	--	13,4	--
	154	--	219	3	3	3,5	--	--	--	13,4	--
154	168,7	219	3	3	3,5	HJ324-E	14	22,5	13,4	1,4	
	168,7	219	3	3	--	--	--	--	13,4	--	
	--	219	3	3	7,2	--	--	--	23,5	--	
	168,7	219	3	3	7,2	HJ2324-E	14	26	23,5	1,5	
	168,7	219	3	3	--	--	--	--	23,5	--	
	170	--	244	5	5	3,3	--	--	--	30,5	--
	170	188	244	5	5	3,3	HJ424	17	30,5	30,5	2,7
130	147	--	178	2	1,1	2,6	--	--	--	3,8	--
	209,5	164,2	--	3	3	1,2	--	--	--	6,5	--
	153,5	--	202,6	3	3	1,2	--	--	--	6,5	--
	153,5	164,2	202,6	3	3	1,2	HJ226-E	11	17	6,5	0,8
	153,5	164,2	202,6	3	3	--	--	--	--	6,5	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G		
130	230	64	591	739	75,4	2300	3400	NU2226-E-TVP3	M6, MA6, MPA
	230	64	591	739	75	2300	3400	NJ2226-E-TVP3	M6, MA6, MPA
	230	64	591	739	75	2300	3400	NUP2226-E-TVP3	M6, MA6, MPA
	280	58	690	741	73	2300	3000	N326-E-M6	--
	280	58	690	741	73	2300	3000	NU326-E-TVP3	M6, MA6, MPA
	280	58	690	741	73	2300	3000	NJ326-E-TVP3	M6, MA6, MPA
	280	58	690	741	73	2300	3000	NUP326-E-TVP3	M6, MA6, MPA
	280	93	1028	1238	121	1800	3800	NU2326-E-TVP3	M6, MA6, MPA
	280	93	1028	1238	121	1800	3800	NJ2326-E-TVP3	M6, MA6, MPA
	280	93	1028	1238	121	1800	3800	NUP2326-E-TVP3	M6, MA6, MPA
340	78	831	967	91	2000	2800	NU426-M	--	
	78	831	967	91	2000	2800	NJ426-M	--	
140	210	33	231	329	33,9	3100	5300	NU1028-E-MPA	M6
	250	42	438	517	51	2600	3200	N228-E-M6	--
	250	42	438	517	51	2600	3200	NU228-E-M6	MA6, MPA
	250	42	438	517	51	2600	3200	NJ228-E-M6	MA6, MPA
	250	42	438	517	51	2600	3200	NUP228-E-M6	MA6, MPA
	250	68	638	838	83	2100	4800	NU2228-E-M6	MA6, MPA
	250	68	638	838	83	2100	4800	NJ2228-E-M6	MA6, MPA
	250	68	638	838	83	2100	4800	NUP2228-E-M6	MA6, MPA
	300	62	746	808	78	2200	2800	N328-E-M6	--
300	62	746	808	78	2200	2800	NU328-E-M6	MA6, MPA	



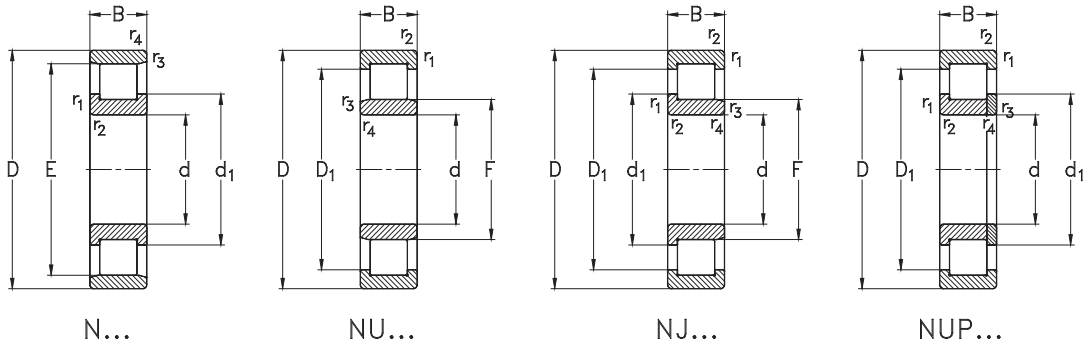
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

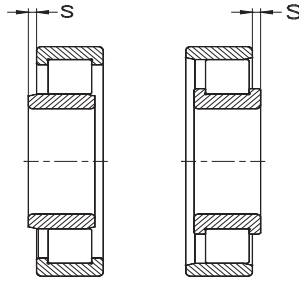
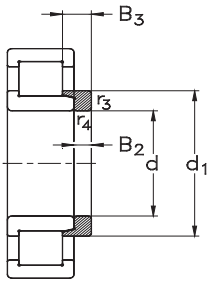
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
130	153,5	--	202,6	3	3	5,2	--	--	--	10,5	--
	153,5	164,2	202,6	3	3	5,2	HJ2226-E	11	21	10,5	0,85
	153,5	164,2	202,6	3	3	--	--	--	--	10,5	--
	247	182,3	--	4	4	3,5	--	--	--	16,5	--
	167	--	235,7	4	4	3,5	--	--	--	16,5	--
	167	182,3	235,7	4	4	3,5	HJ326E	14	23	16,5	1,7
	167	182,3	235,7	4	4	--	--	--	--	16,5	--
	167	--	235,7	4	4	8,1	--	--	--	29,6	--
	167	182,3	235,7	4	4	8,1	HJ2326-E	14	28	29,6	1,8
	167	182,3	235,7	4	4	--	--	--	--	29,6	--
140	185	205	--	6	5	4	--	--	--	42,6	--
	185	205	267	6	5	4	HJ426	18	32	42,6	3,4
	157	--	188	2	1,1	2,6	--	--	--	4,1	--
	225	180	--	3	3	2	--	--	--	9,5	--
	169	--	217	3	3	2	--	--	--	9,5	--
	169	180	217	3	3	2	HJ228-E	11	18	9,5	1
	169	180	217	3	3	--	--	--	--	9,5	--
	169	--	217	3	3	7	--	--	--	15,5	--
	169	180	217	3	3	7	HJ2228-E	11	23	15,5	1,1
	169	180	217	3	3	--	--	--	--	15,5	--
264	195,5	--	4	4	5,2	--	--	--	22,5	--	
180	--	252	4	4	5,2	--	--	--	22,5	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
140	300	62	746	808	78	2200	2800	NJ328-E-M6	MA6, MPA
	300	62	746	808	78	2200	2800	NUP328-E-M6	MA6, MPA
	300	102	1141	1396	134	1600	3600	NU2328-E-M6	MA6, MPA
	300	102	1141	1396	134	1600	3600	NJ2328-E-M6	MA6, MPA
	300	102	1141	1396	134	1600	3600	NUP2328-E-M6	MA6, MPA
	360	82	896	1055	98	1800	2600	NU428-M	--
	360	82	896	1055	98	1800	2600	NJ428-M	--
150	225	35	244	347	35	3000	5000	NU1030-E-MPA	M6
	270	45	500	597	58	2400	2800	N230-E-M6	--
	270	45	500	597	58	2400	2800	NU230-E-M6	MA6, MPA
	270	45	500	597	58	2400	2800	NJ230-E-M6	MA6, MPA
	270	45	500	597	58	2400	2800	NUP230-E-M6	MA6, MPA
	270	73	738	985	96	1900	2800	NU2230-E-M6	MA6, MPA
	270	73	738	985	96	1900	2800	NJ2230-E-M6	MA6, MPA
	270	73	738	985	96	1900	2800	NUP2230-E-M6	MA6, MPA
	320	65	852	934	88	2000	2600	N330-E-M6	--
	320	65	852	934	88	2000	2600	NU330-E-M6	MA6, MPA
	320	65	852	934	88	2000	2600	NJ330-E-M6	MA6, MPA
	320	65	852	934	88	2000	2600	NUP330-E-M6	MA6, MPA
	320	108	1300	1608	151	1500	3400	NU2330-E-M6	MA6, MPA
320	108	1300	1608	151	1500	3400	NJ2330-E-M6	MA6, MPA	
320	108	1300	1608	151	1500	3400	NUP2330-E-M6	MA6, MPA	



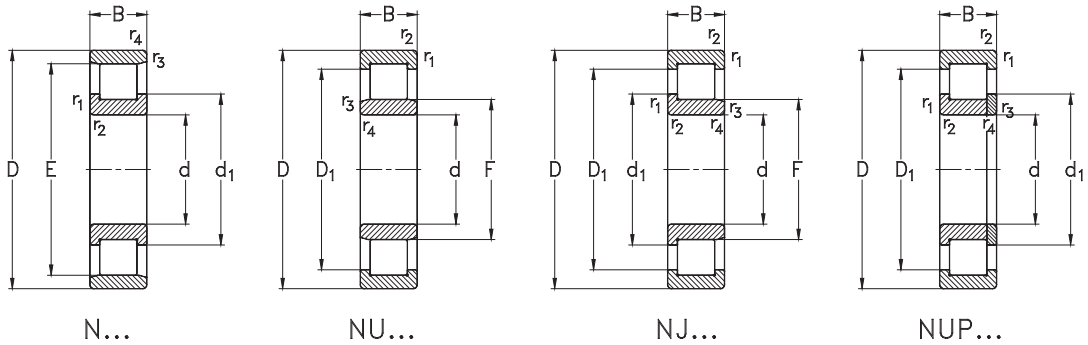
Anschlussmaße siehe Seite 547

Abutment and fillet dimensions
see on page 547

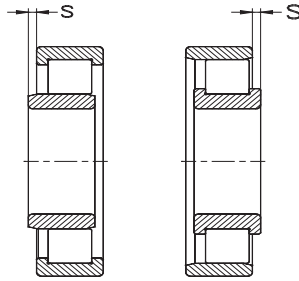
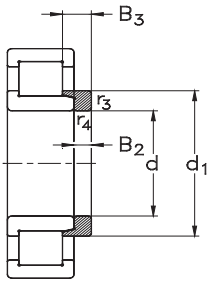
NJ...+ HJ...

Lagerabmessungen [mm] Bearing dimensions [mm]							Winkelring Thrust collar			Gewicht [kg] Weight [kg]	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung Designation	B ₂	B ₃	Lager Bearing	Winkelring Thrust collar
140	180	195,5	252	4	4	5,2	HJ328-E	15	25	22,5	2
	180	195,5	252	4	4	--	--	--	--	22,5	--
	180	--	252	4	4	9,2	--	--	--	37,2	--
	180	195,5	252	4	4	9,2	HJ2328-E	15	31	37,2	2,2
	180	195,5	252	4	4	--	--	--	--	37,2	--
	198	--	283	6	5	4	--	--	--	49,5	--
	198	219	283	6	5	4	HJ428	18	33	49,5	3,9
150	168,5	--	199,1	2,1	1,5	2,9	--	--	--	5	--
	242	193,7	--	3	3	2,5	--	--	--	11,8	--
	182	--	233,5	3	3	2,5	--	--	--	11,8	--
	182	193,7	233,5	3	3	2,5	HJ230-E	12	19,5	11,8	1,3
	182	193,7	133,5	3	3	--	--	--	--	11,8	--
	182	--	233,5	3	3	7,5	--	--	--	19,5	--
	182	193,7	233,5	3	3	7,5	HJ2230-E	12	24,5	19,5	1,4
	182	193,7	233,5	3	3	--	--	--	--	19,5	--
	283	210,1	--	4	4	5,5	--	--	--	27,5	--
	193	--	269,5	4	4	5,5	--	--	--	27,5	--
	193	210,1	269,5	4	4	5,5	HJ330-E	15	25	27,5	2,4
	193	210,1	269,5	4	4	--	--	--	--	27,5	--
	193	--	269,5	4	4	9,7	--	--	--	44,8	--
193	210,1	269,5	4	4	9,7	HJ2330-E	15	31,5	44,8	2,5	
193	210,1	269,5	4	4	--	--	--	--	44,8	--	

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
150	380	85	954	1160	106	1700	2400	NU430-M	--
	380	85	954	1160	106	1700	2400	NJ430-M	--
160	240	38	304	440	43,5	2800	4800	NU1032-E-MPA	M6
	290	48	566	683	65	2200	2600	N232-E-M6	--
	290	48	566	683	65	2200	2600	NU232-E-M6	MA6, MPA
	290	48	566	683	65	2200	2600	NJ232-E-M6	MA6, MPA
	290	48	566	683	65	2200	2600	NUP232-E-M6	MA6, MPA
	290	80	910	1207	115	1700	3600	NU2232-E-M6	MA6, MPA
	290	80	910	1207	115	1700	3600	NJ2232-E-M6	MA6, MPA
	290	80	910	1204	115	1700	3600	NUP2232-E-M6	MA6, MPA
	340	68	964	1066	99	1800	2400	N332-E-M6	--
	340	68	964	1066	99	1800	2400	NU332-E-M6	MA6, MPA
170	340	68	964	1066	99	1800	2400	NJ332-E-M6	MA6, MPA
	340	114	1320	1832	169	1300	2800	NU2332-E-M6	MA6, MPA
	340	114	1320	1832	169	1300	2800	NJ2332-E-M6	MA6, MPA
	260	42	375	539	52	2600	4300	NU1034-E-MPA	M6
	310	52	676	808	76	2000	2400	N234-E-M6	--
	310	52	676	808	76	2000	2400	NU234-E-M6	MA6, MPA
310	52	676	808	76	2000	2400	NJ234-E-M6	MA6, MPA	
	86	1078	1421	133	1500	3200	NU2234-E-M6	MA6, MPA	
	86	1078	1421	133	1500	3200	NJ2234-E-M6	MA6, MPA	
	360	72	936	1166	106	1700	2200	N334-E-M6	--



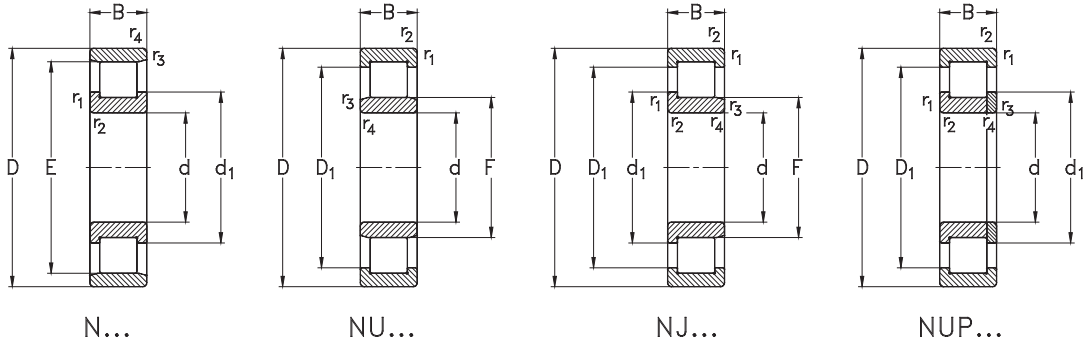
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

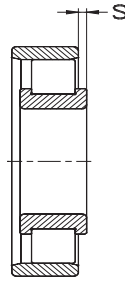
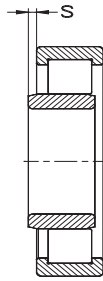
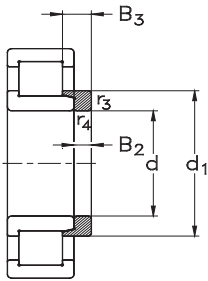
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
150	213	--	298	6	5	4	--	--	--	48	--
	213	234	298	6	5	4	HJ430	20	36,5	48	4,9
160	179	--	215	2,1	1,5	2,7	--	--	--	5,95	--
	259	207,4	--	3	3	4,1	--	--	--	14,6	--
	195	--	247,7	3	3	4,1	--	--	--	14,6	--
	195	207,4	247,7	3	3	4,1	HJ232-E	12	20	14,6	1,5
	195	207,4	247,7	3	3	--	--	--	--	14,6	--
	193	--	250,1	3	3	7,2	--	--	--	24,5	--
	193	206,1	250,1	3	3	7,2	HJ2232-E	12	24,5	24,5	1,6
	193	206,1	250,1	3	3	--	--	--	--	24,5	--
	300	221,6	--	4	4	5,6	--	--	--	32,3	--
	204	--	286	4	4	5,6	--	--	--	32,3	--
204	221,6	286	4	4	5,6	HJ332-E	15	25	32,1	2,7	
204	--	286	4	4	9,9	--	--	--	53,5	--	
204	221,6	286	4	4	9,9	HJ2332-E	15	32	53,5	2,9	
170	191	--	231	2,1	2,1	3,3	--	--	--	8	--
	279	220,8	--	4	4	4,3	--	--	--	18,2	--
	207	--	268,55	4	4	4,3	--	--	--	18,2	--
	207	220,8	268,55	4	4	4,3	HJ234-E	12	20	18,2	1,7
	205	--	268,5	4	4	7,2	--	--	--	30	--
	205	219,6	268,5	4	4	7,2	HJ2234-E	12	24	30	1,8
	318	237	--	4	4	6	--	--	--	37,5	--

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
170	360	72	936	1166	106	1700	2200	NU334-E-M6	MA6, MPA
	360	72	936	1166	106	1700	2200	NJ334-E-M6	MA6, MPA
	360	120	1510	2105	191	1200	3000	NU2334-E-M6	MA6, MPA
	360	120	1510	2105	191	1200	3000	NJ2334-E-M6	MA6, MPA
180	280	46	443	631	60	2400	4000	NU1036-E-MPA	M6
	320	52	708	859	79	1900	3200	N236-E-M6	--
	320	52	708	859	79	1900	3200	NU236-E-M6	MA6, MPA
	320	52	708	859	79	1900	3200	NJ236-E-M6	MA6, MPA
	320	86	1123	1516	140	1400	3200	NU2236-E-M6	MA6, MPA
	320	86	1123	1516	140	1400	3200	NJ2236-E-M6	MA6, MPA
	380	75	1063	1360	121	1500	2200	N336-E-M6	--
	380	75	1063	1360	121	1500	2200	NU336-E-M6	MA6, MPA
	380	75	1063	1360	121	1500	2200	NJ336-E-M6	MA6, MPA
	380	126	1712	2394	214	1100	2800	NU2336-E-M6	MA6, MPA
380	126	1712	2394	214	1100	2800	NJ2336-E-M6	MA6, MPA	
190	290	46	457	665	62	2300	3800	NU1038-E-MPA	M6
	340	55	698	962	87	1700	3000	N238-E-M6	--
	340	55	698	962	87	1700	3000	NU238-E-M6	MA6, MPA
	340	55	698	962	87	1700	3000	NJ238-E-M6	MA6, MPA
	340	92	1233	1678	152	1300	3000	NU2238-E-M6	MA6, MPA
	340	92	1233	1678	152	1300	3000	NJ2238-E-M6	MA6, MPA
400	78	1142	1476	130	1400	2000	NU338-E-M6	MA6, MPA	



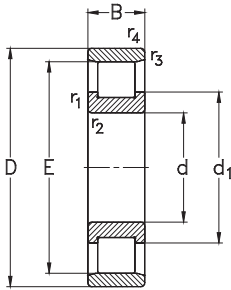
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

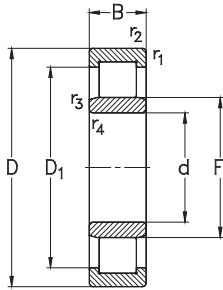
NJ...+ HJ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
170	218	--	302	4	4	6	--	--	--	37,5	--
	218	237	302	4	4	6	HJ334-E	18,5	29,5	37,5	--
	216	--	303	4	4	10,2	--	--	--	62	--
	216	235,7	303	4	4	10,2	HJ2334-E	21	38,5	62	3,7
180	204	--	249	2,1	2,1	3,4	--	--	--	10,5	--
	289	230,2	--	4	4	4,7	--	--	--	19	--
	217	--	278,5	4	4	4,7	--	--	--	19	--
	217	230,2	278,5	4	4	4,7	HJ236-E	12	20	19	1,8
	215	--	279,6	4	4	7,2	--	--	--	31,5	--
	215	229,6	279,6	4	4	7,2	HJ2236-E	12	24	32	1,9
	335	250,5	--	4	4	6,1	--	--	--	44	--
	231	--	319,4	4	4	6,1	--	--	--	44	--
	231	250,5	319,4	4	4	6,1	HJ336-E	19	30,5	44	3,9
	227	--	320,8	4	4	10,5	--	--	--	71,5	--
227	248	320,8	4	4	10,5	--	--	--	71,5	--	
190	214	--	259	2,1	2,1	3,4	--	--	--	11	--
	306	244,6	--	4	4	4,7	--	--	--	24,5	--
	230	--	295	4	4	4,7	--	--	--	24	--
	230	244,6	295	4	4	4,7	HJ238-E	13	21,5	24,5	2,1
	228	--	296	4	4	8	--	--	--	39	--
	228	243,3	296	4	4	8	HJ2238-E	13	26,5	37,9	2,4
	245	--	336	5	5	6,3	--	--	--	50	--

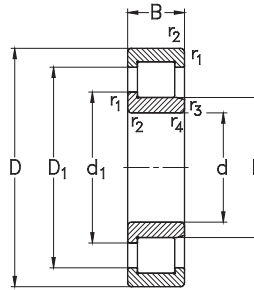
Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



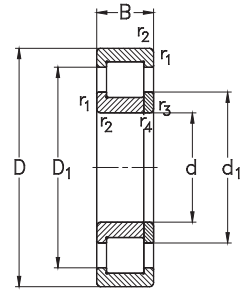
N...



NU...

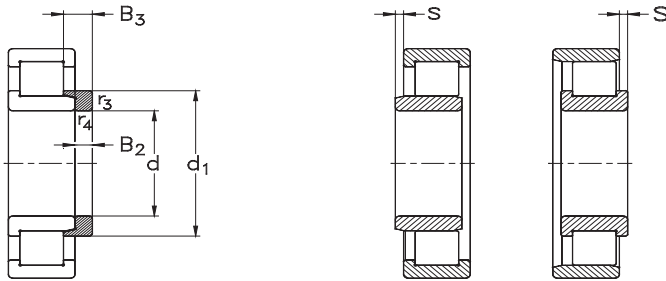


NJ...



NUP...

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
190	400	78	1142	1476	130	1400	2000	NJ338-E-M6	MA6, MPA
	400	132	1925	2707	237	1000	2600	NU2338-E-M6	MA6, MPA
	400	132	1925	2707	237	1000	2600	NJ2338-E-M6	MA6, MPA
200	310	51	509	744	68	2200	3000	NU1040-E-M6	MA6
	360	58	770	1070	96	1600	2800	N240-E-M6	--
	360	58	770	1070	96	1600	2800	NU240-E-M6	MA6, MPA
	360	58	770	1070	96	1600	2800	NJ240-E-M6	MA6, MPA
	360	58	770	1070	96	1600	2800	NUP240-E-M6	MA6, MPA
	360	98	1228	1885	168	1200	2800	NU2240-E-M6	MA6, MPA
	360	98	1228	1885	168	1200	2800	NJ2240-E-M6	MA6, MPA
420	80	1223	1595	138	1300	2400	2400	NU340-E-M6	MA6, MPA
	80	1223	1595	138	1300	2400	2400	NJ340-E-M6	MA6, MPA
	138	2079	2961	256	950	2400	2400	NU2340-E-M6	MA6, MPA
	138	2079	2961	256	950	2400	2400	NJ2340-E-M6	MA6, MPA



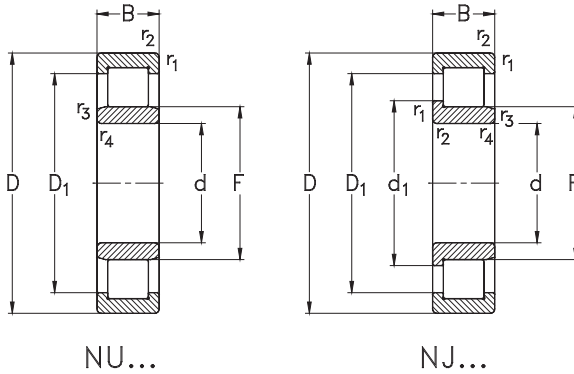
Anschlussmaße siehe Seite 547

*Abutment and fillet dimensions
see on page 547*

NJ...+ HJ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]	
	E,F	Bearing dimensions [mm]				s	Thrust collar		Lager Bearing	Winkelring Thrust collar	
		d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	≈	Bezeichnung Designation	B ₂	B ₃		
190	245	265,5	336	5	5	6,3	HJ338-E	17	29	50,5	4,5
	240	--	340,5	5	5	11	--	--	--	82,5	--
	240	262,5	340,5	5	5	11	--	--	--	82,5	--
200	227	--	275	2,1	2,1	4	--	--	--	14,5	--
	323	258,2	--	4	4	4,8	--	--	--	29	--
	243	--	312,2	4	4	4,8	--	--	--	28,5	--
	243	258,2	312,2	4	4	4,8	HJ240-E	14	23	29	2,6
	243	258,2	312,2	4	4	4,8	--	--	--	29,5	--
	241	--	312,4	4	4	8,2	--	--	--	46	--
	241	256,9	312,4	4	4	8,2	HJ2240-E	14	28	46	2,8
	258	--	351,8	5	5	6,3	--	--	--	57,5	--
	258	279	351,8	5	5	6,3	HJ340-E	18	30	57,5	5,2
253	--	356,9	5	5	11,3	--	--	--	97	--	
253	276,1	356,9	5	5	11,3	HJ2340-E	18	37	97	5,5	

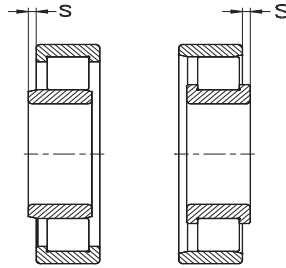
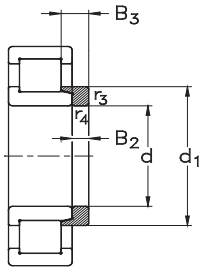
Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



NU...

NJ...

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{br}	n _G		
220	340	56	573	854	76	2000	2800	NU1044-E-M6	MA6
	400	65	952	1338	116	1400	2400	NU244-E-M6	MA6, MPA
	400	65	952	1338	116	1400	2400	NJ244-E-M6	MA6, MPA
	400	108	1654	2408	209	1000	2400	NU2244-E-M6	MA6, MPA
	400	108	1654	2408	209	1000	2400	NJ2244-E-M6	MA6, MPA
	460	88	1485	1964	165	1100	1700	NU344-E-M6	MA6, MPA
	460	145	2388	3415	287	830	2200	NU2344-E-M6	MA6, MPA
240	360	56	604	936	82	1800	2600	NU1048-E-M6	MA6
	440	72	1119	1576	133	1300	2200	NU248-E-M6	MA6, MPA
	440	72	1119	1576	133	1300	2200	NJ248-E-M6	MA6, MPA
	440	120	1888	2855	240	950	2200	NU2248-E-M6	MA6, MPA
	500	95	1769	2370	195	990	2000	NU348-E-M6	MA6, MPA
	500	155	2638	3818	313	760	2000	NU2348-E-M6	MA6, MPA
260	400	65	788	1201	102	1600	2400	NU1052-E-M6	MA6
	480	80	1344	1916	157	1100	2000	NU252-E-M6	MA6, MPA
	480	80	1344	1916	157	1100	2000	NJ252-E-M6	MA6, MPA
	480	130	2124	3244	266	830	2000	NU2252-E-M6	MA6, MPA
	540	102	1867	2545	204	930	1800	NU352-E-M6	MA6, MPA
	540	165	3165	4606	370	660	1800	NU2352-E-M6	MA6, MPA
280	420	65	709	1157	97	1500	2200	NU1056-M6	MA6
	500	80	1444	2109	138	1100	1900	NU256-E-M6	MA6
	500	80	1444	2109	138	1100	1900	NJ256-E-M6	MA6



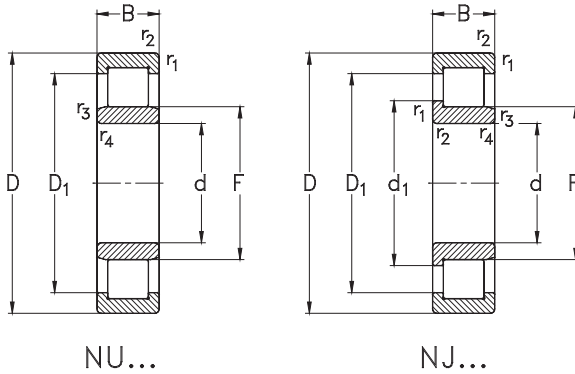
Anschlussmaße siehe Seite 547

Abutment and fillet dimensions
see on page 547

NJ ...+ HJ ...

d	Lagerabmessungen [mm]						Winkelring			Gewicht [kg]	
	E,F	Bearing dimensions [mm]		r_1, r_2 min	r_3, r_4 min	s ≈	Bezeichnung Designation	B_2	B_3	Lager Bearing	Winkelring Thrust collar
220	250	--	301	3	3	4,4	--	--	--	18,5	--
	268	--	340	4	4	5,5	--	--	--	38,5	--
	268	285,1	340	4	4	5,5	HJ244-E	15	25	39	3,3
	259	--	349,4	4	4	8,4	--	--	--	62,5	--
	259	279,4	349,4	4	4	8,4	HJ2244-E	17,5	31,5	62,5	3,6
	282	--	386	5	5	7	--	--	--	72,5	--
	277	--	391,2	5	5	11,9	--	--	--	120	--
240	270	--	323	3	3	4,4	--	--	--	20	--
	295	--	375,4	4	4	6	--	--	--	51,5	--
	295	314	375,4	4	4	6	HJ248-E	16	27	52,5	4,65
	287	--	380,5	4	4	7,8	--	--	--	85,9	--
	306	--	421,2	5	5	7,4	--	--	--	96,2	--
	303	--	424	5	5	13,3	--	--	--	157	--
260	294	--	354	4	4	5,3	HJ1052-E	18	31,5	29	3,3
	320	--	408,3	5	5	6,2	--	--	--	68,3	--
	320	340,9	408,3	5	5	6,2	HJ252-E	20,5	33	68,3	6,2
	313	--	413,5	5	5	10,2	--	--	--	112	--
	337	--	454,6	6	6	10	--	--	--	120	--
	324	--	458,4	6	6	13,7	--	--	--	195	--
280	316	--	369,7	4	4	8,3	HJ1056	16	31,5	32,8	3,6
	337	--	431	5	5	7,5	--	--	--	71,8	--
	337	360	431	5	5	7,5	HJ256-E	21	33	71,8	6,5

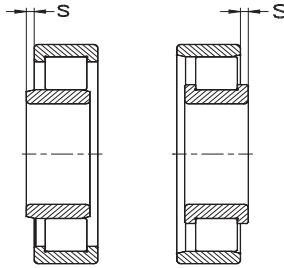
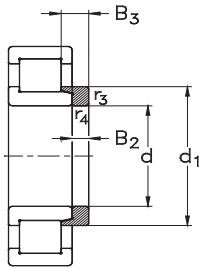
Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



NU...

NJ...

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
280	500	130	2217	3841	282	740	1900	NU2256-E-M6	MA6
	580	108	2233	3118	246	800	1600	NU356-E-M6	MA6
300	460	74	913	1467	120	1400	2000	NU1060-M6	MA6
	540	85	1492	2244	178	950	1800	NU260-E-M6	MA6
	540	85	1492	2244	178	950	1800	NJ260-E-M6	MA6
320	540	140	2583	4153	329	650	1800	NU2260-E-M6	MA6
	480	74	935	1535	124	1300	1900	NU1064-M6	MA6
580	92	1637	2458	191	890	1600	NU264-E-M6	MA6	
	580	92	1637	2458	191	890	1600	NJ264-E-M6	MA6



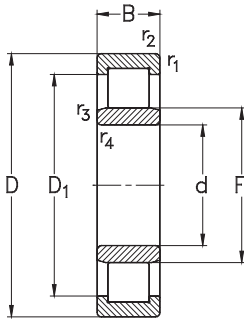
Anschlussmaße siehe Seite 547

Abutment and fillet dimensions
see on page 547

NJ ...+ HJ ...

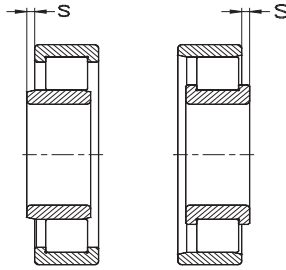
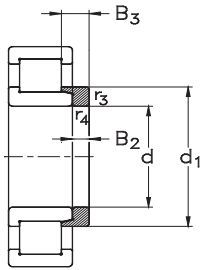
Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
280	333	--	433	5	5	10,5	--	--	--	117	--
	362	--	488	6	6	12	--	--	--	147	--
300	340	356	403,6	4	4	7,3	HJ1060	19	36	46,3	5,3
	364	--	464	5	5	7,2	--	--	--	89,9	--
	364	387	464	5	5	7,2	HJ260	22	34,5	89,9	8,4
	359	--	472	5	5	12	--	--	--	148	--
320	360	376	423,1	4	4	7,3	HJ1064	19	36	48,7	5,7
	390	--	485,3	5	5	8,3	--	--	--	113	--
	390	415	485,3	5	5	8,3	HJ264	17	37	113	10,5

Einreihige Zylinderrollenlager
Single Row Cylindrical Roller Bearings



NU...

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertypen	Alternative Käfige
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation	Alternative cages
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G		
340	520	82	1127	1841	145	1200	1700	NU1068-M6	MA6
360	540	82	1154	1924	149	1100	1600	NU1072-M6	MA6
380	560	82	1180	2008	154	1050	1200	NU1076-M6	MA6
400	600	90	1412	2396	180	970	1500	NU1080-M6	MA6
420	620	90	1443	2498	186	920	1400	NU1084-M6	MA6
440	650	94	1553	2712	199	860	1300	NU1088-M6	MA6
480	650	78	1169	2316	168	900	1100	NU1996-M6	MA6
	700	100	1752	3163	227	780	1200	NU1096-M6	MA6
500	670	78	1139	2261	162	850	1000	NU19/500-MA6	--
	720	100	1787	3283	233	740	1100	NU10/500-M6	MA6
560	750	85	1460	3000	200	750	900	NU19/560-MA6	--
	820	115	2688	5117	350	590	1000	NU10/560-M6	MA6
600	870	118	2864	5439	365	550	900	NU10/600-M6	MA6
630	850	100	1900	3900	280	670	800	NU19/630-MA6	--
710	950	106	3079	6464	418	600	700	NU19/710-MA6	--
	1030	140	4059	8021	511	430	800	NU10/710-M6	MA6



Anschlussmaße siehe Seite 547

Abutment and fillet dimensions
see on page 547

NJ ...+ HJ ...

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Winkelring <i>Thrust collar</i>			Gewicht [kg] <i>Weight [kg]</i>	
d	E,F	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	Bezeichnung <i>Designation</i>	B ₂	B ₃	Lager <i>Bearing</i>	Winkelring <i>Thrust collar</i>
340	385	--	456	5	5	12,5	HJ1068	21	39,5	65	7,1
360	405	--	476,4	5	5	11	HJ1072	21	39,5	68,2	7,6
380	425	--	496,7	5	5	9	--	--	--	71,2	--
400	450	--	529,5	5	5	13,5	--	--	--	92,5	--
420	470	--	549,5	5	5	13,5	--	--	--	96,2	--
440	493	--	575,7	6	6	9,8	--	--	--	110	--
480	525	--	587	5	5	6,8	--	--	--	77,5	--
	536	--	622	6	6	7,1	--	--	--	128	--
500	545	--	606,8	5	5	6,8	--	--	--	80,4	--
	556	--	641,7	6	6	10,5	--	--	--	139	--
560	610	--	679,8	5	5	7,5	--	--	--	110	--
	626	--	728	6	6	7,7	--	--	--	215	--
600	668	--	779	6	6	13,9	--	--	--	240	--
630	688	--	768,5	6	6	8,5	--	--	--	169	--
710	774	--	860,6	6	6	9,3	--	--	--	219	--
	790	--	918	7,5	7,5	12,5	--	--	--	400	--

Vollrollige Zylinderrollenlager

Normen, Hauptabmessungen

Maßpläne DIN 616

Allgemeines:

Vollrollige Zylinderrollenlager haben keinen Käfig, um im vorhandenen Querschnitt möglichst viele Rollen unterzubringen. Daher weisen sie die größtmögliche radiale Tragfähigkeit auf.

Aufgrund der gegenseitigen Berührung der Rollen erzeugen vollrollige Zylinderrollenlager jedoch höhere Reibung und weisen dadurch eine niedrigere Richtdrehzahl auf als vergleichbare Zylinderrollenlager mit Käfig.

Vollrollige Zylinderrollenlager sind in der Regel nicht zerlegbar.

Die einzige Ausnahme stellen einreihige vollrollige Zylinderrollenlager der **Reihe NJ..-VH** dar, bei denen zur Vereinfachung des Einbaus der Innenring aus dem Lager genommen werden kann.

Bauformen vollrolliger Zylinderrollenlager

Vollrollige NKE Zylinderrollenlager werden in ein- und zweireihiger Ausführung gefertigt. Zweireihige Lager der Reihe **NNF 50..-2LS-V** werden standardmäßig in abgedichteter Ausführung geliefert.

Neben dem im folgenden vorgestellten NKE Standard-Lieferprogramm fertigen wir vollrollige Zylinderrollenlager auch nach Kundenspezifikationen sowie Zeichnungslager.

Full Complement Cylindrical Roller Bearings

Standards, Boundary Dimensions

Standard plans DIN 616

General:

Full complement cylindrical roller bearings are designed, without cages, to accommodate the maximum number of cylindrical rollers in the space available. Thus this type of bearing features the maximum load ratings of all rolling element bearings.

However, this kind of bearing features a much higher internal friction, due to the rollers contacting each other during operation, resulting in lowered speed ability when compared to cylindrical roller bearings with cages fitted.

Full complement cylindrical roller bearings are normally non-separable bearings.

The only exception are single row full complement cylindrical roller bearings of the **series NJ..-VH**, that have separable inner rings for easier mounting.

Design Variants of Full Complement Cylindrical Roller Bearings

Full complement NKE cylindrical roller bearings are produced in both single and double row designs. Double row bearings of the series **NNF 50..-2LS-V** are produced with two contact seals fitted as standard.

Additional to the standard product range of full complement cylindrical roller bearings, NKE also produces full complement bearings to individual customer specifications or special bearings on order request.

Einreihige Lager

Lagerreihe NJ23..-VH

Diese Lager entsprechen in ihren Hauptabmessungen den Zylinderrollenlagern mit Käfigen der Reihe **NJ23**, haben allerdings in der vollrolligen Ausführung einen anderen **Laufbahndurchmesser** (Durchmesser **F**).

Diese Lager haben zwei feste Borde am Außenring und einen festen Bord am Innenring und können einseitig auch kleinere Axialkräfte aufnehmen. Lager der Reihe **NJ23** haben einen selbsthaltenden Rollensatz, wodurch die Rollen auch bei herausgenommenem Innenring nicht aus dem Außenring fallen (Nachsetzzeichen VH).

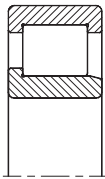
Single Row Bearings

Series NJ23..-VH

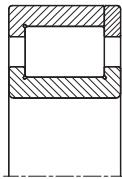
The main dimensions of these types of cylindrical roller bearings are identical to those with cage of the series **NJ23**.; except design where the inner ring **raceway diameter (F)** is different.

These bearings have two flanges in their outer ring and one on the inner ring. Thus they are able to accommodate minor thrust forces in one direction only.

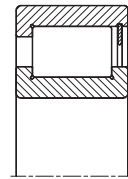
Bearings of the series **NJ23** feature self-retaining roller assemblies that enable the removal of inner rings without loss of roller retention in the outer ring (suffix VH).



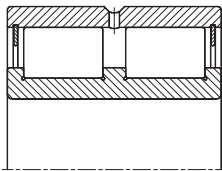
NJ23..-VH



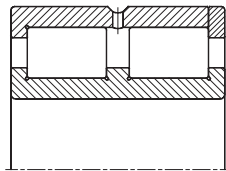
NC



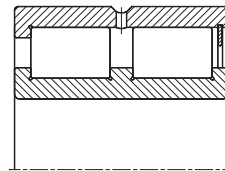
NCF



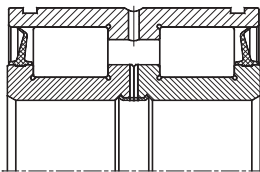
NNCL



NNC



NNCF



NNF50..-2LS-V

Lagerreihe NCF..

Diese Lager haben gleichfalls zwei feste Borde am Innenring, jedoch nur einen festen Bord am Außenring.

Auf der dem Bord gegenüberliegenden Seite des Außenringes haben Lager dieser Ausführung einen in einer Nut eingesetzten Sicherungsring, der ein Abgleiten des Außenringes verhindert.

Diese Lager können einseitig kleinere Axialkräfte aufnehmen. Durch die Verschiebemöglichkeit des Außenringes können diese Lager Längenänderungen bzw. Wärmedehnungen der Welle ausgleichen.

Zweireihige Lager

Zweireihige NKE Zylinderrollenlager in vollrolliger Ausführung haben zur Vereinfachung der Nachschmierung standardmäßig Schmiernuten und Schmierbohrungen an deren Außenringen.

Lagerreihe NNCL..

Zweireihige Lager der Ausführung **NNCL** haben einen Innenring mit drei festen Borden sowie einen bordlosen Außenring.

Der Außenring dieser Lager hat an jeder Seite einen in einer Nut eingesetzten Sicherungsring, die den Außenring während Transport und Montage fixiert.

Series NCF..

These bearing types also feature two flanges on the inner ring but only one flange on the outer ring.

On the outer ring side opposite to the flange they feature a retaining ring sitting in a circumferential groove to prevent the outer ring from sliding away. This bearing type is able to accommodate minor axial forces in one direction only and allows a compensation for changes in length caused by thermal expansion of the shaft and the outer ring positional movement.

Double Row Bearings

To facilitate re-lubrication **NKE double row full complement cylindrical roller bearings** are produced with lubricating grooves and re-lubricating holes on their outer rings as standard.

Series NNCL..

NNCL-type double row cylindrical roller bearings have an inner ring with three flanges and a plain outer ring.

The outer ring features two retaining rings sitting in circumferential grooves on either side of the raceway diameter to retain the outer ring and bearing assembly.

Diese Lager können keine Axialkräfte aufnehmen.

Durch die Verschiebmöglichkeit des Außenringes können diese Lager Längenänderungen bzw. Wärmedehnungen der Welle ausgleichen und eignen sich somit als Loslager.

Lagerreihe NNC..

Zweireihige Lager der Ausführung NNC haben drei feste Borde am Innenring und einen Außenring, der auf einer Seite einen festen Bord sowie eine Bordscheibe an der anderen Seite aufweist. Diese Lager können Axialkräfte dadurch auch beidseitig aufnehmen. Sie eignen sich somit als Festlager.

Lagerreihe NNCF..

Diese Lager haben gleichfalls drei feste Borde am Innenring, jedoch nur einen festen Bord am Außenring.

Auf der dem Bord gegenüberliegenden Seite des Außenringes haben Lager dieser Ausführung einen in einer Nut eingesetzten Sicherungsring, der ein Abgleiten des Außenringes verhindert.

Diese Lager können einseitig kleinere Axialkräfte aufnehmen. Durch die Verschiebmöglichkeit des Außenringes können diese Lager Längenänderungen bzw. Wärmedehnungen der Welle ausgleichen.

Lagerreihe NNF50..-2LS-V

Lager der Reihe **NNF50..-2LS-V** haben einen geteilten Innenring mit jeweils zwei festen Borden sowie einen mit einem Mittelbord versehenen Außenring.

Die Innenringhälften werden zur Vereinfachung der Montage durch einen Ring zusammengehalten.

Die Lager sind standardmäßig mit schleifenden Dichtungen versehen.

NNCL-type bearings are unable to accommodate any axial forces.

These bearings allow a compensation for changes in length caused by thermal expansion of the shaft due to the outer ring's positional movement. This makes them optimum non-locating bearings.

Series NNC..

NNC-type double row cylindrical roller bearings have three flanges on their inner ring and an outer ring with a flange on one side and a loose rib on the opposite side.

This allows them to accommodate minor axial forces in both directions. Thus they may be used as locating bearings.

Series NNCF..

These bearing types also feature three flanges on the inner ring but only one flange on the outer ring.

On the outer ring side opposite to the flange they feature a retaining ring sitting in a circumferential groove to fix the outer.

This bearing type is able to accommodate minor axial forces in one direction only and allows a compensation of length changes caused by thermal expansion of the shaft and the outer ring's positional movement.

Series NNF50..-2LS-V

Bearings of the **series NNF50..-2LS-V** feature an outer ring with a centre flange and two semi-inner rings with two flanges on each half. The semi-inner rings are clamped together by a retaining ring which also retains the outer ring and bearing assembly for ease of mounting.

Each bearing is equipped with two contact rubbing seals fitted as standard.

Diese Lager eignen sich gut zur Aufnahme von in beiden Richtungen wirkenden Axialkräften und Kippmomenten.

Die Lager der Reihe **NNF50..-2LS-V** werden schwerpunktmäßig zur Lagerung von Laufrädern und Seilscheiben verwendet. Daher ist der Außenring um **1 mm schmaler** als der Innenring ausgeführt, wodurch auf zusätzliche Abstandsringe oder Distanzhülsen bei der aneinander gereihten Montage verzichtet werden kann. Zwei Sprengringnuten am Außenring-Manteldurchmesser des Lagers ermöglichen weiters eine einfache und kostengünstige Konstruktion von Seilscheibenlagerungen.

Da die Lager dieser Bauform abgedichtet geliefert werden, werden sie bereits werksseitig mit einem speziellen Tieftemperaturfett befüllt. Lager der Reihe **NNF50..-2LS-V** sollten, speziell bei höheren Drehzahlen oder Einfluss von Salzwasser, hoher Luftfeuchtigkeit usw. häufig nachgeschmiert werden.

Dazu weisen die Lager zusätzlich zu den schon beschriebenen Schmierbohrungen im Außenring auch Schmierbohrungen am Innenring auf.

Schiefstellung

Bei den **einreihigen vollrolligen Zylinderrollenlager** sollte die Verkippung zwischen Innen- und Außenring einen Wert von **2 Winkelminuten** nicht übersteigen.

Zweireihige vollrollige Zylinderrollenlager können keine Schiefstellungen ausgleichen.

Toleranzen

Vollrollige NKE Zylinderrollenlager werden standardmäßig mit Normaltoleranzen (Toleranzklasse **PN**) hergestellt.

These bearings are well suited for supporting axial forces acting in both directions and accommodating some tilting moments.

Bearings of the series **NNF50..-2LS-V** are preferably used as rope pulley bearings. Therefore these bearings have an outer ring width that is **1 mm less** than the width of their inner rings. This feature ensures that additional sleeves or distance pieces are not required for tandem mounting arrangements. Additionally, the two retaining rings grooves in the outer ring provide a method for simple and cost effective bearing arrangement design and mounting of rope pulleys.

As these bearings are fitted with two contact rubbing seals they are grease filled at the factory with an suitable low temperature bearing grease.

Bearings of the series **NNF50..-2LS-V** which run at high speeds or under harsh operating conditions (e.g. salt water, high humidity and other contaminants) require more frequent lubrication. To enable alternative lubrication and maintenance methods, the half inner rings have lubrication grooves in their faces forming lubrication holes, additional, to the outer ring lubrication holes.

Misalignment

For **single row full complement cylindrical roller bearings** a misalignment between inner and outer ring must not exceed **2 angular minutes** maximum.

Double row full complement cylindrical roller bearings, however, are not able to compensate misalignments.

Tolerances

Full complement cylindrical roller bearings are produced to normal tolerance class (**PN**) as standard.

Eine Ausnahme hiervon bilden die Lager der Baureihe **NNC**, bei denen die Toleranz der Außenringbreite (ΔC_s) einheitlich das Doppelte der Normaltoleranz beträgt, wobei die Werte symmetrisch zum Nominalwert liegen (\pm). Darüber hinaus beträgt die Schwankung der Außenringbreite (V_{cs}) das Dreifache der Normaltoleranz.

Auf Anfrage können vollrollige NKE Zylinderrollenlager auch mit anderen Toleranzen gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „Lagerdaten / Toleranzen“, ab Seite 52.

Lagerluft

Vollrollige NKE Zylinderrollenlager werden standardmäßig in **Normalluft** (Luftgruppe **CN**) geliefert.

Auf Anfrage können alle Lager auch mit anderen Luftwerten gefertigt werden.

Lufttabellen siehe Seite 540.

Die darin enthaltenen Werte entsprechen, sofern diese genormt sind, den Festlegungen in DIN 620/ Teil 4 bzw. ISO 5753-1991.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für vollrollige NKE Zylinderrollenlager muss die Mindestradialbelastung 4% der dynamischen Tragzahl betragen.

Except for bearings of series **NNC** which have a tolerance for outer ring width (ΔC_s) of double the normal tolerance, also the tolerance field lies symmetric to the nominal (\pm).

Additionally, the value for the variation of outer ring width (V_{cs}) is three times the normal tolerance value.

On request NKE full complement cylindrical roller bearings are produced to other tolerance classes.

Detailed tolerance values are listed in the chapter “**Bearing Data / Tolerances**” on page 237.

Internal Clearance

NKE full complement cylindrical roller bearings are produced to the **normal internal clearance** group **CN**, as standard.

On request all NKE bearings are also available with different internal clearances.

Values of **internal clearance groups** of **NKE cylindrical roller bearings** are listed in the tables on page 540.

These values conform, as far as they are standardised, and conform to DIN 620/part 4 and ISO 5753-1991, respectively.

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE full complement cylindrical roller bearings the minimum radial load must be 4% of the dynamic load.

Äquivalente dynamische Lagerbelastung

Für vollrollige Zylinderrollenlager die als reine Loslager eingesetzt werden, also keine Axialkräfte aufnehmen, gilt:

$$P = F_r$$

Für axial belastete ein- und zweireihige vollrollige Zylinderrollenlager mit Borden an Innen- und Außenringen gilt bei:

wenn

$$\frac{F_a}{F_r} \leq e \text{ gilt } P = F_r$$

bzw. , bei

$$\frac{F_a}{F_r} > e \text{ gilt } P = X * F_r + Y * F_a$$

Da auf das Lager wirkende Axiallasten Kippmomente an den Rollen erzeugen, darf die auf das Lager wirkende Axialkraftkomponente ein bestimmtes Verhältnis zur radialen Lagerbelastung nicht übersteigen.

Equivalent Dynamic Bearing Load

Where full complement cylindrical roller bearings are being used as non-locating bearings only, (e.g. without any thrust loads applied), the following applies:

$$P = F_r$$

For axially loaded single and double row cylindrical roller bearings with flanges on inner or their outer rings, the following formula must be applied:

Where

$$\frac{F_a}{F_r} \leq e \text{ , then } P = F_r$$

or, when

$$\frac{F_a}{F_r} > e \text{ , then } P = X * F_r + Y * F_a$$

Since axial forces applied to cylindrical roller bearings create a tilting moment acting on the rollers, the magnitude of acting axial forces must not exceed a certain ratio to the applied radial forces.

Lagerreihe <i>Bearing series</i>	Berechnungsfaktoren <i>Calculation factors</i>		
	e	X	Y
Einreihige vollrollige Zylinderrollenlager, Reihe 18.. <i>Single row full complement cylindrical roller bearings, series 18..</i>	0,2	0,92	0,6
Einreihige vollrollige Zylinderrollenlager, allgemein <i>Single row full complement cylindrical roller bearings, other series</i>	0,3	0,92	0,4
Zweireihige vollrollige Zylinderrollenlager <i>Double row full complement cylindrical roller bearings</i>	0,15	0,92	0,53

Bei einreihigen vollrolligen Zylinderrollenlagern gilt:

$$F_{\text{amax}} \leq 0,5 * F_r$$

bzw. bei zweireihigen vollrolligen Zylinderrollenlagern gilt:

$$F_{\text{amax}} \leq 0,2 * F_r$$

Äquivalente statische Lagerbelastung

Für ein- und zweireihige vollrollige Zylinderrollenlager gilt:

$$P_0 = F_r$$

Anschlussmaße zweireihiger Zylinderrollenlager

Die Radien der Kantenverrundung der Lagerringe dürfen nicht an Hohlkehlen von Wellenbund oder Gehäuse anliegen. Daher muss der größte Hohlkehlradius an den Anschlussstellen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe. (siehe Tabelle auf der Folgeseite).

Empfehlungen für Einbaumaße sind auch in **DIN 5418** definiert.

For single row full complement cylindrical roller bearings:

$$F_{\text{amax}} \leq 0,5 * F_r$$

or, in the case of double row full complement cylindrical roller bearings:

$$F_{\text{amax}} \leq 0,2 * F_r$$

Equivalent static bearing load

For single and double row full complement cylindrical roller bearings:

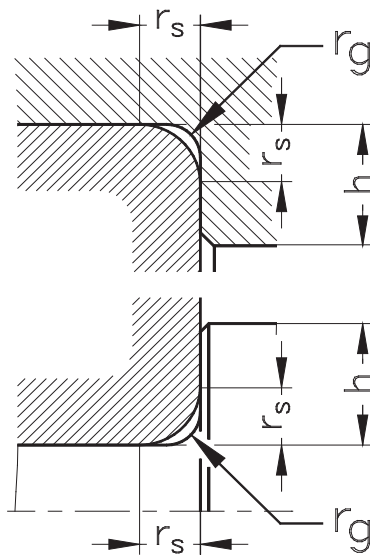
$$P_0 = F_r$$

Abutment and Fillet Dimensions for Full Complement Cylindrical Roller Bearings

The bearing rings must contact adjacent parts with their side faces only. The radii of bearing corners must not touch the shoulder fillet radii of neither the shaft nor the housing shoulders. Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the bearing tables, see following page.

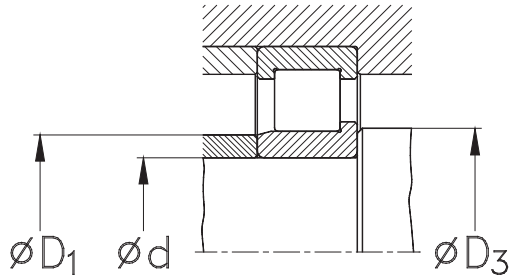
Recommendations for the dimensions of adjacent parts are given by **DIN 5418**.

Anschlussmaße einreihiger vollrolliger Zylinderrollenlager [mm]
Abutment and Fillet Dimensions for Single Row Cylindrical Roller Bearings [mm]



$r_{s \text{ min}}$	$r_{g \text{ max}}$	h_{min} Lagerreihen Bearing series 18, 29, 30 48, 49, 50
0,3	0,3	1
0,6	0,6	1,6
1	1	2,3
1,1	1	3
1,5	1,5	3,5
2	2	4,4
2,1	2,1	2,1
3	2,5	6,2
4	3	7,3
5	4	9

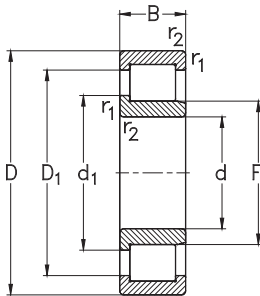
Anschlussmaße einreihiger vollrolliger Zylinderrollenlager, Reihe NJ 23..VH [mm]
Abutment and Fillet Dimensions for Single Row Cylindrical Roller Bearings, Series NJ 23..VH [mm]



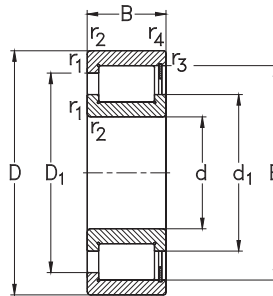
NJ23..-VH

Lagertype Bearing type	$\varnothing d$ [mm]	D_1 max	D_3 min
NJ 2305 VH	25	30	31,5
NJ 2306 VH	30	36	36,5
NJ 2307 VH	35	42	43
NJ 2308 VH	40	49	48
NJ 2309 VH	45	54	53
NJ 2310 VH	50	58	59
NJ 2311 VH	55	64	64
NJ 2313 VH	65	78	76
NJ 2314 VH	70	81	81
NJ 2315 VH	75	88	86
NJ 2316 VH	80	95	91
NJ 2317 VH	85	104	98
NJ 2318 VH	90	105	103
NJ 2319 VH	95	111	109
NJ 2320 VH	100	119	113
NJ 2322 VH	110	130	123
NJ 2324 VH	120	142	133
NJ 2326 VH	130	153	146
NJ 2328 VH	140	163	156
NJ 2330 VH	150	178	166
NJ 2334 VH	170	200	186
NJ 2336 VH	180	216	196
NJ 2340 VH	200	232	220

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

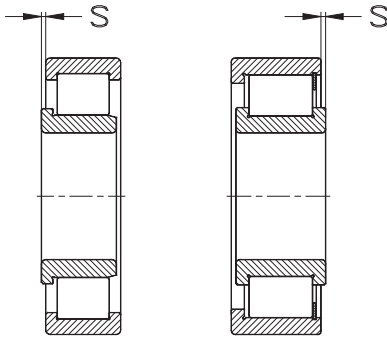


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
20	37	11	15,3	16,8	2	7400	10500	NCF2904-V
	42	16	27,1	27,4	3,3	7400	10000	NCF3004-V
	47	18	39,9	38,5	4,7	6400	10000	NCF2204-V
25	42	11	17,1	20,4	2,5	6100	10000	NCF2905-V
	47	16	30,8	33,8	4,1	6100	9000	NCF3005-V
	52	18	44,9	46,3	5,6	5400	9000	NCF2205-V
	62	24	69,3	68	8,3	4500	5600	NJ2305-VH
30	47	11	18,7	24	2,9	5200	7500	NCF2906-V
	55	19	39,8	44,3	5,4	5500	7500	NCF3006-V
	62	20	60	66	8	4500	6500	NCF2206-V
	72	27	85,7	88	10,8	4000	4800	NJ2306-VH
35	55	13	29,5	38,7	4,7	4500	7000	NCF2907-V
	62	20	48,2	56	6,8	4800	6700	NCF3007-V
	72	23	75	80	9,7	4200	6000	NCF2207-V
	80	31	109	114	13,9	3700	4300	NJ2307-VH
40	62	14	33,4	44,3	5,4	4100	6500	NCF2908-V
	68	21	58	70	8,5	4300	6000	NCF3008-V
	80	23	83	93	11,4	3600	5500	NCF2208-V
	90	33	147	158	19,3	3200	3600	NJ2308-VH
45	68	14	35,5	49	6	3600	5500	NCF2909-V
	75	23	61	77	9,4	4000	5300	NCF3009-V
	85	23	86,6	100	12,2	3300	5000	NCF2209-V

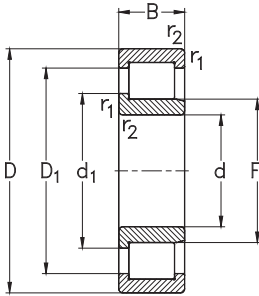


Anschlussmaße siehe Seite 606

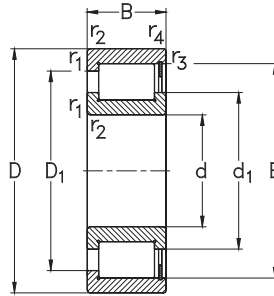
*Abutment and fillet dimensions
see on page 606*

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
20	32,3	--	26,3	30,3	0,3	0,3	0,5	0,05	NCF2904-V
	36,81	--	27,5	34,5	0,6	0,3	1,5	0,11	NCF3004-V
	41,47	--	30,3	36,9	1	1	1	0,16	NCF2204-V
25	37,4	--	31,4	35,4	0,3	0,3	0,5	0,06	NCF2905-V
	42,7	--	34	39	0,6	0,3	1,5	0,12	NCF3005-V
	46,52	--	34,7	42,3	1	1	1	0,18	NCF2205-V
	--	31,71	36,3	49	1	--	1,7	0,4	NJ2305-VH
30	42,5	--	36,5	40,5	0,3	0,3	0,5	0,07	NCF2906-V
	49,6	--	38,4	46,8	1	0,3	2	0,2	NCF3006-V
	55,19	--	42	50,6	1	1,1	1	0,3	NCF2206-V
	--	38,34	43,3	56,5	1	--	1,8	0,56	NJ2306-VH
35	49,9	--	42,4	47,4	0,6	0,3	0,5	0,12	NCF2907-V
	55,52	--	43,6	52,6	1	0,3	2	0,26	NCF3007-V
	63,97	--	47	59,3	1,1	1,1	1	0,44	NCF2207-V
	--	44,74	50,3	65,8	1,5	--	2	0,73	NJ2307-VH
40	56,6	--	48,3	53,9	0,6	0,3	0,5	0,15	NCF2908-V
	61,74	--	49	58,6	1	0,3	2	0,31	NCF3008-V
	70,94	--	54	66,3	1,1	1,1	1	0,55	NCF2208-V
	--	51,1	57,5	76	1,5	--	2,4	1	NJ2308-VH
45	61,9	--	53,6	59,2	0,6	0,3	0,5	0,18	NCF2909-V
	66,85	--	55	65	1	0,3	2	0,4	NCF3009-V
	74,43	--	57,5	69,8	1,1	1,1	1	0,59	NCF2209-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

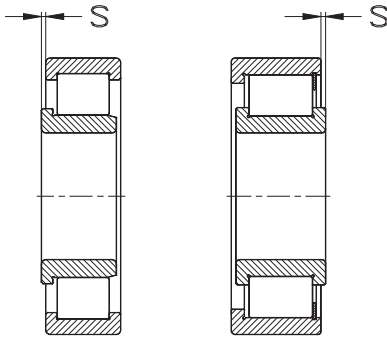


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
45	100	36	172	197	24	2900	3400	NJ2309-VH
50	72	14	37,4	55	6,6	3300	5000	NCF2910-V
	80	23	76	96	11,7	3500	5000	NCF3010-V
	90	23	93	113	13,8	3000	4500	NCF2210-V
55	110	40	199	219	26,6	2600	3000	NJ2310-VH
	80	16	50	76	9,3	3000	4500	NCF2911-V
	90	26	103	139	16,9	3100	4300	NCF3011-V
	100	25	119	150	18,3	2700	3500	NCF2211-V
60	120	43	259	258	31,5	2200	2800	NJ2311-VH
	85	16	54	83	10,1	2800	4500	NCF2912-V
	95	26	106	146	17,8	2900	4000	NCF3012-V
	110	28	147	183	22,3	2500	3000	NCF2212-V
65	130	46	262	304	37,1	2100	2500	NJ2312-VH
	90	16	56	88	10,7	2600	4000	NCF2913-V
	100	26	111,4	160	19,5	2800	3800	NCF3013-V
	120	31	171	217	26,4	2400	2800	NCF2213-V
70	140	48	303	355	42,8	1900	2400	NJ2313-VH
	100	19	77	116	14,2	2500	3800	NCF2914-V
	110	30	131	177	21,6	2700	3600	NCF3014-V
	125	31	178	230	28,1	2300	2600	NCF2214-V
75	150	51	333	394	46,9	2100	2200	NJ2314-VH
	105	19	79	124	15,1	2300	3600	NCF2915-V

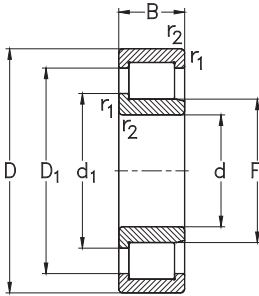


Anschlussmaße siehe Seite 606

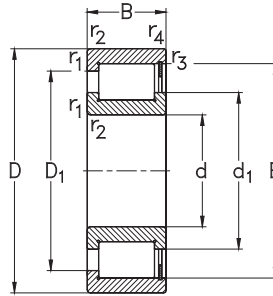
*Abutment and fillet dimensions
see on page 606*

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
45	--	56,13	62,5	81,8	1,5	--	2,4	1,35	NJ2309-VH
50	67,1	--	58,7	64,4	0,6	0,3	0,5	0,18	NCF2910-V
	72,33	--	58	68,8	1	0,3	2	0,43	NCF3010-V
	81,4	--	64,4	76,7	1,1	1,1	1	0,64	NCF2210-V
55	--	60,7	68,3	90,3	2	--	2,6	1,85	NJ2310-VH
	73,2	--	64,2	70,2	1	0,6	0,5	0,27	NCF2911-V
	83,54	--	67,5	79,5	1,1	0,6	2	0,64	NCF3011-V
	88,81	--	70	84,1	1,5	1,5	1,5	0,87	NCF2211-V
60	--	67,1	75,5	98,6	2	--	2,6	2,3	NJ2311-VH
	79,3	--	69,5	76,1	1	0,6	0,5	0,28	NCF2912-V
	86,74	--	70,9	82,9	1,1	0,6	2	0,69	NCF3012-V
	99,17	--	76,8	93,9	1,5	1,5	1,5	1,18	NCF2212-V
65	--	73,68	82,1	106	2,1	--	3	2,83	NJ2312-VH
	83,5	--	73,7	80,3	1	0,6	0,5	0,3	NCF2913-V
	93,1	--	77,1	87,1	1,1	0,6	2	0,72	NCF3013-V
	106,25	--	82,3	100,7	1,5	1,5	1,5	1,57	NCF2213-V
70	--	80,71	89,4	117	2,1	--	3	3,48	NJ2313-VH
	92,5	--	80,5	88,5	1	0,6	0,75	0,48	NCF2914-V
	100,28	--	82,6	97,2	1,1	0,6	3	1,02	NCF3014-V
	111,01	--	87	105,2	1,5	1,5	1,5	1,66	NCF2214-V
75	--	84,22	93,8	121	2,1	--	3	4,4	NJ 2314 VH
	97,6	--	85,6	93,6	1	0,6	0,75	0,5	NCF2915-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

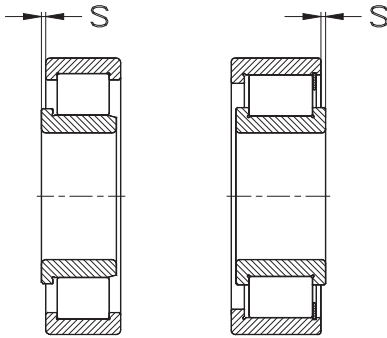


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
75	115	30	139	195	23,8	2500	3200	NCF3015-V
	130	31	184	244	29,7	2100	2500	NCF2215-V
	160	55	395	476	55,4	1600	2000	NJ2315-VH
80	110	19	82	132	16,1	2200	3400	NCF2916-V
	125	34	168	229	27,6	2500	3000	NCF3016-V
	140	33	216	283	33,6	2000	2400	NCF2216-V
	170	58	458	560	63,7	1500	1900	NJ2316-VH
85	120	22	103	168	20,2	2100	3200	NCF2917-V
	130	34	172	240	28,6	2300	3000	NCF3017-V
	150	36	246	326	38,1	1900	2200	NCF2217-V
	180	60	485	611	68	1400	1800	NJ2317-VH
90	125	22	104	173	20,6	2000	3000	NCF2918-V
	140	37	209	285	33,3	2200	2800	NCF3018-V
	160	40	277	372	42,8	1900	2000	NCF2218-V
	190	64	549	680	75	1400	1800	NJ2318-VH
95	130	22	108	183	21,5	1900	2900	NCF2919-V
	145	37	230	360	34,5	2100	2700	NCF3019-V
100	140	24	131	222	25,7	1800	2600	NCF2920-V
	150	37	212	312	35,6	2000	2600	NCF3020-V
	180	46	379	526	58	1700	1900	NCF2220-V
	215	73	694	877	93	1200	1500	NJ2320-VH
110	150	24	139	248	28	1600	2400	NCF2922-V

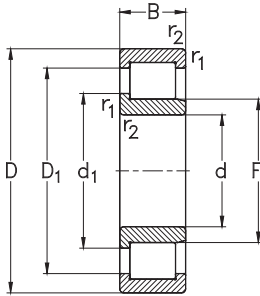


Anschlussmaße siehe Seite 606

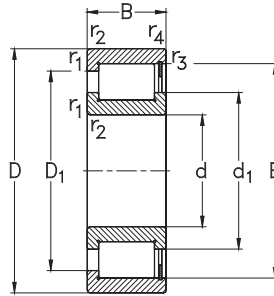
*Abutment and fillet dimensions
see on page 606*

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
75	107,9	--	87	102	1,1	0,6	3	1,06	NCF3015-V
	115,78	--	91,8	110	1,5	1,5	1,5	1,75	NCF2215-V
	--	91,25	100,8	132,5	2,1	--	3	5,18	NJ2315-VH
80	102,7	--	90,7	98,7	1	0,6	0,75	0,53	NCF2916-V
	116,99	--	94,8	112	1,1	0,6	4	1,43	NCF3016-V
	125,81	--	98,6	119,3	2	2	1,5	2,15	NCF2216-V
	--	98,3	109	141	2,1	--	4	6,4	NJ2316-VH
85	112,6	--	99,1	109	1,1	1	0,75	0,78	NCF2917-V
	121,44	--	99,2	116	1,1	0,6	4	1,51	NCF3017-V
	133,21	--	104,4	126,3	2	2	1,5	2,74	NCF2217-V
	--	107,02	117,4	151,5	3	--	4	7,3	NJ2317-VH
90	115,6	--	102	111	1,1	1	0,75	0,82	NCF2918-V
	130,11	--	106,2	125	1,5	1	4	1,97	NCF3018-V
	140,61	--	110,2	133,3	2	2	2,5	3,48	NCF2218-V
	--	108,8	121	156	3	--	4	8,75	NJ2318-VH
95	120,4	--	107	117	1,1	1	0,75	0,86	NCF2919-V
	135,1	--	111	129	1,5	1	4,5	2,15	NCF3019-V
100	129	--	114	124	1,1	1	0,75	1,15	NCF2920-V
	139,65	--	116	134	1,5	1	4	2,15	NCF3020-V
	162,81	--	127,5	154,3	2,1	2,1	2,5	5,13	NCF2220-V
	--	122,8	136	176	3	--	4,5	13	NJ2320-VH
110	141,3	--	126	137	1,1	1	0,75	1,25	NCF2922-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

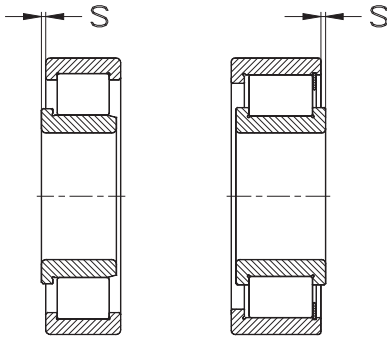


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
110	170	45	278	403	44,5	1900	2200	NCF3022-V
	200	53	439	597	64	1700	1800	NCF2222-V
	240	80	843	1035	106	1100	1300	NJ2322-VH
120	165	27	175	302	33,1	1500	2200	NCF2924-V
	180	46	293	442	48	1800	2000	NCF3024-V
	215	58	517	737	77	1500	1700	NCF2224-V
	260	86	946	1219	123	1000	1200	NJ2324-VH
130	180	30	207	362	38,7	1500	2000	NCF2926-V
	200	52	416	619	66	1600	1900	NCF3026-V
	230	64	600	868	89	1300	1600	NCF2226-V
	280	93	1071	1392	137	950	1200	NJ2326-VH
140	190	30	224	390	41	1400	1900	NCF2928-V
	210	53	439	682	70	1500	1800	NCF3028-V
	250	68	694	1019	102	1200	1500	NCF2228-V
	300	102	1230	1623	157	850	1100	NJ 2328 VH
150	190	20	117	217	22,5	1300	2400	NCF1830-V
	210	36	291	509	52	1300	1700	NCF2930-V
	225	56	461	713	73	1400	1600	NCF3030-V
	270	73	794	1182	116	1100	1400	NCF2230-V
	320	108	1428	1908	180	800	1000	NJ2330-VH
160	200	20	120	230	23,5	1200	2200	NCF1832-V
	220	36	301	541	54	1200	1600	NCF2932-V

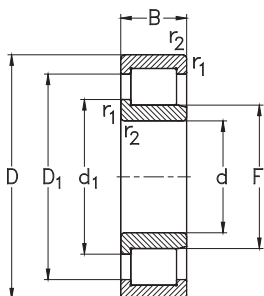


Anschlussmaße siehe Seite 606

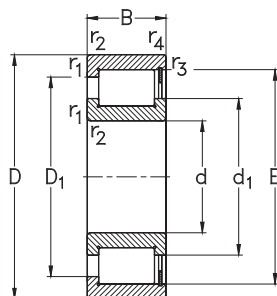
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm]						s ≈	Gewicht [kg] Weight [kg] m	Lagertypen [kg] Designation
	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min			
110	156,13	--	129	150	2	1	5,5	3,5	NCF3022-V
	177	--	137	168	2,1	2,1	4	7,24	NCF2222-V
	--	134,3	151	198	3	--	5	17,8	NJ2322-VH
120	154,3	--	136	149	1,1	1	0,75	1,7	NCF2924-V
	167,58	--	139	160,5	2	1	5,5	3,8	NCF3024-V
	192,32	--	151	182	2,1	2,1	4	9,1	NCF2224-V
	--	147,4	164	211	3	--	5,5	22,3	NJ2324-VH
130	167,1	--	147	161	1,5	1,1	0,75	2,3	NCF2926-V
	183,81	--	148,6	175	2	1	5,5	5,8	NCF3026-V
	207,12	--	162,3	197	3	3	5	11,25	NCF2226-V
	--	157,95	174,1	229,6	4	--	6	28	NJ 2326 VH
140	180	--	159	173	1,5	1,1	0,75	2,4	NCF2928-V
	197,82	--	162,7	189,1	2	1	3,5	6,1	NCF3028-V
	221,92	--	173,9	211,1	3	3	5,5	14,47	NCF2228-V
	--	168,5	184,7	240,5	4	--	6,5	35,5	NJ2328-VH
150	179,5	--	163	176	1,1	1	1,5	1,3	NCF1830-V
	195,5	--	171	188	2	1,1	0,8	3,85	NCF2930-V
	206,8	--	170	197	2,1	1,1	3,7	7,5	NCF3030-V
	236,71	--	185,5	225,2	3	3	6	18,43	NCF2230-V
	--	182,5	203	261	4	--	6,5	42,5	NJ2330-VH
160	189	--	173	185	1,1	1,1	1,5	1,45	NCF1832-V
	205,7	--	181	198	2	1,1	0,8	4,05	NCF2932-V

Vollrollige Zylinderrollenlager, einreihig
 Single Row Full Complement Cylindrical Roller Bearings

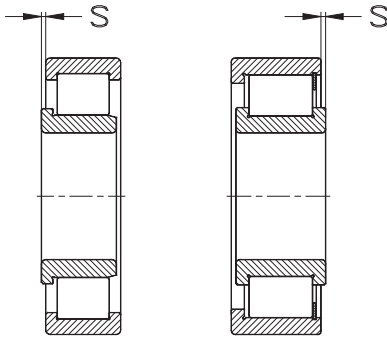


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
160	240	60	528	823	82	1300	1500	NCF3032-V
	290	80	978	1477	140	950	1200	NCF2232-V
	340	114	1630	2550	200	770	950	NJ2332-VH
170	215	22	148	269	27	1200	2000	NCF1834-V
	230	36	310	573	57	1200	1500	NCF2934-V
	260	67	678	1073	104	1100	1400	NCF3034-V
	310	86	1094	1672	156	880	1100	NCF2234-V
	360	120	1766	2406	220	710	900	NJ2334-VH
180	225	22	153	286	28,2	1100	1800	NCF1836-V
	250	42	394	704	68	1100	1400	NCF2936-V
	280	74	784	1260	120	1000	1300	NCF3036-V
	320	86	1119	1811	160	810	1000	NCF2236-V
	380	126	1869	2626	235	700	800	NJ2336-VH
190	240	24	174	326	32,6	1100	1600	NCF1838-V
	260	42	441	797	76	1000	1400	NCF2938-V
	290	75	805	1320	124	1000	1300	NCF3038-V
	340	92	1239	1888	171	780	1000	NCF2238-V
	400	132	2141	2980	263	610	800	NJ2338-VH
200	250	24	178	340	32,5	1000	1400	NCF1840-V
	280	48	530	963	90	930	1300	NCF2940-V
	310	82	921	1532	141	880	1200	NCF3040-V
	360	98	1339	2085	180	730	900	NCF2240-V

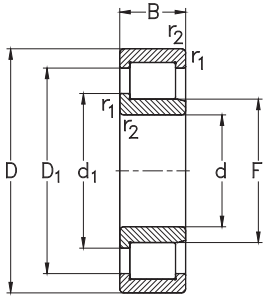


Anschlussmaße siehe Seite 606

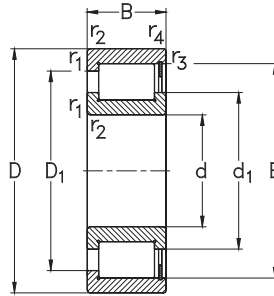
*Abutment and fillet dimensions
see on page 606*

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
160	225,1	--	184,8	214,8	2,1	1,1	4	9,1	NCF3032-V
	267,1	--	208,7	253,4	3	--	6	23	NCF2232-V
	--	196,55	216,7	286	4	--	7	48,8	NJ2332-VH
170	204,5	--	185	200	1,1	1,1	1,5	1,85	NCF1834-V
	216	--	192	208	2	1,1	0,8	4,25	NCF2934-V
	242,85	--	198	232	2,1	1,1	7	12,5	NCF3034-V
	281,09	--	220,3	267,4	4	4	7	28,65	NCF2234-V
	--	203,56	224,5	296,4	3	--	7	59,2	NJ2334-VH
180	215,2	--	196	211	1,1	1,1	1,5	1,95	NCF1836-V
	232	--	203	223	2	1,1	1	6,25	NCF2936-V
	260,22	--	212	249	2,1	2,1	7	16,5	NCF3036-V
	293,22	--	232,4	279,5	4	4	7	29,8	NCF2236-V
	--	221,74	242,6	314,6	3	--	9	69,6	NJ 2336 VH
190	229	--	208	224	1,5	1,1	1,8	2,45	NCF1838-V
	244	--	212	236	2	1,1	1	6,55	NCF2938-V
	269,96	--	222	258	2,1	2,1	9	17	NCF3038-V
	310,68	--	243,5	295,5	4	4	9	35,65	NCF2238-V
	--	224,6	247,6	327	4	--	7	80	NJ2338-VH
200	237,5	--	216	233	1,5	1,1	1,8	2,6	NCF1840-V
	262	--	227	253	2,1	1,5	2,5	9,15	NCF2940-V
	287,75	--	237	276	2,1	2,1	9	22,5	NCF3040-V
	318,6	--	246,6	302,4	4	--	9	43,12	NCF2240-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings

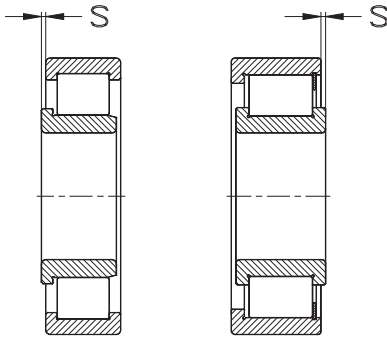


NJ23..-VH



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G	
200	420	138	2284	3157	274	80	750	NJ2340-VH
220	270	24	186	373	34,7	920	1200	NCF1844-V
	300	48	556	1056	97	830	1200	NCF2944-V
	340	90	1213	2059	185	730	1100	NCF3044-V
240	300	28	277	550	50	840	1100	NCF1848-V
	320	48	582	1149	103	740	1100	NCF2948-V
	360	92	1277	2256	198	610	1140	NCF3048-V
260	320	28	288	594	53	770	1000	NCF1852-V

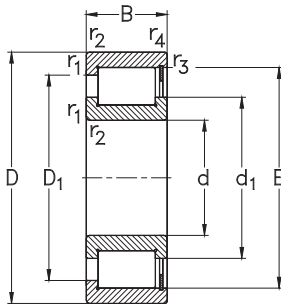


Anschlussmaße siehe Seite 606

*Abutment and fillet dimensions
see on page 606*

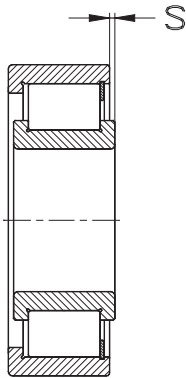
Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	F ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
200	--	238,65	263,2	347,5	5	--	9	91,6	NJ2340-VH
220	258	--	237	253	1,5	1,5	1,8	2,85	NCF1844-V
	283	--	248	274	2,1	1,5	2,5	9,9	NCF2944-V
	312,7	--	254,7	297,9	3	3	7	29,5	NCF3044-V
240	287	--	261	281	2	1,1	1,8	4,4	NCF1848-V
	303	--	268	296	2,1	1,5	2,5	11	NCF2948-V
	335,6	--	278	322	3	3	7	32	NCF3048-V
260	307,2	--	281	301	2	1,1	1,8	4,75	NCF1852-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	
260	360	60	760	1480	129	670	950	NCF2952-V
	400	104	1616	2857	243	570	900	NCF3052-V
280	350	33	348	715	62	720	900	NCF1856-V
	380	60	902	1751	149	590	900	NCF2956-V
	420	106	1697	3066	257	530	850	NCF3056-V
300	380	38	424	849	72	670	850	NCF1860-V
	420	72	1130	2232	186	530	800	NCF2960-V
	460	118	1940	3327	271	500	750	NCF3060-V
320	400	38	438	902	75	610	800	NCF1864-V
	440	72	1166	2372	194	490	750	NCF2964-V
	480	121	1990	3480	280	480	700	NCF3064-V
340	420	38	451	956	78	570	750	NCF1868-V
	460	72	1203	2512	202	450	700	NCF2968-V
	520	133	2394	4180	329	430	670	NCF3068-V
360	440	38	462	1009	81	530	700	NCF1872-V
	480	72	1237	2652	210	420	670	NCF2972-V
	540	134	2664	4975	387	400	630	NCF3072-V
380	480	46	646	1353	106	480	670	NCF1876-V
	520	82	1608	3357	261	370	630	NCF2976-V
	560	135	2728	5192	390	380	600	NCF3076-V
400	500	46	660	1408	110	460	630	NCF1880-V
	540	82	1659	3554	272	350	600	NCF2980-V

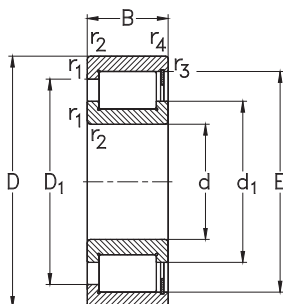


Anschlussmaße siehe Seite 606

*Abutment and fillet dimensions
see on page 606*

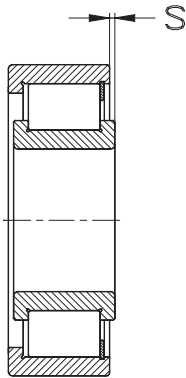
Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Gewicht [kg] <i>Weight [kg]</i>	Lagertyp <i>Designation</i>
d	E ≈	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	m	
260	333,7	294	321	2,1	1,5	4	18,5	NCF2952-V
	373,5	304,1	358,1	4	4	8	46,5	NCF3052-V
280	334	305	327	2	1,1	2,5	7,1	NCF1856-V
	362,7	319	346	2,1	1,5	4	20	NCF2956-V
	391,5	324	375	4	4	9	50	NCF3056-V
300	363	329	355	2,1	1,5	3	10	NCF1860-V
	390,5	342	375	3	3	5	31,5	NCF2960-V
	432	355	413	4	4	10	69	NCF3060-V
320	383	349	375	2,1	1,5	3	10,5	NCF1864-V
	411	363	395	3	3	5	33	NCF2964-V
	447,3	370	428	4	4	12	74,5	NCF3064-V
340	403	369	395	2,1	1,5	3	11	NCF1868-V
	431	383	415	3	3	5	35	NCF2968-V
	482	402	462	5	5	12	100	NCF3068-V
360	423,2	389	415	2,1	1,5	3	12	NCF1872-V
	451,5	403	436	3	3	5	36,5	NCF2972-V
	503,2	417	482	5	5	12	105	NCF3072-V
380	458	416	448	2,1	1,5	3,5	18,5	NCF1876-V
	488	427	473	4	4	5	52,5	NCF2976-V
	520,5	434	499	5	5	14	110	NCF3076-V
400	475	433	465	2,1	1,5	3,5	19,1	NCF1880-V
	511	450	496	4	4	5	54,5	NCF2980-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	
400	600	148	2973	5511	415	340	560	NCF3080-V
420	520	46	680	1491	114	430	600	NCF1884-V
	560	82	1683	3654	277	330	560	NCF2984-V
	620	150	3311	6399	476	320	530	NCF3084-V
440	540	46	692	1547	117	400	560	NCF1888-V
	540	60	1087	2761	209	380	560	NCF2888-V
	600	95	2030	4200	313	320	530	NCF2988-V
	650	157	3753	7381	541	290	500	NCF3088-V
460	580	56	937	2004	149	380	530	NCF1892-V
	580	72	1398	3352	249	350	530	NCF2892-V
	620	95	2064	4327	320	300	500	NCF2992-V
	680	163	4117	7978	578	280	480	NCF3092-V
480	600	56	958	2088	153	360	500	NCF1896-V
	600	72	1339	3211	236	320	500	NCF2896-V
	650	100	2316	4901	355	280	480	NCF2996-V
	700	165	4154	8437	585	270	450	NCF3096-V
500	620	56	978	2171	158	340	480	NCF18/500-V
	620	72	1367	3340	243	310	480	NCF28/500-V
	670	100	2348	5042	362	270	450	NCF29/500-V
	720	167	4313	8672	615	230	450	NCF30/500-V
530	650	56	1007	2297	164	310	450	NCF18/530-V
	650	72	1407	3533	253	290	450	NCF28/530-V

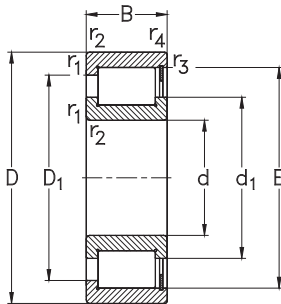


Anschlussmaße siehe Seite 606

*Abutment and fillet dimensions
see on page 606*

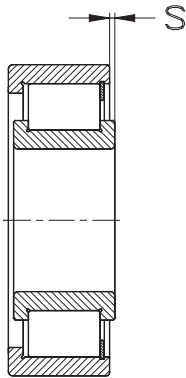
Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Gewicht [kg] <i>Weight [kg]</i>	Lagertyp <i>Designation</i>
d	E ≈	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	m	
400	559,1	460	540	5	5	14	145	NCF3080-V
420	499	457	489	2,1	1,5	3,5	20,2	NCF1884-V
	524	463	509	4	4	5	57	NCF2984-V
	578,2	480	559	5	5	14	150	NCF3084-V
440	516	474	506	2,1	1,5	3,5	22	NCF1888-V
	516	474	508	2,1	1,5	3,5	29	NCF2888-V
	565,5	502	545	4	4	6	80,5	NCF2988-V
	607,5	507	582	6	6	14	175	NCF3088-V
460	553	501	541	3	3	5	32,6	NCF1892-V
	553	501	543	3	3	5	44	NCF2892-V
	576,3	509	559	4	4	7	83,5	NCF2992-V
	635	522	611	6	6	14	195	NCF3092-V
480	573,5	522	561	3	3	5	35,5	NCF1896-V
	573,5	520	562	3	3	5	46	NCF2896-V
	600	538	584	5	5	7	98	NCF2996-V
	655,2	546	628	6	6	15	205	NCF3096-V
500	594	542	582	3	3	5	36,5	NCF18/500-V
	594	541	582	3	3	2,4	48	NCF28/500-V
	630,9	553	611	5	5	7	100	NCF29/500-V
	676,8	565	650	6	6	16	215	NCF30/500-V
530	624,5	573	612	3	3	5	38,5	NCF18/530-V
	624,5	572	614	3	3	5	49,5	NCF28/530-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	
530	710	106	2718	6040	425	230	430	NCF29/530-V
	780	185	5251	10581	734	200	400	NCF30/530-V
560	680	56	1030	2423	171	290	430	NCF18/560-V
	680	72	1439	3726	263	280	430	NCF28/560-V
	750	112	3054	6755	469	220	400	NCF29/560-V
600	820	195	5839	11892	812	190	380	NCF30/560-V
	730	60	1070	2590	179	280	400	NCF18/600-V
	730	78	1596	4332	299	260	400	NCF28/600-V
630	800	118	3225	7206	491	200	380	NCF29/600-V
	780	69	1275	3050	207	260	360	NCF18/630-V
	780	88	1893	5067	344	240	360	NCF28/630-V
670	850	128	3800	8667	578	180	340	NCF29/630-V
	820	69	1325	3260	218	240	340	NCF18/670-V
	820	88	1967	5416	361	230	340	NCF28/670-V
710	900	136	3906	9151	601	170	320	NCF29/670-V
	870	74	1579	3861	253	220	320	NCF18/710-V
	870	95	2354	6451	423	210	320	NCF28/710-V
750	950	140	4377	10180	658	160	300	NCF29/710-V
	920	78	1765	4328	279	200	300	NCF18/750-V
	920	100	2652	7011	453	200	300	NCF28/750-V
800	1000	145	4495	10731	683	150	280	NCF29/750-V
	980	82	1950	4841	306	180	280	NCF18/800-V

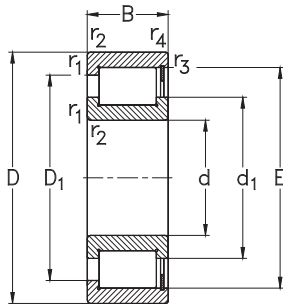


Anschlussmaße siehe Seite 606

*Abutment and fillet dimensions
see on page 606*

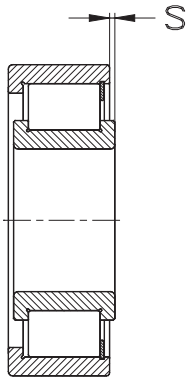
Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	s ≈	m	
530	673	598	648	5	5	7	120	NCF29/530-V
	732,3	610	702	6	6	16	300	NCF30/530-V
560	655	603	643	3	3	5	40,5	NCF18/560-V
	655	606	637	3	3	4,3	54	NCF28/560-V
	700	628	718	5	5	7	140	NCF29/560-V
	770	642	738	6	6	16	345	NCF30/560-V
600	696	644	684	3	3	7	49,5	NCF18/600-V
	696	644	685	3	3	6	65	NCF28/600-V
	754	662	726	5	5	7	170	NCF29/600-V
630	739	681	725	4	4	8	70	NCF18/630-V
	739	680	728	4	4	8	92,5	NCF28/630-V
	807	709	788	6	6	8	205	NCF29/630-V
670	783	725	769	4	4	8	72	NCF18/670-V
	783	724	772	4	4	8	97,5	NCF28/670-V
	846	748	827	6	6	10	245	NCF29/670-V
710	831	767	815	4	4	8	88	NCF18/710-V
	831	766	818	4	4	8	115	NCF28/710-V
	896	790	876	6	6	10	275	NCF29/710-V
750	880	811	863	5	5	8	104	NCF18/750-V
	878	810	867	5	5	8	140	NCF28/750-V
	937	832	916	6	6	12,5	304	NCF29/750-V
800	936	863	922	5	5	8	123	NCF18/800-V

Vollrollige Zylinderrollenlager, einreihig
Single Row Full Complement Cylindrical Roller Bearings



NCF

Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	
800	980	106	2747	7522	476	180	280	NCF28/800-V
	1060	150	4970	12111	756	130	260	NCF29/800-V
850	1030	82	2015	5170	321	170	260	NCF18/850-V
	1030	106	2867	7950	495	160	260	NCF28/850-V
	1120	155	5285	12823	787	130	240	NCF29/850-V
900	1090	85	2265	5819	356	160	240	NCF18/900-V
	1090	112	3238	9216	564	150	240	NCF28/900-V
	1180	165	6025	14870	897	110	220	NCF29/900-V
950	1150	90	2465	6436	387	150	220	NCF18/950-V
	1150	118	3444	9893	595	140	220	NCF28/950-V
	1250	175	6587	16355	972	110	200	NCF29/950-V
1000	1220	100	2960	7620	452	130	200	NCF18/1000-V
	1220	128	4167	11827	701	130	200	NCF28/1000-V
	1320	185	7514	18850	1104	95	190	NCF29/1000-V

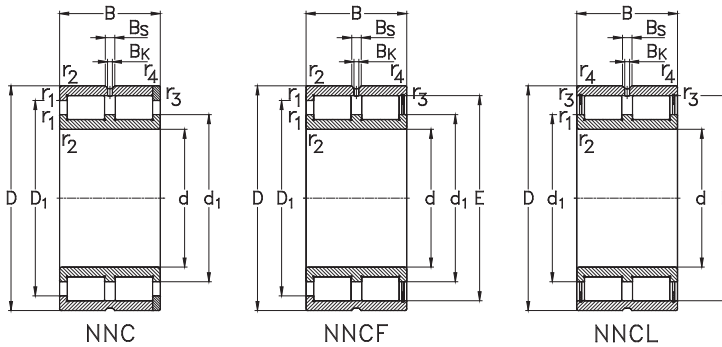


Anschlussmaße siehe Seite 606

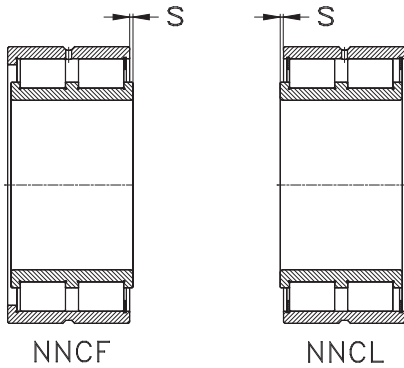
*Abutment and fillet dimensions
see on page 606*

Lagerabmessungen [mm] <i>Bearing dimensions [mm]</i>							Gewicht [kg] <i>Weight [kg]</i>	Lagertypen <i>Designation</i>
d	E ≈	d ₁ ≈	D ₁ ≈	r ₁ ,r ₂ min	r ₃ ,r ₄ min	s ≈	m	
800	936	863	922	5	5	10	165	NCF28/800-V
	1002	891	981	6	6	11	360	NCF29/800-V
850	993	918	978	5	5	9	130	NCF18/850-V
	986	911	972	5	5	10	175	NCF28/850-V
	1061	943	1039	6	6	13	405	NCF29/850-V
900	1044	966	1029	5	5	9	149	NCF18/900-V
	1044	966	1029	5	5	10	208	NCF28/900-V
	1120	996	1096	6	6	13	472	NCF29/900-V
950	1103	1021	1087	5	5	10	185	NCF18/950-V
	1103	1021	1087	5	5	12	240	NCF28/950-V
	1179	1048	1154	7,5	7,5	14	565	NCF29/950-V
1000	1165	1073	1148	6	6	10	230	NCF18/1000-V
	1165	1073	1148	6	6	12	310	NCF28/1000-V
	1252	1113	1226	7,5	7,5	14	680	NCF29/1000-V

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
25	47	30	52,8	67,5	8,2	6000	9000	NNCF5005-V
30	55	34	68,3	88,6	10,8	5300	7500	NNCF5006-V
35	62	36	82,7	112	13,7	4600	6700	NNCF5007-V
40	68	38	99	139	17	4100	6000	NNCF5008-V
45	75	40	105	155	18,9	3800	5300	NNCF5009-V
50	80	40	130	192	23,5	3300	5000	NNCF5010-V
55	90	46	177	277	33,8	2900	4300	NNCF5011-V
60	85	25	74	130	15,9	2600	4500	NNC4912-V
	85	25	74	130	15,9	2600	4500	NNCF4912-V
	85	25	74	130	15,9	2600	4500	NNCL4912-V
65	95	46	181	291	35,5	2800	4000	NNCF5012-V
	100	46	191	319	38,9	2500	3800	NNCF5013-V
	70	100	30	106	195	23,8	2300	3800
70	100	30	106	195	23,8	2300	3800	NNCF4914-V
	100	30	106	195	23,8	2300	3800	NNCL4914-V
	110	54	225	354	43,1	2600	3600	NNCF5014-V
80	110	30	112	217	26,5	2000	3400	NNC4916-V
	110	30	112	217	26,5	2000	3400	NNCF4916-V
	110	30	112	217	26,5	2000	3400	NNCL4916-V
90	125	60	323	530	64	2200	3000	NNCF5016-V
	125	35	150	303	36,1	1800	3000	NNC4918-V
	125	35	150	303	36,1	1800	3000	NNCF4918-V

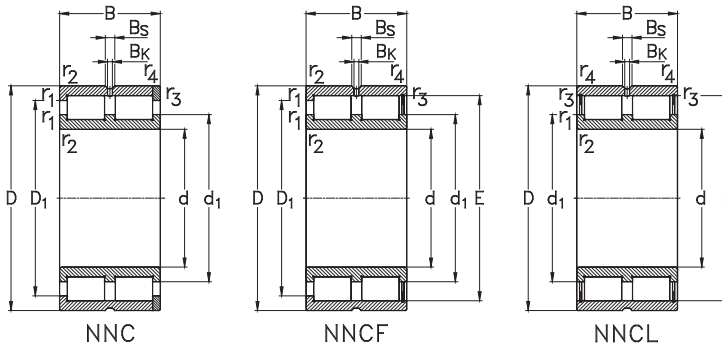


Anschlussmaße siehe Seite 606

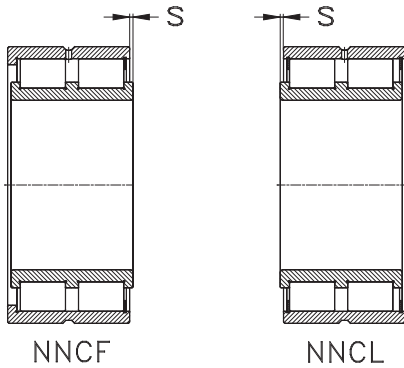
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm]								Gewicht [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
25	42,51	34,5	38,5	0,6	0,6	4,5	3	1	0,23
30	49,6	40	45,5	1	1	4,5	3	1,5	0,35
35	55,52	45	51,5	1	1	4,5	3	1,5	0,46
40	61,74	50,5	57,5	1	1	4,5	3	1,5	0,56
45	66,85	55,5	62,5	1	1	4,5	3	1,5	0,7
50	72,23	59	67,5	1	1	4,5	3	1,5	0,75
55	83,54	68,5	78,5	1,1	1,1	4,5	3,5	1,5	1,15
60	--	69,5	76,5	1	1	4,5	3,5	--	0,48
	78,9	69,5	76,5	1	1	4,5	3,5	1	0,46
	78,9	69,5	76,5	1	1	4,5	3,5	1	0,46
	86,74	71,5	82	1,1	1,1	4,5	3,5	1,5	1,25
65	93,09	78	88	1,1	1,1	4,5	3,5	1,5	1,3
70	--	82	89	1	1	4,5	3,5	--	0,8
	92,3	82	89	1	1	4,5	3,5	1	0,79
	92,3	82	89	1	1	4,5	3,5	1	0,79
	100,28	81,5	95	1,1	1,1	5	3,5	3	1,85
80	--	90,5	98	1	1	5	3,5	--	0,87
	101,2	90,5	98	1	1	5	3,5	1	0,84
	101,2	90,5	98	1	1	5	3,5	1	0,84
	116,99	95	111	1,1	1,1	5	3,5	2,5	2,6
90	--	103,5	111,5	1,1	1,1	5	3,5	--	1,35
	115,5	103,5	111,5	1,1	1,1	5	3,5	1,5	1,34

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
90	125	35	150	303	36,1	1800	3000	NNCL4918-V
	140	67	344	569	67	2100	2800	NNCF5018-V
100	140	40	192	396	45,6	1700	2600	NNC4920-V
	140	40	192	396	45,6	1700	2600	NNCF4920-V
	140	40	192	396	45,6	1700	2600	NNCL4920-V
	150	67	363	624	71	1900	2600	NNCF5020-V
110	150	40	200	427	48,1	1500	2400	NNC4922-V
	150	40	200	427	48,1	1500	2400	NNCF4922-V
	150	40	200	427	48,1	1500	2400	NNCL4922-V
	170	80	477	807	89	1700	2200	NNCF5022-V
120	165	45	224	474	52	1500	2200	NNC4924-V
	165	45	224	474	52	1500	2200	NNCF4924-V
	165	45	224	474	52	1500	2200	NNCL4924-V
	180	80	502	884	96	1500	2000	NNCF5024-V
130	180	50	259	549	59	1500	2000	NNC4926-V
	180	50	259	549	59	1500	2000	NNCF4926-V
	180	50	259	549	59	1500	2000	NNCL4926-V
	200	95	714	1238	131	1300	1900	NNCF5026-V
140	190	50	270	589	62	1300	1900	NNC4928-V
	190	50	270	589	62	1300	1900	NNCF4928-V
	190	50	270	589	62	1300	1900	NNCL4928-V
	210	95	754	1363	141	1200	1800	NNCF5028-V

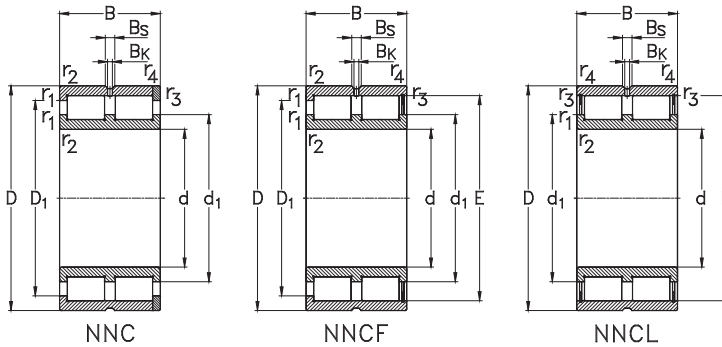


Anschlussmaße siehe Seite 606

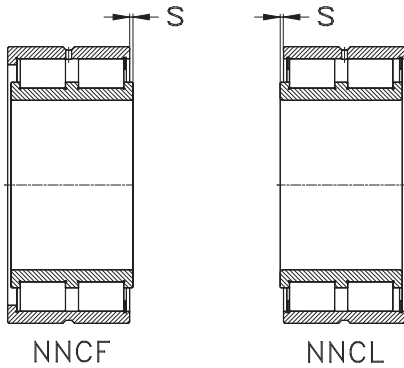
Abutment and fillet dimensions
see on page 606

d	Lagerabmessungen [mm]								Gewicht [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
90	115,5	103,5	--	1,1	1,1	5	3,5	1,5	1,34
	130,11	106,5	124	1,5	1,5	5	3,5	4	3,75
100	--	116,5	125,5	1,1	1,1	5	3,5	--	2,1
	130	116,5	125,5	1,1	1,1	5	3,5	2	2
	139,65	116	133,5	1,5	1,5	6	3,5	4	4,05
110	--	125	134	1,1	1,1	5	3,5	--	2,3
	138,6	125	134	1,1	1,1	5	3,5	2	2,2
	138,6	125	--	1,1	1,1	5	3,5	2	2,2
	156,13	127,5	148,5	2	2	6	3,5	5	6,6
120	--	139	149	1,1	1,1	6	3,5	--	3,2
	154	139	149	1,1	1,1	6	3,5	3	3
	154	139	--	1,1	1,1	6	3,5	3	3
	167,58	139	160	2	2	6	3,5	5	7,1
130	--	149,5	160,5	1,5	1,5	6	3,5	--	4,2
	166	149,5	160,5	1,5	1,5	6	3,5	4	4
	166	149,5	--	1,5	1,5	6	3,5	4	4
	183,81	149	174,5	2	2	7	4	5	11
140	--	160	171	1,5	1,5	6	3,5	--	4,4
	176,4	160	171	1,5	1,5	6	3,5	4	4,2
	176,4	160	--	1,5	1,5	6	3,5	4	4,2
	197,82	163	188,5	2	2	7	4	5	11,5

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
150	190	40	234	576	60	1200	1800	NNCF4830-V
	190	40	234	576	60	1200	1800	NNCL4830-V
	210	60	386	852	87	1200	1700	NNC4930-V
	210	60	386	852	87	1200	1700	NNCF4930-V
	210	60	386	852	87	1200	1700	NNCL4930-V
	225	100	791	1425	145	1100	1700	NNCF5030-V
160	200	40	239	600	62	1200	1700	NNCF4832-V
	200	40	239	600	62	1200	1700	NNCL4832-V
	220	60	402	915	92	1100	1600	NNC4932-V
	220	60	402	915	92	1100	1600	NNCF4932-V
	220	60	402	915	92	1100	1600	NNCL4932-V
	240	109	906	1645	163	1000	1500	NNCF5032-V
170	215	45	268	665	67	1100	1600	NNCF4834-V
	215	45	268	665	67	1100	1600	NNCL4834-V
	230	60	411	958	95	1000	1500	NNC4934-V
	230	60	411	958	95	1000	1500	NNCF4934-V
	230	60	411	958	95	1000	1500	NNCL4934-V
	260	122	1163	2147	208	900	1400	NNCF5034-V
180	225	45	272	689	68	1100	1500	NNCF4836-V
	225	45	272	689	68	1100	1500	NNCL4836-V
	250	69	553	1241	120	910	1400	NNC4936-V
	250	69	553	1241	120	910	1400	NNCF4936-V

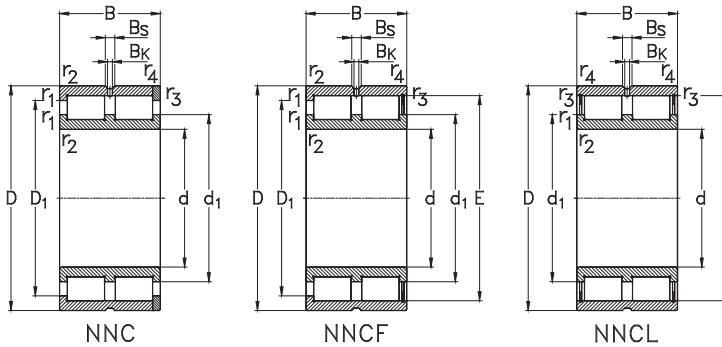


Anschlussmaße siehe Seite 606

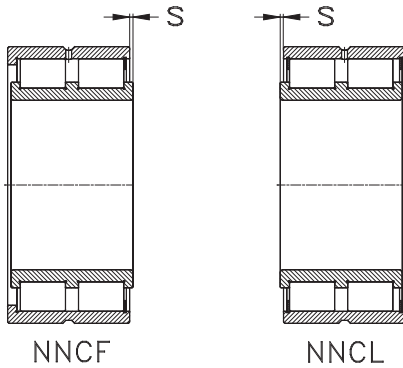
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm] Bearing dimensions [mm]								Gewicht [kg] Weight [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
150	178,7	165	174	1,1	1,1	7	4	2	2,8
	178,7	165	--	1,1	1,1	7	4	2	2,8
	--	172,5	185,5	2	2	--	4	--	7
	192	172,5	185,5	2	2	7	4	4	6,8
	192	172,5	--	2	2	7	4	4	6,8
206,8	170,5	197,5	2,1	2,1	7	4	6	14	
160	190,1	176,5	185,5	1,1	1,1	7	4	2	3
	190,1	176,5	--	1,1	1,1	7	4	2	3
	--	184,5	197,5	2	2	7	4	--	7,2
	203,9	184,5	197,5	2	2	7	4	4	7,1
	203,9	184,5	--	2	2	7	4	4	7,1
225	185	214,5	2,1	2,1	7	4	6	16	
170	201,7	187,5	196,5	1,1	1,1	7	4	3	4
	201,7	187,5	--	1,1	1,1	7	4	3	4
	--	192,5	205,5	2	2	7	4	--	7,6
	212,2	192,5	205,5	2	2	7	4	4	7,5
	212,2	192,5	--	2	2	7	4	4	7,5
242,85	198,5	231,5	2,1	2,1	7	4	6	23	
180	211,3	196	207	1,1	1,1	7	4	3	4,2
	211,3	196	--	1,1	1,1	7	4	3	4,2
	--	207	223	2	2	7	4	--	11
	231,1	207	223	2	2	7	4	4	10,8

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
180	250	69	553	1241	120	910	1400	NNCL4936-V
	280	136	1344	2521	239	810	1300	NNCF5036-V
190	240	50	311	777	75	1000	1400	NNCF4838-V
	240	50	311	777	75	1000	1400	NNCL4838-V
	260	69	568	1305	125	850	1400	NNC4938-V
	260	69	568	1305	125	850	1400	NNCF4938-V
	260	69	568	1305	125	850	1400	NNCL4938-V
	290	136	1381	2640	248	770	1300	NNCF5038-V
	290	136	1381	2640	248	770	1300	NNCL5038-V
200	250	50	320	817	78	940	1400	NNCF4840-V
	250	50	320	817	78	940	1400	NNCL4840-V
	280	80	664	1503	141	810	1300	NNC4940-V
	280	80	664	1503	141	810	1300	NNCF4940-V
	280	80	664	1503	141	810	1300	NNCL4940-V
	310	150	1580	3063	282	740	1200	NNCF5040-V
220	270	50	336	898	84	830	1200	NNCF4844-V
	270	50	336	898	84	830	1200	NNCL4844-V
	300	80	692	1619	148	730	1200	NNC4944-V
	300	80	692	1619	148	730	1200	NNCF4944-V
	300	80	692	1619	148	730	1200	NNCL4944-V
	340	160	1895	3654	329	610	1100	NNCF5044-V
240	300	60	502	1308	119	710	1100	NNCF4848-V
	300	60	502	1308	119	710	1100	NNCL4848-V

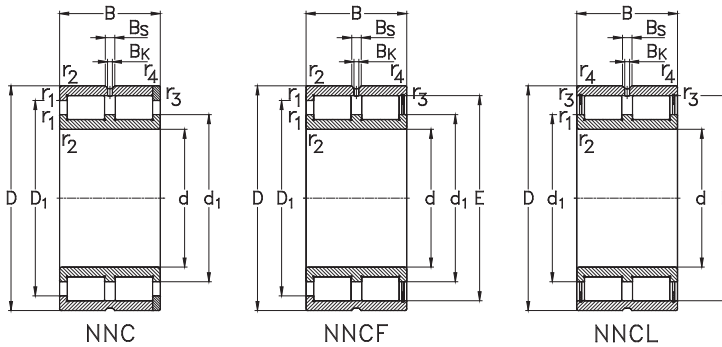


Anschlussmaße siehe Seite 606

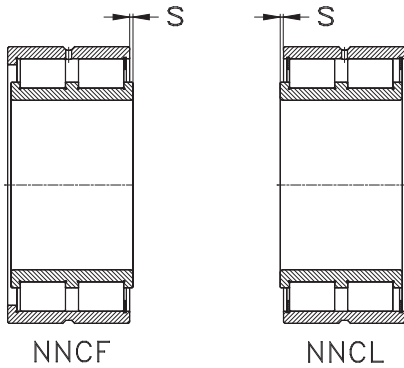
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm] Bearing dimensions [mm]								Gewicht [kg] Weight [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
180	231,1	207	--	2	2	7	4	4	10,8
	260,5	212,5	248	2,1	2,1	8	4	6	29
190	225,4	209	220	1,5	1,5	7	4	4	5,5
	225,4	209	--	1,5	1,5	7	4	4	5,5
	--	217,5	233	2	2	7	4	--	11,5
	241,3	217,5	233	2	2	7	4	4	11,3
	241,3	217,5	--	2	2	7	4	4	11,3
	270	222	257,5	2,1	2,1	8	4	8	31,5
200	235,9	219,5	230	1,5	1,5	7	4	4	5,8
	235,9	219,5	--	1,5	1,5	7	4	4	5,8
	--	233	251	2,1	2,1	8	4	--	16
	260	233	251	2,1	2,1	8	4	5	15,9
	260	233	--	2,1	2,1	8	4	5	15,9
	287,75	237	274,5	2,1	2,1	8	4	9	41
220	256,9	240,5	251,5	1,5	1,5	7	4	4	6,3
	256,9	240,5	--	1,5	1,5	7	4	4	6,3
	--	250	268	2,1	2,1	8	4	--	17,5
	277,2	250	268	2,1	2,1	8	4	5	17,2
	277,2	250	--	2,1	2,1	8	4	5	17,2
	312,7	255	298	3	3	8	4	9	52,5
240	282,4	261,5	275,5	2	2	8	4	4	10
	282,4	261,5	--	2	2	8	4	4	10

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{or}	n _G	
240	320	80	727	1773	158	650	1100	NNC4948-A-V
	320	80	727	1773	158	650	1100	NNCF4948-V
	320	80	727	1773	158	650	1100	NNCL4948-V
260	360	160	1996	4005	351	550	1000	NNCF5048-V
	320	60	526	1423	126	640	1000	NNCF4852-V
	320	60	526	1423	126	640	1000	NNCL4852-V
260	360	100	1075	2533	220	560	950	NNC4952-V
	360	100	1075	2533	220	560	950	NNCF4952-V
	360	100	1075	2533	220	560	950	NNCL4952-V
280	400	190	2604	5416	461	470	900	NNCF5052-V
	350	69	687	1879	162	560	950	NNCF4856-V
	350	69	687	1879	162	560	950	NNCL4856-V
280	380	100	1121	2729	233	510	900	NNC4956-V
	380	100	1121	2729	233	510	900	NNCF4956-V
	380	100	1121	2729	233	510	900	NNCL4956-V
300	420	190	2721	5624	471	440	850	NNCF5056-V
	380	80	805	2159	183	530	850	NNCF4860-V
	380	80	805	2159	183	530	850	NNCL4860-V
300	420	118	1559	3637	302	450	800	NNC4960-V
	420	118	1559	3637	302	450	800	NNCF4960-V
	420	118	1559	3637	302	450	800	NNCL4960-V
300	460	218	3414	7072	575	400	750	NNCF5060-V

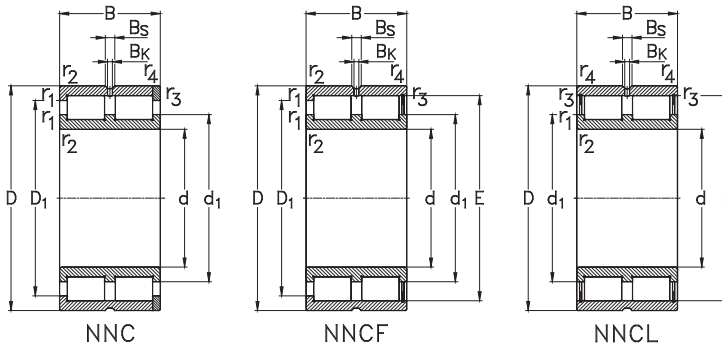


Anschlussmaße siehe Seite 606

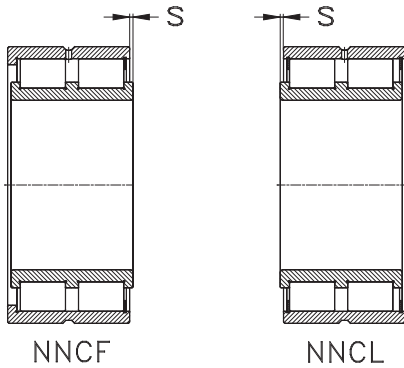
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm] Bearing dimensions [mm]								Gewicht [kg] Weight [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
240	--	273	291	2,1	2,1	8	4	--	18,7
	300,1	273	291	2,1	2,1	8	4	5	18,5
	300,1	273	--	2,1	2,1	8	4	5	18,5
	335,6	278	321	3	3	9,4	5	9	54
260	304,7	283,5	297,5	2	2	8	4	4	10,8
	304,7	283,5	--	2	2	8	4	4	10,8
	--	297	320	2,1	2,1	9,4	5	--	33,1
	331,5	297	320	2,1	2,1	9,4	5	6	32,2
	331,5	297	--	2,1	2,1	9,4	5	6	32,2
	372,7	308,5	357	4	4	9,4	5	10	83
280	332,9	309	325	2	2	8	4	4	15,8
	332,9	309	--	2	2	8	4	4	15,8
	--	319	342	2,1	2,1	9,4	5	--	34,5
	353,5	319	342	2,1	2,1	9,4	5	6	34,2
	353,5	319	--	2,1	2,1	9,4	5	6	34,2
	391	324	375	4	4	9,4	5	9	90,5
300	356,7	330,5	348,5	2,1	2,1	9,4	5	6	22,5
	356,7	330,5	--	2,1	2,1	9,4	5	6	22,5
	--	346,5	375,5	3	3	9,4	5	--	53
	390,2	346,5	375,5	3	3	9,4	5	6	52,8
	390,2	346,5	--	3	3	9,4	5	6	52,8
	432	355	413	4	4	9,4	5	9	123

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
320	400	80	826	2277	189	490	800	NNCF4864-V
	400	80	826	2277	189	490	800	NNCL4864-V
440	118	1603	3840	314	410	750	NNC4964-V	
	118	1603	3840	314	410	750	NNCF4964-V	
480	218	3424	6976	562	370	700	NNCF5064-V	
	340	420	80	858	2430	199	450	750
420		80	858	2430	199	450	750	NNCL4868-V
460	118	1645	4043	326	390	700	NNC4968-V	
	118	1645	4043	326	390	700	NNCF4968-V	
520	243	4121	8386	660	330	670	NNCF5068-V	
	360	440	80	884	2584	208	420	700
440		80	884	2584	208	420	700	NNCL4872-V
480	118	1693	4246	337	360	670	NNC4972-V	
	118	1693	4246	337	360	670	NNCF4972-V	
480	118	1693	4246	337	360	670	NNCL4972-V	
	540	243	3979	8080	629	330	630	NNCF5072-V
380	480	100	1299	3641	286	370	670	NNCF4876-V
	480	100	1299	3641	286	370	670	NNCL4876-V
520	140	2134	5493	427	320	630	NNC4976-V	
	140	2134	5493	427	320	630	NNCF4976-V	

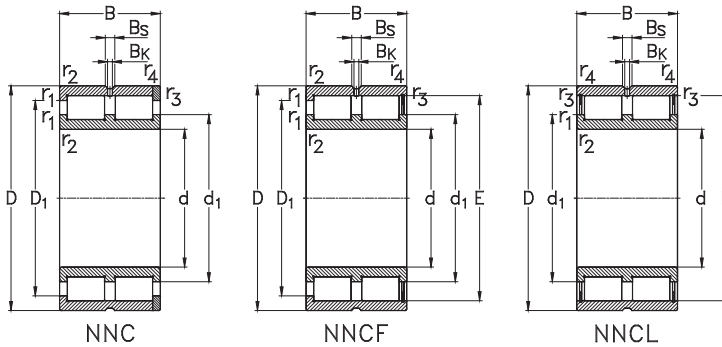


Anschlussmaße siehe Seite 606

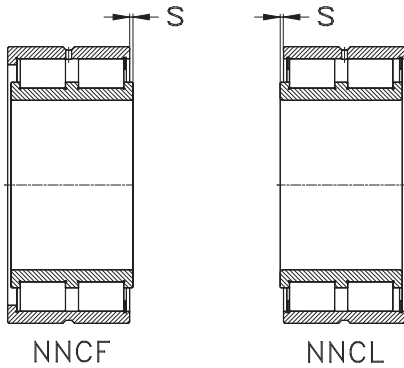
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm]								Gewicht [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
320	380,3	353,5	371,5	2,1	2,1	9,4	5	6	23,8
	380,3	353,5	--	2,1	2,1	9,4	5	6	23,8
	--	365,5	399	3	3	9,4	5	--	56
	409	365,5	399	3	3	9,4	5	6	55,2
	409	365,5	--	3	3	9,4	5	6	55,2
449,5	370	428	4	4	9,4	5	9	135	
340	397,4	370,5	388,5	2,1	2,1	9,4	5	6	25,2
	397,4	370,5	--	2,1	2,1	9,4	5	6	25,2
	--	383,5	412,5	3	3	9,4	5	--	60,5
	427,1	383,5	412,5	3	3	9,4	5	6	58,8
	427,1	383,5	--	3	3	9,4	5	6	58,8
485,65	395	468	5	5	9,4	5	11	170	
360	420,2	393	411	2,1	2,1	9,4	5	6	26,5
	420,2	393	--	2,1	2,1	9,4	5	6	26,5
	--	399	436,5	3	3	--	5	--	61
	446	399	436,5	3	3	9,4	5	6	60,5
	446	399	--	3	3	9,4	5	6	60,5
503,2	417	482	5	5	9,4	5	11	195	
380	456	421,5	444,5	2,1	2,1	9,4	5	6	44,6
	456	421,5	--	2,1	2,1	9,4	5	6	44,6
	--	433,5	465,5	4	4	9,4	5	--	93
	481,5	433,5	465,5	4	4	9,4	5	7	92,4

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
380	520	140	2134	5493	427	320	630	NNCL4976-V
	560	243	4341	9189	707	300	600	NNCF5076-V
400	500	100	1317	3771	293	350	630	NNCF4880-V
	500	100	1317	3771	293	350	630	NNCL4880-V
	540	140	2194	5762	442	300	600	NNC4980-V
	540	140	2194	5762	442	300	600	NNCF4980-V
	540	140	2194	5762	442	300	600	NNCL4980-V
	600	272	5115	11053	833	270	560	NNCF5080-V
420	520	100	1359	3967	304	330	600	NNCF4884-V
	520	100	1359	3967	304	330	600	NNCL4884-V
	560	140	2245	6031	456	290	560	NNC4984-V
	560	140	2245	6031	456	290	560	NNCF4984-V
	560	140	2245	6031	456	290	560	NNCL4984-V
440	540	100	1394	4162	315	310	560	NNCF4888-V
	540	100	1394	4162	315	310	560	NNCL4888-V
	600	160	3009	7633	567	250	530	NNC4988-V
	600	160	3009	7633	567	250	530	NNCF4988-V
	600	160	3009	7633	567	250	530	NNCL4988-V
	460	580	118	1569	4655	347	300	530
580		118	1569	4655	347	300	530	NNCL4892-V
620		160	3041	7836	577	240	500	NNC4992-V
620		160	3041	7836	577	240	500	NNCF4992-V

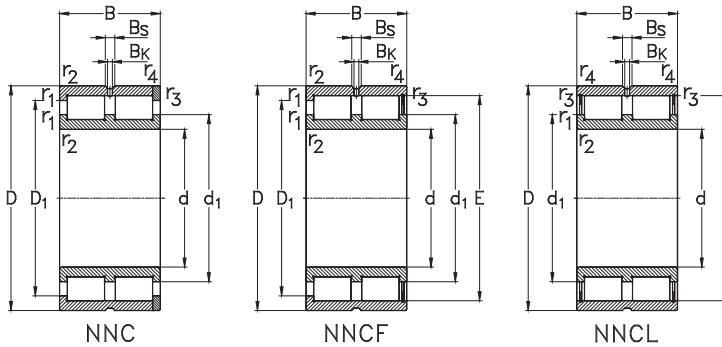


Anschlussmaße siehe Seite 606

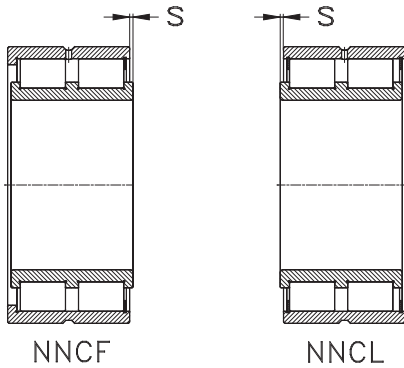
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm] Bearing dimensions [mm]								Gewicht [kg] Weight [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
380	481,5	433,5	--	4	4	9,4	5	7	92,4
	520,5	434	499	5	5	9,4	5	11	200
400	470,3	436	459	2,1	2,1	9,4	5	6	46,8
	470,3	436	--	2,1	2,1	9,4	5	6	46,8
	--	454	486	4	4	9,4	5	--	97,5
	502	454	486	4	4	9,4	5	7	96,5
	502	454	--	4	4	9,4	5	7	96,5
559,1	463	535	5	5	9,4	5	11	270	
420	492,6	458	481	2,1	2,1	9,4	5	6	48,8
	492,6	458	--	2,1	2,1	9,4	5	6	48,8
	--	470,5	512	4	4	9,4	5	--	100
	522,5	470,5	512	4	4	9,4	5	7	99
	522,5	470,5	--	4	4	9,4	5	7	99
440	514,6	480	503	2,1	2,1	9,4	5	6	50,9
	514,6	480	--	2,1	2,1	9,4	5	6	50,9
	--	503,5	543,5	4	4	9,4	5	--	140
	563,5	503,5	543,5	4	4	9,4	5	7	138
	563,5	503,5	--	4	4	9,4	5	7	138
460	543,3	506	531	3	3	9,4	5	7	76,9
	543,3	506	--	3	3	9,4	5	7	76,9
	--	512	564	4	4	9,4	5	--	145
	577	512	564	4	4	9,4	5	7	141

Vollrollige Zylinderrollenlager, zweireihig
Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Designation
d	D	B	C _r dyn.	C _{or} stat.	C _u	n _{0r}	n _G	
460	620	160	3041	7836	577	240	500	NNCL4992-V
480	600	118	1608	4881	358	290	500	NNCF4896-V
	600	118	1608	4881	358	290	500	NNCL4896-V
	650	170	3267	8409	611	230	480	NNC4996-V
	650	170	3267	8409	611	230	480	NNCF4996-V
	650	170	3267	8409	611	230	480	NNCL4996-V
500	620	118	1636	5031	366	270	480	NNCF48/500-V
	620	118	1636	5031	366	270	480	NNCL48/500-V
	670	170	3350	8841	633	220	450	NNC49/500-V
	670	170	3350	8841	633	220	450	NNCF49/500-V
	670	170	3350	8841	633	220	450	NNCL49/500-V
530	650	118	1681	5332	382	250	450	NNCF48/530-V
	650	118	1681	5332	382	250	450	NNCL48/530-V
	710	180	3887	10154	717	200	430	NNC49/530-V
	710	180	3887	10154	717	200	430	NNCF49/530-V
	710	180	3887	10154	717	200	430	NNCL49/530-V

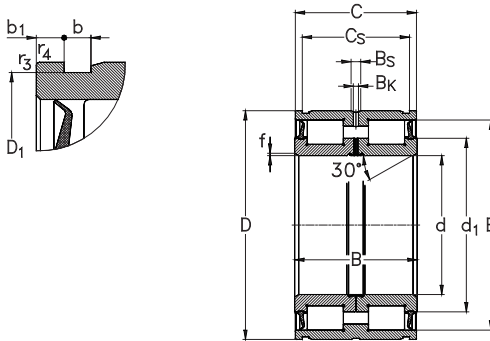


Anschlussmaße siehe Seite 606

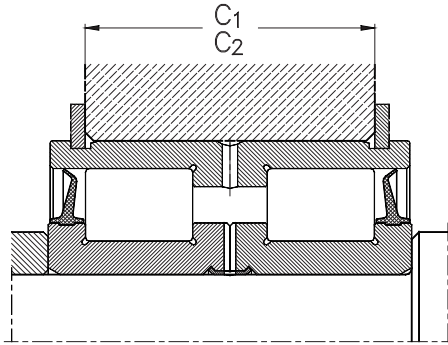
*Abutment and fillet dimensions
see on page 606*

d	Lagerabmessungen [mm]								Gewicht [kg]
	E	d ₁ ≈	D ₁ ≈	r ₁ , r ₂ min	r ₃ , r ₄ min	B _s ≈	B _K	s ≈	m ≈
460	577	512	--	4	4	9,4	5	7	141
480	567,3	530	555	3	3	9,4	5	7	78,5
	567,3	530	--	3	3	9,4	5	7	78,5
500	--	537	592	5	5	9,4	5	--	170
	605,5	537	592	5	5	9,4	5	8	166
530	605,5	537	--	5	5	9,4	5	8	166
	583,5	547	571	3	3	9,4	5	7	83
580	583,5	547	--	3	3	9,4	5	7	83
	--	568,5	610,5	5	5	9,4	5	--	179
630	631,5	568,5	610,5	5	5	9,4	5	8	175
	631,5	568,5	--	5	5	9,4	5	8	175
680	615	577,5	602,5	3	3	9,4	5	7	87,2
	615	577,5	--	3	3	9,4	5	7	87,2
730	--	588	648	5	5	9,4	5	--	208
	663	588	648	5	5	9,4	5	8	205
780	663	588	--	5	5	9,4	5	8	205

Vollrollige Zylinderrollenlager, zweireihig, abgedichtet
Sealed Double Row Full Complement Cylindrical Roller Bearings



Hauptabmessungen [mm]			Tragzahlen [kN]			Grenzdrehzahlen [min ⁻¹]	Lagertyp	Sprengring	Sicherungsring nach DIN 471	
Boundary dimensions [mm]			Load ratings [kN]			Speed ratings [rpm]	Designation	Snapping	Snap ring according to DIN 471	
d	D	B	C	C _r dyn.	C _{0r} stat.	C _u				
25	47	30	29	43,3	59	7,2	3000	NNF5005-2LS-V	WRE47	47X1,75
30	55	34	33	51	72	8,7	2600	NNF5006-2LS-V	WRE55	55X2
35	62	36	35	66	92	11,2	2200	NNF5007-2LS-V	WRE62	62X2
40	68	38	37	80	117	14,2	2000	NNF5008-2LS-V	WRE68	68X2,5
45	75	40	39	96	145	17,7	1800	NNF5009-2LS-V	WRE75	75X2,5
50	80	40	39	101	159	19,4	1700	NNF5010-2LS-V	WRE80	80X2,5
55	90	46	45	119	194	23,6	1500	NNF5011-2LS-V	WRE90	90X3
60	95	46	45	124	209	25,5	1400	NNF5012-2LS-V	WRE95	95X3
65	100	46	45	129	225	27,4	1300	NNF5013-2LS-V	WRE100	100X3
70	110	54	53	190	326	39,7	1200	NNF5014-2LS-V	WRE110	110X4
75	115	54	53	206	343	41,9	1100	NNF5015-2LS-V	WRE115	115X4
80	125	60	59	237	423	51	1000	NNF5016-2LS-V	WRE125	125X4
85	130	60	59	255	443	53	1000	NNF5017-2LS-V	WRE130	130X4
90	140	67	66	302	564	66	900	NNF5018-2LS-V	WRE140	140X4
100	150	67	66	313	574	66	850	NNF5020-2LS-V	WRE150	150X4
110	170	80	79	417	774	86	750	NNF5022-2LS-V	WRE170	170X4
120	180	80	79	404	761	82	750	NNF5024-2LS-V	WRE180	180X4
130	200	95	94	579	1054	111	630	NNF5026-2LS-V	WRE200	200X4
	190	80	79	419	815	87	670	NNF130-2LS-V	WRE190	190X4
140	210	95	94	629	1254	129	600	NNF5028-2LS-V	WRE210	210X5
	200	80	79	434	870	91	630	NNF140-2LS-V	WRE200	200X4
150	225	100	99	694	1296	131	560	NNF5030-2LS-V	WRE225	225X5

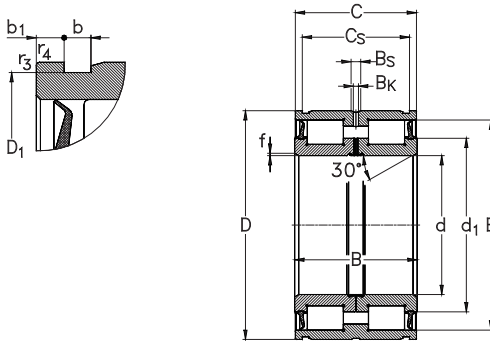


Anschlussmaße siehe Seite 606

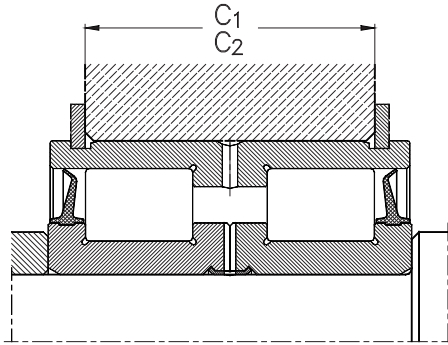
Abutment and fillet dimensions
see on page 606

Lagerabmessungen [mm] Bearing dimensions [mm]													Gewicht [kg] Weight [kg]
d	d ₁ ≈	D ₁	E	b	b ₁	B _s ≈	B _K	f	C ₁ ± 0,1	C ₂	C _S + 0,2	r ₃ , r ₄ min	m ≈
25	33	44,8	40,4	1,8	2,15	4,5	3	0,5	21,7	21,2	24,7	0,3	0,23
30	39,7	52,8	47,9	2,1	2,4	6,5	3	0,5	25,2	24,2	28,2	0,3	0,35
35	44,8	59,8	54,5	2,1	2,4	6,5	3	0,5	27,2	26,2	30,2	0,3	0,45
40	50,5	65,8	61	2,7	2,4	6,5	3	0,8	28,2	27,2	32,2	0,6	0,53
45	56,5	72,8	67,7	2,7	2,4	6,5	3	0,8	29,2	28,2	34,2	0,6	0,65
50	61,2	77,8	72,5	2,7	2,4	6,5	3	0,8	30,2	29,2	34,2	0,6	0,73
55	68	87,4	80	3,2	2,4	6,5	3,5	1	35,2	34,2	40,2	0,6	1,1
60	73	92,4	85	3,2	2,4	6,5	3,5	1	35,2	34,2	40,2	0,6	1,2
65	78	97,4	90	3,2	2,4	6,5	3,5	1	35,2	34,2	40,2	0,6	1,3
70	85	107,1	100	4,2	2,4	7,5	3,5	1	43,2	40,2	48,2	0,6	1,85
75	91	112	106	4,2	2,4	7,5	3,5	1	43,2	40,2	48,2	0,6	2
80	97	122,1	113,5	4,2	2,4	7,5	3,5	1,5	49,2	46,2	54,2	0,6	2,7
85	101,5	127,1	119,5	4,2	2,4	7,5	3,5	1,5	49,2	46,2	54,2	0,6	2,8
90	109,5	137	127,5	4,2	3,4	7,5	3,5	1,5	54,2	51,2	59,2	0,6	3,8
100	118,5	147	138	4,2	3,4	9	3,5	1,5	54,2	51,2	59,2	0,6	4,05
110	132	167	154,5	4,2	4,4	9	3,5	1,8	65,2	62,2	70,2	0,6	6,45
120	141,5	176	164	4,2	3,9	9	3,5	1,8	65,2	62,2	70,2	0,6	6,9
130	155	196	183,5	4,2	5,4	10,5	4	1,8	77,2	75,2	83,2	0,6	10,5
	151	186	173,5	4,2	3,9	10,5	4	1,8	65,2	63,2	71,2	0,6	7,3
140	167	206	196,08	5,2	5,4	10,5	4	1,8	77,3	73,3	83,2	0,6	10,7
	160,5	196	183	4,2	3,9	10,5	4	1,8	65,2	63,2	71,2	0,6	7,8
150	177,7	221	209,15	5,2	5,9	10,5	4	2	81,2	77,2	87,2	0,6	13,3

Vollrollige Zylinderrollenlager, zweireihig, abgedichtet
Sealed Double Row Full Complement Cylindrical Roller Bearings



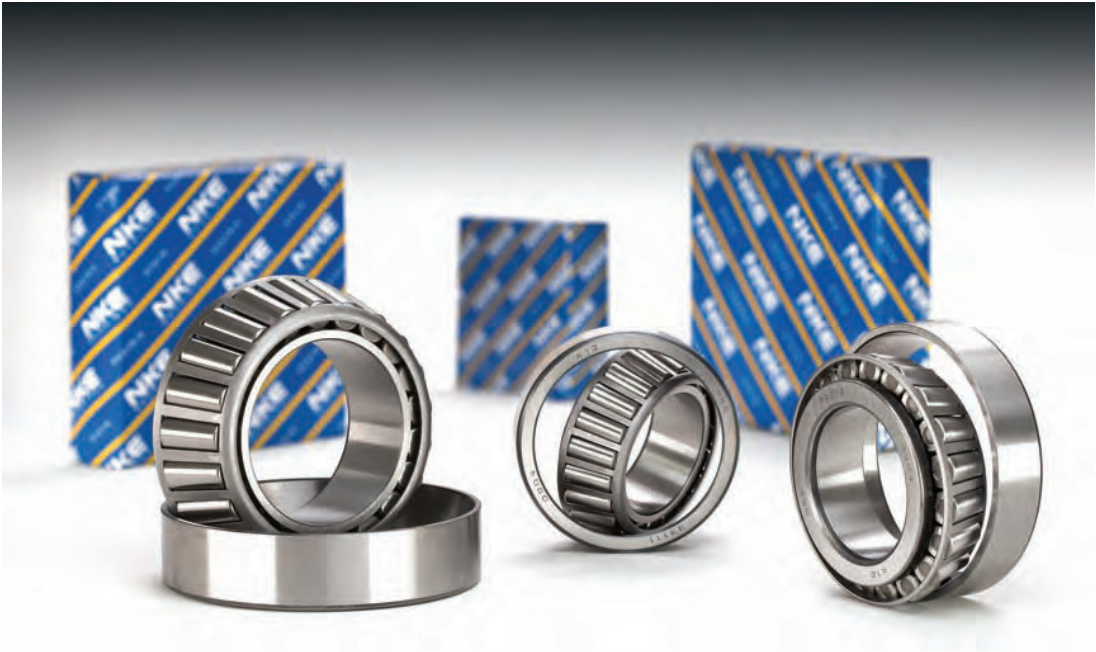
Hauptabmessungen [mm]			Tragzahlen [kN]			Grenzdrehzahlen [min ⁻¹]	Lagertyp	Sprengling	Sicherungsring nach DIN 471
Boundary dimensions [mm]			Load ratings [kN]			Speed ratings [rpm]	Designation	Snapring	Snap ring according to DIN 471
d	D	B	C	C _r dyn.	C _{0r} stat.	C _u			
150	210	80	79	448	924	95	560	NNF150-2LS-V	WRE210 210X5
160	240	109	108	722	1401	138	500	NNF5032-2LS-V	WRE240 240X5
	220	80	79	469	1006	101	530	NNF160-2LS-V	WRE220 220X5
170	260	122	121	931	1797	174	480	NNF5034-2LS-V	WRE260 260X5
	230	80	79	480	1061	105	530	NNF170-2LS-V	WRE230 230X5
180	280	136	135	1106	2174	206	450	NNF5036-2LS-V	WRE280 280X5
	240	80	79	493	1115	109	500	NNF180-2LS-V	WRE240 240X5
190	290	136	135	1129	2262	212	430	NNF5038-2LS-V	WRE290 290X5
	260	80	79	568	1304	125	450	NNF190-2LS-V	WRE260 260X5
200	310	150	149	1363	2947	270	400	NNF5040-2LS-V	WRE310 310X6
	270	80	79	584	1368	129	430	NNF200-2LS-V	WRE270 270X5
220	340	160	159	1515	3124	280	360	NNF5044-2LS-V	WRE340 340X6
	300	95	94	692	1619	148	400	NNF220-2LS-V	WRE300 300X5
240	360	160	159	1577	3365	296	340	NNF5048-2LS-V	WRE360 360X6
	320	95	94	727	1773	158	380	NNF240-2LS-V	WRE320 320X6
260	340	95	94	902	2130	188	320	NNF260-2LS-V	WRE340 340X6
280	420	190	189	2389	5128	429	320	NNF5056-2LS-V	WRE420 420X7
300	460	218	216	2634	5954	471	300	NNF5060-2LS-V	WRE460 460X7



Anschlussmaße siehe Seite 606

Abutment and fillet dimensions
see on page 606

Lagerabmessungen [mm]													Gewicht [kg]	
Bearing dimensions [mm]													Weight [kg]	
d	d ₁ ≈	D ₁	E	b	b ₁	B _s ≈	B _K	f	C ₁ ± 0,1	C ₂	C _S + 0,2	r ₃ , r ₄ min	m ≈	
150	170	206	192,5	5,2	3,9	10,5	4	1,8	65,2	61,2	71,2	0,6	8,3	
160	191	236	222,55	5,2	6,4	10,5	4	2	89,2	85,2	95,2	0,6	16,5	
	184,5	216	207	5,2	3,9	10,5	4	1,8	65,2	61,2	71,2	0,6	8,7	
170	203	254	239	5,2	6,9	10,5	4	2	99,2	97,2	107,2	0,6	22,5	
	194	226	216,5	5,2	3,9	10,5	4	1,8	65,2	61,2	71,2	0,6	8,72	
180	220	274	259	5,2	8,4	12	4	2	110,2	108,2	118,2	0,6	30	
	203,5	236	226	5,2	3,9	10,5	4	1,8	65,2	61,2	71,2	0,6	9,31	
190	228	284	267,3	5,2	8,4	12	4	2	110,2	108,2	118,2	0,6	31,5	
	217	254	241	5,2	2,9	10,5	4	1,8	65,2	63,2	73,2	0,6	11,94	
200	245	304	284	6,3	10,4	12	4	2	120,2	116,2	128,2	0,6	40,5	
	227,5	264	251,5	5,2	2,9	14	4	1,8	65,2	63,2	73,2	0,6	12,3	
220	263,5	334	308,5	6,3	10,4	12	4	2	130,2	126,2	138,2	1	52,5	
	248,7	294	277,5	5,2	5,4	10,5	4	2	75,2	73,2	83,2	1	19,2	
240	282,5	354	327,5	6,3	10,4	14	5	2	130,2	126,2	138,2	1	56	
	272	314	300,1	6,3	5,4	12	4	2	75,2	71,2	83,2	1	20,8	
260	282,7	334	316,25	6,3	5,4	10,5	4,5	2	75,2	71,2	83,2	1	22	
280	333,5	413	390,5	7,3	12,9	14	5	3	152,2	149,2	163,2	1,1	88	
300	363,5	453	423,5	7,3	15,4	14	6	3	168,2	171,2	185,2	1,1	126	



Kegelrollenlager
Tapered Roller Bearings

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

Einreihige Kegelrollenlager in Zollabmessungen
Single Row Tapered Roller, Inch Sizes

Metrische einreihige Kegelrollenlager, gepaart
Paired Metric Single Row Tapered Roller Bearings

IKOS Integral Kegelrollenlager
Tapered Roller Bearing, IKOS Design

Einreihige Kegelrollenlager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Metrische Kegelrollenlager	DIN 720

Allgemeines

Einreihige Kegelrollenlager sind zerlegbare Radiallager. Sie bestehen aus einem Innenteil (Innenring mit Rollensatz und Käfig) und einem losen Außenring.

Da einreihige Kegelrollenlager Axialkräfte nur in einer Richtung aufnehmen, müssen sie immer gegen ein zweites Lager angestellt werden, das die Führung der Welle in die Gegenrichtung übernimmt.

Kegelrollenlager sind zur Aufnahme sowohl radialer als auch axialer Kräfte geeignet, nehmen aber auch kombinierte Belastungen und Kippmomente gut auf.

Kegelrollenlager übertragen die auf das Lager wirkenden Belastungen unter einem Winkel, dem sogenannten **Druckwinkel α** , zur Mittelachse hin (siehe Abb. 1).

Single Row Tapered Roller Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Tapered roller bearings, metric dimensions	DIN 720

General

Single row tapered roller bearings are separable radial bearings. They consist of the inner ring with roller set and cage assembly, (cone) and a loose outer ring (cup). As single row tapered roller bearings are only able to accept thrust loads in one direction they must always be used in pairs where one bearing is adjusted against another one which guides the shaft in the opposite direction.

Tapered roller bearings are suitable for both radial and thrust forces but also accept combined loads and tilting moments.

Tapered roller bearings transfer the loads acting on the bearing at a certain angle, the so called "**contact angle α** " towards the shafts centre line (see fig.1).

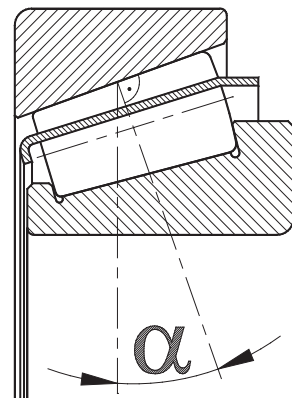


Abb. 1
 Fig. 1

Die Eignung zur Aufnahme axialer Belastungen hängt von der Höhe des **Druckwinkels α** ab: Je **größer der Druckwinkel** wird, desto besser ist das betreffende Lager zur Aufnahme axialer Kräfte geeignet.

Der Druckwinkel der meisten Kegelrollenlager liegt zwischen **10°** und **16°**.

Hingegen sind Kegelrollenlager der Reihe **313** aufgrund deren größeren Druckwinkel (ca. **30°**) zur Axiallastaufnahme geeignet.

Schiefstellung

Schiefstellungen von maximal **1,5** Winkelminuten haben unter normalen Betriebsverhältnissen noch keine negativen Auswirkungen auf die Funktion bei einreihigen Kegelrollenlagern.

Allerdings weisen Lager, die unter Schiefstellungen laufen, erheblich höhere Laufgeräusche auf. Es ist mit einer Verringerung der Gebrauchsdauer durch die entstehenden Zusatzbelastungen zu rechnen.

Toleranzen

Kegelrollenlager werden standardmäßig in Normaltoleranz (**PN, Klasse 4**) gefertigt. Auf Anfrage können diese auch mit eingengten Toleranzen in den Toleranzklassen **P6X** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 58-63.

The ability of tapered roller bearings to accommodate axial loads depends on their **contact angle α** . the larger the angle the better the thrust load capability. The contact angle of most tapered roller bearings lies between **10°** and **16°**.

Tapered roller bearings of the series **313** are particularly suitable to accommodate axial loads due to their comparatively large contact angle (approximately **30°**).

Misalignment

Misalignments not exceeding **1,5** angular minutes from their centre position usually do not negatively affect the function of single row tapered roller bearings.

But it must be considered, that tapered roller bearings which run misaligned are subjected to considerably additional forces that will shorten their service life and generate increased running noise levels.

Tolerances

Tapered roller bearings are produced to normal tolerance class (**PN, class 4**) as standard. On request these bearings are also produced to closer tolerances, such as tolerance class **P6X**.

Detailed tolerance values are listed in the tables shown in the chapter "**Bearing data / Tolerances**", page 243-248.

Einreihige Kegelrollenlager

Single Row Tapered Roller Bearings

NKE
B E A R I N G S

Käfige

NKE Kegelrollenlager werden standardmäßig mit Stahlblechkäfigen geliefert.

Da bei den Kegelrollenlagern die Käfige seitlich über die Planfläche vorstehen können, müssen die Anschlussmaße unbedingt eingehalten werden.

Lagerluft

Bei einreihigen Kegelrollenlagern wird die Lagerluft erst durch die Anstellung gegen ein zweites Lager definiert.

Temperaturbedingte Längenänderungen der Welle durch Wärmedehnungen führen zu Änderungen der Betriebslagerluft. Daher ist der Lagerabstand so klein als möglich zu wählen.

Mindestbelastung

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Kegelrollenlager muss die Mindestbelastung **2%** der dynamischen Tragzahl betragen.

Cages

NKE tapered roller bearings are fitted with pressed steel cages as standard.

Because the cages of tapered roller bearings usually protrude beyond the bearing faces, special care must be taken to follow the abutment dimensions listed in the product section.

Internal Clearance

The axial play of tapered roller bearings is determined during mounting by adjusting one bearing against another.

The changes in shaft length (e.g. caused by thermal expansion) lead to changes in operating clearance. For this reason the distance between bearing positions should be kept to a minimum.

Minimum Load

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE tapered roller bearings the minimum load must be **2%** of the dynamic load rating.

Äquivalente dynamische Lagerbelastung

Bei einreihigen Kegelrollenlagern gilt:

bei

$$\frac{F_a}{F_r} \leq e \text{ gilt } P = F_r$$

bzw. , wenn

$$\frac{F_a}{F_r} > e \text{ dann } P = 0,4 * F_r + Y * F_a$$

Achtung:

Bei Kegelrollenlagern verursacht jede äußere Belastung durch den Druckwinkel eine innere Axialkraft.

Zur Berechnung der Axialkraft F_a sind daher die folgenden Hinweise zu beachten. Diese gelten für im Betrieb spielfrei angestellte, aber ohne Vorspannung laufende Lager.

Equivalent Dynamic Bearing Load

In the case of single row tapered roller bearings the following equations should be used:

when

$$\frac{F_a}{F_r} \leq e \text{ then } P = F_r$$

or, if

$$\frac{F_a}{F_r} > e \text{ then } P = 0,4 * F_r + Y * F_a$$

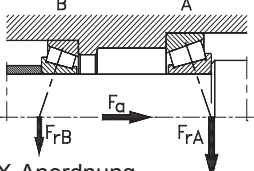
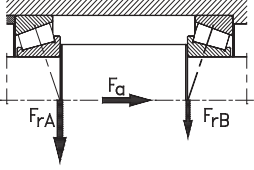
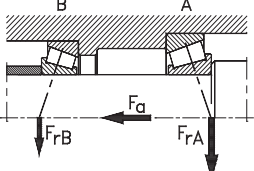
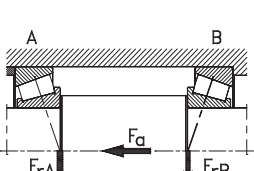
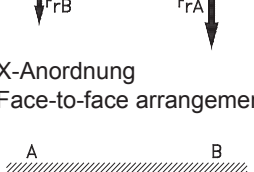
Note:

Each external radial load applied to tapered roller bearings generates an internal thrust force.

For the calculation of axial force F_a the following information should be considered.

These formulas apply to tapered roller bearings operating without axial clearance and without preload.

Axialbelastung bei einreihigen Kegelrollenlagern
Axial Loads of Single Row Tapered Roller Bearings

Lageranordnung Bearing arrangement	Belastungsfall: bei Load case: if	Axialbelastung Axial loads an Lager / on bearing	
		A	B
<p>O-Anordnung Back-to-back arrangement</p>  <p>X-Anordnung Face-to-face arrangement</p> 	<p>A</p> $\frac{F_{rA}}{Y_A} \geq \frac{F_{rB}}{Y_B}$ $F_{aA} = \frac{0,5 * F_{rA}}{Y_A}$ <p>$F_a \geq 0$</p>	$F_{aB} = F_{aA} + F_a$	
	<p>B</p> $\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $F_{aA} = \frac{0,5 * F_{rA}}{Y_A}$ $F_a \geq 0,5 * \left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A} \right)$	$F_{aB} = F_{aA} + F_a$	
<p>O-Anordnung Back-to-back arrangement</p>  <p>X-Anordnung Face-to-face arrangement</p> 	<p>C</p> $\frac{F_{rA}}{Y_A} < \frac{F_{rB}}{Y_B}$ $F_{aA} = F_{aB} - F_a$ $F_a < 0,5 * \left(\frac{F_{rB}}{Y_B} - \frac{F_{rA}}{Y_A} \right)$	$F_{aB} = \frac{0,5 * F_{rB}}{Y_B}$	
	<p>D</p> $\frac{F_{rA}}{Y_A} \leq \frac{F_{rB}}{Y_B}$ $F_{aA} = F_{aB} + F_a$ <p>$F_a \geq 0$</p>	$F_{aB} = \frac{0,5 * F_{rB}}{Y_B}$	
<p>X-Anordnung Face-to-face arrangement</p> 	<p>E</p> $\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $F_{aA} = F_{aB} + F_a$ $F_a \geq 0,5 * \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B} \right)$	$F_{aB} = \frac{0,5 * F_{rB}}{Y_B}$	
	<p>F</p> $\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$ $F_{aA} = \frac{0,5 * F_{rA}}{Y_A}$ $F_a < 0,5 * \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B} \right)$	$F_{aB} = F_{aA} - F_a$	

Äquivalente statische Lagerbelastung

Für einreihige Kegelrollenlager gilt:

$$P_0 = 0,5 * F_r + Y_0 * F_a$$

Wird allerdings P_0 kleiner als F_r , ist F_r zur Berechnung der äquivalenten statischen Lagerbelastung heranzuziehen.

Anschlussmaße

Kegelrollenlager erfordern aufgrund der entstehenden inneren Axiallastkomponente eine ausreichende axiale Unterstützung der Lagerringe durch die Umgebungsstruktur.

Dazu müssen die Schulterhöhen der Anlageflächen an den Wellenbunden bzw. der Gehäuseschultern eine ausreichende Mindesthöhe aufweisen. Allerdings dürfen die Radien der Kantenverrundung der Lagerringe nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muß der grösste Hohlkehradius an den Anschlussstellen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe.

Empfehlungen zur Gestaltung der Anschlusssteile sind in den Produkttabellen angegeben.

Förderwirkung bei Ölschmierung

Asymmetrische Lager, wozu auch Kegelrollenlager gehören, weisen eine Pumpwirkung in Richtung des größeren Käfigdurchmessers auf, die bei Ölumlaufschmierung zur Unterstützung der Ölzirkulation herangezogen werden kann.

Bei Ölzuführung in Gegenrichtung ist allerdings mit einem erhöhten Durchflusswiderstand zu rechnen.

Equivalent Static Bearing Load

For single row tapered roller bearings:

$$P_0 = 0,5 * F_r + Y_0 * F_a$$

When P_0 is smaller than F_r , the F_r value must be used for calculating the equivalent static bearing load.

Abutment and Fillet Dimensions

Particularly with tapered roller bearings sufficient support of bearing rings by the adjacent parts is required due to the generated internal thrust force component.

To gain satisfactory support both the shaft shoulders as well as the housing shoulders must have a certain minimum height. The bearing rings, however, must contact adjacent parts with their side faces only. The radii of bearing corners must not touch the shoulder fillet radii of neither the shaft nor housing shoulders.

Therefore, the largest fillet radius (r_g or r_{g1} , respectively) must be kept smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the bearing tables.

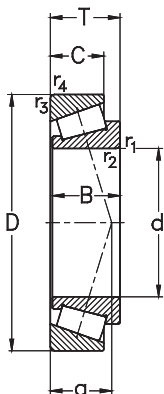
Recommendations for the dimensions of adjacent parts are stated in the bearing tables.

Pumping Effect with Oil Lubrication

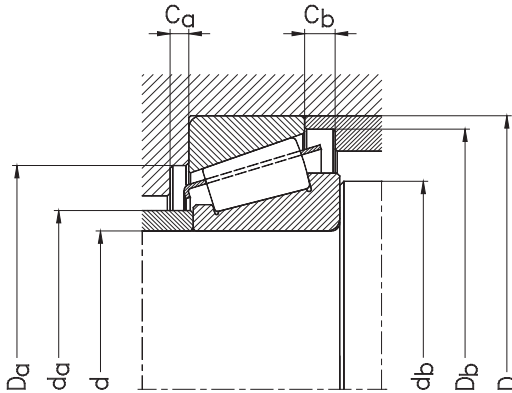
Asymmetrical bearings, to which tapered roller bearings belong, feature a certain pumping effect due to their internal design. This effect may be used to support the oil circulation in the lubricating circuit.

In case of an oil feed in the opposite direction an enlarged resistance against the oil flow must be taken into consideration.

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

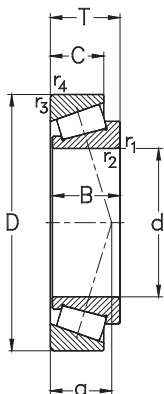


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
15	35	11,75	15,2	14,6	1,8	12700	18000	0,06	30202	--
	42	14,25	24,1	20,8	2,5	11600	18000	0,09	30302	T2FB015
17	40	13,25	22,2	21,8	2,7	10800	18000	0,08	30203	T2DB017
	47	15,25	28,1	25	2,75	10500	16000	0,13	30303	T2FB017
	47	20,25	35,4	34,3	3,9	10000	16000	0,18	32303	T2FD017
20	42	15	26,4	28,8	3,5	10900	16000	0,11	32004-X	T3CC020
	47	15,25	31	31,3	3,8	9500	15000	0,13	30204	T2DB020
	52	16,25	34,1	32,3	3,6	9200	14000	0,18	30304	T2FB020
	52	22,25	44,8	46,5	5,3	8900	14000	0,25	32304	T2FD020
22	47	17	34,1	36,5	4,4	10400	15000	0,14	--	T2CC022
25	47	15	29,5	34,9	4,3	9100	14000	0,12	32005-X	T4CC025
	52	16,25	35,6	38,2	4,7	8400	13000	0,16	30205	T3CC025
	52	19,25	36,5	43,3	5,3	7700	13000	0,18	32205	T2CD025
	52	22	48,3	58	7	8200	13000	0,22	33205	T2DE025
	62	18,25	45,8	44	4,9	7700	12000	0,27	30305	T2FB025
	62	18,25	37,5	39	4,4	6400	11000	0,28	31305	T7FB025
	62	25,25	61	64	7,5	7400	12000	0,38	32305	T2FD025
30	55	17	37,7	47,9	5,8	7800	12000	0,17	32006-X	T4CC030
	62	17,25	47,5	52	6,3	6900	11000	0,22	30206	T3DB030
	62	21,25	52	60	6,9	6400	11000	0,28	32206	T3DC030
	62	25	68	82	9,9	7000	11000	0,35	33206	T2DE030
	72	20,75	58,1	58,5	6,7	6700	10000	0,45	30306	T2FB030

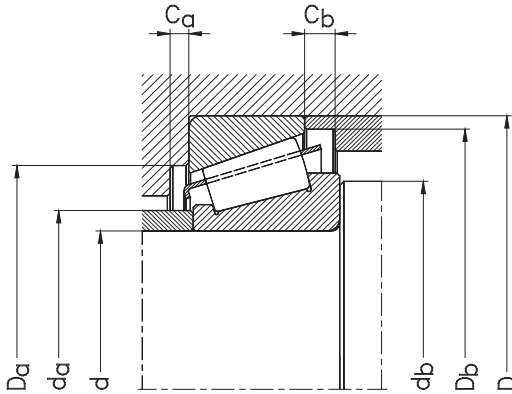


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
15	11	10	0,6	0,6	10	0,24	2,53	1,39	21	21	29	32	2	2
	13	11	1	1	10	0,29	2,11	1,16	22	21	36	38	2	3
17	12	11	1	1	10	0,34	1,74	0,96	23	23	34	37	2	2
	14	12	1	1	10	0,29	2,11	1,16	25	23	40	42	2	3
	19	16	1	1	12	0,18	3,26	1,79	24	23	39	43	3	4
20	15	12	0,6	0,6	10	0,37	1,6	0,88	25	25	36	39	2	3
	14	12	1	1	11	0,34	1,74	0,96	27	26	40	43	2	3
	15	13	1,5	1,5	11	0,3	2	1,1	28	27	44	47	2	3
	21	18	1,5	1,5	14	0,3	2	1,1	27	27	43	47	3	4
22	17,5	13,5	1	1	11	0,33	1,8	1	28	28	40	44	4	3,5
25	15	11,5	0,6	0,6	12	0,43	1,39	0,77	30	30	40	44	3	3,5
	15	13	1	1	13	0,37	1,6	0,88	31	31	44	48	2	3
	18	15	1	1	13	0,43	1,39	0,77	31	31	44	48	2	3
	22	18	1	1	14	0,24	2,53	1,39	30	31	43	49	4	4
	17	15	1,5	1,5	13	0,3	2	1,1	34	32	54	57	2	3
	17	13	1,5	1,5	20	0,83	0,73	0,4	34	32	47	59	3	5
	24	20	1,5	1,5	16	0,44	1,38	0,76	33	32	52	57	3	5
30	17	13	1	1	14	0,43	1,39	0,77	35	36	48	52	3	4
	16	14	1	1	14	0,37	1,6	0,88	38	36	53	57	2	3
	20	17	1	1	16	0,37	1,6	0,88	37	36	52	59	3	4
	25	19,5	1	1	16	0,24	2,53	1,39	36	36	53	59	5	5,5
	19	16	1,5	1,5	15	0,31	1,9	1,05	41	37	62	66	3	4,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

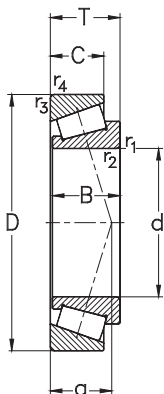


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r	C _{or}	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
			dyn.	stat.						
30	72	20,75	45,9	48,3	5,5	5700	9500	0,41	31306	T7FB030
	72	28,75	79	88	10,2	6300	10000	0,59	32306	T2FD030
35	62	18	46,3	62	7,5	6800	11000	0,23	32007-X	T4CC035
	72	18,25	58	64	7,8	5900	9500	0,32	30207	T3DB035
	72	24,25	68	81	9,4	5600	9500	0,43	32207	T3DC035
	72	28	83	102	12,4	6200	9500	0,59	33207	T2DE035
	80	22,75	73,6	75,8	8,5	6000	9000	0,53	30307	T2FB035
	80	22,75	60,5	65,5	7,6	5100	8500	0,54	31307	T7FB035
	80	32,75	97	114	13,4	5900	9000	0,83	32307	T2FE035
	40	68	19	52	68	8,3	6300	9500	0,29	32008-X
75		26	82	107	13,1	5500	9000	0,52	33108	T2CE040
80		19,75	68	75	9,2	5300	8500	0,43	30208	T3DB040
80		24,75	77	90	10	4900	8500	0,56	32208	T3DC040
80		32	114	142	17,4	5600	8500	0,74	33208	T2DE040
85		33	121	150	18,3	6200	8000	0,9	--	T2EE040
90		25,25	89	99	11,4	5300	8000	0,77	30308	T2FB040
90		25,25	80	82	9,5	4600	7500	0,75	31308	T7FB040
90		35,25	119	145	17	5200	8000	1,2	32308	T2FD040
45	75	20	62	84	10,3	5500	8500	0,33	32009-X	T3CC045
	75	24	76	106	12,9	5800	8500	0,43	33009	T2CE045
	80	26	89	122	14,9	4900	8000	0,53	33109	T3CE045
	85	20,75	74	85	10,4	5000	8000	0,5	30209	T3DB045

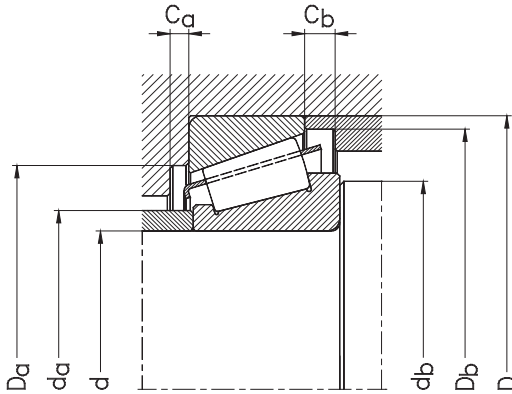


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
30	19	14	1,5	1,5	24	0,83	0,73	0,4	40	37	55	68	3	6,5
	27	23	1,5	1,5	18	0,31	1,9	1,05	39	37	59	66	3	5,5
35	18	14	1	1	16	0,45	1,32	0,73	41	41	54	59	4	4
	17	15	1,5	1,5	15	0,37	1,6	0,88	44	42	62	67	3	3
	23	19	1,5	1,5	18	0,37	1,6	0,88	43	42	61	67	3	5
	28	22	1,5	1,5	18	0,37	1,62	0,89	42	42	61	68	5	6
	21	18	2	1,5	16	0,31	1,9	1,05	46	44	70	74	3	4,5
	21	15	2	1,5	26	0,83	0,73	0,4	45	44	62	76	3	7,5
	31	25	2	1,5	20	0,31	1,9	1,05	44	44	66	76	4	7,5
40	19	14,5	1	1	15	0,38	1,58	0,87	46	44	60	65	4	4,5
	26	20,5	1,5	1,5	18	0,26	2,27	1,25	47	47	65	71	4	5,5
	18	16	1,5	1,5	17	0,37	1,6	0,88	49	47	69	74	3	3,5
	23	19	1,5	1,5	19	0,37	1,6	0,88	49	47	68	75	3	5,5
	32	25	1,5	1,5	21	0,36	1,68	0,92	47	47	67	76	5	7
	32,5	28	2,5	2	22	0,35	1,7	0,9	48	50	70	80	5	5
	23	20	2	1,5	20	0,34	1,74	0,96	53	49	77	81	3	5
	23	17	2	1,5	30	0,83	0,73	0,4	51	49	71	86	3	8
33	27	2	1,5	23	0,35	1,74	0,96	51	49	73	82	3	8	
45	20	15,5	1	1	17	0,38	1,58	0,87	52	51	67	72	4	4,5
	24	19	1	1	16	0,29	2,04	1,12	52	52	72	78	5	7
	26	20,5	1,5	1,5	19	0,29	2,06	1,13	52	52	69	77	4	5,5
	19	16	1,5	1,5	18	0,4	1,48	0,81	54	52	74	80	3	4,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

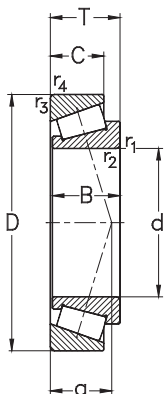


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
45	85	24,75	87	99	11,5	4500	8000	0,57	32209	T3DC045
	85	32	118	153	18,6	5100	7500	0,79	33209	T3DE045
	95	29	90	112	13,65	5500	7500	0,92	--	T7FC045
	95	36	147	186	22,68	5500	7000	1,2	--	T2ED045
	100	27,25	110	124	14,6	4800	7000	0,96	30309	T2FB045
	100	27,25	100	105	12,5	4200	6700	1	31309	T7FB045
	100	38,25	145	185	22	4700	7000	1,5	32309	T5FD045
50	80	20	65	92	11,2	5100	8000	0,42	32010-X	T3CC050
	80	24	81	115	14	5300	8000	0,42	33010	T2CE050
	85	26	92	110	13,4	4800	7500	0,6	33110	T3CE050
	90	21,75	80	94	11,5	4700	7500	0,54	30210	T3DB050
	90	24,75	85	105	12,3	4200	7500	0,6	32210	T3DC050
	90	32	122	163	19,9	4700	7000	0,85	33210	T3DE050
	100	36	154	200	24,4	4400	7500	1,3	--	T2ED050
	105	32	108	137	16,6	4300	6300	1,2	--	T7FC050
	110	29,25	137	144	17,1	4400	6300	1,3	30310	T2FB050
	110	29,25	115	123	14,5	4000	6000	1,4	31310	T7FB050
110	42,25	180	225	27	4400	6300	1,9	32310	T5FD050	
55	90	23	85	121	14,8	4700	7000	0,58	32011-X	T3CC055
	90	27	100	150	18,2	4800	7000	0,67	33011	T2CE055
	95	30	114	160	19,5	4300	6700	0,89	33111	T3CE055
	100	22,75	98	116	14,1	4200	6700	0,7	30211	T3DB055

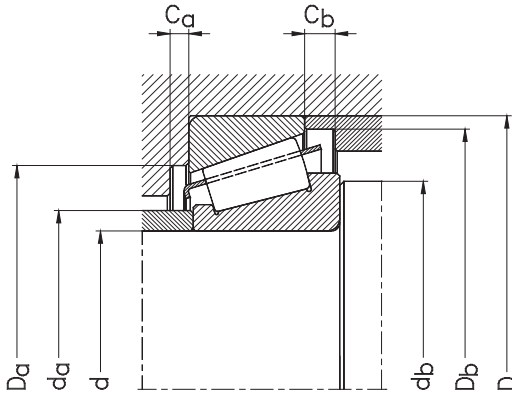


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
45	23	19	1,5	1,5	20	0,4	1,48	0,81	54	52	73	80	3	5,5
	32	25	1,5	1,5	22	0,39	1,56	0,86	52	52	72	81	5	7
	26,5	20	2,5	2,5	32	0,88	0,68	0,4	54	56	71	91	3	9
	35	30	2,5	2,5	23	0,33	1,8	1	55	56	80	89	6	6
	25	22	2	1,5	21	0,34	1,74	160,96	59	53	86	92	3	5
	25	18	2	1,5	32	0,83	0,73	0,4	57	53	79	95	4	9
	36	30	2	1,5	30	0,55	1,1	0,6	57	53	82	93	4	8
50	20	15,5	1	1	18	0,42	1,43	0,78	57	56	72	77	4	4,5
	24	19	1	1	17	0,32	1,9	1,04	56	56	72	76	4	5
	26	20	1,5	1,5	20	0,32	1,88	1,04	56	57	74	82	4	6
	20	17	1,5	1,5	20	0,42	1,43	0,79	58	57	79	85	3	4,5
	23	19	1,5	1,5	21	0,42	1,43	0,79	58	57	78	85	3	5,5
	32	24,5	1,5	1,5	23	0,42	1,43	0,79	57	57	77	87	5	7,5
	35	30	2,5	2,5	25	0,35	1,7	0,9	59	60	84	94	6	6
	29	22	3	3	36	0,88	0,68	0,4	60	62	78	100	4	10
	27	23	2,5	2	23	0,34	1,74	0,96	65	60	95	102	4	6
	27	19	2,5	2	35	0,83	0,73	0,4	62	60	87	104	4	10
40	33	2,5	2	33	0,55	1,1	0,6	63	60	90	102	5	9	
55	23	17,5	1,5	1,5	20	0,41	1,48	0,81	63	62	81	86	4	5,5
	27	21	1,5	1,5	19	0,31	1,92	1,06	63	62	81	86	5	6
	30	23	1,5	1,5	22	0,29	2,06	1,13	63	62	83	91	5	7
	21	18	2	1,5	21	0,4	1,48	0,81	64	64	88	94	4	4,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

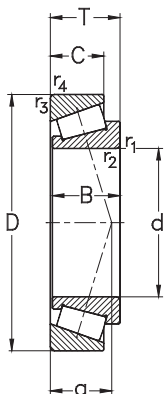


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
55	100	26,75	108	133	15,6	3800	6700	0,87	32211	T3DC055
	100	35	154	207	25,2	4300	6300	1,21	33211	T3DE055
	110	39	179	232	28,29	4200	6300	1,7	--	T2ED055
	115	34	125	163	19,87	4000	5600	1,6	--	T7FC055
	120	31,5	159	167	20	4100	5600	1,8	30311	T2FB055
	120	31,5	122	138	16,5	3700	5600	1,6	31311	T7FB055
	120	45,5	205	260	31	4100	5600	2,55	32311	T2FD055
60	95	23	86	127	15,4	4400	6700	0,63	32012-X	T4CC060
	95	27	102	157	19,1	4500	6700	0,73	33012	T2CE060
	100	30	110	174	21	4000	6300	0,89	33112	T3CE060
	110	23,75	111	131	15,9	3900	6000	0,92	30212	T3EB060
	110	29,75	129	165	19,6	3500	6000	1,14	32212	T3EC060
	110	38	178	242	29,5	4000	6000	1,5	33212	T3EE060
	115	39	168	250	30,5	4400	5600	1,85	--	T5ED060
	115	40	194	260	31,7	4400	5900	1,85	--	T2EE060
	125	37	154	204	24,8	4200	5300	2,05	--	T7FC060
	130	33,5	172	200	23,9	3800	5300	2,1	30312	T2FB060
130	33,5	144	168	20,1	3400	5300	1,9	31312	T7FB060	
130	48,5	231	307	37	3900	5300	3,15	32312	T5FD060	
65	100	23	87	132	16,1	4100	6000	0,62	32013-X	T4CC065
	100	27	103	163	19,9	4300	6300	0,78	33013	T2CE065
	110	34	153	230	28,1	3700	5600	1,34	33113	T3DE065

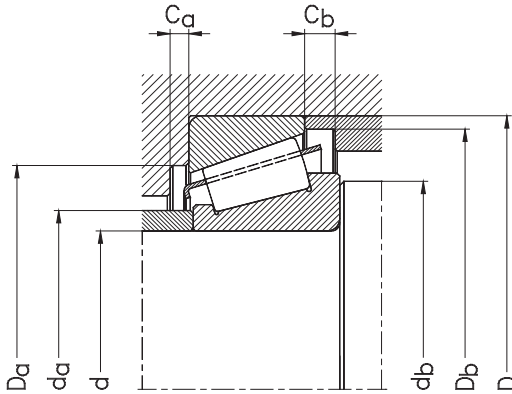


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
55	25	21	2	1,5	23	0,4	1,48	0,81	64	64	87	95	4	5,5
	35	27	2	1,5	26	0,4	1,5	0,83	63	64	85	96	6	8
	39	32	2,5	2,5	27	0,35	1,7	0,9	66	65	93	104	7	7
	31	23,5	3	3	39	0,88	0,68	0,4	66	67	86	109	4	10,5
	29	25	2,5	2	25	0,34	1,74	0,96	71	65	104	111	4	6,5
	29	21	2,5	2	39	0,83	0,73	0,4	68	65	94	113	4	10,5
	43	35	2,5	2	30	0,55	1,1	0,6	68	65	99	112	5	10,5
60	23	17,5	1,5	1,5	21	0,43	1,39	0,77	67	67	85	91	4	5
	27	21	1,5	1,5	20	0,33	1,83	1,01	67	67	85	90	5	6
	30	23	1,5	1,5	23	0,4	1,51	0,83	67	67	88	96	5	7
	22	19	2	1,5	22	0,4	1,48	0,81	70	68	96	103	4	4,5
	28	24	2	1,5	24	0,4	1,48	0,81	69	68	95	104	4	5,5
	38	29	2	1,5	28	0,4	1,48	0,81	69	68	93	105	6	9
	38	31	4	2,5	33	0,54	1,1	0,6	70	74	92	110	5	8
	39	33	2,5	2,5	28	0,33	1,8	1	70	70	98	109	6	7
	33,5	26	3	3	41	0,83	0,72	0,4	72	72	94	119	4	11
	31	26	3	2,5	26	0,34	1,74	0,96	77	72	112	120	5	7,5
	31	22	3	2,5	41	0,83	0,73	0,4	74	72	103	123	5	11,5
46	37	3	2,5	39	0,55	1,1	0,6	74	72	107	120	6	11,5	
65	23	17,5	1,5	1,5	23	0,46	1,31	0,72	72	72	90	97	4	5,5
	27	21	1,5	1,5	21	0,35	1,72	0,95	72	72	89	96	5	6
	34	26,5	1,5	1,5	26	0,39	1,55	0,85	74	72	96	106	6	7,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

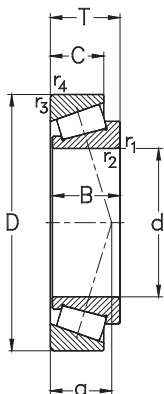


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
65	120	24,75	123	144	17,5	3600	5600	1,1	30213	T3EB065
	120	32,75	154	197	23,7	3300	5600	1,59	32213	T3EC065
	120	39	161	240	29,26	4400	5100	1,95	--	T5ED065
	120	41	216	295	35,9	3700	5300	2,04	33213	T3EE065
	130	37	157	216	26,34	4000	5000	2,2	--	T7FC065
	140	36	198	232	27,3	3600	4800	2,4	30313	T2GB065
	140	36	163	189	23	3200	4800	2,6	31313	T7GB065
	140	51	270	343	41,8	3600	4800	3,82	32313	T2GD065
70	110	25	109	164	19,9	3800	5600	0,97	32014-X	T2GD070
	110	31	140	225	27,5	3900	5600	1,14	33014	T2CE070
	120	37	184	279	34	3400	5300	1,75	33114	T3DE070
	125	26,25	143	176	21,5	3400	5300	1,2	30214	T3EB070
	125	33,25	160	211	25,5	3100	5300	1,7	32214	T3EC070
	125	41	224	312	38,1	3500	5000	2,06	33214	T3EE070
	130	43	233	325	39,6	3900	5600	2,45	--	T2ED070
	140	39	176	240	28,8	3800	4500	2,65	--	T7FC070
	140	52	281	405	48,7	3900	4600	3,7	--	T4FE070
	150	38	224	265	31	3400	4500	3,1	30314	T2GB070
75	105	20	81	127	15,5	3500	6300	0,52	32915	T2BC075
	115	25	97	144	17,5	3800	5300	0,93	32015-X	T4CC075

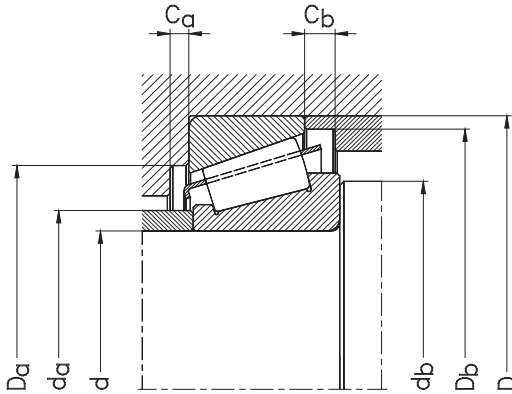


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
65	23	20	2	1,5	23	0,4	1,48	0,81	78	74	106	113	4	4,5
	31	27	2	1,5	27	0,4	1,48	0,81	76	74	104	115	4	5,5
	38	31	4	2,5	35	0,57	1,05	0,6	75	74	96	115	6	8
	41	32	2	1,5	30	0,39	1,54	0,85	75	74	102	115	6	9
	33,5	26	3	3	44	0,88	0,68	0,4	77	77	98	124	4	11
	33	28	3	2,5	28	0,34	1,74	0,96	84	77	122	130	5	8
	33	23	3	2,5	44	0,83	0,73	0,4	80	77	111	132	5	13
	48	39	3	2,5	41	0,55	1,1	0,6	80	77	117	130	6	12
70	25	19	1,5	1,5	24	0,43	1,38	0,76	78	77	98	105	5	6
	31	25,5	1,5	1,5	22	0,28	2,11	1,16	78	77	99	105	5	5,5
	37	29	2	1,5	28	0,38	1,58	0,87	80	79	104	115	6	8
	24	21	2	1,5	25	0,42	1,43	0,79	82	78	110	118	4	5
	31	27	2	1,5	28	0,42	1,43	0,79	80	78	108	119	4	6
	41	32	2	1,5	31	0,41	1,47	0,81	79	78	107	120	7	9
	42	35	3	2,5	30	0,33	1,8	1	81	82	111	123	7	8
	35,5	27	3	3	47	0,88	0,68	0,4	82	82	106	133	5	12
	51	43	5	3	39	0,44	1,35	0,8	82	88	111	133	7	9
	35	30	3	2,5	30	0,34	1,74	0,96	90	82	130	140	5	8
35	25	3	2,5	47	0,83	0,73	0,4	85	82	118	141	5	13	
51	42	3	2,5	44	0,55	1,1	0,6	86	82	125	140	6	12	
75	20	16	1	1	19	0,33	1,8	0,99	81	82	98	101	4	4
	25	19	1,5	1,5	25	0,46	1,31	0,72	83	82	103	110	5	6

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

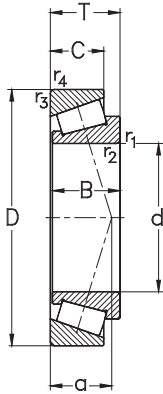


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
75	115	31	139	226	27,6	3700	5300	1,12	33015	T2CE075
	125	37	189	293	35,6	3200	5000	1,74	33115	T3DE075
	130	27,25	150	189	22,8	3200	5000	1,4	30215	T4DB075
	130	33,25	166	221	26,3	2900	5000	1,93	32215	T4DC075
	130	41	222	314	38	3300	4800	2,24	33215	T3EE075
	150	42	201	280	32,9	3600	4300	3,25	--	T7FC075
	160	40	251	295	34,3	3200	4300	3,64	30315	T2GB075
	160	40	206	241	28,4	2900	4300	3,4	31315	T7GB075
	160	58	348	458	54	3100	4000	5,7	32315	T5GD075
80	125	29	148	227	27,4	3400	5000	1,24	32016-X	T3CC080
	125	36	189	315	37,6	3400	5000	1,67	33016	T2CE080
	130	37	193	305	36,7	3100	4800	1,93	33116	T3DE080
	140	28,25	174	214	25,8	3000	4800	1,6	30216	T3EB080
	140	35,25	193	253	29,8	2800	4500	2,18	32216	T3EC080
	140	46	256	394	46,7	3200	4500	3,01	33216	T3EE080
	145	46	281	400	47,1	3400	4300	3,25	--	T2ED080
	170	42,5	280	335	38,8	3000	4300	4,34	30316	T2GB080
	170	42,5	224	268	31,3	2800	4000	4,2	31316	T7GB080
170	61,5	393	520	60,5	3000	4300	6,74	32316	T5GD080	
85	130	29	147	227	27,1	3300	4800	1,31	32017-X	T4CC085
	130	36	189	315	37,6	3300	4800	1,76	33017	T2CE085
	140	41	230	368	43,3	2900	4500	2,38	33117	T3DE085

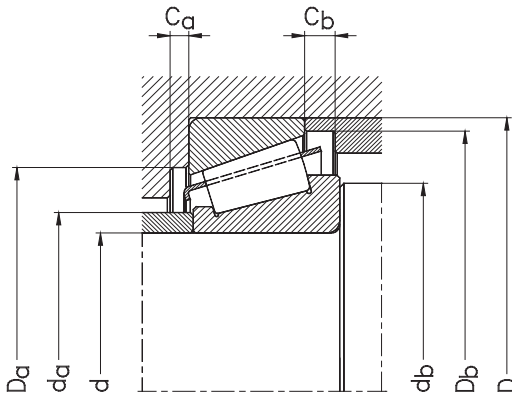


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
75	31	25,5	1,5	1,5	23	0,3	2,01	1,11	84	82	104	110	6	5,5
	37	29	2	1,5	30	0,4	1,51	0,83	84	84	109	120	6	8
	25	22	2	1,5	27	0,44	1,38	0,76	86	84	115	124	4	5
	31	27	2	1,5	29	0,44	1,38	0,76	85	84	114	125	4	6
	41	31	2	1,5	32	0,43	1,4	0,77	84	84	111	125	7	10
	38	29	3	3	50	0,88	0,68	0,4	88	87	114	143	5	13
	37	31	3	2,5	32	0,34	1,74	0,96	96	87	139	149	5	9
	37	26	3	2,5	50	0,83	0,73	0,4	91	87	127	151	6	14
	55	45	3	2,5	47	0,55	1,1	0,6	92	87	133	149	7	13
80	29	22	1,5	1,5	27	0,42	1,42	0,78	90	87	112	120	6	7
	36	29,5	1,5	1,5	26	0,29	2,06	1,13	90	87	112	119	6	6,5
	37	29	2	1,5	31	0,42	1,44	0,79	89	89	114	126	6	8
	26	22	2,5	2	28	0,42	1,43	0,79	92	90	124	132	4	6
	33	28	2,5	2	31	0,42	1,43	0,79	91	90	122	134	5	7
	46	35	2,5	2	35	0,41	1,45	0,8	89	90	119	135	7	11
	45	38	3	2,5	32	0,31	1,9	1,1	92	92	125	137	8	8
	39	33	3	2,5	34	0,34	1,74	0,96	102	92	148	159	5	9,5
	39	27	3	2,5	53	0,83	0,73	0,4	97	92	134	159	6	15,5
58	48	3	2,5	49	0,55	1,1	0,6	98	92	142	159	7	13,5	
85	29	22	1,5	1,5	28	0,44	1,36	0,75	94	92	117	125	6	7
	36	29,5	1,5	1,5	26	0,29	2,06	1,13	94	92	118	125	6	6,5
	41	32	2,5	2	33	0,41	1,48	0,81	95	95	122	135	7	9

Metrische einreihige Kegelrollenlager
 Metric Single Row Tapered Roller Bearings

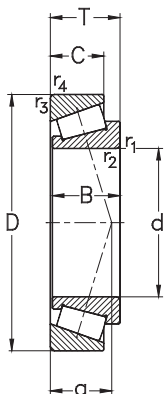


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
85	150	30,5	190	237	27,6	2900	4300	2,1	30217	T3EB085
	150	38,5	219	295	34,8	2700	4300	2,76	32217	T3EC085
	150	49	300	432	50	3000	4300	3,5	33217	T3EE085
	180	44,5	309	373	41,3	2900	4000	4,83	30317	T2GB085
	180	44,5	247	293	33,8	2700	3800	4,9	31317	T7GB085
	180	63,5	413	570	65	2800	4000	7,86	32317	T5GD085
90	140	32	180	279	32,7	3100	4300	1,69	32018-X	T3CC090
	140	39	242	397	46,4	3000	4500	2,3	33018	T2CE090
	150	45	269	432	49,9	2800	4300	3,07	33118	T3DE090
	155	46	286	430	49,4	3200	4000	3,5	--	T2ED090
	160	32,5	219	279	31,8	2800	4000	2,6	30218	T3FB090
	160	42,5	256	348	40	2500	4000	3,78	32218	T3FC090
	175	48	270	380	42,5	3200	3200	4,95	--	T7FC090
	190	46,5	333	403	43,8	2800	4000	5,87	30318	T2GB090
	190	46,5	270	320	36	2600	3400	5,4	31318	T7GB090
	190	67,5	474	640	72	2600	4000	8,5	32318	T2GD090
95	145	32	183	290	33,5	2900	4300	1,8	32019-X	T4CC095
	145	39	240	399	46	3000	4300	2,24	33019	T2CE095
	160	46	297	455	51,6	3100	3800	3,65	--	T2ED095
	170	34,5	248	320	35,8	2600	3800	3,2	30219	T3FB095
	170	45,5	291	405	45,8	2400	3800	4,23	32219	T3FC095
	200	49,5	350	420	45	2700	3400	6,77	30319	T2GB095

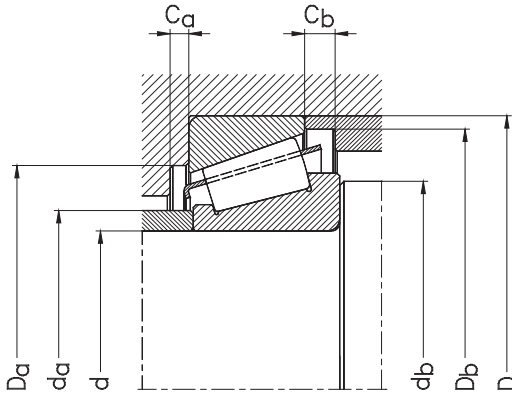


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
85	28	24	2,5	2	30	0,42	1,43	0,79	97	95	132	141	5	6,5
	36	30	2,5	2	34	0,42	1,43	0,79	97	95	130	142	5	8,5
	49	37	2,5	2	37	0,43	1,41	0,78	96	95	128	144	7	12
	41	34	4	3	36	0,35	1,74	0,96	107	99	156	167	6	10,5
	41	28	4	3	55	0,83	0,73	0,4	103	99	143	169	6	16,5
	60	49	4	3	51	0,55	1,1	0,6	103	99	150	167	7	14,5
90	32	24	2	1,5	30	0,42	1,42	0,78	100	98	125	134	6	8
	39	32,5	2	1,5	28	0,27	2,23	1,23	100	98	127	135	7	6,5
	45	35	2,5	2	36	0,4	1,51	0,83	101	101	130	144	7	10
	46	38	3	3	34	0,33	1,8	1	102	102	135	147	7	8
	30	26	2,5	2	32	0,42	1,43	0,79	104	101	140	150	5	6,5
	40	34	2,5	2	36	0,42	1,43	0,79	102	101	138	152	5	8,5
	45	33	4	4	57	0,83	0,72	0,4	105	104	134	167	6	15
	43	36	4	3	37	0,34	1,74	0,96	113	105	165	176	6	10,5
	43	30	4	3	58	0,83	0,73	0,4	109	105	151	179	6	16,5
	64	53	4	3	47	0,35	1,74	0,96	109	105	157	177	7	14,5
95	32	24	2	1,5	32	0,44	1,36	0,75	105	104	130	139	6	8
	39	32,5	2	1,5	29	0,27	2,26	1,24	104	104	131	139	7	6,5
	46	38	3	3	35	0,33	1,8	1	107	107	140	152	7	8
	32	27	3	2,5	34	0,42	1,43	0,79	110	107	149	159	5	7,5
	43	37	3	2,5	39	0,42	1,43	0,79	109	107	145	161	5	8,5
	45	38	4	3	40	0,34	1,74	0,96	118	110	172	184	6	11,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

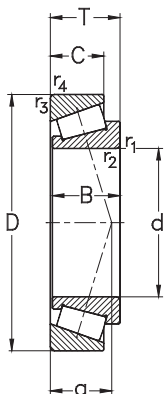


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
95	200	49,5	297	362	39,3	2400	3400	6,7	31319	T7GB095
	200	71,5	516	695	76	2400	3400	10,3	32319	T2GD095
100	145	24	125	190	21,8	2600	4500	1,15	--	T4CB100
	150	32	182	291	33,2	2900	4000	1,93	32020-X	T4CC100
	150	39	238	400	45,6	2900	4000	2,33	33020	T2CE100
	180	37	277	360	39,7	2500	3600	3,8	30220	T3FB100
	180	49	327	458	51	2300	3600	5,67	32220	T3FC100
	215	51,5	411	500	58	2500	3200	8,38	30320	T2GB100
	215	56,5	429	522	56	2300	3000	8,8	31320	T7GB100
	215	77,5	596	815	95,5	2200	3000	13,1	32320	T2GD100
105	160	35	215	345	38,7	2700	3800	2,33	32021-X	T4DC105
	160	43	250	437	48,9	2900	3800	3,09	33021	T2DE105
	190	39	282	368	40	2500	3400	4,2	30221	T3FB105
	190	53	372	530	59	2300	3400	6,07	32221	T3FC105
	225	81,5	638	878	101	2100	3000	15,1	32321	T2GD105
110	150	25	133	234	26,4	2500	4300	1,25	32922	T2CC110
	160	27	154	232	25,8	2500	3600	1,6	--	T4CB110
	170	38	259	413	46	2600	3600	2,96	32022-X	T4DC110
	170	47	301	516	57	2800	3600	3,71	33022	T2DE110
	200	41	344	456	48,7	2300	3200	5,2	30222	T3FB110
	200	56	409	580	63,5	2100	3200	7,35	32222	T3FC110
	240	54,5	474	583	66,5	2200	2800	11,1	30322	T2GB110

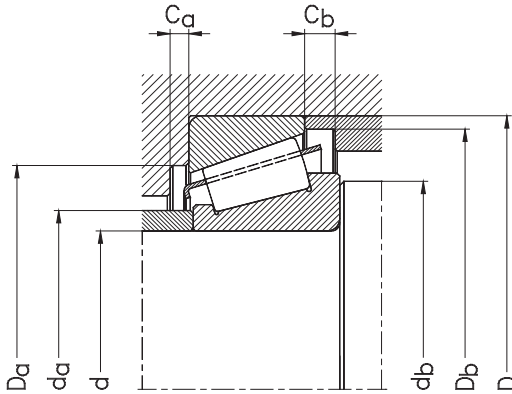


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
95	45	32	4	3	61	0,83	0,73	0,4	114	110	157	187	6	17,5
	67	55	4	3	49	0,35	1,74	0,96	115	110	166	186	8	16,5
100	22,5	17,5	3	3	30	0,48	1,25	0,7	109	112	133	140	4	6,5
	32	24	2	1,5	33	0,46	1,31	0,72	110	108	134	144	6	8
	39	32,5	2	1,5	29	0,29	2,09	1,15	109	108	135	143	7	6,5
	34	29	3	2,5	36	0,42	1,43	0,79	116	112	157	168	5	8
	46	39	3	2,5	42	0,42	1,43	0,79	115	112	154	171	5	10
	47	39	4	3	42	0,34	1,74	0,96	127	115	184	197	6	12,5
	51	35	4	3	68	0,83	0,73	0,4	121	115	168	202	7	21,5
73	60	4	3	53	0,35	1,74	0,96	123	115	177	201	8	17,5	
105	35	26	2,5	2	35	0,44	1,35	0,74	116	116	143	154	6	9
	43	34	2,5	2	31	0,24	2,53	1,39	117	116	145	153	7	9
	36	30	3	2,5	38	0,31	1,88	1,04	123	117	165	177	6	9
	50	43	3	2,5	44	0,42	1,43	0,79	120	117	161	180	6	10
	77	63	4	3	56	0,35	1,74	0,96	129	120	185	209	9	18,5
110	25	20	1,5	1,5	26	0,36	1,69	0,93	118	117	140	145	5	5
	25,5	19,5	3	3	31	0,44	1,35	0,8	120	122	148	154	5	7,5
	38	29	2,5	2	37	0,43	1,39	0,77	123	121	152	163	7	9
	47	37	2,5	2	33	0,29	2,09	1,15	123	121	152	161	7	10
	38	32	3	2,5	39	0,42	1,43	0,79	129	122	174	187	6	9
	53	46	3	2,5	46	0,42	1,43	0,79	127	122	170	190	6	10
	50	42	4	3	45	0,34	1,74	0,96	142	125	206	220	8	12,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

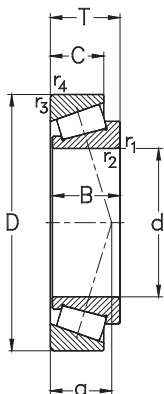


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
110	240	63	457	583	66,5	2000	2800	12,3	31322	T7GB110
	240	84,5	684	930	107	1900	2800	18,1	32322	T2GD110
120	170	27	157	250	27,3	2200	3800	1,7	--	T4CB120
	180	38	254	416	45	2500	3400	3,28	32024-X	T4DC120
	180	48	302	539	58	2600	3400	4,06	33024	T2DE120
	215	43,5	371	500	52	2200	3000	6,8	30224	T4FB120
	215	61,5	479	713	82,5	2000	3000	10,1	32224	T4FD120
	260	59,5	566	710	78,3	2000	2600	14,3	30324	T2GB120
	260	68	542	700	78	1900	2400	15,1	31324	T7GB120
	260	90,5	731	1045	114	1700	2600	21,1	32324	T2GD120
130	180	32	213	387	41,4	2200	3600	2,4	32926	T2CC130
	185	29	194	315	33,5	2100	3200	2,25	--	T4CB130
	200	45	348	580	61	2300	3000	5,05	32026-X	T4EC130
	230	43,75	401	538	55	2000	2800	7,2	30226	T4FB130
	230	67,75	555	845	96	1800	2800	11,7	32226	T4FD130
	280	63,75	619	775	85	1800	2400	17,2	30326	T2GB130
	280	72	611	788	87	1700	2400	19,2	31326	T7GB130
	280	98,75	840	1130	133	1800	2400	30,2	32326	--
140	190	321	214	399	41,9	2100	3400	2,55	32928	T2CC140
	195	29	194	325	33,9	1900	3200	2,4	--	T4CB140
	210	45	344	572	60	2200	2800	5,18	32028-X	T4DC140
	250	45,75	442	593	59	1900	2600	8,5	30228	T4FB140

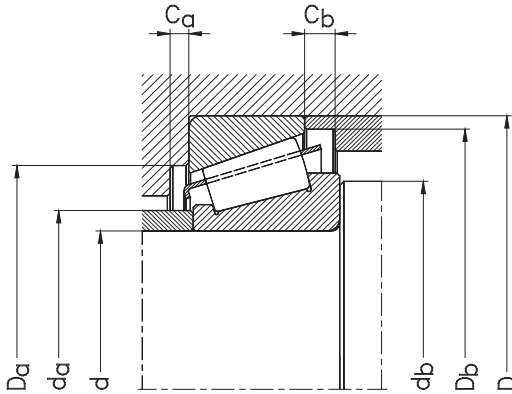


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
110	57	38	4	3	75	0,83	0,73	0,4	135	125	188	224	7	25
	80	65	4	3	58	0,35	1,74	0,96	137	125	198	222	9	19,5
120	25	19,5	3	3	34	0,48	1,25	0,7	130	132	157	164	4	7,5
	38	29	2,5	2	40	0,46	1,31	0,72	132	131	161	173	7	9
	48	38	2,5	2	36	0,31	1,97	1,08	132	131	160	171	6	10
	40	34	3	2,5	43	0,44	1,38	0,76	141	132	187	201	6	9,5
	58	50	3	2,5	51	0,44	1,38	0,76	137	132	181	204	7	11,5
	55	46	4	3	48	0,34	1,74	0,96	153	135	221	237	7	13,5
	62	42	4	3	82	0,83	0,73	0,4	145	135	203	244	9	26
86	69	4	3	66	0,35	1,74	0,96	148	135	213	239	9	21,5	
130	32	25	2	1,5	31	0,34	1,77	0,97	141	140	167	172	6	7
	27	21	3	3	37	0,48	1,25	0,7	141	144	171	179	5	8
	45	34	2,5	2	44	0,43	1,38	0,76	144	142	178	192	7	11
	40	34	4	3	46	0,44	1,38	0,76	152	146	203	217	7	9,5
	64	54	4	3	56	0,44	1,38	0,76	146	146	193	219	7	13,5
	58	49	5	4	53	0,34	1,74	0,96	164	150	239	255	8	14,5
	66	44	5	4	87	0,83	0,73	0,4	157	150	218	261	8	28
93	78	5	4	68	0,34	1,75	0,96	160	147	230	260	10	20,5	
140	32	25	2	1,5	33	0,36	1,67	0,92	150	150	177	184	6	7
	27	21	3	3	40	0,5	1,2	0,7	151	152	180	189	5	8
	45	34	2,5	2	46	0,46	1,31	0,72	153	150	187	202	7	11
	42	36	4	3	47	0,44	1,38	0,76	164	156	219	236	7	9,5

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

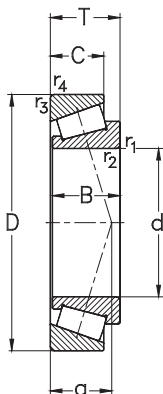


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r	C _{0r}	C _u	n _{br}	n _G	m	DIN 720	ISO 355
			dyn.	stat.						
140	250	71,75	647	1000	111	1600	2600	14	32228	T4FD140
	300	67,75	664	845	89,5	1600	2200	20,5	30328	T2GB140
	300	77	695	903	95	1500	2200	35,5	31328	T7GB140
	300	107,75	1170	1710	198	1400	2200		32328	--
150	210	32	233	390	39,9	1900	3000	3,05	--	T4DB150
	225	48	390	663	68	2000	2600	6,31	32030-X	T4EC150
	270	49	492	665	65	1700	2400	11,1	30230	T4GB150
	270	77	739	1150	125	1500	2400	18,5	32230	T4GD150
	320	72	818	1045	107,5	1500	2200	25,5	30330	T2GB150
	320	82	785	1033	107	1400	2000	28,5	31330	T7GB150
	320	114	1330	1950	221	1300	2000	45	32330	--
160	220	32	242	415	42	1700	2800	3,25	--	T4DB160
	240	51	444	767	76	1800	2400	7,78	32032-X	T4EC160
	290	52	558	760	73	1600	2200	13,2	30232	T4GB160
	290	84	875	1395	147	1300	2200	23,8	32232	T4GD160
	340	75	902	1160	118,5	1400	2000	29,9	30332	T2GB160
170	230	38	289	571	57	1800	2800	4,5	32934	T3DC170
	260	57	548	956	93	1600	2200	10,6	32034-X	T4EC170
	310	57	639	878	82	1500	2000	17	30234	T4GB170
	310	91	1000	1610	165	1200	2000	29,1	32234	T4GD170
180	250	45	357	728	71	1600	2600	6,65	32936	T4DC180
	280	64	679	1202	114	1400	2200	14,2	32036-X	T3FD180

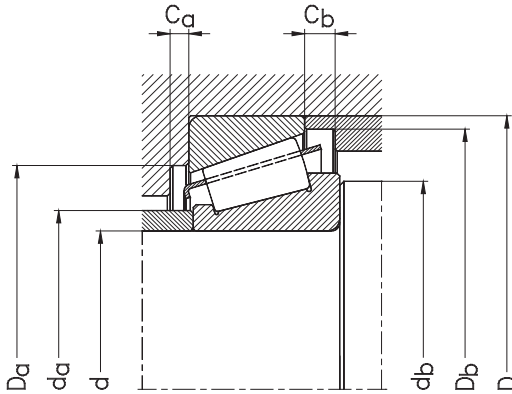


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
140	68	58	4	3	60	0,44	1,38	0,76	159	156	210	238	8	13,5
	62	53	5	4	52	0,34	1,74	0,96	176	158	255	283	8	14,5
	70	47	5	4	94	0,8	0,75	0,41	169	160	235	280	9	30
	102	85	5	4	74	0,24	2,53	1,39	170	157	194	203	5	9
150	30	23	3	3	41	0,46	1,3	0,7	162	162	194	203	5	9
	48	36	3	2,5	50	0,46	1,31	0,72	164	162	200	216	8	12
	45	38	4	3	52	0,44	1,38	0,76	175	116	234	256	9	11
	73	60	4	3	64	0,44	1,38	0,76	171	166	226	254	8	17
	65	55	5	4	60	0,34	1,74	0,96	189	168	273	292	9	17
	75	50	5	4	100	0,83	0,73	0,4	181	170	251	300	9	32
	108	90	5	4	79	0,24	2,53	1,39	184	167	264	299	12	24
160	30	23	3	3	44	0,48	1,25	0,7	172	172	204	213	5	9
	51	38	3	2,5	53	0,46	1,31	0,72	175	174	213	231	8	13
	48	40	4	3	51	0,44	1,38	0,79	189	176	252	269	8	12
	80	67	4	3	69	0,44	1,38	0,76	183	174	242	274	10	17
	68	58	5	4	63	0,35	1,74	0,96	201	180	290	310	9	17
170	38	30	2,5	2	42	0,38	1,57	0,86	183	182	213	222	7	8
	57	43	3	2,5	57	0,44	1,35	0,74	188	184	230	249	10	14
	52	43	5	4	60	0,44	1,38	0,76	203	190	268	288	8	14
	86	71	5	4	74	0,44	1,38	0,76	196	190	259	294	10	20
180	45	34	2,5	2	53	0,48	1,25	0,69	194	192	225	241	8	11
	64	48	3	2,5	60	0,42	1,42	0,78	199	194	247	267	10	16

Metrische einreihige Kegelrollenlager
Metric Single Row Tapered Roller Bearings

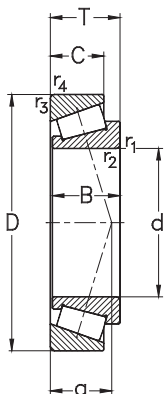


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
180	320	57	660	928	86	1400	2000	17,9	30236	T4GB180
	320	91	1015	1650	169	1100	1900	29,9	32236	T4GD180
190	260	45	375	761	73	1500	2400	7	32938	T4DC190
	290	64	693	1231	115	1400	2000	14,8	32038-X	T4FD190
	340	60	752	1043	95	1300	1800	21	30238	T4GB190
	340	97	1150	1840	200	1100	1800	36,7	32238	T4GD190
200	280	51	480	976	92	1400	2200	9,5	32940	T3EC200
	310	70	839	1449	139	1300	1900	18,9	32040-X	T4FD200
	360	64	822	1147	103	1200	1700	25,1	30240	T4GB200
	360	104	1265	2035	203	1000	1700	43,7	32240	T3GD200
220	285	41	396	830	77	1300	1600	6,45	--	T2DC220
	340	76	963	1736	155	1100	1700	24,4	32044-X	T4FD220
	400	72	983	1367	120	1100	1600	34,6	30244	T4GB220
	400	114	1575	2625	251	900	1500	60,2	32244	--
240	320	42	429	815	73	1100	1900	8,45	--	T4EB240
	320	51	541	1100	99	1100	1900	11	32948	T4EC240
	360	76	973	1804	158	1000	1600	25,1	32048-X	T4FD240
	440	127	1825	3250	298	800	1400	78,6	32248	--
260	400	87	1191	2255	192	900	1400	38,1	32052-X	T4FC260
	480	137	2220	3725	340	700	1200	106	32252	--
280	380	63,5	779	1630	139	900	1600	40,4	32956	T4EC280
	420	87	843	1782	149	1000	1300		32056-X	T4FC280

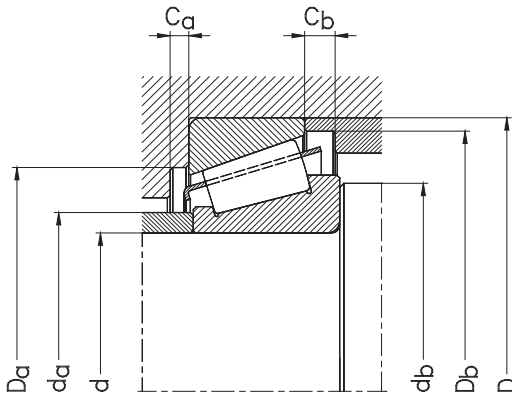


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
180	52	43	5	4	62	0,44	1,38	0,76	211	200	278	297	9	14
	86	71	5	4	77	0,45	1,33	0,73	204	200	267	303	10	20
190	45	34	2,5	2	55	0,48	1,26	0,69	204	202	235	251	8	11
	64	48	3	2,5	63	0,44	2,27	1,49	210	204	257	279	10	16
	55	46	5	4	62	0,44	1,38	0,76	224	210	298	318	9	14
200	92	75	5	4	81	0,44	1,38	0,76	216	207	286	323	10	22
	51	39	2,5	1	53	0,39	1,52	0,84	217	214	257	271	9	12
	70	53	3	2,5	67	0,43	1,39	0,77	222	214	273	297	11	17
	58	48	5	4	69	0,44	1,38	0,76	237	220	315	336	9	16
220	98	82	5	4	83	0,41	1,48	0,81	231	220	302	340	11	22
	40	33	4	3	45	0,31	1,9	1,1	233	234	270	277	7	8
	76	57	4	3	73	0,43	1,39	0,77	244	236	300	326	12	19
	65	54	5	4	75	0,42	1,43	0,79	2559	242	348	371	10	18
240	108	90	5	4	94	0,44	1,36	0,75	258	242	334	383	13	24
	39	30	3	3	60	0,46	1,3	0,7	256	252	299	310	7	12
	51	30	3	3	60	0,46	1,31	0,72	255	254	294	311	9	12
	76	57	4	3	79	0,46	1,31	0,72	262	256	318	346	12	19
260	120	100	5	4	105	0,45	1,34	0,73	290	262	365	415	13	27
	87	65	5	4	86	0,43	1,38	0,76	287	282	352	383	13	22
	130	106	6	5	113	0,32	1,88	1,04	303	268	401	458	16	31
280	63,5	48	3	2,5	74	0,43	1,39	0,76	298	295	348	366	11	15,5
	87	65	5	4	91	0,46	1,31	0,72	305	302	400	402	14	22

Metrische einreihige Kegelrollenlager
 Metric Single Row Tapered Roller Bearings

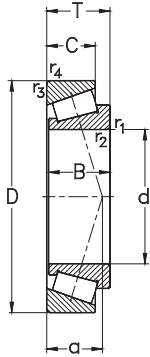


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertypen	
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation	
d	D	T	C _r dyn.	C _{0r} stat.	C _u	n _{gr}	n _G	m	DIN 720	ISO 355
300	420	76	1059	2251	187	800	1400	32	32960	T3FD300
	460	100	1604	3066	251	700	1200	57,2	32060-X	T4GD300
320	480	100	1615	3099	249	700	1100	59,4	32064-X	T4GD320
340	460	76	1092	2433	196	700	1300	35,4	32968	T4FD340
360	480	76	1096	2492	198	600	1200	36,8	32972	T4FD360

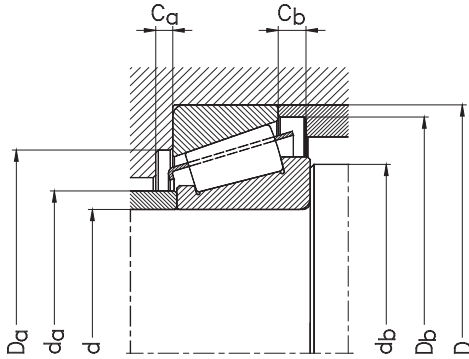


Berechnungsfaktoren									Anschlussmaße [mm]					
Calculation factors									Abutment and fillet dimensions [mm]					
d	B	C	r ₁ , r ₂ min	r ₃ , r ₄ min	a ≈	e	Y	Y ₀	d _a max	d _b min	D _a min	D _b min	C _a min	C _b min
300	76	57	4	3	79	0,39	1,52	0,84	324	317	383	404	12	19
	100	74	5	4	98	0,43	1,38	0,76	330	322	404	440	15	26
320	100	74	5	4	104	0,46	1,31	0,72	350	342	424	460	15	26
340	76	57	4	3	90	0,44	1,37	0,75	361	357	421	446	14	19
360	76	57	4	3	97	0,46	1,31	0,72	380	377	439	464	14	19

Kegelrollenlager in Zollabmessung
Tapered Roller Bearings Single Row, Inch Sizes

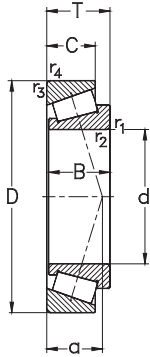


Hauptabmessungen						Tragzahlen		Grenzdrehzahlen		Gewicht	Lagertyp	Serie
Boundary dimensions						Load ratings		Limited speed ratings		Weight	Designation	Series
d		D		T		C _r	C ₀	C _u	n _G	m		
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	dyn.	stat.		rpm	[kg]		
3,7500	95,250	5,7500	146,050	1,3125	33,338	176,1	292,9	33,9	4500	1,90	K-47896/47820	47800
		6,0000	152,400	1,5625	39,688	170	261	30,1	4500	2,55	K-594/592A	595
		6,0000	152,400	1,5625	39,688	170	261	30,1	4500	2,55	K-594A/592A	595
		6,6250	168,275	1,6250	41,275	209,6	317,3	35,6	4000	3,80	K-683/672	675
4,0000	101,600	6,6250	168,275	1,6250	41,275	209,6	317,3	35,6	4000	3,45	K-687/672	675
4,2500	107,950	6,2500	158,750	0,9063	23,020	89,5	140	15,7	4300	1,40	K-37425/625	37000
4,5000	114,300	7,0000	177,800	1,6250	41,275	218,3	345,8	37,7	3800	3,60	K-64450/700	64000
		7,1250	180,975	1,3750	34,925	151,4	213,8	23,2	3800	2,95	K-68450/712	68000
5,0000	127,000	7,1875	182,562	1,5625	39,688	214,9	412,1	44	3600	3,30	K-48290/220	48200
		7,7500	196,850	1,8125	46,038	294,6	520,8	54,6	3400	5,20	K-67388/322	67300
5,2500	133,350	6,9688	177,008	1,0000	25,400	123,1	246,6	26,3	3600	1,80	K-L327249/210	L327200
		7,7500	196,850	1,8135	46,038	294,2	520,1	54,4	3400	4,80	K-67391/67322	67300
5,5000	139,700	9,3125	236,538	2,2500	57,150	476,4	777,1	77,9	2800	10,00	K-HM231132/110	HM 231100
5,8750	149,225	9,3125	236,538	2,2500	57,150	476,4	777,1	77,9	2800	10,00	K-HM231148/110	HM 231100
6,0000	152,400	8,7500	222,250	1,8437	46,830	299,6	548,4	55,4	3000	5,90	K-M231649/610	M 231600
6,2500	158,750	8,0938	205,583	0,9375	23,812	114,8	221,9	22,6	3000	1,95	K-L432349/310	L 432300
7,0000	177,800	8,9375	227,012	1,1875	30,162	167,5	372,3	36,7	2800	3,00	K-36990/920	36900
7,3750	187,325	11,1250	282,575	2,0000	50,800	336,3	558,1	52,6	2800	9,80	K-87737/87111	87000
7,5000	190,500	11,1250	282,575	2,0000	50,800	336,7	558,8	52,7	2200	9,60	K-87750/111	87000
7,7500	196,850	9,5000	241,300	0,9375	23,812	138,2	273,7	26,4	2600	2,00	K-LL639249/210	LL639200
		10,1250	257,175	1,5625	39,688	258,5	601,2	57,3	2400	5,30	K-LM739749/710	LM 739749
8,1250	206,375	11,1250	282,575	1,8125	46,038	341,2	727,4	67,8	2200	8,60	K-67985/920	67900

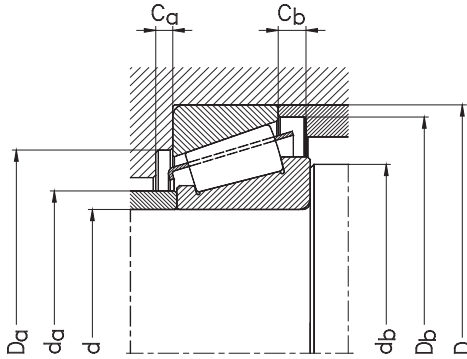


d		B		C		r ₁ , r ₂ , r ₃ , r ₄				Berechnungsfaktoren				Anschlussmaße [mm]									
d		B		C		r ₁ , r ₂ , r ₃ , r ₄				Calculation factors				Abutment and fillet dimensions [mm]									
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]
[inch] [mm]										≈				max	min	min	min	min	min	min			
3,7500	95,250	1,3750	34,925	1,0313	26,195	0,14	3,5	0,13	3,3	32	0,44	1,37	0,75	103,132	109,982	131,064	139,954	1,866	4,578				
		1,4300	36,322	1,1875	30,162	0,14	3,5	0,13	3,3	37	0,46	1,31	0,72	103,886	109,982	134,874	114,018	1,690	5,411				
		1,4300	36,322	1,1875	30,162	0,2	5	0,13	3,3	37	0,46	1,31	0,72	103,886	113,03	134,874	144,018	1,690	5,411				
		1,6250	41,275	1,1875	30,162	0,14	3,5	0,13	3,3	38	0,47	1,29	0,71	105,918	113,03	149,098	160,02	2,007	6,16				
4,0000	101,600	1,6250	41,275	1,1875	30,162	0,14	3,5	0,13	3,3	38	0,47	1,29	0,71	112,014	118,11	149,098	160,02	2,006	6,16				
4,2500	107,950	0,8440	21,438	0,6250	15,875	0,14	3,5	0,13	3,3	37	0,58	1,03	0,56	115,062	121,92	143,002	151,892	1,368	4,55				
4,5000	114,300	1,6250	41,275	1,1875	30,162	0,14	3,5	0,13	3,3	42	0,51	1,17	0,64	124,968	131,064	160,02	171,958	2,007	5,855				
		1,2500	31,750	1,0000	25,400	0,14	3,5	0,13	3,3	40	0,5	1,2	0,66	122,936	130,048	163,068	171,958	0,914	4,394				
5,0000	127,000	1,5000	38,100	1,3125	33,338	0,14	3,5	0,13	3,3	34	0,32	1,88	1,04	134,874	140,97	167,894	176,022	1,638	4,470				
		1,8125	46,038	1,5000	38,100	0,14	3,5	0,13	3,3	39	0,34	1,78	0,98	137,922	144,018	180,086	188,976	1,321	3,722				
5,2500	133,350	1,0313	26,195	0,8125	20,638	0,06	1,5	0,06	1,5	29	0,36	1,68	0,92	139,954	141,986	166,878	170,942	2,472	4				
		1,8125	46,038	1,5000	38,100	0,31	8	0,13	3,3	39	0,35	1,73	0,95	143,002	156,972	180,086	188,976	1,321	3,722				
5,5000	139,700	2,2300	56,642	1,7500	44,450	0,14	3,5	0,13	3,3	45	0,31	1,94	1,06	155,956	160,02	216,916	224,028	3,175	8,438				
5,8750	149,225	2,2300	56,642	1,7500	44,450	0,25	6,4	0,13	3,3	45	0,31	1,94	1,06	163,068	171,958	216,916	224,028	3,175	8,433				
6,0000	152,400	1,8437	46,830	1,3750	34,925	0,14	3,5	0,06	1,5	40	0,36	1,66	0,91	163,068	168,91	207,01	213,106	1,473	6,19				
		0,9375	23,812	0,7188	18,258	0,06	1,5	0,06	1,5	33	0,39	1,52	0,84	166,116	167,894	195,072	198,882	1,194	3,522				
7,0000	177,800	1,1875	30,162	0,9063	23,020	0,06	1,5	0,06	1,5	43	0,44	1,36	0,75	185,928	187,96	214,122	220,98	1,829	4,602				
7,3750	187,325	1,8750	47,625	1,4375	36,512	0,14	3,5	0,13	3,3	55	0,41	1,46	0,8	200,914	207,01	261,112	266,7	0,559	5,525				
7,5000	190,500	1,8750	47,625	1,4375	36,512	0,14	3,5	0,13	3,3	55	0,4	1,49	0,82	202,946	209,04	261,112	266,7	0,559	5,525				
7,7500	196,850	0,9062	23,017	0,6875	17,462	0,06	1,5	0,06	1,5	41	0,38	1,59	0,88	202,946	204,978	231,902	235,966	1,389	4,496				
		1,5625	39,688	1,1875	30,162	0,14	3,5	0,13	3,3	50	0,46	1,3	0,72	205,994	213,106	239,014	250,952	2,06	6,076				
8,1250	206,375	1,8125	46,038	1,4375	36,512	0,14	3,5	0,13	3,3	62	0,5	1,2	0,66	218,948	224,028	260,096	275,082	1,7	5,056				

Kegelrollenlager in Zollabmessung
Tapered Roller Bearings Single Row, Inch Sizes

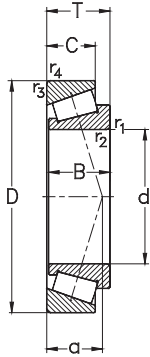


Hauptabmessungen						Tragzahlen			Grenzdrehzahlen		Gewicht	Lagertyp	Serie
Boundary dimensions						Load ratings			Limited speed	Weight	Designation	Series	
d		D		T		C _r	C ₀	C _u	n _G	m			
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	dyn.	stat.		rpm	[kg]			
8,5200	216,408	11,2500	285,750	1,8125	46,038	348,6	744,2	68,9	2200	7,85	K-LM742747/710	LM 742700	
9,1250	231,775	11,8125	300,038	1,3125	33,338	188,2	369,4	33,7	2000	5,30	K-544091/118A	544000	
10,0630	255,600	13,5000	342,900	2,2500	57,150	531	1057,6	92,8	1800	14,00	K-M349547/510	M 349500	
10,126	257,175	13,5000	342,900	2,2500	57,150	578,6	1185,7	104	1800	14,00	K-M349549/510	M 349500	
		14,1250	358,775	2,8125	71,438	706,3	1363,1	118,9	1700	20,50	K-M249747/710	M 249700	
10,3750	263,525	12,8125	325,438	1,1250	28,575	187,7	447,7	39,5	1800	53,00	K-38880/820	38800	
11,500	292,100	14,7500	374,650	1,8750	47,625	436,2	930,4	79,1	1600	12,00	K-L555249/210	L 555200	
12,0000	304,800	15,5000	393,700	2,0000	50,800	498,4	1082,9	90,7	1500	14,50	K-L357049/010	L 357000	
13,5100	343,154	17,7500	450,850	2,6250	66,675	828,6	1851,6	149,4	1300	28,00	K-LM361649/610	LM 361600	
13,6250	346,075	19,2500	488,950	3,7500	95,250	1470,2	3155,1	250,7	1200	55,00	K-HM262749/710	HM 262700	
15,0000	381,000	18,8750	479,425	1,9375	49,213	505,8	113,2	89,2	1200	20,00	K-L865547/512	L 865500	
15,1250	384,175	21,5000	546,100	4,1250	104,775	1814,1	3949,4	303,9	1100	77,00	K-HM266449/410	HM266400	
15,8750	403,225	18,1250	460,375	1,1250	28,575	194,3	565,5	44,5	1200	6,70	K-LL566848/810	LL 566800	
16,0000	406,400	21,6250	549,275	3,3750	85,725	1217,1	2609,2	199,1	1000	53,50	K-LM567949/910	LM 567900	
18,0000	457,200	23,7500	603,250	3,3750	85,725	1263,4	2854	211,1	950	61,50	K-LM770949/910	LM 770900	
19,2500	488,950	24,9950	634,873	3,3125	84,138	1386,2	3240,1	235,6	850	63,50	K-LM772748/710	LM 772700	
19,6250	498,475	24,9950	634,873	3,1875	80,962	1426,6	2857,1	260,2	850	59,50	K-EE243196/250	243000	
22,0000	558,800	29,0000	736,600	3,4688	88,108	1726,3	3700,7	257,6	750	92,50	K-EE843220/290	843000	
		29,0000	736,600	4,1250	104,775	2163,5	5247,5	365,4	750	115,00	K-LM377449/410	LM 377400	
24,0000	609,600	31,0000	787,400	3,6875	93,662	1907,6	4578	311,9	670	110,00	K-EE649240/310	649000	
29,5000	749,300	39,0000	990,600	6,2795	159,500	4439,2	11436,2	729,2	500	330,00	K-LM283649/610	LM 283600	
29,9183	760,000	35,0000	889,000	2,7500	69,850	1168,3	3521,2	228,5	560	67,50	K-LL483448/418	LL 483448	

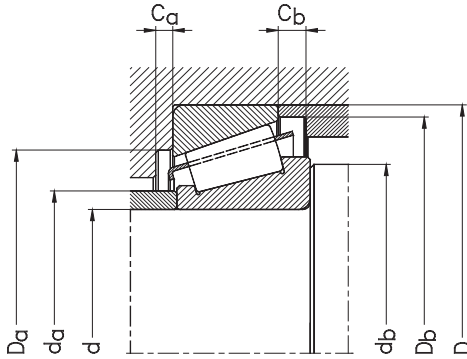


d		B		C		r_1, r_2				Berechnungsfaktoren				Anschlussmaße [mm]							
d		B		C		r_1, r_2				Calculation factors				Abutment and fillet dimensions [mm]							
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]
										a	e	Y	Y_0	d_a	d_b	D_a	D_b	C_a	C_b		
										≈				max	min	min	min	min	min		
8,5200	216,408	1,9375	49,212	1,3750	34,924	0,14	3,5	0,13	3,3	60	0,51	1,18	0,65	227,076	232,918	265,938	278,892	1,981	5,982		
9,1250	231,775	1,2500	31,750	0,9375	23,812	0,13	3,5	0,13	3,3	49	0,41	1,46	0,8	243,078	246,88	281,94	287,02	1,206	5,306		
10,0630	255,600	2,5000	63,500	1,7500	44,450	0,06	1,5	0,13	3,3	60	0,36	1,66	0,91	270,002	270,002	322,072	332,994	6,121	9,728		
10,1250	257,175	2,2500	57,150	1,7500	44,450	0,25	6,4	0,13	3,3	60	0,36	1,66	0,91	268,986	280,924	322,072	332,994	3	7,95		
		3,0000	76,200	2,1250	53,975	0,06	1,5	0,13	3,3	64	0,35	1,73	0,95	272,034	272,034	335,026	342,9	5,702	10,373		
10,3750	263,525	1,1250	28,575	1,0000	25,400	0,06	1,5	0,06	1,5	49	0,34	1,77	0,98	275,082	275,05	311,912	314,96	1,27	1,880		
11,5000	292,100	1,8750	47,625	1,3750	34,925	0,14	3,5	0,13	3,3	65	0,41	1,45	0,8	305,054	309,118	355,092	361,95	2,311	7,188		
12,0000	304,800	2,0000	50,800	1,5000	38,100	0,25	6,4	0,13	3,3	64	0,37	1,62	0,89	319,024	328,93	373,888	379,984	1,930	7,061		
13,5100	343,154	2,6250	66,675	2,0625	52,388	0,33	8,5	0,14	3,5	75	0,37	1,6	0,88	359,918	373,126	424,942	435,102	4,851	9,537		
13,6250	346,075	3,7500	95,250	2,9375	74,612	0,25	6,4	0,13	3,3	88	0,34	1,75	0,96	367,03	376,936	455,93	467,106	***	***		
15,0000	381,000	1,8750	47,625	1,3750	34,925	0,25	6,4	0,13	3,3	92	0,51	1,19	0,65	394,97	406,908	455,93	465,074	1,156	7,632		
15,1250	384,175	4,1250	104,775	3,2500	82,550	0,25	6,4	0,25	6,4	96	0,33	1,8	0,99	406,908	417,068	506,984	519,938	***	***		
15,8750	403,225	1,1250	28,575	0,8125	20,638	0,14	3,5	0,13	3,3	70	0,43	1,38	0,76	414,02	418,084	445,008	452,12	1,956	5,880		
16,0000	406,400	3,3125	84,138	2,4375	61,962	0,25	6,4	0,13	3,3	100	0,41	1,45	0,8	426,974	436,88	518,922	526,288	1,588	11,113		
18,0000	457,200	3,3125	84,138	2,3750	60,325	0,25	6,4	0,13	3,3	115	0,46	1,31	0,72	479,044	488,95	569,976	579,628	1,690	11,988		
19,2500	489,950	3,3125	84,138	2,4375	61,912	0,25	6,4	0,13	3,3	124	0,49	1,23	0,68	510,032	521,97	599,948	613,41	2,921	11,939		
19,6250	498,475	3,1875	80,962	2,5000	63,500	0,25	6,4	0,13	3,3	98	0,33	1,79	0,99	521,97	528,066	602,996	609,6	2,489	9,359		
22,0000	558,800	3,4686	88,108	2,5000	63,500	0,25	6,4	0,25	6,4	111	0,36	1,68	0,92	584,962	591,058	699,009	707,136	***	***		
		4,1250	104,775	3,1875	80,962	0,25	6,4	0,25	6,4	130	0,35	1,73	0,95	584,962	594,106	695,96	707,898	***	***		
24,0000	609,600	3,6875	93,662	2,7500	69,850	0,25	6,4	0,25	6,4	125	0,37	1,6	0,88	632,968	642,112	747,014	755,396	***	***		
29,5000	749,300	6,3125	160,338	4,8425	123,000	0,25	6,4	0,25	6,4	165	0,33	1,82	1	785,876	791,972	935,99	952,5	***	***		
29,9183	760,000	2,7500	69,850	2,0000	50,800	0,13	3,3	0,13	3,3	132	0,37	1,61	0,89	776,987	783,082	854,964	858,012	4,699	11,709		

Kegelrollenlager in Zollabmessung
Tapered Roller Bearings Single Row, Inch Sizes



Hauptabmessungen						Tragzahlen			Grenzdrehzahlen	Gewicht	Lagertyp	Serie
Boundary dimensions						Load ratings			Limited speed ratings	Weight	Designation	Series
d		D		T		C _r	C ₀	C _u	n _G	m		
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	dyn.	stat.		rpm	[kg]		
	35,0000	889,000	3,5000	88,900	1768,4	5241,8	339,4	530	94,00	K-L183448/410	L 1837400	
30,0000	762,000	35,0000	889,000	2,7500	69,850	1168,3	3521,2	228,5	560	66,50	K-LL483449/418	LL 483400
	35,0000	889,000	3,5000	88,900	1768,4	5241,8	339,4	530	94,00	K-L183449/410	L 183400	
33,0000	838,200	41,0000	1041,400	3,6875	93,662	1858,8	4765,2	296,8	460	160,00	K-EE763330/410	763000



		Berechnungsfaktoren											Anschlussmaße [mm]						
		Calculation factors											Abutment and fillet dimensions [mm]						
d	d	B	B	C	C	r_1, r_2	r_1, r_2	r_3, r_4	r_3, r_4	a	e	Y	Y_0	d_a	d_b	D_a	D_b	C_a	C_b
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	≈				max	min	min	min	min	min
	3,5000	88,900	2,8346	72,000	0,13	3,3	0,13	3,3	123	0,31	1,97	1,08	780,034	783,082	864,108	871,982	6,020	12,252	
30,0000	762,000	2,7500	69,850	2,0000	50,800	0,13	3,3	0,13	3,3	132	0,37	1,61	0,89	780,034	783,082	854,964	858,012	4,699	11,709
	3,5000	88,900	2,8346	72,000	0,13	3,3	0,13	3,3	123	0,31	1,96	1,08	780,034	783,082	864,108	871,982	6,020	12,252	
33,0000	838,200	3,5000	88,900	2,6250	66,675	0,25	6,4	0,25	6,4	177	0,45	1,33	0,73	869,95	876,046	995,934	1001,014	***	***

Allgemeines

Gepaarte einreihige Kegelrollenlager sind einbaufertige, vorabgestimmte Lagereinheiten.

Gepaarte Kegelrollenlager werden dann verwendet, wenn entweder die Tragfähigkeit eines Einzellagers nicht mehr ausreicht, ein bestimmtes Axialspiel der Lagerung erforderlich ist, oder aber um unter den Bedingungen einer Serienmontage das aufwendige Einstellen eines bestimmten Lagerspieles zu vermeiden.

Dazu wird ein Paar einreihiger Kegelrollenlager mit Abstandsringen auf ein definiertes Axialspiel oder eine definierte Vorspannung hin abgestimmt.

Je nach den Erfordernissen des Anwendungsfalles können Kegelrollenlagerpaare in **X-**, **O-** oder **Tandemanordnung** (vgl. Abb. 1) geliefert werden.

Verschiedene Typen metrischer, gepaarter, einreihiger NKE Kegelrollenlager werden standardmäßig in **X-Anordnung** (Nachsetzzeichen **DF**) angeboten, andere Ausführungen gehören zum Bedarfsprogramm und sind auf Anfrage lieferbar.

General

Paired single row tapered roller bearings are ready-to-mount bearing units.

Paired tapered roller bearings are used in applications where either the load capacity of single bearings does not meet the requirements or a defined axial play is required to overcome the time-consuming adjustment of tapered roller bearing assemblies under the conditions of a multiple mounting.

Paired tapered roller bearings consist of two single row tapered roller bearings that have been matched using spacers for a specific axial clearance or, if required, a preload.

Depending on the particular requirements, such pairs may be supplied arranged either in tandem arrangement (suffix "**DT**"), in face-to-face arrangement (suffix "**DF**") or in back-to-back arrangement (suffix "**DB**") as shown in the fig. 1.

Several types of paired metric NKE tapered roller bearings are produced as units arranged face-to-face (suffix **DF**) as standard.

Other arrangements are produced upon order request.

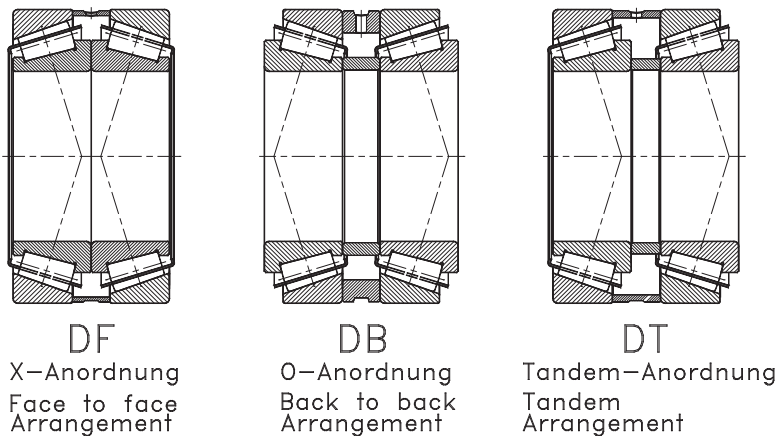


Abb. 1
Fig. 1

Lagerpaare

Einreihige NKE Kegelrollenlager können paarweise in folgenden Anordnungen geliefert werden:

Tandem-Anordnung, Nachsetzzeichen DT

Kegelrollenlagerpaare in **Tandemanordnung** werden verwendet, wenn die auftretende Axiallast die Tragfähigkeit eines einzelnen Lagers übersteigt.

Bei Tandemanordnung werden Axialkräfte nur in einer Richtung aufgenommen und gleichmäßig auf beide Lager aufgeteilt.

Kegelrollenlager in Tandemanordnung sind immer gegen ein drittes Lager, welches die Wellenführung in der Gegenrichtung übernimmt, anzustellen.

Da bei Kegelrollenlagerpaaren in Tandemanordnung zwei Zwischenringe erforderlich sind, ist bei einer Bestellung immer die gewünschte Gesamtbaubreite der Lagereinheit anzugeben.

X-Anordnung, Nachsetzzeichen DF

Axialkräfte werden in beide Richtungen, aber nur von jeweils einem der Kegelrollenlager aufgenommen.

Aufgrund der geringeren Starrheit dieser Anordnung Kippmomente weniger gut aufgenommen werden.

Bei Lagerpaaren in X-Anordnung führt eine Erwärmung der Welle zu einer Verminderung der Axialluft bzw. zu einer erhöhten Vorspannung.

Bearing Pairs

NKE produces single row tapered roller bearings as units in the following arrangements:

Tandem Arrangement, suffix DT

Tapered roller bearings in tandem arrangements are used where the actual thrust force exceeds the load capacity of a single tapered roller bearing.

With a tandem arrangement thrust forces are accommodated in one direction only and distributed to both bearings equally.

Tapered roller bearings in tandem arrangement must always be adjusted against another bearing arranged in parallel which guides the shaft in the opposite direction.

Tapered roller bearings in tandem arrangements require two spacers for matching as a unit. The desired total width of the bearing arrangement must be defined when ordering.

Face-to-face arrangement, suffix DF

Thrust forces are accommodated in both directions by each of bearing in the direction.

This arrangement is less suitable to support tilting moments due to the lower stiffness.

For bearing pairs arranged face-to-face the thermal expansion of the shaft will cause either a reduction of the axial internal clearance or an increase in preloading forces.

Metrische einreihige Kegelrollenlager, gepaart *Paired Metric Single Row Tapered Roller Bearings*



O-Anordnung, Nachsetzzeichen DB

Axialkräfte werden, wie bei der X-Anordnung, in beide Richtungen aber nur von jeweils einem Lager aufgenommen.

Kegelrollenlager in O-Anordnung weisen durch ihre **Stützbreite** eine hohe Starrheit auf und sind dadurch auch zur Aufnahme von Kippmomenten gut geeignet.

Lagerpaare in O-Anordnung sind zum Ausgleich von Schiefstellungen nicht geeignet.

Da bei Kegelrollenlagerpaaren in O-Anordnung zwei Zwischenringe erforderlich sind, ist bei einer Bestellung immer die gewünschte Gesamtbaubreite der Lagereinheit anzugeben.

Schiefstellung

Gepaarte einreihige Kegelrollenlager sollten keinen Schiefstellungen ausgesetzt werden, da Verkippungen zwischen Innen- und Außenring erhebliche Zusatzkräfte und höhere Laufgeräusche verursachen.

Darüber hinaus ist mit einer Verringerung der Gebrauchsdauer durch die entstehenden Zusatzbelastungen zu rechnen.

Toleranzen

Gepaarte NKE Kegelrollenlager werden standardmäßig in Normaltoleranz (**PN, Class 4**) gefertigt.

Auf Anfrage können diese aber auch mit eingeschränkten Toleranzen, wie beispielsweise in der Toleranzklasse **P6X, P5, Class 3, Class 2**, gefertigt werden.

Die **Breitentoleranz** der **NKE Lagereinheiten** in X Anordnung setzt sich aus der **Axialluft** des Lagerpaares sowie zweimal der Breitenabweichung Δ_{TS} der jeweiligen Einzellager zusammen.

Werte der einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, ab Seite 58.

Back-to-back arrangement, suffix DB

Axial forces are, similar to bearings arranged face-to-face, accommodated in both directions by each of the bearings.

Tapered roller bearings arranged back-to-back provide very rigid bearing arrangements due to their **support width**. They also effectively support tilting moments.

Bearing pairs arranged back-to-back are unsuitable to compensate for any misalignments.

Tapered roller bearing pairs arranged back to back require two spacers for matching as a unit, the desired total width of bearing arrangement must be defined at ordering.

Misalignment

Single row tapered roller bearings arranged in pairs should not be exposed to misalignments as they may generate considerable additional forces and cause high running noise levels.

Such additional forces due to misalignment will shorten the service life of tapered roller bearings significantly.

Tolerances

Paired NKE tapered roller bearings are produced in normal tolerance class (**PN, Class 4**) as standard.

These bearings may also be produced with closer tolerance classes (e.g. **P6X, P5, Class 3, Class 2**) on request.

The **total width tolerance of NKE tapered roller bearing units** arranged **face-to-face** consist of the internal axial play of the bearing pair and twice the width deviation of the each single bearing, Δ_{TS} .

Values for the single bearing tolerance classes are listed in the tables (see chapter “**Bearing Data / Tolerances**” from page 243).

Käfige

NKE Kegelrollenlager werden standardmäßig mit Stahlblechkäfigen geliefert.

Da auch bei den Kegelrollenlagerpaaren in X-Anordnung die Käfige seitlich etwas über die Planfläche vorstehen, müssen die entsprechenden Anschlussmaße berücksichtigt werden.

Lagerluft

NKE Kegelrollenlagerpaare in X-Anordnung (Nachsetzzeichen **DF**) werden standardmäßig mit folgenden Axialluftwerten hergestellt.

Auf Anfrage fertigen wir diese Einheiten auch mit Luftwerten nach Kundenspezifikationen.

Cages

NKE tapered roller bearings are fitted with pressed steel cages as standard. Because the cages of tapered roller bearings, arranged in pairs face-to-face protrude beyond the bearings faces, special care must be taken to follow the respective abutment dimensions.

Internal Clearance

NKE tapered roller bearing pairs arranged face-to-face (suffix **DF**) are produced with axial internal clearances values, as listed in the table below, as standard.

NKE also produces other bearing units with alternative internal clearances according to customers' specification.

Axialluft gepaarter NKE Kegelrollenlager in X- Anordnung (DF)

Axial internal clearance of paired NKE tapered roller bearings, arranged face-to-face (DF)

Lagerbohrung Bearing bore \varnothing $\varnothing d$ [mm]		Axialluft [μ m]					
		Axial internal clearance [microns]					
		Reihe / Series 303...-DF / 323...-DF		Reihe / Series 313...-DF		Reihe / Series 320...-DF	
>	\leq	min	max	min	max	min	max
-	30	130	170	60	100	80	120
30	40	140	180	70	110	100	140
40	50	160	200	80	120	120	160
50	65	180	220	100	140	140	180
65	80	200	260	110	170	160	200
80	100	240	300	110	170	190	230
100	120	280	340	130	190	220	280
120	140	330	390	160	220	240	300
140	160	370	430	180	240	270	330

Äquivalente Dynamische Lagerbelastung

Bei gepaarten einreihigen Kegelrollenlager in X-Anordnung gilt:

bei

$$\frac{F_a}{F_r} \leq e \text{ gilt} \quad \mathbf{P = F_r + Y_1 * F_a}$$

bzw. , wenn

$$\frac{F_a}{F_r} > e \text{ dann} \quad \mathbf{P = 0,67 * F_r + Y_2 * F_a}$$

F_a und F_r sind die auf das **Lagerpaar** wirkenden Kräfte.

Äquivalente statische Lagerbelastung

Für gepaarte einreihige Kegelrollenlager in X-Anordnung gilt:

$$\mathbf{P_0 = F_r + Y_0 * F_a}$$

Anschlussmaße

Auch paarweise angeordnete Kegelrollenlager erfordern eine ausreichende axiale Unterstützung der Lagerringe durch die Umgebungs-konstruktion.

Empfehlungen zur Gestaltung der Anschlusssteile sind in den Produkttabellen angegeben.

Equivalent Dynamic Bearing Load

For single row tapered roller bearings arranged face-to-face, the following formula should be used:

when

$$\frac{F_a}{F_r} \leq e \text{ then} \quad \mathbf{P = F_r + Y_1 * F_a}$$

or, if

$$\frac{F_a}{F_r} > e \text{ then} \quad \mathbf{P = 0,67 * F_r + Y_2 * F_a}$$

F_a and F_r are the forces acting on the **bearing pairs**.

Equivalent Static Bearing Load

When single row tapered roller bearings are arranged in pairs face to face the equivalent static load on the bearing unit is:

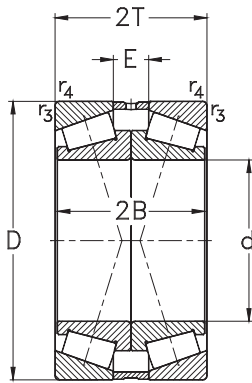
$$\mathbf{P_0 = F_r + Y_0 * F_a}$$

Abutment and Fillet Dimensions

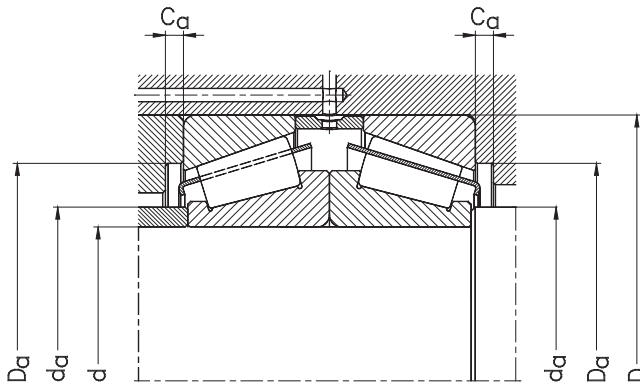
Paired single row tapered roller bearings must be supported axially by surrounding machine components in a satisfactory manner.

Values of the bearing fillet dimensions are stated in the bearing tables.

Gepaarte metrische einreihige Kegelrollenlager in X-Anordnung
Paired Metric Single Row Tapered Roller Bearings, arranged Face-to-Face

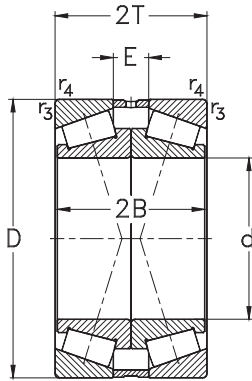


Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation
d	D	2T	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
30	72	41,5	79	97	11	7200	9500	0,86	31306-DF
35	80	45,5	104	131	15,3	6500	8500	1,13	31307-DF
40	90	50,5	138	164	19	6000	7500	1,58	31308-DF
45	100	54,5	173	211	25	5600	6700	2,1	31309-DF
50	110	58,5	199	245	29	5100	6000	2,9	31310-DF
55	120	63	210	275	33	5600	5600	3,45	31311-DF
60	95	46	147	253	30,8	4400	6700	1,9	32012-X-DF
	130	67	248	335	40,3	4400	5300	4,13	31312-DF
65	140	72	281	378	46	5000	4800	5,6	31313-DF
70	110	50	185	327	40	3700	5600	1,8	32014-X-DF
	150	76	320	438	53	4000	4500	6,22	31314-DF
75	160	80	354	483	56,8	4200	4300	7,2	31315-DF
80	125	58	254	453	54,8	3500	5000	2,65	32016-X-DF
	170	85	385	535	62,5	3400	4000	9,1	31316-DF
85	180	89	424	585	67,5	3600	3800	10,5	31317-DF
90	140	64	308	558	65,4	3100	4300	3,65	32018-X-DF
	190	93	464	640	72,3	2900	3400	11,65	31318-DF
95	200	99	511	725	78,5	3300	3400	14,4	31319-DF
100	150	64	311	581	66,4	2400	4300	3,95	32020-X-DF
	215	113	652	945	102	2900	3000	19,1	31320-DF
110	170	76	443	826	92	2000	3600	6,3	32022-X-DF
	200	112	703	1160	127	2300	3200	15,2	32222-DF

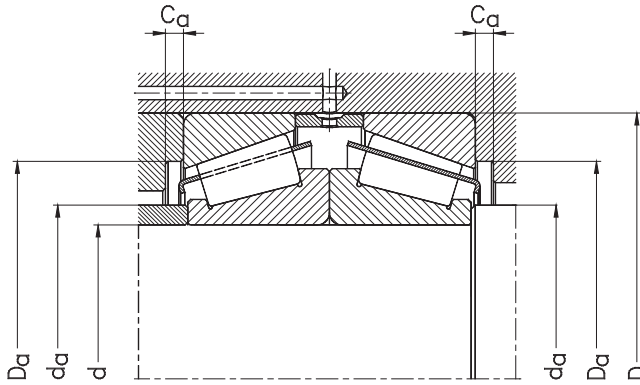


Berechnungsfaktoren								Anschlussmaße [mm]			
Calculation factors								Abutment and fillet dimensions [mm]			
d	2B	r ₃ , r ₄ min	r ₅ min.	e	Y ₁	Y ₂	Y ₀	d _a max	D _a min	D _a max	C _a min
30	38	1,5	0,6	0,83	0,72	1,21	0,4	40	55	65	3
35	42	1,5	0,6	0,83	0,72	1,21	0,4	45	62	71	3
40	46	1,5	0,6	0,83	0,72	1,21	0,4	51	71	81	3
45	50	1,5	0,6	0,83	0,72	1,21	0,4	57	79	91	4
50	54	2	0,6	0,83	0,72	1,21	0,4	62	87	100	4
55	58	2	0,6	0,83	0,72	1,21	0,4	68	94	112	4
	46	1,5	0,6	0,43	1,6	2,3	1,6	67	85	88	4
60	62	2,5	1	0,83	0,72	1,21	0,4	74	103	118	5
65	66	2,5	0,6	0,83	0,72	1,21	0,4	80	111	128	5
70	50	1,5	0,6	0,43	1,6	2,3	1,6	78	98	103	5
	70	2,5	1	0,85	0,72	1,21	0,4	85	118	138	5
75	74	2,5	1	0,83	0,72	1,21	0,4	91	127	148	6
80	58	1,5	0,6	0,43	1,6	2,3	1,6	90	112	117	6
	78	2,5	1	0,83	0,72	1,21	0,4	97	134	158	6
85	82	3	1	0,83	0,72	1,21	0,4	103	143	166	6
90	64	1,5	0,6	0,43	1,6	2,3	1,6	100	125	132	6
	86	3	1	0,83	0,72	1,21	0,4	109	151	176	5
95	90	3	1	0,83	0,72	1,21	0,4	114	157	186	5
100	64	1,5	0,6	0,43	1,6	2,3	1,6	110	134	142	6
	102	3	1	0,83	0,72	1,21	0,4	121	168	201	7
110	76	2	0,6	0,43	1,6	2,3	1,6	123	152	160	7
	106	2,5	0,6	0,43	1,4	2,4	0,8	127	170	188	6

Gepaarte metrische einreihige Kegelrollenlager in X-Anordnung
Paired Metric Single Row Tapered Roller Bearings, arranged Face-to-Face



Hauptabmessungen [mm]			Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	Gewicht [kg]	Lagertyp
Boundary dimensions [mm]			Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	Weight [kg]	Designation
d	D	2T	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G	m	
110	240	126	786	1165	133	2800	2800	26,9	31322-DF
120	180	76	433	833	90	1700	3400	6,75	32024-X-DF
	215	123	824	1425	165	2100	3000	20,9	32224-DF
	260	136	933	1400	156	2300	2400	32,8	31324-DF
130	200	90	595	1160	122	1600	3000	10	32026-X-DF
	230	135,5	955	1690	192	1900	2800	24,2	32226-DF
	280	144	1050	1575	174	2200	2400	41,95	31326-DF
140	210	90	588	1140	120	1400	2800	11	32028-X-DF
	250	143,5	1113	2000	221	1700	2600	29	32228-DF
	300	154	1195	1805	190	2000	2200	51,1	31328-DF
150	225	96	667	1325	136	1200	2600	13,5	32030-X-DF
	270	154	1270	2300	250	1500	2400	38,8	32230-DF
	320	164	1350	2065	215	1000	2000	61,9	31330-DF



Berechnungsfaktoren								Anschlußmaße [mm]			
Calculation factors								Abutment and fillet dimensions [mm]			
d	2B	r ₃ , r ₄ min	r ₅ min.	e	Y ₁	Y ₂	Y ₀	d _a max	D _a min	D _a max	C _a min
110	114	3	1	0,83	0,72	1,21	0,4	135	188	226	7
120	76	2	0,6	0,43	1,6	2,3	1,6	132	161	170	7
	116	2,5	1	0,43	1,4	2,3	0,8	137	181	203	7
	124	3	1	0,83	0,72	1,21	0,4	145	203	245	9
130	90	2	0,6	0,43	1,6	2,3	1,6	144	178	190	7
	128	3	1	0,43	1,4	2,3	0,8	146	193	216	7
	132	4	1,5	0,83	0,72	1,21	0,4	157	218	263	8
140	90	2	0,6	0,43	1,6	2,3	1,6	153	187	200	7
	136	3	1	0,43	1,4	2,3	0,8	159	210	236	8
	140	4	1	0,83	0,72	1,21	0,4	169	235	283	9
150	96	2,5	1	0,43	1,6	2,3	1,6	164	200	213	8
	146	3	1	0,43	1,4	2,3	0,8	171	226	256	8
	150	4	1,5	0,83	0,4	1,21	0,4	181	251	303	9

IKOS Integral-Kegelrollenlager

Allgemeines:

NKE Integral-Kegelrollenlager der Baureihe IKOS (siehe Abb. 1) sind einbaufertige Einheiten, die, anders als übliche Kegelrollenlager, nicht zerlegbar sind.

NKE IKOS Integral-Kegelrollenlager weisen eine an der großen Innenring-Planseite in den Außenring (1), integrierte Zweilippendichtung (2) auf.

Diese Lager sind standardmäßig mit einem speziellen, glasfaserverstärkten Polyamid-Fensterkäfig (3) ausgestattet, der in eine Nut im Außenring einrastet und somit ein Auseinanderfallen des Lagers beim Handling oder beim Einbau verhindert.

IKOS Tapered Roller Bearings

General:

The **NKE IKOS integral tapered roller bearings** are ready for use bearing units (see fig. 1).

Unlike the standard tapered roller bearings, **IKOS integral tapered roller bearings** are non-separable bearing units.

NKE IKOS integral tapered roller bearings have a double lip seal (2) fitted into the outer ring (1), which contacts the inner ring outer diameter.

These bearings are produced with a special glass fibre reinforced window type polyamide cage (3) that snaps into a circumferential groove in the outer ring and thereby preventing the bearing components from separating during handling and mounting.

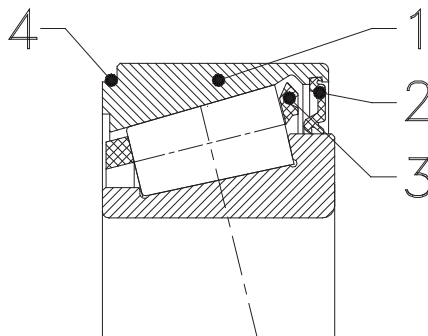


Abb. 1
Fig. 1

Befettung:

NKE IKOS Integral-Kegelrollenlager werden standardmäßig mit einer speziellen Fettfüllung (NKE Kurzbezeichnung **MT 32**) geliefert.

Dabei handelt es sich um einen speziell auf die typischen Anforderungen dieser Lager abgestimmten Hochleistungsschmierstoff (KP2 N-25 nach DIN 51502) mit EP-Additivierung.

Dieser Schmierstoff ist für einen Temperaturbereich von -25°C bis $+140^{\circ}\text{C}$ geeignet.

Dadurch kann beim Verbau dieser **NKE IKOS Integral-Kegelrollenlager** die sonst bei der Montage von Kegelrollenlagern erforderliche Befettung entfallen.

Montagehinweise

NKE IKOS Integral-Kegelrollenlager werden in der Regel paarweise in O-Anordnung verbaut, siehe Abb. 2.

Grease Filling:

NKE IKOS integral tapered roller bearings are produced and supplied with a specific grease fill (NKE code **MT 32**) as standard.

This is a high performance lubricant that has been specifically selected to fulfil typical application requirements. This grease fulfils the requirements of KP2 N-25 according to DIN 51502 it also contains EP-additives.

The grease is suitable for an operating temperature range from -25°C (or -13°F) up to $+140^{\circ}\text{C}$ (or $+284^{\circ}\text{F}$).

For this reason, when using **NKE IKOS integral tapered roller bearings**, the re-greasing of the bearings, which is normally required when using tapered roller bearings, can be omitted.

Mounting Instructions

NKE IKOS integral tapered roller bearings are normally used in pairs in "back-to-back" arrangements, see fig. 2.

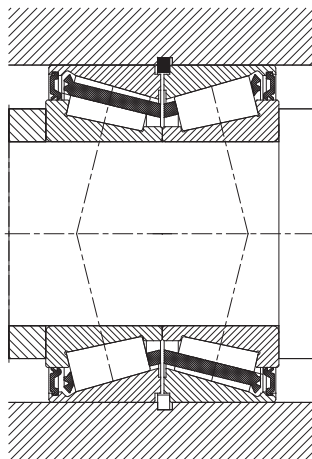


Abb. 2
Fig. 2

Axialluft

Bei **NKE IKOS Integral-Kegelrollenlagern** braucht die Axialluft des Lagerpaares nicht extra eingestellt werden.

Eine ausreichende Axialluft ergibt sich automatisch durch die standardmäßig durchgeführte Abstimmung des Überstandes von Innenringplanfläche zu Außenringplanfläche (Abmessung **g**).

Bei der Montage von **NKE IKOS Integral-Kegelrollenlagern** ist darauf zu achten, dass die in den Produkttabellen angegebene empfohlene maximale Zusammenspannkraft ($F_{s \max}$) nicht überschritten wird, um einer unzulässigen Verspannung der Lager vorzubeugen.

Axiale Belastbarkeit der Sprengringverbindung

Bei **NKE IKOS Integral-Kegelrollenlagern** weisen die Außenringe einen Absatz auf (siehe Abb. 1 / 4). Bei einem paarweise Verbau der Lager in O-Anordnung (siehe Abb. 2) bildet sich dadurch automatisch eine passende Sprengringnut für NKE Sprengringe der Bauform **BR**.

Eine Produkttable von Sprengringen der Bauform BR finden Sie auf Seite 706.

Bei der Verwendung von **NKE IKOS Integral-Kegelrollenlagern** ist darauf zu achten, dass die in den Produkttabellen angegebene empfohlene maximale Tragfähigkeit der Sprengringverbindung (F_{BR}) nicht überschritten wird.

Es ist weiters darauf zu achten, dass es sich bei den angegebenen Werten um Maximalwerte handelt, die nur bei einer ordnungsgemäßen Anlage des Sprengringes in der Sprengringnut des Gehäuses gewährleistet sind.

Axial Internal Clearance

When mounting **NKE IKOS integral tapered roller bearings** there is no particular set up necessary to ensure an appropriate axial internal clearance.

The correct adjustment is achieved during production due to the careful matching of the recess of the outer ring face relative to the inner ring side face i.e. dimension "g".

When mounting **NKE IKOS integral tapered roller bearings**, particular attention must be taken to ensure that the axial clamping force ($F_{s \max}$) do not exceed the recommended maximum values as per the product tables. This is to avoid a preloading to the bearings.

Maximum Load Ability of the Snap Ring Joint

The outer rings of **NKE IKOS integral tapered roller bearings** have as standard a step in their large broad face side, see fig. 1 / 4.

Thus, the outer rings automatically build an appropriate snap ring groove for NKE snap rings of **BR** design when used as pairs in "back to back" arrangement.

A product table of BR type snap rings, see page 706.

When using **NKE IKOS integral tapered roller bearings** particular attention must be made to ensure that the recommended maximum values of the load capability of the snap ring joint (F_{BR}) is not exceeded.

It must also be taken into consideration that the recommended maximum values (F_{BR}) only apply when the snap ring is seating properly in the snap ring groove of the housing bore.

Toleranzen

NKE IKOS Integral-Kegelrollenlager werden in **Normaltoleranz (PN)** gefertigt.

Detaillierte Werte der einzelnen Toleranzklassen ab Seite 58.

Wärmebehandlung

Die Rollen und Ringe der **NKE IKOS Integral-Kegelrollenlager** werden standardmäßig für Betriebstemperaturen bis +150 °C (**Wärmestabilisierungsklasse S0**) maßstabiliert.

Es muss allerdings beachtet werden, dass die permanente Betriebstemperatur dieser Lager durch die verwendeten Dichtscheiben, die Polyamidkäfige sowie den verwendeten Schmierstoff limitiert wird und daher 120 °C nicht übersteigen sollte.

Weiters ist darauf zu achten, dass bei Dauerbetriebstemperaturen über 70 °C der Schmierstoffgebrauchsdauer stark reduziert wird.

Weitere Informationen dazu entnehmen Sie bitte dem Abschnitt „**Schmierung von Wälzlagern**“, ab Seite 145.

Passungswahl

Um eine korrekte Einstellung der Axialluft sicherzustellen, darf nur einer der Ringe der **NKE IKOS Integral-Kegelrollenlager** eine feste Passung aufweisen, während der jeweils andere Ring einen Schiebesitz aufweisen muss.

Tolerances

NKE IKOS integral tapered roller bearings are produced, as standard, to **normal tolerance class (PN)**

Values for the individual tolerance classes are listed in the tables, page 243 onwards.

Thermal Stabilisation Class

The rings and rollers of **NKE IKOS integral tapered roller bearing** are thermal stabilised for operating temperatures up to +150 °C or (+302 °F) as standard, i.e. **thermal stabilisation class S0**.

However, it must be taken into consideration that an actual constantly operating temperature of + 120 °C or (+248 °F) maximum must not be exceeded, due to the double lip seal material, the polyamide cages and the temperature limits of the grease used.

It must also be considered that the actual service life of the grease drops dramatically when the actual operating temperature is constantly above +70 °C (+158 °F).

For further specific information please refer to the chapter “**Lubrication of Rolling Bearings**”, page 330 onwards.

Selection of Fits

To ensure the correct adjustment of the axial internal clearance when using **NKE IKOS integral tapered roller bearings** only one of the rings may be fixed with a tight fit, whilst the other ring must have a loose fit.

In Abhängigkeit vom jeweiligen Belastungsfall (Punktlast oder Umfangslast) werden daher folgende Wellen- und Gehäusesitze empfohlen:

Depending upon the actual load situation in an individual application, e.g. where point loads or circumferential loads occur, the following fits are recommended to ensure a correct function:

Belastungsfall <i>Load condition</i>	Umfangslast an <i>Circumferential load on</i>		Punktlast an <i>Point load on</i>	
	Welle <i>Shaft</i>	Gehäuse <i>Housing</i>	Welle <i>Shaft</i>	Gehäuse <i>Housing</i>
empfohlener Lagersitz <i>recommended bearing fit</i>	m6	M7	g6	H7

Weitere Informationen zur Passungswahl sowie zu den verschiedenen Belastungsfällen auf Seite 101.

For further general information on the selection of bearing fits and the various loading conditions see page 286.

Schiefstellung

Grundsätzlich sind Kegelrollenlager zum Ausgleich von Schiefstellungen nur sehr eingeschränkt geeignet.

Da NKE IKOS Integral-Kegelrollenlager in der Regel paarweise in O-Anordnung verbaut werden, weisen die Druckkegelspitzen eine relativ große Stützbreite auf, siehe Abb. 2.

Dadurch bilden NKE IKOS Integral-Kegelrollenlager sehr starre Lagerungen, die jedoch keine Schiefstellungen kompensieren können.

Mindestbelastung

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE IKOS Kegelrollenlager muss die Mindestbelastung 2% der dynamischen Tragzahl betragen.

Misalignment

Normally tapered roller bearings have very limited ability to compensate for any misalignments.

NKE IKOS integral tapered roller bearings are generally used in pairs with “back-to-back” arrangements, see fig. 2.

Thus, the NKE IKOS integral tapered roller bearings build a very rigid bearing arrangement that has no ability for compensation of any misalignments.

Minimum Load

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE tapered roller bearings the minimum load must be 2% of the dynamic load rating.

Äquivalente dynamische Lagerbelastung

Bei einreihigen Kegelrollenlagern gilt:

bei

$$\frac{F_a}{F_r} \leq e \text{ gilt } P = F_r$$

bzw. , wenn

$$\frac{F_a}{F_r} > e \text{ dann } P = 0,4 * F_r + Y * F_a$$

Achtung:

Bei Kegelrollenlagern verursacht jede äußere Belastung durch den Druckwinkel eine innere Axialkraft.

Zur Berechnung der Axialkraft F_a sind daher die Hinweise auf Seite 702 zu beachten.

Werte für die Berechnungsfaktoren e und Y sind für jede Type in den Produkttabellen angegeben.

Äquivalente statische Lagerbelastung

Für NKE IKOS Integral-Kegelrollenlager gilt:

$$P_0 = 0,5 * F_r + Y_0 * F_a$$

Equivalent Dynamic Bearing Load

In the case of single row tapered roller bearings

when

$$\frac{F_a}{F_r} \leq e \text{ then } P = F_r$$

or, if

$$\frac{F_a}{F_r} > e \text{ then } P = 0,4 * F_r + Y * F_a$$

Note:

Each external radial load applied to tapered roller bearings generates an internal thrust force.

For the calculation of axial force F_a the information given on page 702 must also be considered.

Values for the individual calculating factors e and Y are given in the product tables for each bearing type.

Equivalent Static Bearing Load

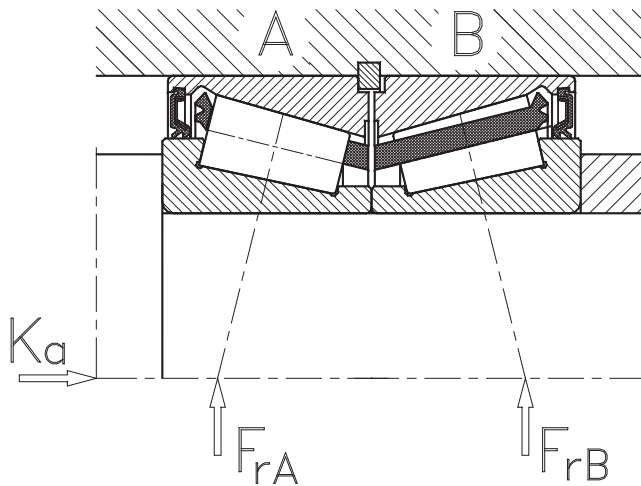
For NKE IKOS integral tapered roller bearings:

Wird P_0 kleiner als F_r , ist F_r zur Berechnung der äquivalenten statischen Lagerbelastung heranzuziehen.

When P_0 is smaller than F_r , the F_r value must be used for calculating the equivalent static bearing load.

Werte für Y_0 sind für jede Type in den Produkttabellen angegeben.

Y_0 values for every individual bearing type are listed in the product tables.



Lastverhältnisse <i>Loading conditions</i>	Die bei der Berechnung zu berücksichtigende dynamisch äquivalente Axialkraft F_a beträgt für <i>The dynamic equivalent axial load F_a to be considered in the calculation values for</i>			
	Lager <i>Bearing</i>	A	Lager <i>Bearing</i>	B
$F_{rA} \leq F_{rB}$		$F_a = K_a + 0,5 \cdot \frac{F_{rB}}{Y}$		--
$F_{rA} > F_{rB}$ $K_a \leq 0,5 \cdot \left(\frac{F_{rA} - F_{rB}}{Y} \right)$		$F_a = K_a + 0,5 \cdot \frac{F_{rB}}{Y}$		--
$F_{rA} > F_{rB}$ $K_a > 0,5 \cdot \left(\frac{F_{rA} - F_{rB}}{Y} \right)$		--		$F_a = 0,5 \cdot \frac{F_{rA}}{Y} - K_a$

Anschlussmaße

NKE IKOS Integral-Kegelrollenlager erfordern - wie auch alle anderen Kegelrollenlager - aufgrund der entstehenden inneren Axiallastkomponente eine ausreichende axiale Unterstützung der Lagerringe durch die Umgebungsstruktur.

Dazu müssen die Schulterhöhen der Anlageflächen an den Wellenbunden bzw. der Gehäuseschultern eine ausreichende Mindesthöhe aufweisen.

Allerdings dürfen die Radien der Kantenverrundung der Lagerringe nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anlussteilen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe.

Empfehlungen zur Dimensionierung der Anlussteile sind in den Produkttabellen angegeben.

Abutment and fillet dimensions

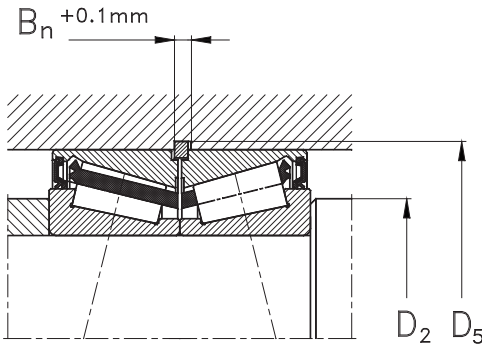
Like all types of tapered roller bearings the **NKE IKOS integral tapered roller bearings** must have sufficient support, from its adjacent parts, of the bearing rings. This is due to the generated internal thrust force of the components.

To obtain an acceptable support both the shaft and the housing shoulders must have a certain minimum height.

The bearing rings, however, must contact adjacent parts with their side faces only. The corner radii of bearing rings must not contact the shoulder fillet radii of the shaft or housing shoulders. Therefore, the largest fillet radius (r_g or r_{g1} , respectively) must be smaller than the minimum fillet dimension of the bearing rings (r_s).

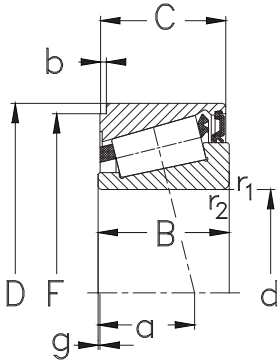
The values of bearing fillet dimensions are given in the appropriate bearing tables.

IKOS Integral Kegelrollenlager
Tapered Roller Bearings, IKOS Design



Hauptabmessungen [mm]					Lagertypen Designation	Tragzahlen [kN]					Grenzdrehzahlen [min ⁻¹]		
Boundary dimensions [mm]						Load ratings [kN]					Limited speed ratings [rpm]		
d	D	B	C	r ₁ , r ₂ min		dyn. C _r	stat. C _{0r}	C _u	F	b	a	n _g Fett ¹⁾	n _g grease ¹⁾
20	42	17	16,5	0,6	IKOS020	24,5	29	4	38,1	0,75	11,1	4800	
25	47	17	16,5	0,6	IKOS025	26,5	34	4	43,1	0,75	12,4	4000	
30	55	19	18,5	1	IKOS030	39	47,5	6	51,4	0,75	14,8	3400	
35	62	20	19,5	1	IKOS035	46	58	6	58,4	0,75	16,2	3000	
40	68	21	20,5	1	IKOS040	54	71	9	64,4	0,75	15,8	2700	
45	75	22	21,5	1	IKOS045	60	83	10	70,7	1	17,2	2400	
50	80	22	21,5	1	IKOS050	64	95	12	75,7	1	18,7	2200	
60	95	26	25	1,5	IKOS060	83	125	15	89,8	1,25	23,1	1800	
70	110	27	26,5	1,5	IKOS070	104	160	20	104,8	1,25	25	1500	
80	125	30	29,5	1,5	IKOS080	137	212	26	119,8	1,25	28	1300	
90	140	33,5	33	2	IKOS090	166	255	29	133,7	1,25	31,6	1200	
100	150	33,5	33	2	IKOS100	173	285	31	143,6	1,25	34,4	1100	
110	170	40	39,5	2,5	IKOS110	240	390	40	163,7	1,25	38,9	1000	
120	180	40	39,5	2,5	IKOS120	250	425	42	173,7	1,25	41,6	900	
130	200	47,5	47	2,5	IKOS130	325	550	52	192	1,5	46,3	800	
140	210	47,5	47	2,5	IKOS140	315	610	56	202	1,5	49,7	320	
150	225	50	49,5	3	IKOS150	375	695	62	217	1,5	48,3	280	
160	240	54,5	54	3	IKOS160	415	800	69	232	1,5	56,3	280	

1) Empfohlene Richtdrehzahl für Lagerpaare
Recommended speed limit for bearing pairs

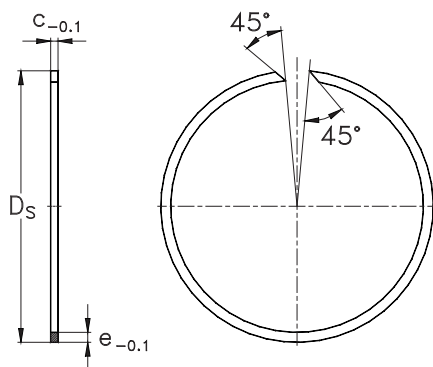


Berechnungsfaktoren			Toleranz [mm]	Anschlussmaße [mm]		Maximalbelastungen [kN]		Gewicht [kg]
Calculation factors			Tolerance [mm]	Abutment and fillet dimensions [mm]		Maximum loads [kN]		Weight [kg]
d	e	Y ₀	+0,05	Welle Shaft	Nut Groove	F _{S max} ²⁾	F _{BR} ³⁾	m
			0	D _{2 min}	D ₅			
20	0,37	0,9	0,025	25	43,2 ^{+0,16}	4,5	13,3	0,1
25	0,42	0,8	0,015	30	48,2 ^{+0,16}	5	14,9	0,128
30	0,43	0,8	0,02	36	56,5 ^{+0,19}	7,2	15,7	0,18
35	0,44	0,7	0,02	41	63,5 ^{+0,19}	7,2	14,2	0,24
40	0,37	0,9	0,03	46	69,5 ^{+0,19}	10	12,9	0,29
45	0,38	0,9	0,02	51	76,8 ^{+0,19}	11	33,8	0,363
50	0,42	0,8	0,02	56	81,8 ^{+0,22}	12	31,4	0,4
60	0,43	0,8	0,03	67	97 ^{+0,22}	15,3	50,2	0,62
70	0,43	0,8	0,03	77	112,3 ^{+0,22}	19,6	49	0,9
80	0,42	0,8	0,03	87	127,3 ^{+0,25}	25,8	40,2	1,33
90	0,42	0,8	0,03	99	142,6 ^{+0,25}	31,2	40,2	1,9
100	0,46	0,7	0,03	109	152,6 ^{+0,25}	33,2	36,2	2
110	0,43	0,8	0,035	120	172,6 ^{+0,25}	45,6	32	3,3
120	0,46	0,7	0,03	130	182,6 ^{+0,29}	47,2	30,8	3,5
130	0,43	0,8	0,045	140	203 ^{+0,29}	63	59	5,2
140	0,48	0,7	0,04	150	213 ^{+0,29}	60	56,8	5,9
150	0,41	0,8	0,04	162	228 ^{+0,29}	71	53,3	7
160	0,47	0,7	0,04	172	243 ^{+0,29}	78	49,6	8,8

2) max. axiale Zusammenspannkraft pro Lagerpaar
max. axial clamping force per bearing pair

3) max. Tragfähigkeit der Sprengringverbindung bei scharfkantiger Anlage
max. loadability of the snap ring joint at sharp-edged contact

IKOS Integral-Sprengringe
Snap Rings, IKOS Design



Lagertyp	passender Sprengring	Hauptabmessungen			Gewicht [kg]
Bearing Type	Snap ring reference	Boundary dimensions			Weight [kg]
		[mm]			[m]
		$D_{s\ min}$	e	c	
IKOS020	BR 42	43,8	2,3	1,5	2,92
IKOS025	BR 47	48,8	2,3	1,5	3,29
IKOS030	BR 55	57,3	2,3	1,5	3,93
IKOS035	BR 62	64,3	2,3	1,5	4,42
IKOS040	BR 68	70,3	2,3	1,5	4,9
IKOS045	BR 76	78,6	2,8	2	8,89
IKOS050	BR 80	82,6	2,8	2	9,22
IKOS060	BR 95	98	3,4	2,5	16,9
IKOS070	BR 110	113,3	3,4	2,5	19,8
IKOS080	BR 125	128,3	3,4	2,5	22,5
IKOS090	BR 140	143,6	4	2,5	29,3
IKOS100	BR 150	153,6	4	2,5	31,9
IKOS110	BR 170	173,6	4	2,5	36,2
IKOS120	BR 180	183,6	4	2,5	38,3
IKOS130	BR 200	204,5	5	3	64,5
IKOS140	BR 210	214,5	5	3	68,8
IKOS150	BR 225	229,5	5	3	72,9
IKOS160	BR 240	244,5	5	3	80,9



Pendelrollenlager
Spherical Roller Bearings

Pendelrollenlager
Spherical Roller Bearings

Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve

Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve

Pendelrollenlager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Pendelrollenlager	DIN 635 / Teil 2

Allgemeines:

Pendelrollenlager sind zweireihige, nicht zerlegbare Radiallager. Die beiden Reihen tonnenförmiger Rollen laufen in einer gemeinsamen hohlkugelförmigen Laufbahn des Außenringes.

Dadurch sind Pendelrollenlager winkeleinstellbar und gleichen Schiefstellungen durch Fluchtungsfehler oder Wellendurchbiegungen sehr gut aus.

Pendelrollenlager sind typische Lager für den Groß- und Schwermaschinenbau. Sie werden verwendet, wenn große Radialkräfte und stoßartige Belastungen aufzunehmen sind und Fluchtungsfehler oder größere Wellendurchbiegungen erwartet werden, sie können aber auch axiale Belastungen in beiden Richtungen aufnehmen.

Aufgrund ihrer kinematischen Eigenschaften sind Pendelrollenlager für geringe bis mittlere Drehzahlen geeignet.

Pendelrollenlager werden häufig mit kegeliger Bohrung verwendet. Dabei werden die Lager mittels Spann- oder Abziehhülsen auf zylindrische Wellen, seltener direkt auf einen kegeligen Wellensitz, montiert. Bei den meisten Pendelrollenlagern mit kegeliger Bohrung beträgt der Kegel **1:12** (Nachsetzzeichen **K**). Bei den Lagerreihen mit geringerer Querschnittshöhe (Reihen 240 und 241) ist der Kegel flacher (Verhältnis **1:30**, Nachsetzzeichen **K30**).

Durch die kegelige Bohrung können die Lager direkt auf gezogene Wellen bzw. auf Wellen mit lediglich gedrehten Lagersitzen montiert werden, eine aufwendige Feinbearbeitung der Lagersitze kann vermieden werden.

Spherical Roller Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Spherical roller bearings	DIN 635 / Part 2

General:

Spherical roller bearings are non-separable double row radial bearings.

Both rows of barrel shaped rollers rotate, in parallel, within the spherical outer ring. This allows excellent alignment compensation, caused by machining and mounting errors, between the shaft and housing.

Spherical roller bearings are typical bearings for heavy machinery and mining.

They are suitable for applications with large radial loads to or where larger misalignments may occur. They are also able to support minor axial forces in both directions.

Due to their poor kinematic behaviours, spherical roller bearings are only suitable for operating at low to medium speeds.

NKE spherical roller bearings are produced in open design as standard.

They are frequently used with **tapered bores** (i.e. **taper 1:12**) namely suffix **K** or for series **240** and **241** the taper bore is (**1:30**) namely suffix **K30**, for ease of mounting. The facility of mounting these bearing types using adapter and withdrawal sleeves enables mounting directly onto drawn or fine turned seats of shaft for applications where high running accuracy is not necessary.

For some applications it remains necessary to mount tapered bore bearings directly onto a tapered seat of the shaft.

Bauformen (siehe Abb. 1 unten)

Je nach Größe und Lagerreihe werden NKE Pendelrollenlager in unterschiedlichen Ausführungen gefertigt.

Lager der Ausführung **MB** haben einen festen Mittelbord und innenringgeführte Messing-Massivkäfige.

Pendelrollenlager der Ausführung **C** bzw. **CE** haben Stahlblechkäfige und symmetrische Tonnenrollen.

NKE Pendelrollenlager in **E**-Ausführung weisen einen verstärkten Innenaufbau mit größeren, symmetrischen Rollen und einen Stahlblechkäfig auf. Diese weisen dadurch eine höhere Tragfähigkeit als vergleichbare Lager der Normalausführung auf.

Design Variants (see fig. 1 below)

Depending on their size and series NKE spherical roller bearings are produced in several different design variations.

Bearings of the design **MB** have a fixed centre flange and an inner ring riding, machined, solid brass cage. Bearings of the designs **C** and **CE** have symmetric spherical rollers and are fitted with a pressed steel cage as standard.

NKE spherical roller bearings of the **E**-design feature an optimized internal design with large symmetrical rollers and a pressed steel cage. Therefore, NKE spherical roller bearings of the **E**-design allow for higher load ratings when compared to identical bearings of conventional design.

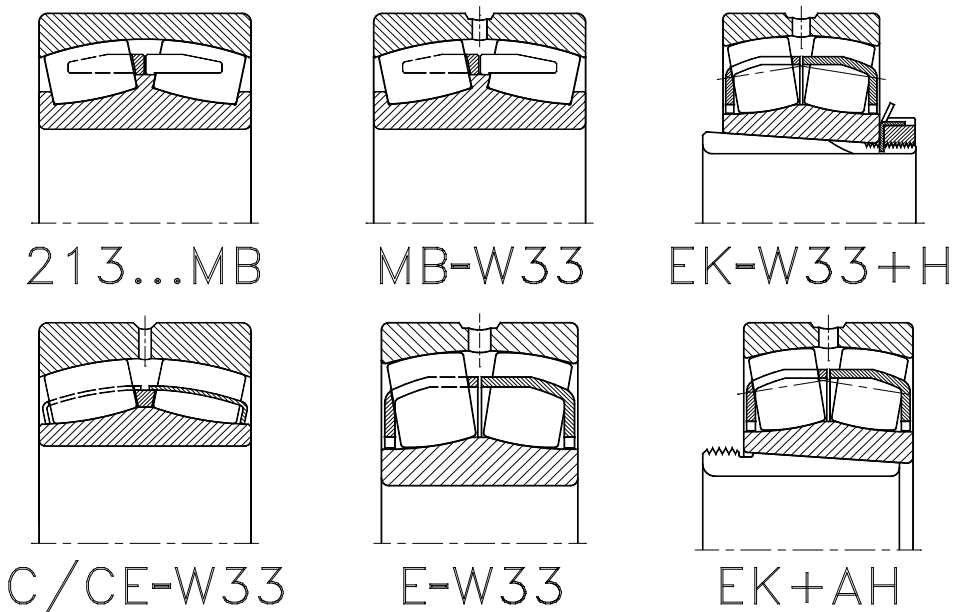


Abb. 1
Fig. 1

Schmiernut und Bohrungen

NKE Pendelrollenlager mit Ausnahme der Reihe 213.. werden zur Vereinfachung der Nachschmierung bereits serienmäßig mit **Schmiernut** und **Schmierbohrungen** im Außenring angeboten. Dieses Merkmal wird durch das **Nachsetzzeichen W33** beschrieben.

Käfige

NKE Pendelrollenlager der Ausführungen CE und E werden standardmäßig mit Stahlblechkäfigen geliefert, größere Pendelrollenlager haben Messingmassivkäfige, Nachsetzzeichen **MB**.

Verschiedene Pendelrollenlager sind sowohl mit Stahlblechkäfig als auch alternativ mit Messingmassivkäfigen verfügbar.

Die Liefermöglichkeit von Lagern mit von der Standardausführung abweichenden Käfigen bitten wir anzufragen.

Lagerluft

Bei der Lagerluft von Pendelrollenlagern wird grundsätzlich zwischen Lagern mit zylindrischer und kegeliger Bohrung unterschieden.

Da bei Lagern mit kegeliger **Bohrung** das Risiko einer unbeabsichtigten Verspannung bei der Montage besteht, weisen diese bei gleicher Luftklasse größere Luftwerte im Vergleich zu Lagern mit zylindrischer Bohrung auf.

NKE Pendelrollenlager werden standardmäßig mit der jeweiligen Luftklasse **CN** (Normalluft) gefertigt.

Zusätzlich kann NKE auch Pendelrollenlager mit größerer Lagerluft (Radialluftklassen **C3**, **C4**, **C5**) oder eingeschränkter Radialluft (Klasse **C2**) liefern.

Werte für die Lagerluft von NKE Pendelrollenlagern sind in den Tabellen auf den folgenden Seiten angegeben.

Diese entsprechen, soweit genormt, den in DIN 620 / Teil 4 bzw. ISO 5753 – 1981 definierten Werten.

Lubricating Groove and Holes

NKE spherical roller bearings - with the exception of series 213.. - are produced incorporating simple re-lubrication features, i.e. a circumferential groove and lubricating holes in the outer ring, as standard. These features are identified with the suffix **-W33**.

Cages

NKE spherical roller bearings of the designs C and CE are normally fitted with pressed steel cages as standard.

Large bearings are generally fitted with machined brass cages (suffix **MB**) as standard.

Several types of spherical roller bearings are produced with either pressed steel cages or solid brass cages, as standard.

For the availability of spherical roller bearings with other cages, please contact NKE

Internal Clearance

For the internal clearance group of spherical roller bearings a distinction must be made between bearings with cylindrical or tapered bores.

Because of the risk of applying accidental preloading to the bearing during mounting, bearings with tapered bores feature larger values of clearance compared to cylindrical bore bearings even in the same clearance group.

NKE spherical roller bearings are produced all to the relevant normal clearance group **CN** (as standard).

NKE also produces spherical roller bearings with enlarged (radial clearance groups **C3**, **C4** or **C5**) or reduced radial clearance (clearance group **C2**) on order request.

The values of clearance groups for NKE spherical roller bearings are given in the tables listed on the tables on the following pages.

These values conform, where standardised, to DIN 620 / part 4 and ISO 5753 – 1981 respectively.

Radialluft der NKE Pendelrollenlager, Bohrung ≤ 250 mm [μm]

Radial internal clearance of **NKE** spherical roller bearings, bore diameter ≤ 250 mm [μm]

Pendelrollenlager mit zylindrischer Bohrung

Spherical roller bearings with cylindrical bore

Lagerbohrung Bore diameter	[mm]	>	18	24	30	40	50	65	80	100	120	140	160	180	200	225
			24	30	40	50	65	80	100	120	140	160	180	200	225	250
Luftgruppe Clearance group	C2	min	10	15	15	20	20	30	35	40	50	60	65	70	80	90
		max	20	25	30	35	40	50	60	75	95	110	120	130	140	150
Luftgruppe Clearance group (NORMAL)	CN	min	20	25	30	35	40	50	60	75	95	110	120	130	140	150
		max	35	40	45	55	65	80	100	120	145	170	180	200	220	240
Luftgruppe Clearance group	C3	min	35	40	45	55	65	80	100	120	145	170	180	200	220	240
		max	45	55	60	75	90	110	135	160	190	220	240	260	290	320
Luftgruppe Clearance group	C4	min	45	55	60	75	90	110	135	160	190	220	240	260	290	320
		max	60	75	80	100	120	145	180	210	240	280	310	340	380	420
Luftgruppe Clearance group	C5	min	60	75	80	100	120	145	180	210	240	280	310	340	380	420
		max	75	95	100	125	150	185	225	260	300	350	390	430	470	520

Pendelrollenlager mit kegeliger Bohrung

Spherical roller bearings with tapered bore

Luftgruppe Clearance group	C2	min	15	20	25	30	40	50	55	65	80	90	100	110	120	140
		max	25	30	35	45	55	70	80	100	120	130	140	160	180	200
Luftgruppe Clearance group (NORMAL)	CN	min	25	30	35	45	55	70	80	100	120	130	140	160	180	200
		max	35	40	50	60	75	95	110	135	160	180	200	220	250	270
Luftgruppe Clearance group	C3	min	35	40	50	60	75	95	110	135	160	180	200	220	250	270
		max	45	55	65	80	95	120	140	170	200	230	260	290	320	350
Luftgruppe Clearance group	C4	min	45	55	65	80	95	120	140	170	200	230	260	290	320	350
		max	60	75	85	100	120	150	180	220	260	300	340	370	410	450
Luftgruppe Clearance group	C5	min	60	75	85	100	120	150	180	220	260	300	340	370	410	450
		max	75	95	105	130	160	200	230	280	330	380	430	470	520	570

Radialluft der NKE Pendelrollenlager, Bohrung > 250 mm [µm]

Radial internal clearance of **NKE** spherical roller bearings, **bore diameter > 250 mm [µm]**

Pendelrollenlager mit zylindrischer Bohrung

Spherical roller bearings with cylindrical bore

Lagerbohrung Bore diameter	[mm]	> ≤	250	280	315	355	400	450	500	560	630	710	800	900	1000	1120
			280	315	355	400	450	500	560	630	710	800	900	1000	1120	1250
Luftgruppe Clearance group	C2	min	100	110	120	130	140	140	150	170	190	210	230	260	290	320
		max	170	190	200	220	240	260	280	310	350	390	430	480	530	580
Luftgruppe Clearance group(NORMAL)	CN	min	170	190	200	220	240	260	280	310	350	390	430	480	530	580
		max	260	280	310	340	370	410	440	480	530	580	650	710	770	840
Luftgruppe Clearance group	C3	min	260	280	310	340	370	410	440	480	530	580	650	710	770	840
		max	350	370	410	450	500	550	600	650	700	770	860	930	1050	1140
Luftgruppe Clearance group	C4	min	350	370	410	450	500	550	600	650	700	770	860	930	1050	1140
		max	460	500	550	600	660	720	780	850	920	1010	1120	1220	1430	1560
Luftgruppe Clearance group	C5	min	460	500	550	600	660	720	780	850	920	1010	1120	1220	1430	1560
		max	570	630	690	760	840	910	980	1070	1160	1270	1410	1540	1820	1990

Pendelrollenlager mit kegeliger Bohrung

Spherical roller bearings with tapered bore

Luftgruppe Clearance group	C2	min	150	170	190	210	230	260	290	320	350	390	440	490	540	600
		max	220	240	270	300	330	370	410	460	510	570	640	710	780	860
Luftgruppe Clearance group(NORMAL)	CN	min	220	240	270	300	330	370	410	460	510	570	640	710	780	860
		max	300	330	360	400	440	490	540	600	670	750	840	930	1020	1120
Luftgruppe Clearance group	C3	min	300	330	360	400	440	490	540	600	670	750	840	930	1020	1120
		max	390	430	470	520	570	630	680	760	850	960	1070	1190	1300	1420
Luftgruppe Clearance group	C4	min	390	430	470	520	570	630	680	760	850	960	1070	1190	1300	1420
		max	490	540	590	650	720	790	870	980	1090	1220	1370	1520	1650	1800
Luftgruppe Clearance group	C5	min	490	540	590	650	720	790	870	980	1090	1220	1370	1520	1650	1800
		max	620	680	740	820	910	1000	1100	1230	1360	1500	1690	1860	2030	2220

Toleranzen

NKE Pendelrollenlager werden standardmäßig in Normaltoleranz (PN) gefertigt.

Werte zu den einzelnen Toleranzklassen entnehmen Sie den Tabellen im Abschnitt „Lagerdaten / Toleranzen“, ab Seite 52.

Schiefstellung

Pendelrollenlager sind zum Ausgleich von Schiefstellungen optimal geeignet.

Die Größe der maximal zulässigen Verkipfung um die Mittelachse ψ hängt dabei von der jeweiligen Lagerreihe ab.

Unter normalen Betriebsbedingungen und bei rotierendem Innenring sind folgende Werte zulässig:

Maximal zulässige Schiefstellung bei NKE Pendelrollenlagern

Maximum permissible misalignment for NKE spherical roller bearings

Lagerreihe <i>Bearing series</i>	Maximal zulässige Schiefstellung <i>Maximum permissible misalignment</i> $\psi \leq [^\circ]$
213	1,0
222	1,5
223	2,0
230	1,5
231	1,5
232	2,5
239	1,5
240	2,0
241	2,5

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Pendelrollenlager muss die Mindestradialbelastung 2% der dynamischen Tragzahl betragen.

Tolerances

NKE spherical roller bearings are produced to normal tolerance class (PN) as standard.

Values for the individual tolerance classes are listed in the tables in the chapter “**Bearing Data / Tolerances**”, page 237.

Misalignment

Spherical roller bearings are optimized to compensate misalignments.

The maximum permissible misalignment from their centre position (ψ), is dependant upon bearing design, series and actual operating conditions.

The following values are permissible:

Minimum Load

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE spherical roller bearings the minimum radial load must be 2% of the dynamic loadrating.

Äquivalente Dynamische Lagerbelastung

bei

$$\frac{F_a}{F_r} \leq e \quad \text{gilt} \quad P = F_r + Y * F_a$$

bzw. , wenn

$$\frac{F_a}{F_r} > e \quad \text{dann} \quad P = 0,67 * F_r + Y * F_a$$

Werte für Y und e sind in den Produkttabellen angegeben.

Äquivalente Statische Lagerbelastung

Bei Pendelrollenlagern gilt:

$$P_0 = F_r + Y_0 * F_a$$

Y_0 - Werte sind in den Produkttabellen angegeben.

Anschlussmaße

Die Radien der Kantenverrundungen der Lagerringe dürfen nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen. Dazu muss der größte Hohlkehlradius an den Anschlussstellen (r_g bzw. r_{g1}) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerringe.

Equivalent Dynamic Bearing Load

where

$$\frac{F_a}{F_r} \leq e \quad \text{then} \quad P = F_r + Y * F_a$$

or, if

$$\frac{F_a}{F_r} > e \quad \text{then} \quad P = 0,67 * F_r + Y * F_a$$

Values of Y and e are stated in the product tables.

Equivalent Static Bearing Load

For spherical roller bearings:

$$P_0 = F_r + Y_0 * F_a$$

Values of Y_0 are stated in the product tables.

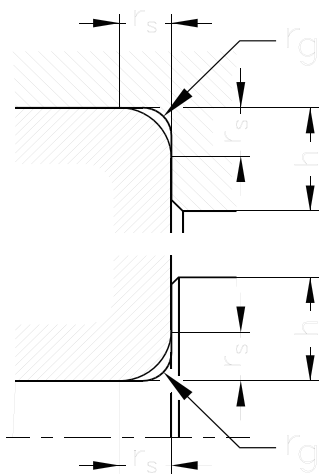
Abutment and Fillet Dimensions

The corner radii of bearing rings must not touch the shoulder fillet radii of shaft or housing shoulders. Therefore, the largest fillet radius (r_g or r_{g1}) must be smaller than the minimum fillet dimension of the bearing rings (r_s), see also the drawings on following pages.

Values of bearing fillet dimensions are stated in the bearing tables.

Anschlussmaße für Pendelrollenlager nach DIN 5418

Abutment and Fillet Dimensions for Spherical Roller Bearing According to DIN 5418



r_s min	r_g max	h_{min} Lagerreihen Bearing Series	
		230 239 240	213, 231, 223, 241, 222, 233, 232
1	1	2,3	2,8
1,1	1	3	3,5
1,5	1,5	3,5	4,5
2	2	4,4	5,5
2,1	2,1	5,1	6
3	2,5	6,2	7
4	3	7,3	8,5
5	4	9	10
6	5	11,5	13
7,5	6	14	16
9,5	8	17	20

Pendelrollenlager auf Spann- oder Abziehhülsen

Wenn, wie in Abb. 2a dargestellt, Pendelrollenlager auf Spannhülsen ohne festen seitlichen Anschlag auf glatten Wellen montiert werden, darf die auf das Lager wirkende Axialkraft eine bestimmte Höhe nicht überschreiten, da diese nur durch die Reibung zwischen Spannhülse und Welle aufgenommen wird.

Die Höhe der zulässigen Axiallast lässt sich wie folgt abschätzen:

$$F_{\text{amax}} \leq 3 \cdot d \cdot B$$

wobei:

- F_{amax}** maximal zulässige Axiallast bei Pendelrollenlagern auf Spannhülse [N]
- B** Lagerbreite [mm]
- d** Bohrungsdurchmesser des Lagers [mm]

Beim Auftreten größerer Axialkräfte müssen die Lager axial durch zusätzliche Stützringe gesichert werden, siehe Abb. 2b.

Zur Auslegung der Stützringe sind folgende Anschlussmaße zu beachten:

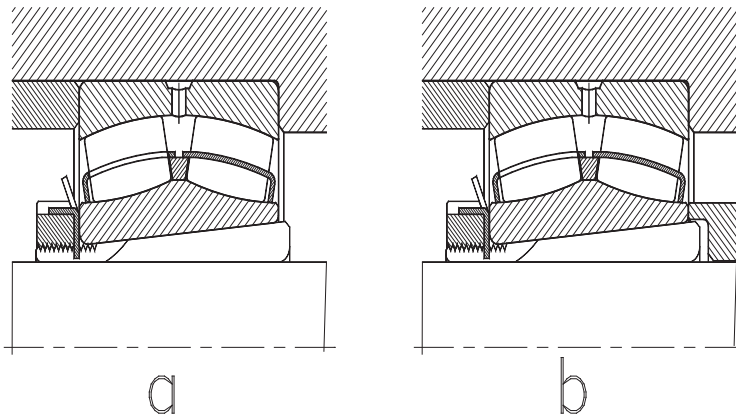


Abb. 2
Fig. 2

Spherical Roller Bearings Mounted on Adapter or Withdrawal Sleeves

For applications where spherical roller bearings and adapter sleeves are mounted on straight shafts without additional axial support (fig. 2a), their ability to accept axial forces is limited by the friction between the adapter sleeve and the shaft.

The permissible thrust load may be estimated using the following formula:

$$F_{\text{amax}} \leq 3 \cdot d \cdot B$$

where:

- F_{amax}** maximum permissible thrust load for spherical roller bearings mounted on adapter sleeves [N]
- B** bearing width [mm]
- d** bearing bore diameter [mm]

With higher axial forces, the bearing must be secured additionally by supporting rings as shown in fig. 2b.

When designing such supporting rings, however, specific dimensions have to be obtained:

Montagehinweise

Bei der Montage von Pendelrollenlagern mit kegeliger Bohrung ist besonders auf die Einhaltung einer verbleibenden Mindest-Radialluft nach der Montage zu achten.

Bitte beachten Sie in diesem Zusammenhang die ausführlichen Hinweise im Abschnitt „**Handling, Ein- und Ausbau von Wälzlagern**“, Seite 157.

Pendelrollenlager in Sonderausführung für Vibrationsmaschinen

NKE Pendelrollenlager der Sonderausführung **SQ 34** wurden besonders für einen Einsatz in Vibrationsmaschinen, wie beispielsweise in Schwingsieben und Rüttlern, ausgelegt.

Für eine optimale Funktionserfüllung weisen die Lager dieser Ausführung folgende Merkmale auf:

- außenringgeführte Messingmassivkäfige
- eingeschränkte Toleranz des Außendurchmessers

NKE Pendelrollenlager der Sonderausführung **SQ 34** werden sowohl mit zylindrischer Bohrung als auch mit kegeliger Bohrung, Kegel 1:12 hergestellt.

- reduced bore tolerance for spherical roller bearings with cylindrical bore diameter

Mounting Instructions

Particularly when mounting spherical roller bearings with tapered bores special care must be taken to retain a minimum radial internal bearing clearance after mounting.

Please see the relevant detailed information in the chapter “**Handling, Mounting and Dismounting Rolling Bearings**”, page 342.

Spherical Roller Bearings in Special Execution for Vibrating Applications

NKE spherical roller bearings suffix (**SQ34**) are especially designed for use in vibrating applications, (e.g. shaker screens or compactors).

To perform in an optimum way, bearings of the special design “**SQ34**” have the following additional quality features:

- outer ring land riding solid brass cages
- reduced tolerance of outer diameter
- eingeschränkte Bohrungstoleranz bei den Pendelrollenlagern mit zylindrischer Bohrung

NKE spherical roller bearings “SQ34” are produced with either, cylindrical bores, or tapered bores, (taper 1:12).

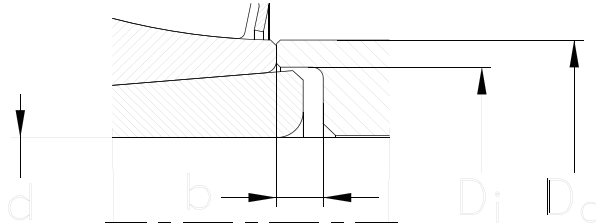
Bohrungstoleranzen der NKE Pendelrollenlager, Ausführung SQ 34 [µm]
Bore tolerances of **NKE “SQ 34”** spherical roller bearings [µm]

Nennmaß der Lagerbohrung d [mm] <i>Nominal bore diameter, d [mm]</i>	>	30	50	80	120	180	250
	≤	50	80	120	180	250	315
Abweichung <i>Deviation</i>	Δ_{dmp}	0	0	0	0	0	0
		-7	-9	-12	-15	-18	-21

Toleranzen des Außendurchmessers von NKE Pendelrollenlagern, Ausführung SQ 34 [µm]
Tolerances of outer ring outer diameter of **NKE “SQ 34”** spherical roller bearings [µm]

Nennmaß des Außendurchmessers D [mm] <i>Nominal outer diameter, D [mm]</i>	>	80	150	180	315	400	500
	≤	150	180	315	400	500	630
Abweichung <i>Deviation</i>	Δ_{Dmp}	-5	-5	-10	-13	-13	-15
		-13	-18	-23	-28	-30	-35

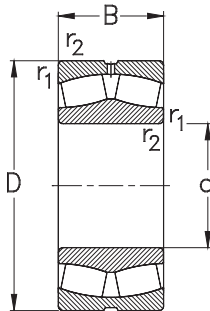
Anschlussmaße bei Stützringen für Pendelrollenlager auf Spannhülse [mm]
Abutment and Fillet Dimensions for Supporting Rings of Spherical Roller Bearings [mm]



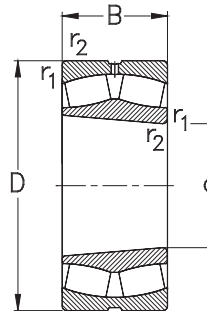
Welle Shaft Ød [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing Series								
		239..K			230..K			231..K		
		D _i min	D _a max	b min	D _i min	D _a max	b min	D _i min	D _a max	b min
90	20	--	--	--	--	--	--	107	113	7
100	22	--	--	--	--	--	--	117	124	7
110	24	--	--	--	127	133	7	128	136	7
115	26	--	--	--	137	145	8	138	145	8
125	28	--	--	--	147	155	8	149	157	8
135	30	--	--	--	158	166	8	160	170	8
140	32	--	--	--	168	177	8	170	183	8
150	34	--	--	--	179	189	8	180	193	8
160	36	--	--	--	189	201	8	191	204	8
170	38	--	--	--	199	211	9	202	216	9
180	40	--	--	--	210	223	9	212	231	9
200	44	--	--	--	231	247	9	233	253	9
220	48	--	--	--	251	268	11	254	276	11
240	52	--	--	--	272	291	11	276	302	11
260	56	--	--	--	292	310	12	296	321	12
280	60	--	--	--	313	337	12	318	347	12
300	64	--	--	--	334	357	12	338	369	12
320	68	--	--	--	355	382	14	360	395	14
340	72	--	--	--	375	402	14	380	416	14
360	76	--	--	--	396	422	15	401	436	15
380	80	--	--	--	417	448	15	421	457	15
400	84	--	--	--	437	468	15	443	483	16
410	88	--	--	--	458	488	17	463	504	17
430	92	--	--	--	478	509	17	484	533	17
450	96	--	--	--	499	529	18	505	554	18
470	/500	516	543	18	519	550	18	527	578	18
500	/530	546	576	18	--	--	--	--	--	--
530	/560	577	609	18	--	--	--	--	--	--
560	/600	618	653	20	--	--	--	--	--	--
600	/630	649	688	20	--	--	--	--	--	--
630	/670	689	730	20	--	--	--	--	--	--
670	/710	730	770	22	--	--	--	--	--	--
710	/750	771	810	23	--	--	--	--	--	--
750	/800	822	865	25	--	--	--	--	--	--
800	/850	873	917	25	--	--	--	--	--	--
850	/900	923	972	27	--	--	--	--	--	--
900	/950	974	1030	27	--	--	--	--	--	--

Welle Shaft Ød [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing Series											
		222..K			232..K			213..K			223..K		
		D _i min	D _a max	b min	D _i min	D _a max	b min	D _i min	D _a max	b min	D _i min	D _a max	b min
20	05	28	31	5	--	--	--	--	--	--	--	--	--
25	06	33	37	5	--	--	--	--	--	--	--	--	--
30	07	39	43	5	--	--	--	39	47	7	--	--	--
35	08	44	48	5	--	--	--	44	53	5	45	52	5
40	09	50	54	7	--	--	--	50	59	5	50	58	5
45	10	55	59	9	--	--	--	55	66	5	56	63	5
50	11	60	67	10	--	--	--	60	72	6	61	68	6
55	12	65	71	9	--	--	--	65	79	6	66	74	6
60	13	70	79	8	--	--	--	70	85	6	72	83	6
60	14	75	84	11	--	--	--	75	92	6	77	86	6
65	15	80	89	12	--	--	--	80	98	6	82	92	6
70	16	85	94	12	--	--	--	85	105	6	88	98	6
75	17	91	99	12	--	--	--	91	111	7	94	104	7
80	18	86	106	10	100	104	18	96	117	7	100	110	7
85	19	102	112	9	--	--	--	102	124	7	105	115	7
90	20	108	118	8	110	116	19	108	131	7	110	124	7
100	22	118	129	6	121	129	17	118	146	9	121	143	7
110	24	128	141	11	131	139	17	--	--	--	131	150	7
115	26	138	151	8	142	150	21	--	--	--	142	162	8
125	28	149	164	8	152	162	22	--	--	--	152	173	8
135	30	160	177	15	163	174	20	--	--	--	163	185	8
140	32	170	190	14	174	186	18	--	--	--	174	191	8
150	34	180	199	10	185	199	18	--	--	--	185	204	8
160	36	191	211	18	195	210	22	--	--	--	195	217	8
170	38	202	223	21	206	222	21	--	--	--	206	228	9
180	40	212	234	23	216	237	19	--	--	--	216	240	9
200	44	233	258	21	236	259	10	--	--	--	236	272	9
220	48	254	283	19	257	284	6	--	--	--	257	296	11
240	52	276	308	25	278	309	2	--	--	--	278	322	11
260	56	296	324	28	299	329	11	--	--	--	299	349	12
280	60	318	352	32	321	353	12	--	--	--	--	--	--
300	64	338	378	38	343	378	12	--	--	--	--	--	--
320	68	--	--	--	364	402	14	--	--	--	--	--	--
340	72	--	--	--	385	424	14	--	--	--	--	--	--
360	76	--	--	--	405	447	15	--	--	--	--	--	--
380	80	--	--	--	427	473	15	--	--	--	--	--	--
400	84	--	--	--	449	495	15	--	--	--	--	--	--
410	88	--	--	--	469	516	17	--	--	--	--	--	--
430	92	--	--	--	490	541	17	--	--	--	--	--	--
450	96	--	--	--	513	568	18	--	--	--	--	--	--
470	/500	--	--	--	534	593	18	--	--	--	--	--	--

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

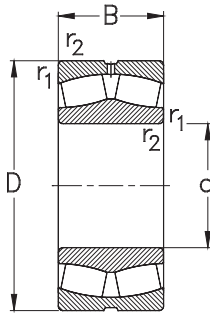
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
25	52	18	1	22205-E-W33	46	46	6	9500	17000
	52	18	1	22205-E-K-W33	46	46	6	9500	17000
30	62	20	1	22206-E-W33	61	65	8	8000	14000
	62	20	1	22206-E-K-W33	61	65	8	8000	14000
35	72	23	1,1	22207-E-W33	81	92	11	7100	12000
	72	23	1,1	22207-E-K-W33	81	92	11	7100	12000
40	80	23	1,1	22208-E-W33	93	105	13	6200	11000
	80	23	1,1	22208-E-K-W33	93	105	13	6200	11000
	90	33	1,5	22308-E-W33	140	160	20	5700	8000
45	90	33	1,5	22308-E-K-W33	140	160	20	5700	8000
	85	23	1,1	22209-E-W33	97	113	14	5700	10000
	85	23	1,1	22209-E-K-W33	97	113	14	5700	10000
	100	36	1,5	22309-E-W33	167	194	24	5200	7000
50	100	36	1,5	22309-E-K-W33	167	194	24	5200	7000
	90	23	1,1	22210-E-W33	105	124	15	5200	9500
	90	23	1,1	22210-E-K-W33	105	124	15	5200	9500
	110	40	2	22310-E-W33	200	238	29	4900	6300
55	110	40	2	22310-E-K-W33	200	238	29	4900	6300
	100	25	1,5	22211-E-W33	125	147	18	4800	8500
	100	25	1,5	22211-E-K-W33	125	147	18	4800	8500
	120	43	2	22311-E-W33	230	279	34	4500	5600
	120	43	2	22311-E-K-W33	230	279	34	4500	5600

Anschlussmaße siehe Seite 717

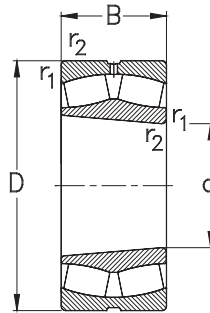
*Abutment and fillet dimensions
see on page 717*

d	e	Berechnungsfaktoren				B _s	B _k	Gewicht
		Calculation factors						[kg]
		F _a /F _r ≤ e	F _a /F _r > e	Y ₀				Weight
		Y ₁	Y ₂			m		
25	0,34	2	3	2	4	2	0,16	
	0,34	2	3	2	4	2	0,16	
30	0,31	2,1	3,2	2,1	4	2	0,25	
	0,31	2,1	3,2	2,1	4	2	0,25	
35	0,31	2,2	3,3	2,1	4	2	0,42	
	0,31	2,2	3,3	2,1	4	2	0,41	
40	0,27	2,5	3,7	2,4	2,5	5,4	0,51	
	0,27	2,5	3,7	2,4	2,5	5,4	0,5	
	0,36	1,8	2,6	1,8	3	5,5	1,05	
	0,36	1,8	2,6	1,8	3	5,5	1,03	
45	0,26	2,6	3,9	2,6	2,5	5,8	0,55	
	0,26	2,6	3,9	2,6	2,5	5,8	0,53	
	0,36	1,9	2,8	1,9	3	5,5	1,4	
	0,36	1,9	2,8	1,9	3	5,5	1,37	
50	0,24	2,8	4,2	2,8	2,5	5,8	0,59	
	0,24	2,8	4,2	2,8	2,5	5,8	0,57	
	0,36	1,9	2,7	1,8	3	5,5	1,87	
	0,36	1,9	2,7	1,8	3	5,5	1,83	
55	0,23	2,9	4,4	2,9	3	5,5	0,83	
	0,23	2,9	4,4	2,9	3	5,5	0,82	
	0,35	1,9	2,8	1,9	3	5,5	2,36	
	0,35	1,9	2,8	1,9	3	5,5	2,31	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

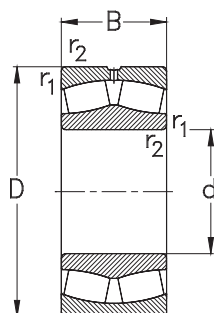
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
60	110	28	1,5	22212-E-W33	152	183	22	4600	7500
	110	28	1,5	22212-E-K-W33	152	183	22	4600	7500
	130	46	2,1	22312-E-W33	273	315	38	4300	5300
	130	46	2,1	22312-E-K-W33	273	315	38	4300	5300
65	120	31	1,5	22213-E-W33	182	224	27	4300	7000
	120	31	1,5	22213-E-K-W33	182	224	27	4300	7000
	140	48	2,1	22313-E-W33	304	351	42	4000	5000
	140	48	2,1	22313-E-K-W33	304	351	42	4000	5000
70	125	31	1,5	22214-E-W33	189	239	29	4100	6700
	125	31	1,5	22214-E-K-W33	189	239	29	4100	6700
	150	51	2,1	22314-E-W33	344	402	48	3800	4500
	150	51	2,1	22314-E-K-W33	344	402	48	3800	4500
75	130	31	1,5	22215-E-W33	196	255	31	3800	6300
	130	31	1,5	22215-E-K-W33	196	255	31	3800	6300
	160	55	2,1	22315-E-W33	396	489	57	3500	4300
	160	55	2,1	22315-E-K-W33	396	489	57	3500	4300
80	140	33	2	22216-E-W33	224	295	35	3600	6000
	140	33	2	22216-E-K-W33	224	295	35	3600	6000
	170	58	2,1	22316-E-W33	443	551	63	3400	4000
	170	58	2,1	22316-E-K-W33	443	551	63	3400	4000
85	150	36	2	22217-E-W33	260	337	39	3500	5600
	150	36	2	22217-E-K-W33	260	337	39	3500	5600

Anschlussmaße siehe Seite 717

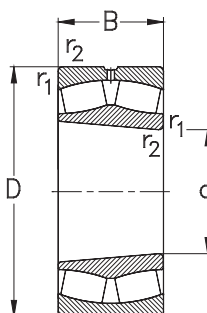
*Abutment and fillet dimensions
see on page 717*

d	e	Berechnungsfaktoren				B_s	B_k	Gewicht
		Calculation factors						[kg]
		$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0				Weight [kg] m
60	0,24	2,8	4,2	2,8	3	5,5	1,14	
	0,24	2,8	4,2	2,8	3	5,5	1,12	
	0,35	1,9	2,9	1,9	3	5,5	2,91	
	0,35	1,9	2,9	1,9	3	5,5	2,84	
65	0,24	2,9	4,2	2,8	3	5,5	1,51	
	0,24	2,9	4,2	2,8	3	5,5	1,48	
	0,34	2	3	2	3	5,5	3,46	
	0,34	2	3	2	3	5,5	3,38	
70	0,23	2,9	4,2	2,8	3	5,5	1,61	
	0,23	2,9	4,2	2,8	3	5,5	1,57	
	0,34	2	3	2	3	5,5	4,19	
	0,34	2	3	2	3	5,5	4,1	
75	0,22	3,1	4,5	2,9	3	5,5	1,7	
	0,22	3,1	4,5	2,9	3	5,5	1,66	
	0,33	2	3	2	4,5	8,3	5,27	
	0,33	2	3	2	4,5	8,3	5,15	
80	0,22	3,1	4,5	3	3	5,5	2,11	
	0,22	3,1	4,5	3	3	5,5	2,07	
	0,33	2	3	2	4,5	8,3	6,25	
	0,33	2	3	2	4,5	8,3	6,11	
85	0,22	3	4,4	2,9	3	5,5	2,66	
	0,22	3	4,4	2,9	3	5,5	2,61	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

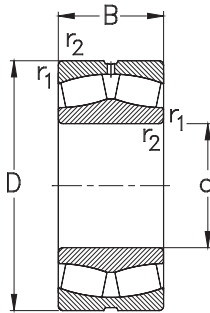
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
85	180	60	3	22317-E-W33	482	603	68	3200	3800
	180	60	3	22317-E-K-W33	482	603	68	3200	3800
90	160	40	2	22218-E-W33	308	406	46	3400	5300
	160	40	2	22218-E-K-W33	308	406	46	3400	5300
	160	52,4	2	23218-MB-W33	303	412	47	2900	3800
	160	52,4	2	23218-K-MB-W33	303	412	47	2900	3800
	190	64	3	22318-E-W33	536	673	74	3700	3800
	190	64	3	22318-E-K-W33	536	673	74	3000	3800
95	170	43	2,1	22219-E-W33	346	464	52	3300	4800
	170	43	2,1	22219-E-K-W33	346	464	52	3300	4800
	200	67	3	22319-E-W33	587	744	81	2800	3400
	200	67	3	22319-E-K-W33	587	744	81	2800	3400
100	165	52	2	23120-MB-W33	327	502	56	2900	4000
	165	52	2	23120-K-MB-W33	327	502	56	2900	4000
	180	46	2,1	22220-E-W33	379	510	56	3200	4500
	180	46	2,1	22220-E-K-W33	379	510	56	3200	4500
	180	60,3	2,1	23220MB-W33	390	532	59	2700	3400
	180	60,3	2,1	23220-K-MB-W33	390	532	59	2700	3400
	215	73	3	22320-E-W33	682	842	90	2600	3000
	215	73	3	22320-E-K-W33	682	842	90	2600	3000
110	170	45	2	23022-MB-W33	274	447	49,2	3100	4300
	170	45	2	23022-K-MB-W33	274	447	49,2	3100	4300

Anschlussmaße siehe Seite 717

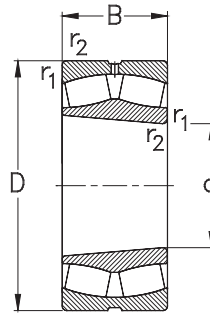
*Abutment and fillet dimensions
see on page 717*

d	e	Berechnungsfaktoren					Gewicht [kg] Weight [kg] m
		Calculation factors					
		$F_a/F_r \leq e$ Y ₁	$F_a/F_r > e$ Y ₂	Y ₀	B _s	B _k	
85	0,32	2,1	3,1	2	4,5	8,3	7,16
	0,32	2,1	3,1	2	4,5	8,3	7,01
90	0,23	2,9	4,2	2,8	4,5	8,3	3,4
	0,23	2,9	4,2	2,8	4,5	8,3	3,33
	0,33	2	3	1,9	3	5,5	4,7
	0,33	2	3	1,9	3	5,5	4,6
	0,33	2,1	3,1	2	4,5	8,3	8,54
	0,33	2,1	3,1	2	4,5	8,3	8,35
95	0,23	2,9	4,2	2,7	4,5	8,3	4,17
	0,23	2,9	4,2	2,7	4,5	8,3	4,08
	0,33	2,1	3,1	2	4,5	8,3	9,86
	0,33	2,1	3,1	2	4,5	8,3	9,64
100	0,26	2,55	3,8	2,5	6,5	3	4,5
	0,26	2,55	3,8	2,5	6,5	3	4,5
	0,24	2,9	4,1	2,7	4,5	8,3	5,01
	0,24	2,9	4,1	2,7	4,5	8,3	4,9
	0,34	2	2,8	1,9	4,5	8,3	6,9
	0,34	2	2,8	1,9	4,5	8,3	6,7
	0,33	2	3	2	4,5	8,3	12,3
	0,33	2	3	2	4,5	8,3	12,1
110	0,24	2,84	4,23	2,78	6,5	3	3,54
	0,24	2,84	4,23	2,78	6,5	3	3,54

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

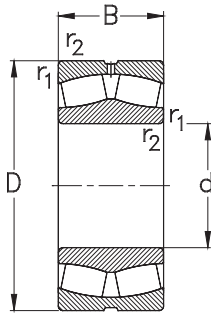
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
110	180	56	2	23122-MB-W33	354	541	59	2800	3600
	180	56	2	23122-K-MB-W33	354	541	59	2800	3600
	180	69	2	24122-CE-W33	458	752	82	2000	3000
	180	69	2	24122-CE-K30-W33	458	752	82	2000	3000
	200	53	2,1	22222-E-W33	488	653	70	3000	4000
	200	53	2,1	22222-E-K-W33	488	653	70	3000	4000
	200	69,8	2,1	23222-MB-W33	524	778	83	2200	3200
	200	69,8	2,1	23222-K-MB-W33	524	778	83	2200	3200
	240	80	3	22322-E-W33	805	1000	103	2300	2800
	240	80	3	22322-E-K-W33	805	1000	103	2300	2800
120	180	46	2	23024-MB-W33	287	467	50	3000	4000
	180	46	2	23024-K-MB-W33	287	467	50	3000	4000
	180	60	2	24024-CE-W33	382	671	73	2400	3400
	180	60	2	24024-CE-K30-W33	382	671	73	2400	3400
	200	62	2	23124-MB-W33	430	648	69	2500	3400
	200	62	2	23124-K-MB-W33	430	648	69	2500	3400
	200	80	2	24124-CE-W33	581	958	102	1800	2600
	200	80	2	24124-CE-K30-W33	581	958	102	1800	2600
	215	58	2,1	22224-E-W33	553	775	81	2800	3800
	215	58	2,1	22224-E-K-W33	553	775	81	2800	3800
	215	76	2,1	23224-MB-W33	564	803	84	2100	2800
	215	76	2,1	23224-K-MB-W33	564	803	84	2100	2800

Anschlussmaße siehe Seite 717

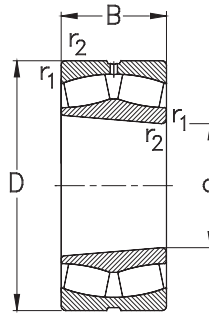
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				[kg]
							[kg]
110	0,31	2,2	3,1	2,1	4,5	8,3	6
	0,31	2,2	3,1	2,1	4,5	8,3	5,8
	0,37	1,8	2,69	1,76	6,5	3	6,94
	0,37	1,8	2,69	1,76	6,5	3	6,83
	0,25	2,7	4	2,6	4,5	8,3	7,09
	0,25	2,7	4	2,6	4,5	8,3	6,94
	0,35	1,95	2,9	1,91	9,2	4,5	9,9
	0,35	1,95	2,9	1,91	9,2	4,5	9,6
	0,33	2,1	3,1	2	6	11,1	17,2
	0,33	2,1	3,1	2	6	11,1	16,8
120	0,24	2,7	4,2	2,6	3	5,5	4,3
	0,24	2,7	4,2	2,6	3	5,5	4,2
	0,32	2,12	3,15	2,07	6,5	3	5,36
	0,32	2,12	3,15	2,07	6,5	3	5,36
	0,31	2,1	3,1	2	4,5	8,3	8,2
	0,31	2,1	3,1	2	45	8,3	8
	0,37	1,8	2,69	1,76	6,5	3	10
	0,37	1,8	2,69	1,76	6,5	3	10
	0,25	2,7	3,9	2,5	4,5	8,3	8,96
	0,25	2,7	3,9	2,5	4,5	8,3	8,76
	0,36	1,9	2,7	1,8	4,5	8,3	12,3
	0,36	1,9	2,7	1,8	4,5	8,3	11,9

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

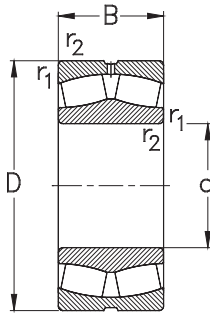
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
120	260	86	3	22324-E-W33	938	1180	119	2100	2600
	260	86	3	22324-E-K-W33	938	1180	119	2100	2600
130	200	52	2	23026-MB-W33	367	579	61	2800	3600
	200	52	2	23026-K-MB-W33	367	579	61	2800	3600
	200	69	2	24026-CE-W33	476	823	86	2200	3000
	200	69	2	24026-CE-K30-W33	476	823	86	2200	3000
	210	64	2	23126-MB-W33	474	752	78	2300	3200
	210	64	2	23126-K-MB-W33	474	752	78	2300	3200
	210	80	2	24126-CE-W33	597	1012	105	1600	2400
	210	80	2	24126-CE-K30-W33	570	1012	105	1600	2400
	230	64	3	22226-E-W33	641	948	97	2500	3600
	230	64	3	22226-E-K-W33	641	948	97	2500	3600
140	230	80	3	23226-MB-W33	636	948	97	1900	2600
	230	80	3	23226-K-MB-W33	636	948	97	1900	2600
	280	93	4	22326-E-W33	1090	1380	136	1900	2400
	280	93	4	22326-E-K-W33	1090	1380	136	1900	2400
	210	53	2	23028-MB-W33	380	633	65	2600	3400
	210	53	2	23028-K-MB-W33	380	633	65	2600	3400
	210	69	2	24028-CE-W33	503	900	93	2000	2800
	210	69	2	24028-CE-K30-W33	503	900	93	2000	2800
	225	68	2,1	23128-MB-W33	540	865	88	2100	2800
	225	68	2,1	23128-K-MB-W33	540	865	88	2100	2800

Anschlussmaße siehe Seite 717

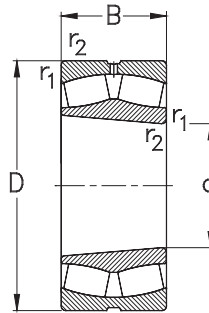
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				
120	0,33	2,1	3,1	2	6	11,1	21,5
	0,33	2,1	3,1	2	6	11,1	21,1
130	0,26	2,6	3,8	2,5	3	5,5	6,3
	0,26	2,6	3,8	2,5	3	5,5	6,1
	0,32	2,12	3,15	2,07	6,5	3	7,95
	0,32	2,12	3,15	2,2	6,5	3	7,95
	0,3	2,2	3,2	2,1	4,5	8,3	9,1
	0,3	2,2	3,2	2,1	4,5	8,3	8,8
	0,37	1,8	2,69	1,76	6,5	3	10,6
	0,34	1,8	2,69	1,76	6,5	3	10,6
	0,26	2,6	3,8	2,5	6	11,1	11,2
	0,26	2,6	3,8	2,5	6	11,1	11
140	0,35	1,9	2,7	1,8	6	11,1	15
	0,35	1,9	2,7	1,8	6	11,1	14,4
	0,33	2,1	3,1	2	7,5	13,9	26,8
	0,33	2,1	3,1	2	7,5	13,9	26,2
	0,24	2,7	4,2	2,6	4,5	8,3	6,9
	0,24	2,7	4,2	2,6	4,5	8,3	6,7
	0,29	2,32	3,45	2,26	6,5	3	8,42
	0,29	2,32	3,45	2,26	6,5	3	8,42
	0,3	2,2	3,2	2,1	4,5	8,3	10,8
	0,3	2,2	3,2	2,1	4,5	8,3	10,5

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

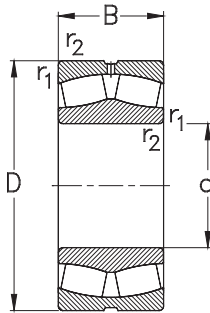
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
140	225	85	2,1	24128-CE-W33	677	1156	118	1500	2400
	225	85	2,1	24128-CE-K30-W33	677	1156	118	1500	2400
	250	68	3	22228-E-W33	747	1080	108	2300	3200
	250	68	3	22228-E-K-W33	747	1080	108	2300	3200
	250	88	3	23228-MB-W33	815	1320	132	1600	2400
	250	88	3	23228-K-MB-W33	815	1320	132	1600	2400
	300	102	4	22328-MB-W33	993	1270	122	1900	2200
	300	102	4	22328-K-MB-W33	993	1270	122	1900	2200
150	225	56	2,1	23030-MB-W33	419	697	70	2400	3200
	225	56	2,1	23030-K-MB-W33	419	697	70	2400	3200
	225	75	2,1	24030-CE-W33	572	1044	105	1800	2600
	225	75	2,1	24030-CE-K30-W33	572	1044	105	1800	2600
	250	80	2,1	23130-MB-W33	711	1130	112	1900	2600
	250	80	2,1	23130-K-MB-W33	711	1130	112	1900	2600
	250	100	2,1	24130-CE-W33	899	1544	153	1300	2200
	250	100	2,1	24130-CE-K30-W33	899	1544	153	1300	2200
	270	73	3	22230-E-W33	863	1260	123	2100	3000
	270	73	3	22230-E-K-W33	863	1260	123	2100	3000
	270	96	3	23230-MB-W33	874	1300	127	1600	2200
	270	96	3	23230-K-MB-W33	874	1300	127	1600	2200
320	108	4	22330-MB-W33	1190	1610	152	1700	2000	
320	108	4	22330-K-MB-W33	1190	1610	152	1700	2000	

Anschlussmaße siehe Seite 717

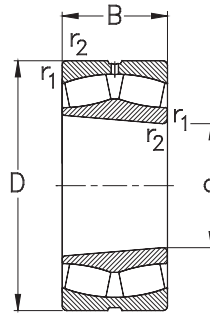
*Abutment and fillet dimensions
see on page 717*

d	e	Berechnungsfaktoren					Gewicht [kg] Weight [kg] m
		Calculation factors					
		$F_a/F_r \leq e$ Y ₁	$F_a/F_r > e$ Y ₂	Y ₀	B _s	B _k	
140	0,35	1,95	2,9	1,91	9,3	4,5	12,8
	0,35	1,95	2,9	1,91	9,3	4,5	12,8
	0,25	2,7	3,9	2,5	6	11,1	14,1
	0,25	2,7	3,9	2,5	6	11,1	13,8
	0,33	2	3	2	6	11,1	18,6
	0,33	2	3	2	6	11,1	18
	0,38	1,8	2,5	1,7	7,5	13,9	35,6
	0,38	1,8	2,5	1,7	7,5	13,9	34,8
150	0,24	2,7	4,2	2,6	4,5	8,3	8,3
	0,24	2,7	4,2	2,6	4,5	8,3	8
	0,32	2,12	3,15	2,07	6,5	3	10,5
	0,32	2,12	3,15	2,07	6,5	3	10,5
	0,32	2,1	3	2	4,5	8,3	16,6
	0,32	2,1	3	2	4,5	8,3	16,1
	0,37	1,8	2,69	1,76	9,3	4,5	19,9
	0,37	1,8	2,69	1,76	9,3	4,5	19,9
	0,25	2,7	3,9	2,5	7,5	13,9	17,9
	0,25	2,7	3,9	2,5	7,5	13,9	17,5
	0,36	1,8	2,7	1,8	7,5	13,9	24,6
	0,36	1,8	2,7	1,8	7,5	13,9	23,9
0,37	1,8	2,7	1,8	9	16,7	41,7	
0,37	1,8	2,7	1,8	9	16,7	40,8	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

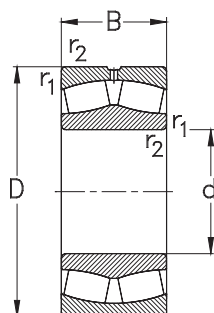
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
160	240	60	2,1	23032-MB-W33	521	903	89	2100	3000
	240	60	2,1	23032-K-MB-W33	521	903	89	2100	3000
	240	80	2,1	24032-CE-W33	659	1211	120	1700	2400
	240	80	2,1	24032-CE-K30-W33	659	1211	120	1700	2400
	270	86	2,1	23132-MB-W33	817	1310	127	1700	2400
	270	86	2,1	23132-K-MB-W33	817	1310	127	1700	2400
	270	109	2,1	24132-CE-W33	1038	1758	170	1200	1900
	270	109	2,1	24132-CE-K30-W33	1038	1758	170	1200	1900
	290	80	3	22232-E-W33	978	1440	138	1900	2800
	290	80	3	22232-E-K-W33	978	1440	138	1900	2800
	290	104	3	23232-MB-W33	1130	1830	175	1300	2200
	290	104	3	23232-K-MB-W33	1130	1830	175	1300	2200
170	340	114	4	22332-MB-W33	1250	1680	156	1600	1900
	340	114	4	22332-K-MB-W33	1250	1680	156	1600	1900
	260	67	2,1	23034-MB-W33	618	1050	102	2000	2800
	260	67	2,1	23034-K-MB-W33	618	1050	102	2000	2800
	260	90	2,1	24034-CE-W33	808	1486	144	1600	2400
	260	90	2,1	24034-CE-K30-W33	808	1486	144	1600	2400
	280	88	2,1	23134-MB-W33	826	1350	129	1600	2400
	280	88	2,1	23134-K-MB-W33	826	1350	129	1600	2400
280	109	2,1	24134-CE-W33	1076	1864	178	1100	1900	
280	109	2,1	24134-CE-K30-W33	1076	1864	178	1100	1900	

Anschlussmaße siehe Seite 717

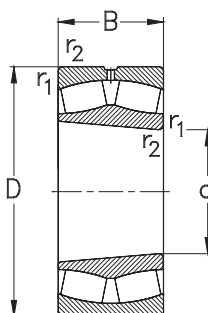
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m
160	0,24	2,8	4	2,6	6	11,1	10,3
	0,24	2,8	4	2,6	6	11,1	10
	0,29	2,32	3,45	2,26	9,3	4,5	12,7
	0,29	2,32	3,45	2,26	9,3	4,5	12,7
	0,32	2,1	3	2	6	11,1	21,3
	0,32	2,1	3	2	6	11,1	20,7
	0,4	1,68	2,5	1,64	9,3	4,5	25,4
	0,4	1,68	2,5	1,64	9,3	4,5	25,4
	0,26	2,6	3,8	2,5	7,5	13,9	22,7
	0,26	2,6	3,8	2,5	7,5	13,9	22,2
	0,36	1,9	2,8	1,8	7,5	13,9	31
	0,36	1,9	2,8	1,8	7,5	13,9	30,1
	0,37	1,8	2,6	1,7	9	16,7	51,9
	0,37	1,8	2,6	1,7	9	16,7	50,8
170	0,25	2,7	3,9	2,6	6	11,1	13,8
	0,25	2,7	3,9	2,6	6	11,1	13,4
	0,32	2,12	3,15	2,07	9,3	4,5	17,8
	0,32	2,12	3,15	2,07	9,3	4,5	17,8
	0,31	2,1	3,1	2	6	11,1	22,8
	0,31	2,1	3,1	2	6	11,1	22,2
	0,37	1,8	2,69	1,76	9,3	4,5	26,4
	0,37	1,8	2,69	1,76	9,3	4,5	26,4

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

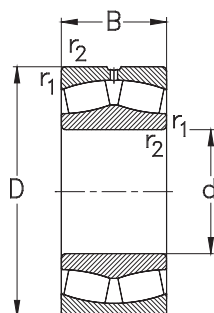
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
170	310	86	4	22234-MB-W33	921	1310	123	1900	2600
	310	86	4	22234-K-MB-W33	921	1310	123	1900	2600
	310	110	4	23234-MB-W33	1280	1880	176	1300	2000
	310	110	4	23234-K-MB-W33	1280	1880	176	1300	2000
	360	120	4	22334-MB-W33	1400	1970	179	1400	1800
	360	120	4	22334-K-MB-W33	1400	1970	179	1400	1800
180	250	52	2	23936-MB-W33	422	823	80	1900	2800
	250	52	2	23936-K-MB-W33	422	823	80	1900	2800
	280	74	2,1	23036-MB-W33	725	1230	117	1900	2600
	280	74	2,1	23036-K-MB-W33	725	1230	117	1900	2600
	280	100	2,1	24036-MB-W33	953	1740	165	1400	2200
	280	100	2,1	24036-K30-MB-W33	953	1740	165	1400	2200
	300	96	3	23136-MB-W33	957	1540	144	1500	2200
	300	96	3	23136-K-MB-W33	957	1540	144	1500	2200
	300	118	3	24136-MB-W33	1233	2162	203	1000	1700
	300	118	3	24136-K30-MB-W33	1233	2162	203	1000	1700
	320	86	4	22236-MB-W33	943	1380	128	1800	2600
	320	86	4	22236-K-MB-W33	943	1380	128	1800	2600
	320	112	4	23236-MB-W33	1360	2110	195	1200	1900
	320	112	4	23236-K-MB-W33	1360	2110	195	1200	1900
380	126	4	22336-MB-W33	1540	2130	191	1300	1700	
380	126	4	22336-K-MB-W33	1540	2130	191	1300	1700	

Anschlussmaße siehe Seite 717

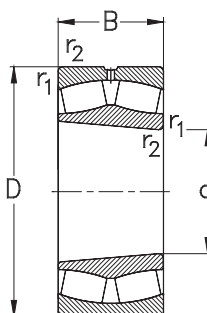
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				
170	0,29	2,3	3,3	2,1	7,5	13,9	30
	0,29	2,3	3,3	2,1	7,5	13,9	29,4
	0,36	1,9	2,8	1,8	7,5	13,9	37,7
	0,36	1,9	2,8	1,8	7,5	13,9	36,4
	0,37	1,8	2,6	1,7	9	16,7	59,2
	0,37	1,8	2,6	1,7	9	16,7	58,2
180	0,18	3,66	5,46	3,58	6,5	3	8,12
	0,18	3,66	5,46	3,58	6,5	3	8,12
	0,26	2,6	3,7	2,5	6	11,1	17,6
	0,23	2,6	3,7	2,5	6	11,1	17,1
	0,32	2,12	3,15	2,07	9,3	4,5	23,4
	0,32	2,12	3,15	2,07	9,3	4,5	23,4
	0,32	2,1	3	2	6	11,1	28,9
	0,32	2,1	3	2	6	11,1	28
	0,37	1,8	2,69	1,76	12,2	6	33,8
	0,37	1,8	2,69	1,76	12,2	6	33,8
	0,28	2,4	3,4	2,3	9	16,7	31,5
	0,28	2,4	3,4	2,3	9	16,7	30,8
	0,36	1,9	2,8	1,9	7,5	13,9	39,8
	0,36	1,9	2,8	1,9	7,5	13,9	38,6
0,37	1,8	2,6	1,7	12	22,3	73,2	
0,37	1,8	2,6	1,7	12	22,3	71,7	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

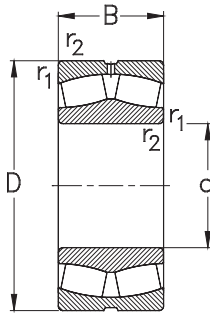
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
190	260	52	2	23938-MB-W33	406	795	76	1800	2600
	260	52	2	23938-K-MB-W33	406	795	76	1800	2600
	290	75	2,1	23038-MB-W33	759	1310	123	1800	2400
	290	75	2,1	23038-K-MB-W33	759	1310	123	1800	2400
	290	100	2,1	24038-MB-W33	976	1822	171	1400	2000
	290	100	2,1	24038-K30-MB-W33	976	1822	171	1400	2000
	320	104	3	23138-MB-W33	1130	1840	169	1400	2000
	320	104	3	23138-K-MB-W33	1130	1840	169	1400	2000
	320	128	3	24138-MB-W33	1412	2506	231	900	1600
	320	128	3	24138-K30-MB-W33	1412	2506	231	900	1600
	340	92	4	22238-MB-W33	1040	1550	141	1700	2400
	340	92	4	22238-K-MB-W33	1040	1550	141	1700	2400
	340	120	4	23238-MB-W33	1550	2420	220	1100	1800
	340	120	4	23238-K-MB-W33	1550	2420	220	1100	1800
200	400	132	5	22338-MB-W33	1920	2710	239	1200	1600
	400	132	5	22338-K-MB-W33	1920	2710	239	1200	1600
	280	60	2,1	23940-MB-W33	550	1055	99	1700	2400
	280	60	2,1	23940-K-MB-W33	550	1055	99	1700	2400
	310	82	2,1	23040-MB-W33	880	1550	143	1600	2200
	310	82	2,1	23040-K-MB-W33	880	1550	143	1600	2200
	310	109	2,1	24040-MB-W33	1129	2122	195	1300	1900
	310	109	2,1	24040-K30-MB-W33	1129	2122	195	1300	1900

Anschlussmaße siehe Seite 717

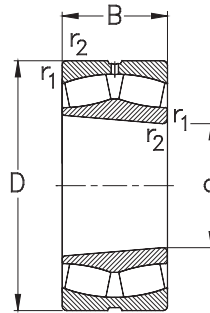
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_K	m
		Y_1	Y_2				
190	0,16	4,28	6,37	4,19	6,5	3	8,46
	0,16	4,28	6,37	4,19	6,5	3	8,46
	0,25	2,7	3,8	2,5	6	11,1	18,8
	0,25	2,7	3,8	2,5	6	11,1	18,3
	0,32	2,12	3,15	2,7	9,3	4,5	24,5
	0,32	2,12	3,15	2,7	9,3	4,5	24,5
	0,32	2,1	3	2	7,5	13,9	36,1
	0,32	2,1	3	2	7,5	13,9	35
	0,37	1,8	2,69	1,76	12,2	6	41,9
	0,37	1,8	2,69	1,76	12,2	6	41,9
	0,29	2,3	3,4	2,2	9	16,7	38,4
	0,29	2,3	3,4	2,2	9	16,7	37,7
	0,36	1,9	2,8	1,9	9	16,7	47,7
	0,36	1,9	2,8	1,9	9	16,7	47,1
	0,36	1,9	2,8	1,9	12	22,3	84,1
	0,36	1,9	2,8	1,9	12	22,3	82,9
200	0,18	3,66	5,46	3,58	9,3	4,5	11,5
	0,18	3,66	5,46	3,58	9,3	4,5	11,5
	0,25	2,7	4	2,7	6	11,1	23,8
	0,25	2,7	4	2,7	6	11,1	23,4
	0,32	2,12	3,15	2,07	12,2	6	30,5
	0,32	2,12	3,15	2,07	12,2	6	30,5

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

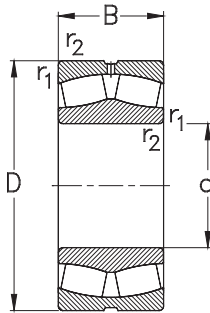
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
200	340	112	3	23140-MB-W33	1240	2010	182	1300	1900
	340	112	3	23140-K-MB-W33	1240	2010	182	1300	1900
	340	140	3	24140-MB-W33	1579	2773	251	860	1500
	340	140	3	24140-K30-MB-W33	1579	2773	251	860	1500
	360	98	4	22240-MB-W33	1160	1760	158	1600	2200
	360	98	4	22240-K-MB-W33	1160	1760	158	1100	2200
	360	128	4	23240-MB-W33	1710	2760	247	1000	1700
	360	128	4	23240-K-MB-W33	1710	2760	247	1000	1700
	420	138	5	22340-MB-W33	1820	2650	230	1200	1500
	420	138	5	22340-K-MB-W33	1820	2650	230	1200	1500
220	300	60	2,1	23944-MB-W33	544	1075	98	1500	2200
	300	60	2,1	23944-K-MB-W33	544	1075	98	1500	2200
	340	90	3	23044-MB-W33	1020	1850	166	1500	2000
	340	90	3	23044-K-MB-W33	1020	1850	166	1500	2000
	340	118	3	24044-MB-W33	1361	2585	232	1100	1700
	340	118	3	24044-K30-MB-W33	1361	2585	232	1100	1700
	370	150	4	24144-MB-W33	1929	3523	311	720	1400
	370	150	4	24144-K30-MB-W33	1929	3523	311	720	1400
	370	120	4	23144-K-MB-W33	1480	2470	218	1100	1700
	370	120	4	23144-MB-W33	1480	2470	218	1100	1700
	400	108	4	22244-MB-W33	1380	2080	181	1400	2000
	400	108	4	22244-K-MB-W33	1380	2080	181	1400	2000

Anschlussmaße siehe Seite 717

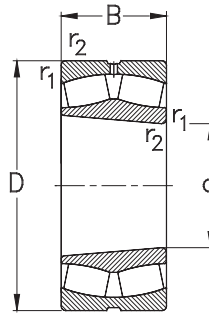
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]	
Calculation factors							Weight [kg]	
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m	
200	0,33	2	2,9	1,9	9	16,7	44	
	0,33	2	2,9	1,9	9	16,7	42,7	
	0,4	1,68	2,5	1,64	12,2	6	52,5	
	0,4	1,68	2,5	1,64	12,2	6	52,5	
	0,29	2,3	3,3	2,2	9	16,7	46	
	0,29	2,3	3,3	2,2	9	16,7	45,1	
	0,36	1,9	2,8	1,8	9	16,7	58,6	
	0,36	1,9	2,8	1,8	9	16,7	56,7	
	0,36	1,9	2,7	1,8	12	22,3	99	
	0,36	1,9	2,7	1,8	12	22,3	97	
	220	0,18	3,66	5,46	3,58	9,3	4,5	13
		0,18	3,66	5,46	3,58	9,3	4,5	13
		0,25	2,7	4	2,7	7,5	13,9	32,1
		0,25	2,7	4	2,7	7,5	13,9	31,2
0,32		2,12	3,15	2,07	12,2	6	39,5	
0,32		2,12	3,15	2,07	12,2	6	39,5	
0,4		1,68	2,5	1,64	12,2	6	65,5	
0,4		1,68	2,5	1,64	12,2	6	65,5	
0,32		2	3	2	9	16,7	55,2	
0,32		2	3	2	9	16,7	56,8	
0,28		2,4	3,4	2,2	9	16,7	63	
0,28		2,4	3,4	2,2	9	16,7	61	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

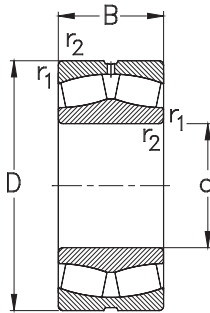
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
220	400	144	4	23244-MB-W33	2040	3290	286	880	1500
	400	144	4	23244-K-MB-W33	2040	3290	286	880	1500
	460	145	5	22344-MB-W33	2110	3130	264	1000	1400
	460	145	5	22344-K-MB-W33	2110	3130	264	1000	1400
240	320	60	2,1	23948-K-MB-W33	592	1233	110	1400	2000
	320	60	2,1	23948-MB-W33	592	1233	110	1400	2000
	360	92	3	23048-K-MB-W33	1080	2010	176	1300	1900
	360	92	3	23048-MB-W33	1080	2010	176	1300	1900
	360	118	3	24048-K30-MB-W33	1393	2841	238	1000	1600
	360	118	3	24048-MB-W33	1393	2718	238	1000	1600
	400	160	4	24148-MB-W33	2115	3921	337	660	1600
	400	160	4	24148-K30-MB-W33	2115	3921	337	660	1600
	400	128	4	23148-K-MB-W33	1690	2860	246	1000	1300
	400	128	4	23148-MB-W33	1690	2860	246	1000	1300
	440	120	4	22248-MB-W33	1660	2560	216	1300	1800
	440	120	4	22248-K-MB-W33	1660	2560	216	1300	1800
	440	160	4	23248-MB-W33	2440	3920	331	790	1300
	440	160	4	23248-K-MB-W33	2440	3920	331	790	1300
500	155	5		22348-MB-W33	2440	3690	304	890	1300
	155	5		22348-K-MB-W33	2440	3690	304	890	1300
260	360	75	2,1	23952-K-MB-W33	882	1827	159	1200	1900
	360	75	2,1	23952-MB-W33	882	1827	159	1200	1900

Anschlussmaße siehe Seite 717

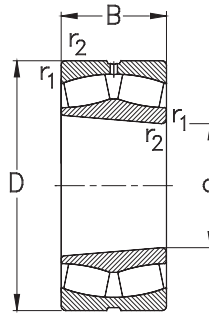
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				
220	0,36	1,9	2,8	1,8	9	16,7	83
	0,36	1,9	2,8	1,8	9	16,7	79
	0,35	1,9	2,8	1,8	9	16,7	125
	0,35	1,9	2,8	1,8	9	16,7	122
240	0,16	4,28	6,37	4,19	9,3	4,5	14
	0,16	4,28	6,37	4,19	9,3	4,5	14
	0,24	2,8	4,2	2,8	7,5	13,9	33,8
	0,24	2,8	4,2	2,8	7,5	13,9	34,9
	0,29	2,32	3,45	2,26	12,2	6	42,5
	0,29	2,32	3,45	2,26	12,2	6	42,5
	0,4	1,68	2,5	1,64	12,2	6	79,5
	0,4	1,68	2,5	1,64	12,2	6	79,5
	0,32	2,1	3	2	9	16,7	66,7
	0,32	2,1	3	2	9	16,7	68,7
	0,29	2,3	3,3	2,2	12	22,3	85
	0,29	2,3	3,3	2,2	12	22,3	83,2
	0,35	1,9	2,9	1,8	12	22,3	111
	0,35	1,9	2,9	1,8	12	22,3	108
0,34	2	2,9	1,9	12	22,3	159	
0,34	2	2,9	1,9	12	22,3	156	
260	0,18	3,66	5,46	3,58	9,3	4,5	24
	0,18	3,66	5,46	3,58	9,3	4,5	24

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

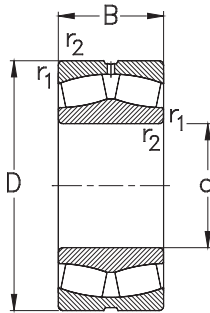
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
260	400	104	4	23052-K-MB-W33	1460	2360	201	1200	1700
	400	104	4	23052-MB-W33	1460	2360	201	1200	1700
	400	140	4	24052-K30-MB-W33	1811	3528	301	900	1400
	400	140	4	24052-MB-W33	1811	3528	301	900	1400
	440	180	4	24152-MB-W33	2608	4821	404	570	1200
	440	180	4	24152-K30-MB-W33	2608	4821	404	570	1200
	440	144	4	23152-K-MB-W33	2240	3720	312	890	1400
	440	144	4	23152-MB-W33	2240	3720	312	890	1400
	480	130	5	22252-MB-W33	1940	3030	250	1100	1600
	480	130	5	22252-K-MB-W33	1940	3030	250	1100	1600
	540	165	6	22352-MB-W33	2760	4220	340	800	1200
	540	165	6	22352-K-MB-W33	2760	4220	340	800	1200
280	380	75	2,1	23956-K-MB-W33	869	1830	156	1100	1700
	380	75	2,1	23956-MB-W33	869	1830	156	1100	1700
	420	106	4	23056-K-MB-W33	1440	2690	225	1100	1600
	420	106	4	23056-MB-W33	1440	2690	225	1100	1600
	420	140	4	24056-K30-MB-W33	1904	3836	321	820	1400
	420	140	4	24056-MB-W33	1904	3836	321	820	1400
	460	146	5	23156-K-MB-W33	2312	4182	345	810	1300
	460	146	5	23156-MB-W33	2312	4182	345	810	1300
	460	180	5	24156-MB-W33	2683	5090	419	530	1100
	460	180	5	24156-K30-MB-W33	2683	5090	419	530	1100

Anschlussmaße siehe Seite 717

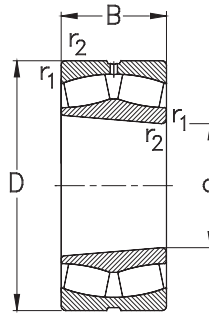
*Abutment and fillet dimensions
see on page 717*

d	e	Berechnungsfaktoren				B _s	B _k	Gewicht
		Calculation factors						[kg]
		F _a /F _r ≤ e	F _a /F _r > e	Y ₀				Weight
Y ₁	Y ₂			[kg]	m			
260	0,25	2,7	4	2,7	9	16,7	45,3	
	0,25	2,7	4	2,7	9	16,7	46,8	
	0,32	2,12	3,15	2,07	12,2	6	66	
	0,32	2,12	3,15	2,07	12,2	6	66	
	0,4	1,68	2,5	1,64	15	7,5	110	
	0,4	1,68	2,5	1,64	15	7,5	110	
	0,32	2	3,1	2	9	16,7	87,8	
	0,32	2	3,1	2	9	16,7	90,5	
	0,29	2,3	3,4	2,2	12	22,3	111	
	0,29	2,3	3,4	2,2	12	22,3	109	
	0,34	2	2,9	1,9	12	22,3	196	
	0,34	2	2,9	1,9	12	22,3	192	
	280	0,16	4,28	6,37	4,19	12,2	6	26
		0,16	4,28	6,37	4,19	12,2	6	26
0,24		2,7	4	2,6	9	16,7	54,5	
0,24		2,7	4	2,6	9	16,7	52,9	
0,32		2,12	3,15	20,7	12,2	6	68,5	
0,32		2,12	3,15	20,7	12,2	6	68,5	
0,29		2,32	3,45	2,26	17,7	9	99	
0,29		2,32	3,45	2,26	17,7	9	103	
0,4		1,68	2,5	1,64	15	7,5	99	
0,4		1,68	2,5	1,64	15	7,5	118	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

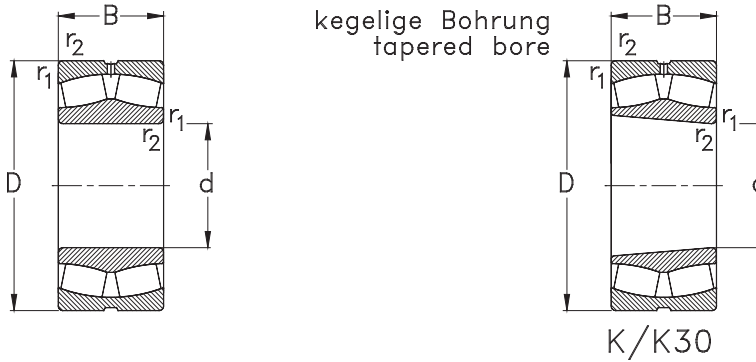
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
280	500	130	5	22256-MB-W33	2010	3200	259	1000	1500
	500	130	5	22256-K-MB-W33	2010	3200	259	1000	1500
	500	176	5	23256-MB-W33	2850	4770	387	660	1100
	500	176	5	23256-K-MB-W33	2850	4770	387	660	1100
	580	175	6	22356-MB-W33	3300	4940	389	720	1100
	580	175	6	22356-K-MB-W33	3300	4940	389	720	1100
300	420	90	3	23960-K-MB-W33	1202	2512	209	1000	1600
	420	90	3	23960-MB-W33	1202	2512	209	1000	1600
	460	118	4	23060-K-MB-W33	1780	3240	265	1000	1500
	460	118	4	23060-MB-W33	1780	3240	265	1000	1500
	460	160	4	24060-K30-MB-W33	2432	4920	402	720	1200
	460	160	4	24060-MB-W33	2432	4920	402	720	1200
	500	160	5	23160-K-MB-W33	2560	4490	361	760	1200
	500	160	5	23160-MB-W33	2560	4490	361	760	1200
	500	200	5	24160-MB-W33	3287	6292	506	460	1000
	500	200	5	24160-K30-MB-W33	3287	6292	506	460	1000
	540	140	5	22260-MB-W33	2350	3810	302	950	1400
	540	140	5	22260-K-MB-W33	2350	3810	302	950	1400
320	440	90	3	23964-K-MB-W33	1254	2712	222	940	1500
	440	90	3	23964-MB-W33	1254	2712	222	940	1500
	480	121	4	23064-K-MB-W33	1890	3510	282	950	1400
	480	121	4	23064-MB-W33	1890	3510	282	950	1400

Anschlussmaße siehe Seite 717

*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_K	m
280	0,28	2,4	3,5	2,3	12	22,3	119
	0,28	2,4	3,5	2,3	12	22,3	116
	0,36	1,9	2,7	1,8	12	22,3	157
	0,36	1,9	2,7	1,8	12	22,3	152
	0,31	2,2	3,2	2,1	12	22,3	232
	0,31	2,2	3,2	2,1	12	22,3	227
300	0,18	3,66	5,46	3,58	12,2	6	40
	0,18	3,66	5,46	3,58	12,2	6	40
	0,25	2,7	3,8	2,5	9	16,7	73,6
	0,25	2,7	3,8	2,5	9	16,7	75,8
	0,32	2,12	3,15	2,07	15	7,5	97
	0,32	2,12	3,15	2,07	15	7,5	97
	0,32	2,1	3	2	9	16,7	130
	0,32	2,1	3	2	9	16,7	134
	0,4	1,68	2,5	1,64	15	7,5	159
	0,4	1,68	2,5	1,64	15	7,5	159
	0,27	2,5	3,6	2,4	12	22,3	150
	0,27	2,5	3,6	2,4	12	22,3	147
320	0,18	3,66	5,46	3,58	12,2	6	42
	0,18	3,66	5,46	3,58	12,2	6	42
	0,24	2,7	3,9	2,6	9	16,7	78,8
	0,24	2,7	3,9	2,6	9	16,7	81,2

Pendelrollenlager
Spherical Roller Bearings



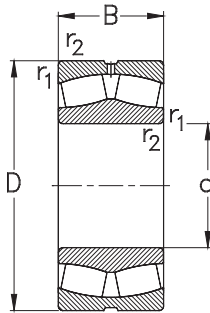
Hauptabmessungen [mm]				Lagertypen	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min	Designation	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
320	480	160	4	24064-K30-MB-W33	2486	5138	413	680	1200
	480	160	4	24064-MB-W33	2486	5138	413	680	1200
	540	176	5	23164-MB-W33	3020	5390	424	690	1100
	540	176	5	23164-K-MB-W33	3020	5390	424	690	1100
	540	218	5	24164-MB-W33	3739	7102	559	430	900
	540	218	5	24164-K30-MB-W33	3739	7102	559	430	900
	580	150	5	22264-MB-W33	2700	4430	344	860	1300
	580	150	5	22264-K-MB-W33	2700	4430	344	860	1300
	580	208	5	23264-MB-W33	3880	6520	506	540	950
	580	208	5	23264-K-MB-W33	3880	6520	506	540	950
340	460	90	3	23968-K-MB-W33	1271	2793	225	880	1400
	460	90	3	23968-MB-W33	1271	2793	225	880	1400
	520	133	5	23068-K-MB-W33	2320	4330	341	860	1300
	520	133	5	23068-MB-W33	2320	4330	341	860	1300
	520	180	5	24068-K30-MB-W33	3007	6196	488	620	1100
	520	180	5	24068-MB-W33	3007	6196	488	620	1100
	580	190	5	23168-K-MB-W33	3510	6230	481	630	1000
	580	190	5	23168-MB-W33	3510	6230	481	630	1000
	580	243	5	24168-MB-W33	4683	8726	673	370	850
	580	243	5	24168-K30-MB-W33	4683	8726	673	370	850
620	224	6	23268-MB-W33	4430	7560	576	490	800	
620	224	6	23268-K-MB-W33	4430	7560	576	490	800	

Anschlussmaße siehe Seite 717

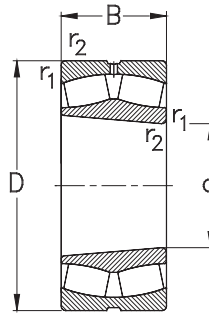
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]	
Calculation factors							Weight [kg]	
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m	
320	0,32	2,12	3,15	2,07	15	7,5	106	
	0,32	2,12	3,15	2,07	15	7,5	106	
	0,32	2	3	2	12	22,3	175	
	0,32	2	3	2	12	22,3	170	
	0,4	1,68	2,5	1,64	17,7	9	215	
	0,4	1,68	2,5	1,64	17,7	9	215	
	0,27	2,5	3,6	2,3	12	22,3	187	
	0,27	2,5	3,6	2,3	12	22,3	181	
	0,37	1,8	2,6	1,7	12	22,3	253	
	0,37	1,8	2,6	1,7	12	22,3	246	
	340	0,16	4,28	6,37	4,19	12,2	6	45
		0,16	4,28	6,37	4,19	12,2	6	45
		0,25	2,7	3,9	2,6	12	22,3	108
		0,25	2,7	3,9	2,6	12	22,3	105
0,32		2,12	3,15	2,07	17,7	9	143	
0,32		2,12	3,15	2,07	17,7	9	143	
0,33		2	2,9	1,9	12	22,3	209	
0,33		2	2,9	1,9	12	22,3	202	
0,4		1,68	2,5	1,64	17,7	9	266	
0,4		1,68	2,5	1,64	17,7	9	266	
0,37		1,8	2,6	1,7	12	22,3	313	
0,37		1,8	2,6	1,7	12	22,3	304	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

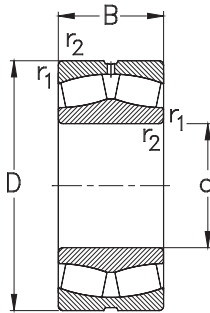
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
360	480	90	3	23972-K-MB-W33	998	2054	163	900	1300
	480	90	3	23972-MB-W33	998	2054	163	900	1300
	540	134	5	23072-K-MB-W33	2360	4460	346	810	1200
	540	134	5	23072-MB-W33	2360	4460	346	810	1200
	540	180	5	24072-K30-MB-W33	3079	6466	502	580	1000
	540	180	5	24072-MB-W33	3079	6466	502	580	1000
	600	192	5	23172-K-MB-W33	3630	6550	499	590	1000
	600	192	5	23172-MB-W33	3630	6550	499	590	1000
	600	243	5	24172-MB-W33	4888	9340	712	350	800
	600	243	5	24172-K30-MB-W33	4888	9340	712	350	800
	650	232	6	23272-MB-W33	4780	8550	641	440	750
	650	232	6	23272-K-MB-W33	4780	8550	641	440	750
380	520	106	4	23976-K-MB-W33	1720	3830	298	760	1200
	520	106	4	23976-MB-W33	1720	3830	298	760	1200
	560	135	5	23076-K-MB-W33	2410	4700	360	770	1200
	560	135	5	23076-MB-W33	2410	4700	360	770	1200
	560	180	5	24076-K30-MB-W33	3151	6758	518	550	950
	560	180	5	24076-MB-W33	3151	6758	518	550	950
	620	194	5	23176-K-MB-W33	3740	6970	524	560	1000
	620	194	5	23176-MB-W33	3740	6970	524	560	1000
	620	243	5	24176-MB-W33	5067	9903	745	320	850
	620	243	5	24176-K30-MB-W33	5067	9903	745	320	850

Anschlussmaße siehe Seite 717

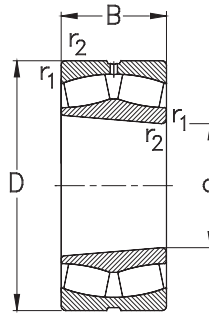
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht	
Calculation factors							Weight	
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m	
360	0,17	4,28	6,37	4,19	12,2	6	47	
	0,17	4,28	6,37	4,19	12,2	6	47	
	0,24	2,8	4	2,6	12	22,3	111	
	0,24	2,8	4	2,6	12	22,3	114	
	0,32	2,12	3,15	2,07	17,7	9	145	
	0,32	2,12	3,15	2,07	17,7	9	145	
	0,32	2	3	2	12	22,3	224	
	0,32	2	3	2	12	22,3	232	
	0,4	1,68	2,5	1,64	17,7	9	278	
	0,4	1,68	2,5	1,64	17,7	9	278	
	0,35	1,9	2,9	1,8	12	22,3	342	
	0,35	1,9	2,9	1,8	12	22,3	332	
	380	0,18	3,66	5,46	3,58	15	7,5	70
		0,18	3,66	5,46	3,58	15	7,5	70
0,23		2,9	4,2	2,7	12	22,3	117	
0,23		2,9	4,2	2,7	12	22,3	120	
0,29		2,32	3,45	2,26	17,7	9	152	
0,29		2,32	3,45	2,26	17,7	9	152	
0,31		2,2	3,1	2,1	12	22,3	237	
0,31		2,2	3,1	2,1	12	22,3	244	
0,37		1,8	2,69	1,76	17,7	9	290	
0,37		1,8	2,69	1,76	17,7	9	290	

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

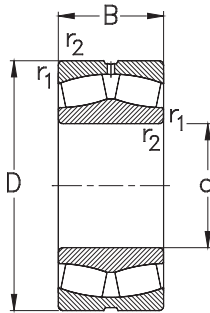
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
380	680	240	6	23276-MB-W33	5160	8920	660	430	750
	680	240	6	23276-K-MB-W33	5160	8920	660	430	750
400	540	106	4	23980-MB-W33	1749	3954	303	720	1200
	540	106	4	23980-K-MB-W33	1749	3954	303	720	1200
	600	148	5	23080-K-MB-W33	2860	5500	414	710	1100
	600	148	5	23080-MB-W33	2860	5500	414	710	1100
	600	200	5	24080-MB-W33	3767	8049	606	500	900
	600	200	5	24080-K30-MB-W33	3767	8049	606	500	900
	650	200	6	23180-K-MB-W33	4040	7580	562	520	950
	650	200	6	23180-MB-W33	4040	7580	562	520	950
	650	250	6	24180-MB-W33	5407	10582	785	300	800
	650	250	6	24180-K30-MB-W33	5407	10582	785	300	800
	720	256	6	23280-MB-W33	5800	10120	736	390	670
	720	256	6	23280-K-MB-W33	5800	10120	736	390	670
420	560	106	4	23984-K-MB-W33	1838	4120	327	680	1100
	560	106	4	23984-MB-W33	1938	4120	327	680	1100
	620	150	5	23084-K-MB-W33	2950	5850	435	670	1100
	620	150	5	23084-MB-W33	2950	5850	435	670	1100
	620	200	5	24084-K30-MB-W33	3845	8382	623	470	900
	620	200	5	24084-MB-W33	3845	8382	623	470	900
	700	224	6	23184-MB-W33	5030	9740	708	460	500
	700	224	6	23184-K-MB-W33	5030	9740	708	460	500

Anschlussmaße siehe Seite 717

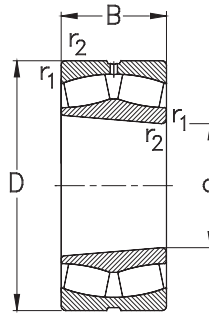
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_K	m
		Y_1	Y_2				[kg]
							[kg]
380	0,36	1,9	2,7	1,8	12	22,3	394
	0,36	1,9	2,7	1,8	12	22,3	382
400	0,16	4,28	6,37	4,19	15	7,5	72
	0,16	4,28	6,37	4,19	15	7,5	72
	0,24	2,8	4	2,7	12	22,3	152
	0,24	2,8	4	2,7	12	22,3	156
	0,29	2,32	3,45	2,26	23,5	12	205
	0,29	2,32	3,45	2,26	23,5	12	205
	0,3	2,2	3,2	2,1	12	22,3	265
	0,3	2,4	3,2	2,1	12	22,3	273
	0,37	1,8	2,69	1,76	23,5	12	326
	0,37	1,8	2,69	1,76	23,5	12	326
420	0,36	1,8	2,7	1,8	12	22,3	476
	0,36	1,8	2,7	1,8	12	22,3	363
	0,16	4,28	6,37	4,19	17,7	9	75
	0,16	4,28	6,37	4,19	17,7	9	75
	0,23	2,9	4,1	2,7	12	22,3	159
	0,23	2,8	4,1	2,7	12	22,3	164
	0,29	2,32	3,45	2,26	23,5	12	214
	0,29	2,32	3,45	2,26	23,5	12	214
	0,32	2,1	3,2	2	12	22,3	363
	0,32	2,1	3,2	2	12	22,3	348

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

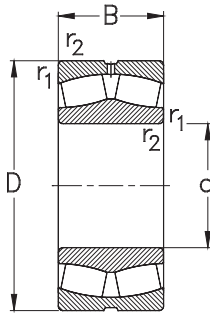
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
420	700	224	6	24184-MB-W33	6504	12611	917	240	700
	700	224	6	24184-K30-MB-W33	6504	12611	917	240	700
	760	272	7,5	23284-MB-W33	6400	11300	809	360	630
	760	272	7,5	23284-K-MB-W33	6400	11300	809	360	630
440	600	118	4	23988-K-MB-W33	2128	4864	362	640	1000
	600	118	4	23988-MB-W33	2128	4864	362	640	1000
	650	157	6	23088-K-MB-W33	3210	6410	470	630	1000
	650	157	6	23088-MB-W33	3210	6410	470	630	1000
	650	212	6	24088-K30-MB-W33	4221	9095	684	450	850
	650	212	6	24088-MB-W33	4221	9095	684	450	850
	720	226	6	23188-MB-W33	4480	9350	673	460	850
	720	226	6	23188-K-MB-W33	4480	9350	673	460	850
	720	280	6	24188-MB-W33	6933	13939	1003	250	700
	720	280	6	24188-K30-MB-W33	6933	13939	1003	250	700
	790	280	7,5	23288-MB-W33	6820	12030	851	340	600
	790	280	7,5	23288-K-MB-W33	6820	12030	851	340	600
460	580	118	3	24892-MB-W33	1753	4938	355	560	1100
	620	118	4	23992-K-MB-W33	2180	5023	369	610	1100
	620	118	4	23992-MB-W33	2180	5023	369	610	1000
	680	163	6	23092-K-MB-W33	3480	7000	506	600	1000
	680	163	6	23092-MB-W33	3480	7000	506	600	950
	680	218	6	24092-K30-MB-W33	4525	9940	719	420	950

Anschlussmaße siehe Seite 717

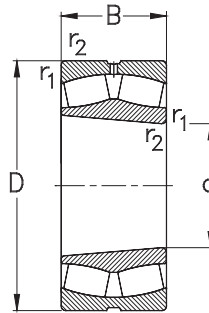
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y ₁	$F_a/F_r > e$ Y ₂	Y ₀	B _s	B _k	m
420	0,37	1,8	2,69	1,76	23,5	12	443
	0,37	1,8	2,69	1,76	23,5	12	443
	0,36	1,7	2,7	1,8	12	22,3	535
	0,36	1,7	2,7	1,8	12	22,3	520
440	0,18	3,66	5,46	3,58	17,7	9	102
	0,18	3,66	5,46	3,58	17,7	9	102
	0,23	2,9	4,1	2,7	12	22,3	182
	0,23	2,9	4,1	2,7	12	22,3	188
	0,29	2,32	3,45	2,26	23,5	12	249
	0,29	2,32	3,45	2,26	23,5	12	249
	0,32	2,1	3	2	12	22,3	390
	0,32	2,1	3	2	12	22,3	379
	0,37	1,8	2,69	1,76	23,5	12	454
	0,37	1,8	2,69	1,76	23,5	12	454
	0,36	1,8	2,7	1,8	12	22,3	613
	0,36	1,8	2,7	1,8	12	22,3	595
460	0,18	3,66	5,46	3,58	17,7	9	75,5
	0,16	4,28	6,37	4,19	17,7	9	105
	0,16	4,28	6,37	4,19	17,7	9	105
	0,23	2,9	4,2	2,8	12	22,3	207
	0,23	2,9	4,2	2,8	12	22,3	214
	0,29	2,32	3,45	2,26	23,5	12	280

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

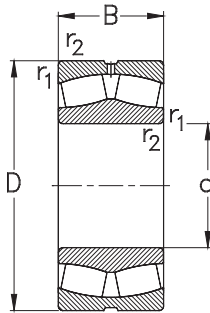
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
460	680	218	6	24092-MB-W33	4525	9940	719	420	800
	760	240	7,5	23192-MB-W33	5720	10950	776	410	800
	760	240	7,5	23192-K-MB-W33	5720	10950	776	410	800
	760	300	7,5	24192-MB-W33	7378	14889	1056	240	800
	760	300	7,5	24192-K30-MB-W33	7378	14889	1056	240	670
	830	296	7,5	23292-MB-W33	7601	14003	976	310	560
	830	296	7,5	23292-K-MB-W33	7601	14003	976	310	560
	480	650	128	5	23996-K-MB-W33	2525	5692	413	580
650		128	5	23996-MB-W33	2525	5692	413	580	1000
700		165	6	23096-K-MB-W33	3660	7490	536	560	950
700		165	6	23096-MB-W33	3660	7490	536	560	950
700		218	6	24096-K30-MB-W33	4634	10361	742	400	750
700		218	6	24096-MB-W33	4634	10361	742	400	750
790		248	7,5	23196-MB-W33	6150	12000	840	390	750
790		248	7,5	23196-K-MB-W33	6150	12000	840	390	750
790		308	7,5	24196-MB-W33	7891	15938	1116	220	630
790		308	7,5	24196-K30-MB-W33	7891	15938	1116	220	630
870		310	7,5	23296-MB-W33	8261	15278	1051	290	530
870		310	7,5	23296-K-MB-W33	8261	15278	1051	290	530
500	670	128	5	239/500-K-MB-W33	2537	5984	430	550	950
	670	128	5	239/500-MB-W33	2537	5984	430	550	950
	720	167	6	230/500-K-MB-W33	3830	7970	565	540	900

Anschlussmaße siehe Seite 717

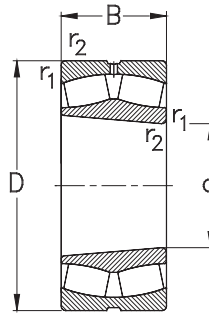
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				
460	0,29	2,32	3,45	2,26	23,5	12	280
	0,31	2,1	3,1	2	12	22,3	456
	0,31	2,1	3,1	2	12	22,3	441
	0,37	1,8	2,69	1,76	23,5	12	578
	0,37	1,8	2,69	1,76	23,5	12	578
	0,35	1,95	2,9	1,91	23,5	12	695
	0,35	1,95	2,9	1,91	23,5	12	695
480	0,18	3,66	5,46	3,58	17,7	9	128
	0,18	3,66	5,46	3,58	17,7	9	128
	0,23	2,9	4,4	2,9	12	22,3	223
	0,23	2,9	4,4	2,9	12	22,3	230
	0,26	2,55	3,8	2,5	23,5	12	288
	0,26	2,55	3,8	2,5	23,5	12	288
	0,31	2,2	3,1	2,1	12	22,3	485
	0,31	2,2	3,1	2,1	12	22,3	469
	0,37	1,8	2,69	1,76	23,5	12	639
	0,37	1,8	2,69	1,76	23,5	12	639
	0,4	1,68	2,5	1,64	23,5	12	835
0,4	1,68	2,5	1,64	23,5	12	835	
500	0,16	4,28	6,37	4,19	23,5	12	130
	0,16	4,28	6,37	4,19	12	12	130
	0,22	3	4,3	2,9	12	22,3	228

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

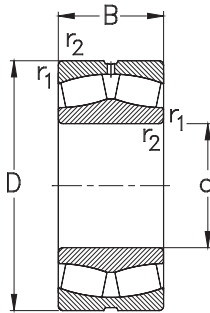
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
500	720	167	6	230/500-MB-W33	3830	7970	565	540	900
	720	218	6	240/500-K30-MB-W33	4846	11112	788	370	700
	720	218	6	240/500-MB-W33	4846	11112	788	370	700
	830	264	7,5	231/500-K-MB-W33	6800	13040	901	370	700
	830	264	7,5	231/500-MB-W33	6800	13040	901	230	700
	830	325	7,5	241/500-MB-W33	8705	17263	1193	210	600
	830	325	7,5	241/500-K30-MB-W33	8705	17263	1193	210	600
	920	336	7,5	232/500-MB-W33	9506	17818	1207	260	500
	920	336	7,5	232/500-K-MB-W33	9506	17819	1207	260	500
530	650	118	3	248/530-K-MB-W33	1835	5266	377	490	950
	710	136	5	239/530-MB-W33	2801	6583	464	510	900
	710	136	5	239/530-K-MB-W33	2801	6583	464	510	900
	780	185	6	230/530-MB-W33	4470	9310	646	490	800
	780	185	6	230/530-K-MB-W33	4470	9310	646	490	800
	780	250	6	240/530-MB-W33	5852	13318	924	340	670
	780	250	6	240/530-K30-MB-W33	5852	13318	924	340	670
	870	335	7,5	241/530-MB-W33	9372	19144	1302	190	560
	870	335	7,5	241/530-K30-MB-W33	9372	19144	1302	190	560
	870	272	7,5	231/530-K-MB-W33	7230	14197	966	340	670
870	272	7,5	231/530-MB-W33	7230	14197	966	340	670	
560	750	140	5	239/560-K-MB-W33	3029	7228	502	480	850
	750	140	5	239/560-MB-W33	3029	7228	502	480	850

Anschlussmaße siehe Seite 717

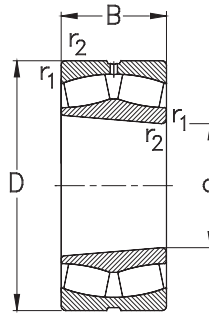
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				[kg]
							[kg]
500	0,22	3	4,3	2,9	12	22,3	236
	0,26	2,55	3,8	2,5	23,5	12	236
	0,26	2,55	3,8	2,5	23,5	12	297
	0,31	2,1	3	2	12	22,3	550
	0,31	2,1	3	2	12	22,3	570
	0,37	1,8	2,69	1,76	23,5	12	753
	0,37	1,8	2,69	1,76	23,5	12	753
	0,35	1,95	2,9	1,91	23,5	12	1010
	0,35	1,95	2,9	1,91	23,5	12	1010
	530	0,16	4,28	6,37	4,19	17,7	9
0,18		3,66	5,46	3,58	23,5	12	150
0,18		3,66	5,46	3,58	23,5	12	150
0,22		3	4,3	2,9	12	22,3	323
0,22		3	4,3	2,9	12	22,3	314
0,29		2,32	3,45	2,26	23,5	12	410
0,29		2,32	3,45	2,26	23,5	12	410
0,37		1,8	2,69	1,7	23,5	12	838
0,37		1,8	2,69	1,7	23,5	12	838
0,29		2,32	3,45	2,26	23,5	12	645
560	0,16	4,28	6,37	4,19	23,5	12	183
	0,16	4,28	6,37	4,19	23,5	12	183

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

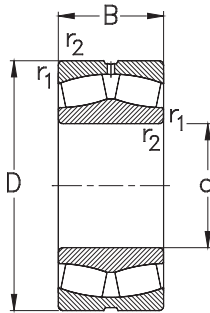
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
560	820	195	6	230/560-K-MB-W33	5110	10690	730	460	750
	820	195	6	230/560-MB-W33	5110	10690	730	460	750
	820	258	6	240/560-K30-MB-W33	6398	14709	1005	310	630
	820	258	6	240/560-MB-W33	6398	14709	1005	310	630
	920	280	7,5	231/560-K-MB-W33	1029	1135	76	660	630
	920	280	7,5	231/560-MB-W33	1029	1135	76	660	630
	920	355	7,5	241/560-MB-W33	10512	21598	1445	180	500
	920	355	7,5	241/560-K30-MB-W33	10512	21598	1445	180	500
	600	800	150	5	239/600-K-MB-W33	3420	8314	566	440
800		150	5	239/600-MB-W33	3420	8314	566	440	750
870		200	6	230/600-K-MB-W33	5500	11420	260	420	700
870		200	6	230/600-MB-W33	5500	11420	260	420	700
870		272	6	240/600-K30-MB-W33	7274	17119	1148	280	560
870		272	6	240/600-MB-W33	7274	17119	1148	280	560
980		300	7,5	231/600-MB-W33	9108	18396	1207	280	560
980		300	7,5	231/600-K-MB-W33	9108	18396	1207	280	560
980		375	7,5	241/600-MB-W33	11631	24141	1584	160	480
980		375	7,5	241/600-K30-MB-W33	11631	24141	1584	160	480
630	850	165	6	239/630-K-MB-W33	4055	9794	655	410	750
	850	165	6	239/630-MB-W33	4055	9794	655	410	750
	920	212	7,5	230/630-K-MB-W33	6270	13360	881	390	670
	920	212	7,5	230/630-MB-W33	6270	13360	881	390	670

Anschlussmaße siehe Seite 717

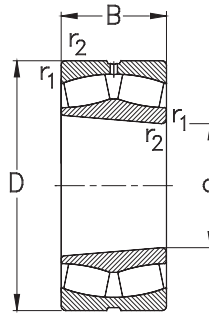
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m
560	0,22	3,1	4,6	3	12	22,3	346
	0,22	3,1	4,6	3	12	22,3	357
	0,29	2,32	3,45	2,26	23,5	12	469
	0,29	2,32	3,45	2,26	23,5	12	469
	0,29	2,32	3,45	2,26	23,5	12	740
	0,29	2,32	3,45	2,26	23,5	12	740
	0,37	1,8	2,69	1,76	23,5	12	979
	0,37	1,8	2,69	1,76	23,5	12	979
600	0,16	4,28	6,37	4,19	23,5	12	221
	0,16	4,28	6,37	4,19	23,5	12	221
	0,22	2,9	4,2	2,8	12	22,3	400
	0,22	2,9	4,2	2,8	12	22,3	405
	0,29	2,32	3,45	2,26	23,5	12	550
	0,29	2,32	3,45	2,26	23,5	12	550
	0,29	2,32	3,45	2,26	23,5	12	933
	0,29	2,32	3,45	2,26	23,5	12	933
	0,37	1,8	2,69	1,76	23,5	12	1180
0,37	1,8	2,69	1,76	23,5	12	1180	
630	0,16	4,28	6,37	4,19	23,5	12	280
	0,16	4,28	6,37	4,19	23,5	12	280
	0,21	3,1	4,5	2,9	12	22,3	470
	0,21	3,1	4,5	2,9	12	22,3	485

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

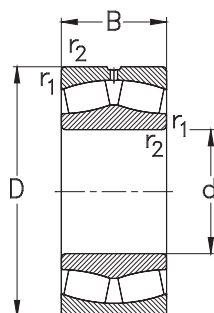
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
630	920	290	7,5	240/630-K30-MB-W33	7745	18127	1196	270	530
	920	290	7,5	240/630-MB-W33	7745	18127	1196	270	530
	1030	400	7,5	241/630-MB-W33	12920	27231	1760	150	450
	1030	400	7,5	241/630-K30-MB-W33	12920	27231	1760	150	450
670	820	150	4	248/670-K-MB-W33	3113	9594	641	370	700
	900	170	6	239/670-K-MB-W33	4388	10796	710	370	670
	900	170	6	239/670-MB-W33	4388	10796	710	280	670
	980	230	7,5	230/670-K-MB-W33	6820	14690	951	360	600
	980	230	7,5	230/670-MB-W33	6820	14690	951	360	600
	980	308	7,5	240/670-K30-MB-W33	8792	20770	1345	250	500
	980	308	7,5	240/670-MB-W33	8792	20770	1345	250	500
	1090	412	7,5	241/670-MB-W33	14112	29716	1887	130	400
	1090	412	7,5	241/670-K30-MB-W33	14112	29716	1887	130	400
710	950	180	6	239/710-K-MB-W33	4874	12104	782	350	600
	950	180	6	239/710-MB-W33	4874	12104	782	350	600
	950	243	6	249/710-MB-W33	5952	15840	1024	300	500
	1030	236	7,5	230/710-K-MB-W33	7402	16453	1049	330	500
	1030	236	7,5	230/710-MB-W33	7402	16453	1049	330	560
	1030	315	7,5	240/710-K30-MB-W33	9421	23139	1475	220	560
	1030	315	7,5	240/710-MB-W33	9421	23139	1475	220	450
	1150	438	9,5	241/710-MB-W33	15441	32939	2058	120	380
	1150	438	9,5	241/710-K30-MB-W33	15441	32939	2058	120	380

Anschlussmaße siehe Seite 717

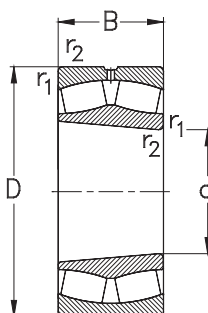
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht
Calculation factors							Weight
d	e	$F_a/F_r \leq e$	$F_a/F_r > e$	Y_0	B_s	B_k	m
		Y_1	Y_2				
630	0,29	2,32	3,45	2,26	23,5	12	661
	0,29	2,32	3,45	2,26	23,5	12	661
	0,37	1,8	2,69	1,76	23,5	12	1410
	0,37	1,8	2,69	1,76	23,5	12	1410
670	0,16	4,28	6,37	4,19	17,7	9	172
	0,16	4,28	6,37	4,19	23,5	12	326
	0,16	4,28	6,37	4,19	23,5	12	326
	0,23	3	4,4	2,9	12	22,3	593
	0,23	3	4,4	2,9	12	22,3	611
	0,29	2,32	3,45	2,26	23,5	12	802
	0,29	2,32	3,45	2,26	23,5	12	802
	0,37	1,8	2,69	1,76	23,5	12	1610
	0,37	1,8	2,69	1,76	23,5	12	1610
710	0,16	4,28	6,37	4,19	23,5	12	386
	0,16	4,28	6,37	4,19	23,5	12	386
	0,21	3,2	4,77	3,13	23,5	12	670
	0,21	3,2	4,77	3,13	23,5	12	495
	0,21	3,2	4,77	3,13	23,5	12	670
	0,26	2,55	3,8	2,5	23,5	12	889
	0,26	2,55	3,8	2,5	23,5	12	889
	0,37	1,8	2,69	1,76	23,5	12	1910
	0,37	1,8	2,69	1,76	23,5	12	1910

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

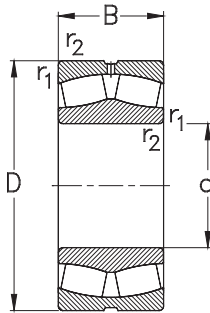
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
750	1000	185	6	239/750-K-MB-W33	5370	13460	856	320	560
	1000	185	6	239/750-MB-W33	5370	13460	856	320	560
	1000	250	6	249/750-MB-W33	6690	18064	1149	280	480
	1090	250	7,5	230/750-K-MB-W33	8612	19032	1193	300	530
	1090	250	7,5	230/750-MB-W33	8612	19032	1193	300	530
	1090	335	7,5	240/750-K30-MB-W33	10351	25386	1591	210	430
	1090	335	7,5	240/750-MB-W33	10351	25386	1591	210	430
800	980	180	5	248/800-MB-W33	4129	12908	817	300	560
	1060	195	6	239/800-K-MB-W33	5644	14479	904	300	530
	1060	195	6	239/800-MB-W33	5644	14479	904	300	530
	1150	258	7,5	230/800-K-MB-W33	9051	20897	1287	280	480
	1150	258	7,5	230/800-MB-W33	9051	20897	1287	280	480
	1150	345	7,5	240/800-K30-MB-W33	11348	28680	1766	190	400
	1150	345	7,5	240/800-MB-W33	11348	28680	1766	190	400
900	1180	200	6	239/900-K-MB-W33	6803	18104	1094	250	450
	1180	200	6	239/900-MB-W33	6803	18104	1094	250	450
	1280	280	7,5	230/900-MB-W33	10280	23948	1426	250	400
	1280	280	7,5	230/900-K-MB-W33	10280	23948	1426	250	400
	1280	375	7,5	240/900-MB-W33	13685	34955	2082	160	340
	1280	375	7,5	240/900-K30-MB-W33	13685	34955	2082	160	340
	1090	190	5	248/900-MB-W33	4660	15157	928	130	480
950	1250	224	7,5	239/950-MB-W33	4238	9459	562	310	430

Anschlussmaße siehe Seite 717

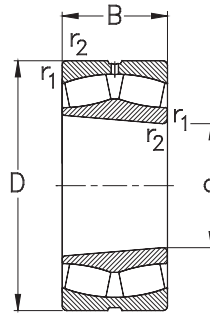
*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m
750	0,16	4,28	6,37	4,19	23,5	12	437
	0,16	4,28	6,37	4,19	23,5	12	437
	0,21	3,2	4,77	3,13	23,5	12	560
	0,21	3,2	4,77	3,13	23,5	12	806
	0,21	3,2	4,77	3,13	23,5	12	806
	0,26	2,55	3,8	2,5	23,5	12	1065
	0,26	2,55	3,8	2,5	23,5	12	1065
800	0,16	4,28	6,37	4,19	23,5	12	300
	0,16	4,28	6,37	4,19	23,5	12	506
	0,16	4,28	6,37	4,19	23,5	12	506
	0,21	3,2	4,77	3,13	23,5	12	906
	0,21	3,2	4,77	3,13	23,5	12	906
	0,26	2,55	3,8	2,5	23,5	12	1200
	0,26	2,55	3,8	2,5	23,5	12	1200
900	0,16	4,28	6,37	4,19	23,5	12	605
	0,16	4,28	6,37	4,19	23,5	12	605
	0,21	3,2	4,77	3,13	23,5	12	1210
	0,21	3,2	4,77	3,13	23,5	12	1210
	0,26	2,55	3,8	2,5	23,5	12	1600
	0,26	2,55	3,8	2,5	23,5	12	1600
	0,13	5,14	7,66	5,03	23,5	12	370
950	0,16	4,28	6,37	4,19	23,5	12	776

Pendelrollenlager
Spherical Roller Bearings



kegelige Bohrung
tapered bore



K/K30

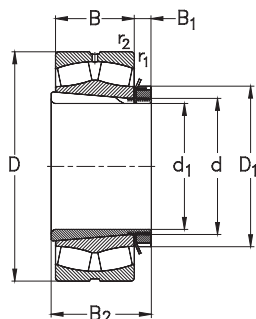
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen [kN]			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
d	D	B	r ₁ , r ₂ min		C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
950	1250	224	7,5	239/950-K-MB-W33	4238	9459	562	310	430
	1250	300	7,5	249/950-MB-W33	9312	26419	1569	200	340
	1360	412	7,5	240/950-MB-W33	15118	392117	2296	200	300
	1360	412	7,5	240/950-K30-MB-W33	15118	39217	2296	150	300
1000	1420	412	7,5	240/1000-MB-W33	15729	41406	2390	140	280
	1420	412	7,5	240/1000-K30-MB-W33	15729	41406	2390	140	280
	1320	315	7,5	249/1000-MB-W33	10395	29500	1725	120	280

Anschlussmaße siehe Seite 717

*Abutment and fillet dimensions
see on page 717*

Berechnungsfaktoren							Gewicht [kg]
Calculation factors							Weight [kg]
d	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	B_s	B_k	m
950	0,16	4,28	6,37	4,19	23,5	12	776
	0,21	3,24	4,82	3,16	23,5	12	1015
	0,26	2,55	3,8	2,5	23,5	12	2010
	0,26	2,55	3,8	2,5	23,5	12	2010
1000	0,26	2,55	3,8	2,5	23,5	12	2150
	0,26	2,55	3,8	2,5	23,5	12	2150
	0,21	3,24	4,82	3,16	23,5	12	1200

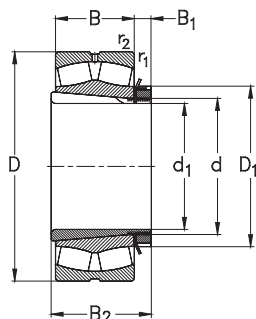
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{or}	C_u	n_{er}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
20	25	52	18	22205-E-K-W33	H305	46	46	6	10100	17000
25	30	62	20	22206-E-K-W33	H306	61	65	8	8500	10000
30	35	72	23	22207-E-K-W33	H307	81	92	11	7500	9000
35	40	80	23	22208-E-K-W33	H308	93	105	13	6500	8000
	40	90	33	22308-E-K-W33	H2308	140	160	20	5900	6000
40	45	85	23	22209-E-K-W33	H309	97	113	14	5900	7500
	45	100	36	22309-E-K-W33	H2309	167	194	24	5400	5300
45	50	90	23	22210-E-K-W33	H310	105	124	15	5400	7000
	50	110	40	22310-EK-W33	H2310	200	238	29	5000	4800
50	55	100	25	22211-E-K-W33	H311	125	147	18	5000	6300
	55	120	43	22311-E-K-W33	H2311	230	279	34	4600	4300
55	60	110	28	22212-E-K-W33	H312	152	183	22	4700	5600
	60	130	46	22312-E-K-W33	H2312	273	315	38	4400	4000
60	65	120	31	22213-E-K-W33	H313	182	224	27	4400	5000
	65	140	48	22313-E-K-W33	H2313	304	351	42	4100	3800
70	125	31	22214-E-K-W33	H314	189	239	29	4300	5000	
	70	150	51	22314-E-K-W33	H2314	344	402	48	3900	3400
65	75	130	31	22215-E-K-W33	H315	196	255	31	4000	4800
	75	160	55	22315-E-K-W33	H2315	396	489	57	3700	3200
70	80	140	33	22216-E-K-W33	H316	224	295	35	3800	6000
	80	170	58	22316-E-K-W33	H2316	443	551	63	3500	4000
75	85	150	36	22217-E-K-W33	H317	260	337	39	3600	5600

Welle	Abmessungen			Berechnungsfaktoren				Gewicht [kg]		
Shaft	Dimensions			Calculation factors				Weight [kg]		
Ød ₁ [mm]	B ₁	B ₂	D ₁	e	F _a /F _r ≤ e		F _a /F _r > e	r ₁ , r ₂ min	Lager	Spannhülse
					Y ₁	Y ₂			Y ₀	Bearing
20	9	29	38	0,34	1	3	2	1	0,18	0,071
25	9	31	45	0,31	2,1	3,2	2,1	1	0,38	0,095
30	10	35	52	0,31	2,2	3,3	2,1	1,1	0,41	0,14
35	11	36	58	0,27	2,5	3,7	2,4	1,1	0,49	0,17
	11	46	58	0,36	1,5	2,6	1,8	1,5	1,1	0,22
40	12	39	65	0,26	2,6	3,9	2,6	1,1	0,54	0,23
	12	50	65	0,36	1,9	2,8	1,9	1,5	1,36	0,27
45	13	42	70	0,24	2,8	4,2	2,8	1,1	0,61	0,27
	13	55	70	0,36	1,9	2,7	1,8	2	1,82	0,34
50	14	45	75	0,23	2,9	4,4	2,9	1,5	0,8	0,32
	14	59	75	0,35	1,9	2,8	1,9	2	2,31	0,39
55	14	47	80	0,24	2,8	4,2	2,8	1,5	1,06	0,36
	14	62	80	0,35	1,9	2,9	1,9	2,1	2,93	0,45
60	15	50	85	0,24	2,9	4,2	2,8	1,5	1,44	0,42
	15	65	85	0,34	2	3	2	2,1	3,54	0,52
	15	52	92	0,23	2,9	4,2	2,8	1,5	1,52	0,67
	15	68	92	0,34	2	3	2	2,1	4,19	0,88
65	16	55	98	0,22	3,1	4,5	2,9	1,5	1,61	0,78
	16	73	98	0,33	2	3	2	2,1	5,21	1,1
70	18	59	105	0,22	3,1	4,5	3	2	1,97	0,95
	18	78	105	0,33	2	3	2	2,1	6,2	1,2
75	19	63	110	0,22	3	4,4	2,9	2	2,47	1,1

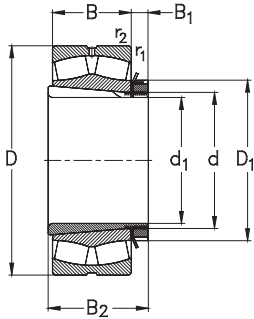
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{Or}	C_u	n_{Br}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
75	85	180	60	22317-E-K-W33	H2317	482	603	68	3300	3800
80	90	160	40	22218-E-K-W33	H318	308	406	46	3500	5300
	90	160	52,4	23218-CK-W33	H2318	370	522	60	2800	3800
	90	190	64	22318-E-K-W33	H2318	536	673	74	3100	3600
85	95	170	43	22219-E-K-W33	H319	346	464	52	3400	4800
	95	200	67	22319-E-K-W33	H2319	587	744	81	2900	3400
90	100	165	52	23120-K-MB-W33	H3120	327	502	56	3000	4000
	100	180	46	22220-E-K-W33	H320	379	510	56	3300	4500
	100	180	60,3	23220-K-MB-W33	H2320	390	532	59	2800	3400
	100	215	73	22320-E-K-W33	H2320	682	842	90	2700	3000
100	110	170	45	23022-K-MB-W33	H322	274	447	49,2	3300	4300
	110	180	56	23122-K-MB-W33	H3122	354	541	59	2900	3600
	110	200	53	22222-E-K-W33	H322	488	653	70	3100	4000
	110	200	69,8	23222-K-MB-W33	H2322	662	801	83	2300	3200
	110	240	80	22322-E-K-W33	H2322	805	1000	103	2400	2800
110	120	180	46	23024-K-MB-W33	H3024	287	467	50	3100	4000
	120	200	62	23124-K-MB-W33	H3124	430	648	69	2600	3400
	120	215	58	22224-E-K-W33	H3124	553	775	81	2800	3800
	120	215	76	23224-K-MB-W33	H2324	564	803	84	2200	2800
	120	260	86	22324-E-K-W33	H2324	938	1180	119	2100	1300
115	130	200	52	23026-K-MB-W33	H3026	367	579	61	2900	3600
	130	210	64	23126-K-MB-W33	H3126	474	752	78	2400	3200

Welle	Abmessungen			Berechnungsfaktoren					Gewicht [kg]	
Shaft	Dimensions			Calculation factors					Weight [kg]	
$\varnothing d_1$ [mm]	B_1	B_2	D_1	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	r_1, r_2 min	Lager Bearing	Spannhülse Adapter sleeve
75	19	82	110	0,32	2,1	3,1	2	3	7,1	1,35
80	19	65	120	0,23	2,9	4,2	2,8	2	3,18	1,3
	19	86	120	0,31	2,2	3,3	2,2	2	4,6	1,6
	19	86	120	0,33	2,1	3,1	2	3	8,44	1,6
85	20	68	125	0,23	2,9	4,2	2,7	2,1	3,86	1,4
	20	90	125	0,33	2,1	3,1	2	3	9,77	1,8
90	21	76	130	0,23	2,9	4,2	2,8	2	4,5	1,8
	21	71	130	0,24	2,9	4,1	2,7	2,1	4,69	1,6
	21	97	130	0,34	2	2,8	1,9	2,1	7,34	2
	21	97	130	0,33	2	3	2	3	12,6	2
100	21	77	145	0,26	2,55	3,8	2,5	2	3,54	2,05
	21	81	145	0,31	2,2	3,1	2,1	2	5,5	2,1
	21	77	145	0,25	2,7	4	2,6	2,1	6,7	2,05
	21	105	145	0,36	1,8	2,6	1,7	2,1	10,8	2,75
	21	105	145	0,33	2,1	3,1	2	3	17,5	2,75
110	22	72	145	0,24	2,7	4,2	2,6	2	3,86	1,8
	22	88	155	0,31	2,1	3,1	2	2	7,6	2,5
	22	88	155	0,25	2,7	3,9	2,5	2,1	8,44	2,5
	22	112	155	0,36	1,9	2,7	1,8	2,1	13,1	3
	22	112	155	0,33	2,1	3,1	2	3	21,9	3
115	23	80	155	0,26	2,6	3,8	2,5	2	5,61	2,8
	23	92	165	0,3	2,2	3,2	2,1	2	8,5	3,45

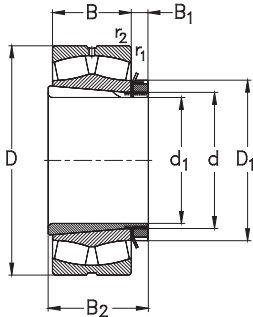
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{Or}	C_u	n_{er}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
115	130	230	64	22226-E-K-W33	H3126	641	948	97	2600	3600
	130	230	80	23226-K-MB-W33	H2326	636	948	97	2000	2600
	130	280	93	22326-E-K-W33	H2326	1090	1380	136	1900	2400
125	140	210	53	23028-K-MB-W33	H3028	380	633	65	2700	3400
	140	225	68	23128-K-MB-W33	H3128	540	865	88	2200	2800
	140	250	68	22228-E-K-W33	H3128	747	1080	108	2400	3200
	140	250	88	23228-K-MB-W33	H2328	815	1320	132	1700	2400
	140	300	102	22328-K-MB-W33	H2328	993	1270	122	2000	2200
135	150	225	56	23030-K-MB-W33	H3030	419	697	70	2500	3200
	150	250	80	23130-K-MB-W33	H3130	711	1130	112	1900	2600
	150	270	73	22230-E-K-W33	H3130	863	1260	123	2200	3000
	150	270	96	23230-K-MB-W33	H2330	874	1300	127	1600	2200
	150	320	108	22330-K-MB-W33	H2330	1190	1610	152	1700	2000
140	160	240	60	23032-K-MB-W33	H3032	521	903	89	2300	3000
	160	270	86	23132-K-MB-W33	H3132	817	1310	127	1800	2400
	160	290	80	22232-E-K-W33	H3132	978	1440	138	2000	2800
	160	290	104	23232-K-MB-W33	H2332	1130	1830	175	1400	2200
	160	340	114	22332-K-MB-W33	H2332	1250	1680	156	1600	1900
150	170	260	67	23034-K-MB-W33	H3034	618	1050	102	2100	2800
	170	280	88	23134-K-MB-W33	H3134	826	1350	129	1700	2400
	170	310	86	22234-K-MB-W33	H3134	921	1310	123	2000	2600
	170	310	110	23234-K-MB-W33	H2334	1280	1880	176	1300	2000

Welle	Abmessungen			Berechnungsfaktoren					Gewicht [kg]	
Shaft	Dimensions			Calculation factors					Weight [kg]	
$\varnothing d_1$ [mm]	B_1	B_2	D_1	e	$F_a/F_r \leq e$ Y_1	$F_a/F_r > e$ Y_2	Y_0	r_1, r_2 min	Lager Bearing	Spannhülse Adapter sleeve
115	23	92	165	0,26	2,6	3,8	2,5	3	10,5	3,45
	23	121	165	0,35	1,9	2,7	1,8	3	15,8	4,45
	23	121	165	0,33	2,1	3,1	2	4	27,1	4,45
125	24	82	165	0,24	2,7	4,2	2,6	2	6,04	3,05
	24	97	180	0,3	2,2	3,2	2,1	2,1	10,5	4,1
	24	97	180	0,25	2,7	3,9	2,5	3	13,4	4,1
	24	131	180	0,33	2	3	2	3	20,8	5,4
	24	131	180	0,38	1,8	2,5	1,7	4	34,1	5,4
135	26	87	180	0,24	2,7	4,2	2,6	2,1	7,33	3,75
	26	111	195	0,32	2,1	3	2	2,1	16,3	5,25
	26	111	195	0,25	2,7	3,9	2,5	3	16,9	5,25
	26	139	195	0,38	1,8	2,7	1,8	3	24,5	6,4
	26	139	195	0,37	1,8	2,7	1,8	4	40,9	6,4
140	28	93	190	0,24	2,8	4	2,6	2,1	8,9	5,1
	28	119	210	0,32	2,1	3	2	2,1	20,5	7,25
	28	119	210	0,26	2,6	3,8	2,5	3	21,7	7,25
	28	147	210	0,36	1,9	2,8	1,8	3	31,7	8,8
	28	147	210	0,37	1,8	2,6	1,7	4	51,1	8,8
150	29	101	200	0,25	2,7	3,9	2,6	2,1	12,1	5,8
	29	122	220	0,31	2,1	3,1	2	2,1	22	8,1
	29	122	220	0,29	2,3	3,3	2,1	4	26,2	8,1
	29	154	220	0,36	1,9	2,8	1,8	4	35,7	9,9

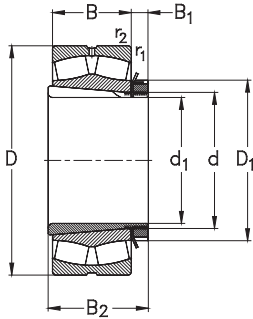
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{Or}	C_u	n_{er}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
150	170	360	120	22334-K-MB-W33	H2334	1400	1970	179	1500	1800
160	180	280	74	23036-K-MB-W33	H3036	725	1230	117	2000	2600
	180	300	96	23136-K-MB-W33	H3136	957	1540	144	1600	2200
	180	320	86	22236-K-MB-W33	H3136	943	1380	128	1900	2600
	180	320	112	23236-K-MB-W33	H2336	1360	2110	195	1200	1900
	180	380	126	22336-K-MB-W33	H2336	1540	2130	191	1400	1700
170	190	290	75	23038-K-MB-W33	H3038	759	1310	123	1800	2400
	190	320	104	23138-K-MB-W33	H3138	1130	1840	169	1400	2000
	190	340	92	22238-K-MB-W33	H3138	1040	1550	141	1800	2400
	190	340	120	23238-K-MB-W33	H2338	1550	2400	220	1100	1800
	190	400	132	22338-K-MB-W33	H2338	1920	2710	239	1200	1600
180	200	310	82	23040-K-MB-W33	H3040	880	1550	143	1700	2200
	200	340	112	23140-K-MB-W33	H3140	1240	2010	182	1400	1900
	200	360	98	22240-K-MB-W33	H3140	1160	1760	158	1600	2200
	200	360	128	23240-K-MB-W33	H2340	1710	2760	247	1000	1700
	200	420	138	22340-K-MB-W33	H2340	1820	2650	230	1200	1500
200	220	340	90	23044-K-MB-W33	OH3044-H	1020	1850	166	1500	2000
	220	370	120	23144-K-MB-W33	OH3144-H	1480	2470	218	1200	1700
	220	400	108	22244-K-MB-W33	OH3144-H	1380	2080	181	1500	2000
	220	400	144	23244-K-MB-W33	OH2344-H	2040	3290	286	910	1500
	220	460	145	22344-K-MB-W33	OH2344-H	2110	3130	750	1000	1400
220	240	360	92	23048-K-MB-W33	OH3048-H	1080	2010	750	1400	1900

Welle	Abmessungen			Berechnungsfaktoren					Gewicht [kg]	
Shaft	Dimensions			Calculation factors					Weight [kg]	
Ød ₁ [mm]	B ₁	B ₂	D ₁	e	F _a /F _r ≤ e		F _a /F _r > e	r ₁ , r ₂ min	Lager Bearing	Spannhülse Adapter sleeve
					Y ₁	Y ₂				
150	29	154	220	0,37	1,8	2,6	1,7	4	59,7	9,9
160	30	109	210	0,26	2,6	3,7	2,5	2,1	15,8	6,7
	30	131	230	0,32	2,1	3	2	3	28,4	9,15
	30	131	230	0,28	2,4	3,4	2,3	4	27,5	9,15
	30	161	230	0,36	1,9	2,8	1,9	4	40,8	11
	30	161	230	0,37	1,8	2,6	1,7	4	69,4	11
170	31	112	220	0,25	2,7	3,8	2,5	2,1	16,08	7,25
	31	141	240	0,32	2,1	3	2	3	35,6	10,5
	31	141	240	0,29	2,3	3,4	2,2	4	37,2	10,5
	31	169	240	0,36	1,9	2,8	1,8	4	52,4	12
	31	169	240	0,36	1,9	2,8	1,9	5	81,2	12
180	32	120	240	0,25	2,7	4	2,7	2,1	21,5	8,9
	32	150	250	0,33	2	2,9	1,9	3	43,5	12
	32	150	250	0,29	2,3	3,3	2,2	4	44,4	12
	32	176	250	0,36	1,9	2,8	1,8	4	58,4	13,5
	32	176	250	0,36	1,9	2,7	1,8	5	91,8	13,5
200	30	126	260	0,25	2,7	4	2,7	3	31	9,9
	35	161	280	0,32	2	3	2	4	52	15
	35	161	280	0,28	2,4	3,4	2,2	4	61,4	15
	35	186	280	0,36	1,9	2,8	1,8	4	79,5	17
	35	186	280	0,35	1,9	2,8	1,8	5	120	17
220	34	133	290	0,24	2,8	4,2	2,8	3	33,9	12

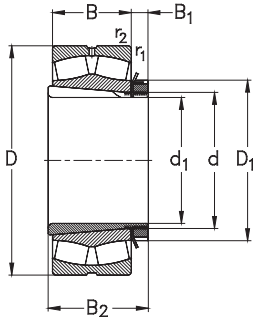
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{Or}	C_u	n_{Br}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
220	240	400	128	23148-K-MB-W33	OH3148-H	1690	1860	246	1200	1600
	240	440	120	22248-K-MB-W33	OH3148-H	1660	2560	216	1300	1800
	240	440	160	23248-K-MB-W33	OH2348-H	2440	3920	331	810	1300
	240	500	155	22348-K-MB-W33	OH2348-H	2440	3690	304	910	1300
240	260	400	104	23052-K-MB-W33	OH3052-H	1460	2360	201	1300	1700
	260	440	144	23152-K-MB-W33	OH3152	2240	3720	312	910	1400
	260	480	130	22252-K-MB-W33	OH3152-H	1940	3030	250	1200	1600
	260	540	165	22352-K-MB-W33	OH2352-H	2760	4220	340	820	1100
260	280	420	106	23056-K-MB-W33	OH3056-H	1440	2690	225	1200	1600
	280	460	146	23156-K-MB-W33	OH3156-H	2180	3900	321	850	1300
	280	500	130	22256-K-MB-W33	OH3156-H	2010	3200	259	1100	1500
	280	500	176	23256-K-MB-W33	OH2356-H	2850	4770	387	680	1100
	280	580	175	22356-K-MB-W33	OH2356-H	3300	4940	389	730	1100
280	300	460	118	23060-K-MB-W33	OH3060-H	1780	3240	265	1000	1500
	300	500	160	23160-K-MB-W33	OH3160-H	2560	4490	361	780	1200
	300	540	140	22260-K-MB-W33	OH3160-H	2350	3810	302	1000	1400
300	320	480	121	23064-K-MB-W33	OH3064-H	1890	3510	282	1000	1000
	320	540	176	23164-K-MB-W33	OH3164-H	3020	5390	424	700	1100
	320	580	150	22264-K-MB-W33	OH3164-H	2700	4430	344	880	1300
	320	580	208	23264-K-MB-W33	OH3264-H	3880	6520	506	550	950
320	340	520	133	23068-K-MB-W33	OH3068-H	2320	4330	341	880	1300
	340	580	190	23168-K-MB-W33	OH3168-H	3510	6230	481	640	1000

Welle	Abmessungen			Berechnungsfaktoren				Gewicht [kg]		
Shaft	Dimensions			Calculation factors				Weight [kg]		
Ød ₁ [mm]	B ₁	B ₂	D ₁	e	F _a /F _r ≤ e		F _a /F _r > e	r ₁ , r ₂ min	Lager	Spannhülse
					Y ₁	Y ₂			Y ₀	Bearing
220	37	172	300	0,32	2,1	3	2	4	66	16
	37	172	300	0,29	2,3	3,3	2,2	4	83,2	16
	37	199	300	0,35	1,9	2,9	1,8	4	109	19
	37	199	300	0,34	2	2,9	1,9	5	151	19
240	34	145	310	0,25	2,7	4	2,7	4	49	13,5
	38	190	330	0,32	2	3,1	2	4	92,5	21
	38	190	330	0,29	2,3	3,4	2,2	5	107	21
	38	211	330	0,34	2	2,9	1,9	6	187	21
260	38	152	330	0,24	2,7	4	2,6	4	52,5	16
	39	195	350	0,31	2,1	3	2	5	98,5	23
	39	195	350	0,28	2,4	3,5	2,3	5	113	23
	39	224	350	0,36	1,9	2,7	1,8	5	153	27
	39	224	350	0,31	2,2	3,2	2,1	6	235	27
280	42	168	360	0,25	2,7	3,8	2,5	4	73,6	20,5
	40	208	380	0,32	2,1	3	2	5	129	29
	40	208	380	0,27	2,5	3,6	2,4	5	142	29
300	42	171	380	0,24	2,7	3,9	2,6	4	79,5	22
	42	226	400	0,32	2	3	2	5	172	32
	42	226	400	0,27	2,5	3,6	2,3	5	180	32
	42	258	400	0,37	1,8	2,6	1,7	5	247	35
320	45	187	400	0,25	2,7	3,9	2,6	5	105	27
	55	254	440	0,33	2	2,9	1,9	5	212	50

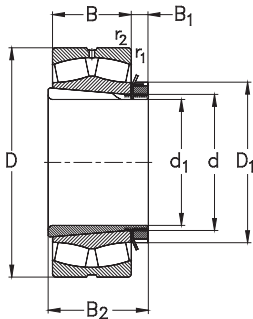
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\varnothing d_1$	[mm]			Lager	Spannhülse	C_r	C_{Or}	C_u	n_{er}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
320	340	620	224	23268-K-MB-W33	OH3268-H	4430	7560	576	500	800
340	360	540	134	23072-K-MB-W33	OH3072-H	2360	4460	346	830	1200
	360	600	192	23172-K-MB-W33	OH3172-H	3630	6550	499	600	1000
	360	650	232	23272-K-MB-W33	OH3272-H	4780	8550	641	450	750
360	380	560	135	23076-K-MB-W33	OH3076-H	2410	4700	360	780	1200
	380	620	194	23176-K-MB-W33	OH3176-H	3740	6970	524	570	1000
	380	680	240	23276-K-MB-W33	OH3276-H	5160	8920	660	430	750
380	400	600	148	23080-K-MB-W33	OH3080-H	2860	5500	414	720	1100
	400	650	200	23180-K-MB-W33	OH3180-H	4040	7580	562	530	950
	400	720	256	23280-K-MB-W33	OH3280-H	5800	10120	736	400	670
400	420	620	150	23084-K-MB-W33	OH3084-H	2950	5850	435	680	1100
	420	700	224	23184-K-MB-W33	OH3184-H	5030	9740	708	460	900
	420	760	272	23284-K-MB-W33	OH3284-H	6400	11300	809	370	630
410	440	650	157	23088-K-MB-W33	OH3088-H	3210	6410	470	650	1000
	440	720	226	23188-K-MB-W33	OH3188-H	4480	9350	673	470	850
	440	790	280	23288-K-MB-W33	OH3288-H	6820	12030	851	350	600
430	460	680	163	23092-K-MB-W33	OH3092-H	3480	7000	506	610	950
	460	760	240	23192-K-MB-W33	OH3192-H	5760	10950	776	420	800
	460	830	296	23292-K-MB-W33	OH3292-H	7601	14003	976	310	560
450	480	700	165	23096-K-MB-W33	OH3096-H	3660	7490	536	580	950
	480	790	248	23196-K-MB-W33	OH3196-H	6150	12000	840	390	750
	480	870	310	23296-K-MB-W33	OH3296-H	8261	15278	1051	290	530

Welle	Abmessungen			Berechnungsfaktoren					Gewicht [kg]	
Shaft	Dimensions			Calculation factors					Weight [kg]	
Ød ₁ [mm]	B ₁	B ₂	D ₁	e	F _a /F _r ≤ e		F _a /F _r > e	r ₁ , r ₂ min	Lager Bearing	Spannhülse Adapter sleeve
					Y ₁	Y ₂				
320	55	288	440	0,37	1,8	2,6	1,7	6	309	51,5
340	45	188	420	0,24	2,8	4	2,6	5	111	29
	58	259	460	0,32	2	3	2	5	220	56
	58	299	460	0,35	1,9	2,9	1,8	6	344	60,5
360	48	193	450	0,23	2,9	4,2	2,7	5	117	35,5
	60	264	490	0,31	2,2	3,1	2,1	5	240	61,5
	60	310	490	0,36	1,9	2,7	1,8	6	375	69,5
380	52	210	470	0,24	2,8	4	2,7	5	152	40
	62	272	520	0,3	2,2	3,2	2,1	6	265	73
	62	328	520	0,36	1,8	2,7	1,8	6	450	87
400	52	212	490	0,23	2,9	4,1	2,7	5	160	47
	70	304	540	0,32	2,1	3,2	2	6	363	80
	70	352	540	0,36	1,7	2,7	1,8	7,5	540	96
410	60	228	520	0,23	2,9	4,1	2,7	6	184	65
	70	307	560	0,32	2,1	3	2	6	380	95
	70	361	560	0,36	2,9	4,2	2,8	7,5	595	117
430	60	234	540	0,23	2,1	4,2	2,8	6	210	71
	75	326	580	0,31	2,1	3,1	2	7,5	441	119
	75	382	580	0,37	1,8	2,69	1,76	7,5	715	134
450	60	237	560	0,23	2,9	4,4	2,9	6	220	75
	75	335	620	0,31	2,2	3,1	2,1	7,5	485	135
	75	397	620	0,4	1,68	2,5	1,64	7,5	835	153

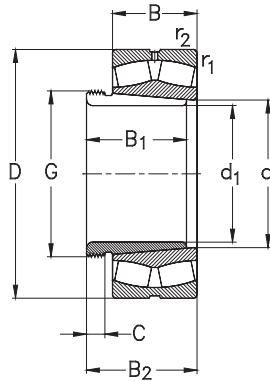
Pendelrollenlager auf Spannhülse
Spherical Roller Bearings with Adapter Sleeve



Welle	Hauptabmessungen			Bezeichnung		Tragzahlen			Referenzdrehzahlen	Grenzdrehzahlen
Shaft	Boundary dimensions			Designation		Load ratings			Thermal speed ratings	Limited speed ratings
$\text{\O}d_1$	[mm]			Lager	Spannhülse	C_r	C_{0r}	C_u	n_{Br}	n_G
[mm]	d	D	B	Bearing	Adapter sleeve	dyn.	stat.		[rpm]	[rpm]
470	500	670	128	239/500-K-MB-W33	H39/500	2537	5984	430	560	950
	500	720	167	230/500-K-MB-W33	OH30/500-H	3830	7970	565	550	900
	500	830	264	231/500-K-MB-W33	OH31/500-H	3660	7490	901	500	700
	500	920	336	232/500-K-MB-W33	OH32/500-H	9506	17818	1207	270	500
500	530	710	136	239/530-K-MB-W33	H39/530	2801	6583	464	530	900
	530	780	185	230/530-K-MB-W33	OH30/530-H	4470	9310	646	510	800
530	560	750	140	239/560-K-MB-W33	OH39/560-H	3029	7228	502	490	850
	560	820	195	230/560-K-MB-W33	OH30/560-H	3660	7490	730	540	750
560	600	800	150	239/600-K-MB-W33	OH39/600-H	3420	9314	566	430	750
	600	870	200	230/600-K-MB-W33	OH30/600-H	5500	11420	766	430	700
600	630	850	165	239/630-K-MB-W33	OH39/630-H	4055	9794	655	410	700
	630	920	212	230/630-K-MB-W33	OH30/630-H	6270	13360	881	390	670
630	670	900	170	239/670-K-MB-W33	OH39/670-H	3660	7490	710	440	670
	670	980	230	230/670-K-MB-W33	OH30/670-H	6820	14690	951	370	600
670	710	950	180	239/710-K-MB-W33	OH39/710-H	4874	12104	782	360	600
	710	1030	236	230/710-K-MB-W33	OH30/710-H	7402	16453	1049	340	560
710	750	1000	185	239/750-K-MB-W33	OH39/750-H	5370	13460	856	330	560
750	800	1060	195	239/800-K-MB-W33	OH39/800-H	3660	7490	904	390	530
	800	1150	258	230/800-K-MB-W33	OH30/800-H	8620	19650	1210	300	500

Welle	Abmessungen			Berechnungsfaktoren					Gewicht [kg]	
Shaft	Dimensions			Calculation factors					Weight [kg]	
Ød ₁ [mm]	B ₁	B ₂	D ₁	e	F _a /F _r ≤ e		F _a /F _r > e	r ₁ , r ₂ min	Lager Bearing	Spannhülse Adapter sleeve
					Y ₁	Y ₂				
470	68	208	580	0,16	4,28	6,37	4,19	5	130	74,3
	68	247	580	0,22	3	4,3	2,9	6	229	82
	80	356	630	0,31	2,1	3	2	7,5	580	145
	80	428	630	0,35	1,95	2,9	1,91	7,5	1010	170
500	68	216	630	0,18	3,66	5,46	3,58	5	150	87,9
	68	265	630	0,22	3	4,3	2,9	6	310	105
530	75	227	650	0,16	4,28	6,37	4,19	5	183	95
	75	282	650	0,22	3,1	4,6	3	6	358	112
560	75	239	700	0,16	4,28	6,37	4,19	5	221	127
	75	289	700	0,22	2,9	4,2	2,8	6	406	147
600	75	254	730	0,16	4,28	6,37	4,19	6	280	124
	75	301	730	0,21	3,1	4,5	2,9	7,5	520	138
630	80	264	780	0,16	4,28	6,37	4,19	6	326	162
	80	324	780	0,23	3	4,4	2,9	7,5	602	190
670	90	286	830	0,16	4,28	6,37	4,19	6	386	183
	90	342	830	0,21	3,2	4,77	3,13	7,5	638	228
710	90	291	870	0,16	4,28	6,37	4,19	6	437	211
750	90	303	920	0,16	4,28	6,37	4,19	6	506	259
	90	366	920	0,21	3,1	4,5	3	7,5	906	302

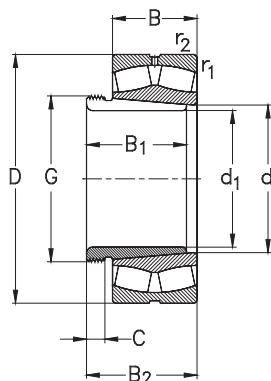
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{6r}	n ₆
35	40	80	23	1,1	22208-E-K-W33	AH308	93	105	13	6500	11000
	40	90	33	1,5	22308-E-K-W33	AH2308	140	160	20	5900	8000
40	45	85	23	1,1	22209-E-K-W33	AH309	97	113	14	5900	10000
	45	100	36	1,5	22309-E-K-W33	AH2309	167	194	24	5400	7000
45	50	90	23	1,1	22210-E-K-W33	AHX310	105	124	15	5400	9500
	50	110	40	2	22310-E-K-W33	AHX2310	200	238	29	5000	6300
50	55	100	25	1,5	22211-E-K-W33	AHX311	125	147	18	5000	8500
	55	120	43	2	22311-E-K-W33	AHX2311	230	279	34	4600	5600
55	60	110	28	1,5	22212-E-K-W33	AHX312	152	183	22	4700	7500
	60	130	46	2,1	22312-E-K-W33	AHX2312	273	315	38	4400	5300
60	65	120	31	1,5	22213-E-K-W33	AH313	182	224	27	4400	7000
	65	140	48	2,1	22313-E-K-W33	AH2313	304	351	42	4100	5000
65	70	125	31	1,5	22214-E-K-W33	AH314	189	239	29	4200	6700
	70	150	51	2,1	22314-E-K-W33	AHX2314	344	402	48	3800	4500
70	75	130	31	1,5	22215-E-K-W33	AH315	196	255	31	3900	6300
	75	160	55	2,1	22315-E-K-W33	AHX2315	396	489	57	3600	6300
75	80	140	33	2	22216-E-K-W33	AH316	224	295	35	3700	6000
	80	170	58	2,1	22316-E-K-W33	AHX2316	443	551	63	3400	4000
80	85	150	36	2	22217-E-K-W33	AHX317	260	337	39	3600	5600
	85	180	60	3	22317-E-K-W33	AHX2317	482	603	68	3200	3800
85	90	160	40	2	22218-E-K-W33	AHX318	308	406	46	3500	5300
	90	160	52,4	2	23218-K-MB-W33	AHX2318	303	412	47	2900	3800

Welle [mm] Shaft [mm] Ød ₁ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
35	29	32	6	M 45x1,5	0,27	2,5	3,7	2,4	0,58	0,09	
	40	43	7	M 45x1,5	0,36	1,8	2,6	1,8	1,1	0,13	
40	31	34	6	M 50x1,5	0,26	2,6	3,9	2,6	0,65	0,12	
	44	47	7	M 50x1,5	0,36	1,9	2,8	1,9	1,4	0,13	
45	35	38	7	M 55x2	0,24	2,8	4,2	2,8	0,72	0,13	
	50	53	9	M 55x2	0,36	1,9	2,7	1,8	1,96	0,19	
50	37	40	7	M 60x2	0,23	2,9	4,4	2,9	0,96	0,16	
	54	57	10	M 60x2	0,35	1,9	2,8	1,9	2,47	0,26	
55	40	43	8	M 65x2	0,24	2,8	4,2	2,8	1,25	0,19	
	58	61	11	M 65x2	0,35	1,9	2,9	1,9	3,09	0,3	
60	42	45	8	M 75x2	0,24	2,9	4,2	2,8	1,69	0,25	
	61	64	12	M 75x2	0,34	2	3	2	3,8	0,39	
65	43	47	8	M 80x2	0,23	2,9	4,2	2,8	1,8	0,28	
	64	68	12	M 80x2	0,34	2	3	2	4,53	0,46	
70	45	49	8	M 85x2	0,22	3,1	4,5	3	1,92	0,31	
	68	72	12	M 85x2	0,33	2	3	2	5,52	0,53	
75	48	52	8	M 90x2	0,22	3,1	4,5	3,1	2,34	0,37	
	71	75	12	M 90x2	0,33	2	3	2	6,53	0,6	
80	52	56	9	M 95x2	0,22	3	4,4	2,9	2,9	0,43	
	74	78	13	M 95x2	0,32	2,1	3,1	2	7,48	0,65	
85	53	57	9	M 100x2	0,23	2,9	4,2	2,8	3,64	0,46	
	63	67	10	M 100x2	0,33	2	3	1,9	4,85	0,57	

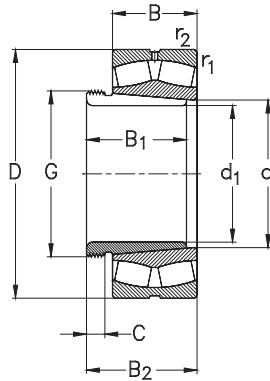
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
85	90	190	64	3	22318-E-K-W33	AH2318	536	673	74	3000	3600
90	95	170	43	2,1	22219-E-K-W33	AHX319	346	464	52	3300	4800
	95	200	67	3	22319-E-K-W33	AHX2319	587	744	81	2800	3400
95	100	165	52	2	23120-K-MB-W33	AHX3120	327	502	56	3000	4000
	100	180	46	2,1	22220-E-K-W33	AHX320	379	510	56	3300	4500
	100	180	60,3	2,1	23220-K-MB-W33	AHX2320-X	390	532	59	2700	3400
	100	215	73	3	22320-E-K-W33	AHX2320	682	842	90	2600	3000
105	110	180	56	2	23122-K-MB-W33	AHX3122	354	541	59	2800	3600
	110	180	69	2	24122-CE-K30-W33	AH24122	458	752	82	2000	3000
	110	200	53	2,1	22222-E-K-W33	AHX3122	488	653	70	3100	4000
	110	200	69,8	2,1	23222-K-MB-W33	AHX3222	502	706	75	2400	3200
	110	240	80	3	22322-E-K-W33	AHX2322	805	1000	103	2300	2800
115	120	180	46	2	23024-K-MB-W33	AHX3024	287	467	50	3000	4000
	120	180	60	2	24024-CE-K30-W33	AH24024	382	671	73	2500	3400
	120	200	62	2	23124-K-MB-W33	AHX3124	430	648	69	2500	3400
	120	200	80	2	24124-CE-K30-W33	AH24124	581	958	102	1800	2600
	120	215	58	2,1	22224-E-K-W33	AHX3124	553	775	81	2800	3800
	120	215	76	2,1	23224-K-MB-W33	AHX3224	564	803	84	2200	2800
	120	260	86	3	22324-E-K-W33	AHX2324	938	1180	119	2100	2600
125	130	200	52	2	23026-K-MB-W33	AHX3026	367	579	61	2800	3600
	130	200	69	2	24026-CE-K30-W33	AH24026	476	823	86	2200	3000
	130	210	64	2	23126-K-MB-W33	AHX3126	474	752	78	2300	3200

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
85	79	83	14	M 100x2	0,33	2,1	3,1	2	8,83	0,76	
90	57	61	10	M 105x2	0,23	2,9	4,2	2,7	4,39	0,54	
	85	89	16	M 105x2	0,33	2,1	3,1	2	10,2	0,9	
95	64	68	11	M 110x2	0,26	2,55	3,8	2,5	4,87	0,66	
	59	63	10	M 110x2	0,24	2,9	4,1	2,7	5,27	0,58	
	73	77	11	M 110x2	0,34	2	2,8	1,9	7,06	0,76	
	90	94	16	M 110x2	0,33	2	3	2	13	1	
105	68	72	11	M 120x2	0,31	2,2	3,1	2,1	6,07	0,76	
	82	91	13	M 115x2	0,37	1,8	2,69	1,76	7,65	0,73	
	68	72	11	M 120x2	0,25	2,7	4	2,6	7,46	0,76	
	82	86	11	M 120x2	0,36	1,9	2,7	1,8	10,1	0,88	
	98	102	16	M 125x2	0,33	2,1	3,1	2	18,4	1,35	
115	60	64	13	M 130x2	0,24	2,7	4,2	2,6	4,61	0,75	
	73	82	13	M 125x2	0,32	2,12	3,15	2,07	5,85	0,65	
	75	79	12	M 130x2	0,31	2,1	3,1	2	8,33	0,94	
	93	102	13	M 130x2	0,37	1,8	2,69	1,76	11	1	
	75	79	12	M 125x2	0,25	2,7	3,9	2,5	9,39	0,94	
	90	94	13	M 135x2	0,36	1,9	2,7	1,8	12,5	1,11	
	105	109	17	M 135x2	0,33	2,1	3,1	2	22,6	1,65	
125	67	71	14	M 140x2	0,26	2,6	3,8	2,5	6,54	0,93	
	83	93	14	M 135x2	0,32	2,12	3,15	2,07	8,56	0,84	
	78	82	12	M 140x2	0,3	2,2	3,2	2,1	9,19	1,1	

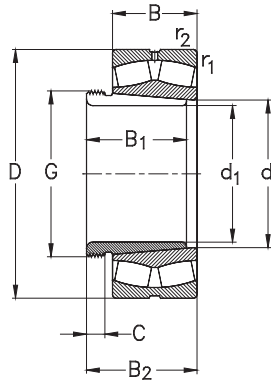
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
125	130	210	80	2	24126-CE-K30-W33	AH24126	597	1012	105	1600	2400
	130	230	64	3	22226-EK-W33	AHX3126	641	948	97	2600	3600
	130	230	80	3	23226-K-MB-W33	AHX3226	636	948	97	1900	2600
	130	280	93	4	22326-E-K-W33	AHX2326	1090	1380	136	1900	2400
135	140	210	53	2	23028-K-MB-W33	AHX3028	380	633	65	2600	3400
	140	210	69	2	24028-CE-K30-W33	AH24028	503	900	93	2000	2800
	140	225	68	2,1	23128-K-MB-W33	AHX3128	540	865	88	2100	2800
	140	225	85	2,1	24128-CE-K30-W33	AH24128	677	1156	118	1500	2400
	140	250	68	3	22228-E-K-W33	AHX3128	747	1080	108	2300	3200
	140	250	88	3	23228-K-MB-W33	AHX3228	815	1320	132	1600	2400
	140	300	102	4	22328-K-MB-W33	AHX2328	993	1270	122	1900	2200
145	150	225	56	2,1	23030-K-MB-W33	AHX3030	419	697	70	2400	3200
	150	225	75	2,1	24030-CE-K30-W33	AH24030	572	1044	105	1900	2600
	150	250	80	2,1	23130-K-MB-W33	AHX3130	711	1130	112	1900	2600
	150	250	100	2,1	24130-CE-K30-W33	AH24130	899	1544	153	1300	2200
	150	270	73	3	22230-E-K-W33	AHX3130	863	1260	123	2100	3000
	150	270	96	3	23230-K-MB-W33	AHX3230	874	1300	127	1600	2200
	150	320	108	4	22330-K-MB-W33	AHX2330	1190	1610	152	1700	2000
150	160	240	60	2,1	23032-K-MB-W33	AH3032	521	903	89	2200	3000
	160	240	80	2,1	24032-CE-K30-W33	AH24032	659	1211	120	1700	2400
	160	270	86	2,1	23132-K-MB-W33	AH3132	817	1310	127	1700	2400
	160	270	109	2,1	24132-CE-K30-W33	AH24132	1038	1758	170	1200	1900

Welle [mm] Shaft [mm] Ød ₁ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
125	94	104	14	M 140x2	0,37	1,8	2,69	1,76	11,7	1,11	
	78	82	12	M 140x2	0,26	2,6	3,8	2,5	11,6	1,1	
	98	102	15	M 145x2	0,35	1,9	2,7	1,8	15	1,55	
	115	119	19	M 145x2	0,33	2,1	3,1	2	28	2	
135	68	73	14	M 150x2	0,24	2,7	4,2	2,6	7,05	1	
	83	93	14	M 145x2	0,29	2,32	3,45	2,26	9,06	0,95	
	83	88	14	M 150x2	0,3	2,2	3,2	2,1	11,1	1,3	
	99	109	14	M 150x2	0,35	1,95	2,9	1,91	14,1	1,3	
	83	88	14	M 150x2	0,25	2,7	3,9	2,5	14,7	1,3	
	104	109	15	M 155x3	0,33	2	3	2	19,5	1,85	
	125	130	20	M 155x3	0,38	1,8	2,5	1,7	35,1	2,35	
145	72	77	15	M 160x3	0,24	2,7	4,2	2,6	8,48	1,15	
	90	101	15	M 155x3	0,32	2,12	3,15	2,07	11,2	1,05	
	96	101	15	M 165x3	0,32	2,1	3	2	16,8	1,8	
	115	126	15	M 160x3	0,37	1,8	2,69	1,76	21,5	1,55	
	96	101	15	M 165x3	0,25	2,7	3,9	2,5	18,7	1,8	
	114	119	17	M 165x3	0,36	1,8	2,7	1,8	25	2,2	
	135	140	24	M 165x3	0,37	1,8	2,7	1,8	42,1	2,8	
150	77	82	16	M 170x3	0,24	2,8	4	2,6	11	2,05	
	95	106	15	M 170x3	0,29	2,32	3,45	2,26	14,6	2,3	
	103	108	16	M 180x3	0,32	2,1	3	2	22	2,87	
	124	135	15	M 170x3	0,4	1,68	2,5	1,64	28,4	3,05	

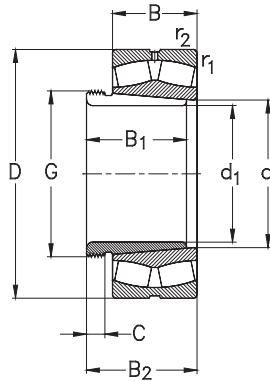
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
150	160	290	80	3	22232-E-K-W33	AH3132	978	1440	138	2000	2800
	160	290	104	3	23232-K-MB-W33	AH3232	1130	1830	175	1400	2200
	160	340	114	4	22332-K-MB-W33	AH2332	1250	1680	156	1600	1900
160	170	260	67	2,1	23034-K-MB-W33	AH3034	618	1050	102	2100	2800
	170	260	90	2,1	24034-K30-MB-W33	AH24034	808	1486	144	1600	2400
	170	280	88	2,1	23134-K-MB-W33	AH3134	826	1350	129	1700	2400
	170	280	109	2,1	24134-K30-MB-W33	AH24134	1150	2090	200	1000	1900
	170	310	86	4	22234-K-MB-W33	AH334-X	921	1310	123	2000	2600
	170	310	110	4	23234-K-MB-W33	AH2334-X	1280	1880	176	1300	2000
	170	360	120	4	22334-K-MB-W33	AH2334	1400	1970	179	1400	1800
170	180	280	74	2,1	23036-K-MB-W33	AH3036	725	1230	117	1900	2600
	180	280	100	2,1	24036-K30-MB-W33	AH24036	953	1740	165	1500	2200
	180	300	96	3	23136-K-MB-W33	AH3136	957	1540	144	1500	2200
	180	300	118	3	24136-K30-MB-W33	AH24136	1233	2162	203	1000	1700
	180	320	86	4	22236-K-MB-W33	AH2236	943	1380	128	1800	2600
	180	320	112	4	23236-K-MB-W33	AH3236	1360	2110	195	1200	1900
	180	380	126	4	22336-K-MB-W33	AH2336	1540	2130	191	1400	1700
180	190	290	75	2,1	23038-K-MB-W33	AH3038	759	1310	123	1800	2400
	190	290	100	2,1	24038-K30-MB-W33	AH24038	976	1822	171	1400	2000
	190	320	104	3	23138-K-MB-W33	AH3138	1130	1840	169	1400	2000
	190	320	128	3	24138-K30-MB-W33	AH24138	1412	2506	231	920	1600
	190	340	92	4	22238-K-MB-W33	AH2238	1040	1550	141	1700	2400

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
150	103	108	16	M 180x3	0,26	2,6	3,8	2,5	24,6	2,87	
	124	130	20	M 180x3	0,36	1,9	2,8	1,8	33,9	4	
	140	146	24	M 180x3	0,37	1,8	2,6	1,7	55,8	4,72	
160	85	90	17	M 180x3	0,25	2,7	3,9	2,6	14,5	2,4	
	106	117	16	M 180x3	0,32	2,12	3,15	2,07	20,6	2,7	
	104	109	16	M 190x3	0,31	2,1	3,1	2	23,6	3,04	
	125	136	16	M 180x3	0,36	1,9	2,8	1,8	29,6	3,25	
	104	109	16	M 190x3	0,29	2,3	3,3	2,1	29,2	3,04	
	134	140	24	M 190x3	0,36	1,9	2,8	1,8	39,7	4,8	
	146	152	24	M 190x3	0,37	1,8	2,6	1,7	65	5,25	
170	92	98	17	M 190x3	0,26	2,6	3,7	2,5	18,6	2,8	
	116	127	16	M 190x3	0,32	2,12	3,15	2,07	26,5	3,2	
	116	122	19	M 200x3	0,32	2,1	3	2	29,7	3,76	
	134	145	16	M 190x3	0,37	1,8	2,69	1,76	37,5	3,68	
	105	110	17	M 200x3	0,28	2,4	3,4	2,3	37,5	5,25	
	140	146	25	M 200x3	0,36	1,9	2,8	1,9	42,6	5,32	
	154	160	26	M 200x3	0,37	1,8	2,6	1,7	75,2	5,83	
180	96	102	18	Tr 205x4	0,25	2,7	3,8	2,5	20,1	3,32	
	118	131	18	M 200x3	0,32	2,12	3,15	2,7	28	3,55	
	125	131	20	Tr 210x4	0,32	2,1	3	2	37,5	4,9	
	146	159	18	M 200x3	0,37	1,8	2,69	1,76	46,2	4,28	
	112	117	18	Tr 210x4	0,29	2,3	3,4	2,2	35,5	4,25	

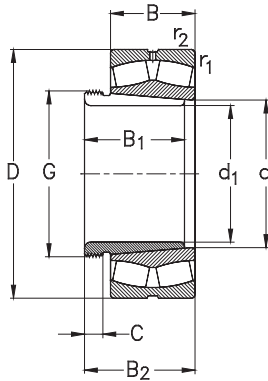
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	
Shaft [mm]	Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
180	190	340	120	4	23238-K-MB-W33	AH3238	1550	2420	220	1100	1800
	190	400	132	5	22338-K-MB-W33	AH2338	1920	2710	239	1200	1600
190	200	310	82	2,1	23040-K-MB-W33	AH3040	880	1550	143	1700	2200
	200	310	109	2,1	24040-K30-MB-W33	AH24040	1129	2122	195	1300	1900
	200	340	112	3	23140-K-MB-W33	AH3140	1240	2010	182	1300	1900
	200	340	140	3	24140-K30-MB-W33	AH24140	1579	2773	251	870	1500
	200	360	98	4	22240-K-MB-W33	AH2240	1160	1760	158	1600	2200
	200	360	128	4	23240-K-MB-W33	AH3240	1710	2760	247	1000	1700
	200	420	138	5	22340-K-MB-W33	AH2340	1820	2650	230	1200	1500
	200	220	340	90	3	23044-K-MB-W33	AH3044	1020	1850	166	1500
220		340	118	3	24044-K30-MB-W33	AH24044	1361	2585	232	1100	1700
220		370	150	4	24144-K30-MB-W33	AH24144	1929	3523	311	740	1400
220		370	120	4	23144-K-MB-W33	AH3144	1480	2470	218	1200	1700
220		400	108	4	22244-K-MB-W33	AH3144	1380	2080	181	1500	2000
220		400	144	4	23244-K-MB-W33	AH2344	2040	3290	286	910	1500
220		460	145	5	22344-K-MB-W33	AH2344	2110	3130	264	1000	1400
220		240	360	92	3	23048-K-MB-W33	AH3048	1080	2010	176	1400
	240	360	118	3	24048-K30-MB-W33	AH24048	1393	2841	238	1000	1600
	240	400	160	4	24148-K30-MB-W33	AH24148	2115	3921	337	670	1600
	240	400	128	4	23148-K-MB-W33	AH3148	1690	2860	246	1100	1600
	240	440	120	4	22248-K-MB-W33	AH3148	1660	2560	216	1300	1800
	240	440	160	4	23248-K-MB-W33	AH2348	2440	3920	331	810	1300

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager Bearing	Abziehhülse Withdrawal sleeve
						Y ₁	Y ₂				
180	145	152	25	Tr 210x4	0,36	1,9	2,8	1,9	53,9	5,9	
	160	167	26	Tr 210x4	0,36	1,9	2,8	1,9	87,8	6,63	
190	102	108	19	Tr 215x4	0,25	2,7	4	2,7	25,3	3,85	
	127	140	18	Tr 210x4	0,32	2,12	3,15	2,07	35,2	4	
	134	140	21	Tr 220x4	0,33	2	2,9	1,9	48,2	5,49	
	158	171	18	Tr 210x4	0,4	1,68	2,5	1,64	57,6	5,05	
	118	223	19	Tr 220x4	0,29	2,3	3,3	2,2	42,5	4,7	
	153	160	24	Tr 220x4	0,36	1,9	2,8	1,8	64,3	6,6	
	170	177	30	Tr 220x4	0,36	1,9	0,7	1,8	99,3	7,6	
	170	177	30	Tr 220x4	0,36	1,9	0,7	1,8	99,3	7,6	
200	111	117	20	Tr 235x4	0,25	2,7	4	2,7	38,4	7,4	
	138	152	20	Tr 230x4	0,32	2,12	3,15	2,07	49	8,2	
	170	184	20	Tr 230x4	0,4	1,68	2,5	1,64	75,5	10	
	145	151	23	Tr 240x4	0,32	2	3	2	64,8	10,4	
	145	151	23	Tr 240x4	0,28	2,4	3,4	2,2	59	9,3	
	181	189	30	Tr 240x4	0,36	1,9	2,8	1,8	95	13,5	
	181	189	30	Tr 240x4	0,35	1,9	2,8	1,8	133	13,5	
	181	189	30	Tr 240x4	0,35	1,9	2,8	1,8	133	13,5	
220	116	123	21	Tr 260x4	0,24	2,8	4,2	2,8	42,7	8,75	
	138	153	20	Tr 250x4	0,29	2,32	3,45	2,26	52,6	9	
	180	195	20	Tr 260x4	0,4	1,68	2,5	1,64	93,1	12,5	
	154	161	25	Tr 260x4	0,32	2,1	3	2	78,4	12	
	154	161	25	Tr 260x4	0,29	2,3	3,3	2,2	82,5	12	
	189	197	30	Tr 260x4	0,35	1,9	2,9	1,8	125	15,5	
	189	197	30	Tr 260x4	0,35	1,9	2,9	1,8	125	15,5	

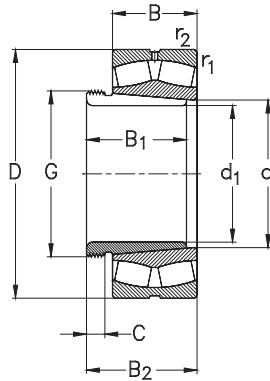
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]	
Shaft [mm]	Boundary dimensions [mm]				Designation	Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]	
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
220	240	500	155	5	22348-K-MB-W33	AH2348	2440	3690	304	910	1300
240	260	400	104	4	23052-K-MB-W33	AH3052	1460	2360	201	1300	1700
	260	400	140	4	24052-K30-MB-W33	AH24052	1811	3528	301	920	1400
	260	440	180	4	24152-K30-MB-W33	AH24152	2608	2821	404	810	1200
	260	440	144	4	23152-K-MB-W33	AH3152	2240	3720	312	910	1400
	260	480	130	5	22252-K-MB-W33	AH2252	1940	3030	250	1200	1600
	260	540	165	6	22352-K-MB-W33	AH2352	2760	4220	340	820	1200
260	280	420	106	4	23056-K-MB-W33	AH3056	1440	2690	225	1200	700
	280	420	140	4	24056-K30-MB-W33	AH24056	1904	3836	321	840	1400
	280	460	146	5	23156-K-MB-W33	AH3156	2180	3900	321	850	1300
	280	460	180	5	24156-K30-MB-W33	AH24156	2683	5090	419	540	1100
	280	500	176	5	23256-K-MB-W33	AH2356	2850	4770	387	680	1100
	280	580	175	6	22356-K-MB-W33	AH2356	3300	4940	389	730	1100
280	300	460	118	4	23060-K-MB-W33	AH3060	1780	3240	265	1000	1500
	300	460	160	4	24060-K30-MB-W33	AH24060	2432	4920	402	740	1200
	300	500	160	5	23160-K-MB-W33	AH3160	2560	4490	361	780	1200
	300	500	200	5	24160-K30-MB-W33	AH24160	3287	6292	506	470	1000
300	320	480	121	4	23064-K-MB-W33	AH3064	1890	3510	282	1000	1400
	320	480	160	4	24064-K30-MB-W33	AH24064	2486	5138	413	690	1200
	320	540	176	5	23164-K-MB-W33	AH3164	3020	5390	424	700	1100
	320	540	218	5	24164-K30-MB-W33	AH24164	3739	7102	559	430	900
	320	580	208	5	23264-K-MB-W33	AH3264	3880	6520	506	550	950

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager Bearing	Abziehhülse Withdrawal sleeve
						Y ₁	Y ₂				
220	189	197	30	Tr 260x4	0,34	2	2,9	1,9	169	15,5	
240	128	135	23	Tr 280x4	0,25	2,7	4	2,7	59,7	10,7	
	162	178	22	Tr 270x4	0,32	2,12	3,15	2,07	77,8	11,8	
	202	218	22	Tr 280x4	0,4	1,68	2,5	1,64	129	15,4	
	172	179	26	Tr 290x4	0,32	2	3,1	2	109	16	
	155	179	26	Tr 290x4	0,29	2,3	3,4	2,2	105	12,5	
	205	213	30	Tr 290x4	0,34	2	2,9	1,9	205	19,6	
260	131	139	24	Tr 300x4	0,24	2,7	4	2,6	64,5	12	
	162	179	22	Tr 290x4	0,32	2,12	3,15	20,7	83,1	12,8	
	175	183	28	Tr 310x5	0,31	2,1	3	2	117	17,5	
	202	219	22	Tr 300x4	0,4	1,68	2,5	1,64	134	16,3	
	212	220	30	Tr 310x5	0,36	1,9	2,7	1,8	174	21,6	
	212	220	30	Tr 310x5	0,31	2,2	3,2	2,1	254	21,6	
280	145	153	26	Tr 320x5	0,25	2,7	3,8	2,5	88	14,4	
	184	202	24	Tr 310x5	0,32	2,12	3,15	2,07	116	15,5	
	192	200	30	Tr 330x5	0,32	2,1	3	2	151	20,8	
	224	242	24	Tr 320x5	0,4	1,68	2,5	1,64	179	19,5	
300	149	157	27	Tr 345x5	0,24	2,7	3,9	2,6	96	16	
	184	202	24	Tr 330x5	0,32	2,12	3,15	2,07	123	16,6	
	209	217	31	Tr 350x5	0,32	2	3	2	196	24,5	
	242	260	24	Tr 340x5	0,4	1,68	2,5	1,64	225	21,4	
	246	254	36	Tr 350x5	0,37	1,8	2,6	1,7	278	30,6	

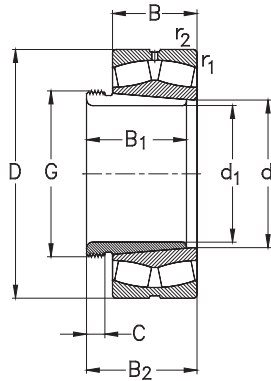
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
320	340	520	133	5	23068-K-MB-W33	AH3068	2320	4330	341	880	1300
	340	520	180	5	24068-K30-MB-W33	AH24068	3007	6196	488	630	1100
	340	580	190	5	23168-K-MB-W33	AH3168	3510	6230	481	640	1000
	340	580	243	5	24168-K30-MB-W33	AH24168	4683	8726	673	380	850
	340	620	224	6	23268-K-MB-W33	AH23268	4430	7560	576	500	800
340	360	540	134	5	23072-K-MB-W33	AH3072	2360	4460	346	830	1200
	360	540	180	5	24072-K30-MB-W33	AH24072	3079	6466	502	590	1000
	360	600	192	5	23172-K-MB-W33	AH3172	3630	6550	499	600	1000
	360	600	243	5	24172-K30-MB-W33	AH24172	4888	9340	712	350	800
	360	650	232	6	23272-K-MB-W33	AH3272	4780	8550	641	450	750
360	380	560	135	5	23076-K-MB-W33	AH3076	2410	4700	360	780	1200
	380	560	180	5	24076-K30-MB-W33	AH24076	3151	6758	518	560	950
	380	620	194	5	23176-K-MB-W33	AH3176	3740	6970	524	570	1000
	380	620	243	5	24176-K30-MB-W33	AH24176	5067	9903	745	330	850
	380	680	240	6	23276-K-MB-W33	AH3276	5160	8920	660	430	750
380	400	600	148	5	23080-K-MB-W33	AH3080	2860	5500	414	720	1100
	400	600	200	5	24080-K30-MB-W33	AH24080	3767	8049	609	510	900
	400	650	200	6	23180-K-MB-W33	AH3180	4040	7580	562	530	950
	400	650	250	6	24180-K30-MB-W33	AH24180	5407	10582	785	310	800
	400	720	256	6	23280-K-MB-W33	AH3280	5800	10120	736	400	670
400	420	620	150	5	23084-K-MB-W33	AH3084	2950	5850	435	680	1100
	420	620	200	5	24084-K30-MB-W33	AH24084	3845	8382	623	480	900

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
320	162	171	28	Tr 365x5	0,25	2,7	3,9	2,6	125	19,5	
	206	225	26	Tr 360x5	0,32	2,12	3,15	2,07	165	21,7	
	225	234	33	Tr 370x5	0,33	2	2,9	1,9	245	29	
	269	288	26	Tr 360x5	0,4	1,68	2,5	1,64	293	27,1	
	264	273	38	Tr 370x5	0,37	1,8	2,6	1,7	291	32	
340	167	176	30	Tr 385x5	0,24	2,8	4	2,6	132	21	
	206	226	26	Tr 380x5	0,32	2,12	3,15	2,07	140	20	
	229	238	35	Tr 400x5	0,32	2	3	2	261	33	
	269	289	26	Tr 380x5	0,4	1,68	2,5	1,64	308	29,6	
	274	283	40	Tr 400x5	0,35	1,9	2,9	1,8	389	41,5	
360	170	180	31	Tr 410x5	0,23	2,9	4,2	2,7	140	23,5	
	208	228	28	Tr 400x5	0,29	2,32	3,45	2,26	145	23,5	
	232	242	36	Tr 420x5	0,31	2,2	3,1	2,1	278	36	
	271	291	28	Tr 400x5	0,37	1,8	2,69	1,76	321	31	
	284	294	42	Tr 420x5	0,36	1,9	2,7	1,8	436	45,5	
380	183	193	33	Tr 430x5	0,24	2,8	4	2,7	179	27	
	228	248	28	Tr 420x5	0,29	1,8	2,69	2,26	200	27	
	240	250	38	Tr 440x5	0,3	2,2	3,2	2,1	310	39	
	278	298	28	Tr 420x5	0,37	1,8	2,69	1,76	360	35	
	302	312	44	Tr 440x5	0,36	1,8	2,7	1,8	517	51,5	
400	186	196	34	Tr 450x5	0,23	2,9	4,1	2,7	189	29	
	230	252	30	Tr 440x5	0,29	2,32	3,45	2,26	205	29	

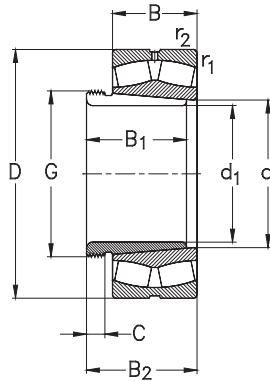
Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm] Shaft [mm] Ød ₁ [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		Tragzahlen Load ratings [kN]			Referenzdrehzahlen [min ⁻¹] Thermal speed ratings [rpm]	Grenzdrehzahlen [min ⁻¹] Limited speed ratings [rpm]
	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{0r}	n _G
	400	420	700	224	6	23184-K-MB-W33	AH3184	4030	9740	708	460
	420	700	280	6	24184-K30-MB-W33	AH24184	6504	12611	917	280	700
	420	760	272	7,5	23284-K-MB-W33	AH3284	6400	11300	809	370	630
420	440	650	157	6	23088-K-MB-W33	AHX3088	3210	6410	470	640	1000
	440	650	212	6	24088-K30-MB-W33	AHX24088	4221	9095	684	460	850
	440	720	226	6	23188-K-MB-W33	AHX3188	4480	9350	473	460	850
	440	720	280	6	24188-K30-MB-W33	AHX24188	6933	13939	1003	250	700
	440	790	280	7,5	23288-K-MB-W33	AHX3288	6820	12030	851	350	600
440	460	680	163	6	23092-K-MB-W33	AHX3092	3480	7000	506	610	950
	460	760	240	7,5	23192-K-MB-W33	AHX3192	5760	10950	776	420	800
	460	760	300	7,5	24192-K30-MB-W33	AH24192	7378	14889	1056	240	670
	460	830	296	7,5	23292-K-MB-W33	AHX3292	7601	14003	976	310	560
460	480	700	165	6	23096-K-MB-W33	AHX3096	3660	7490	536	570	950
	480	790	248	7,5	23196-K-MB-W33	AHX3196	6150	12000	840	390	750
	480	790	308	7,5	24196-K30-MB-W33	AH24196	7891	15938	1116	230	630
	480	870	310	7,5	23296-K-MB-W33	AHX3296	8261	15278	1051	290	530
480	500	670	128	5	239/500-K-MB-W33	AH39/500	2537	5984	430	560	670
	500	720	167	6	230/500-K-MB-W33	AHX30/500	3830	7970	565	540	900
	500	830	264	7,5	231/500-K-MB-W33	AHX31/500	6800	13040	901	370	700
	500	830	325	7,5	241/500-K30-MB-W33	AH241/500	8705	17263	1193	210	600
	500	920	336	7,5	232/500-K-MB-W33	AHX32/500	9506	17819	1207	270	500
500	530	710	136	5	239/530-K-MB-W33	AH39/530	2801	6583	464	530	630

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
400	266	276	40	Tr 460x5	0,32	2,1	3,2	2	409	46	
	310	332	30	Tr 440x5	0,37	1,8	2,69	1,76	483	40,3	
	321	331	46	Tr 460x5	0,36	1,7	2,7	1,8	612	58,9	
420	194	205	35	Tr 470x5	0,23	2,9	4,1	2,7	216	32	
	242	264	30	Tr 460x5	0,29	2,32	3,45	2,26	240	32	
	270	281	42	Tr 480x5	0,32	2,1	3	2	429	49,8	
	310	332	30	Tr 460x5	0,37	1,8	2,69	1,76	496	42,5	
	330	341	48	Tr 480x5	0,36	1,8	2,7	1,8	671	63,8	
440	202	213	37	Tr 490x5	0,23	2,9	4,2	2,8	245	35,2	
	285	296	43	Tr 510x6	0,31	2,1	3,1	2	510	57,9	
	332	355	32	Tr 480x5	0,37	1,8	2,69	1,76	550	50	
	349	360	50	Tr 510x6	0,35	1,95	2,9	1,91	795	74,5	
460	205	217	38	Tr 520x6	0,23	2,9	4,4	2,9	259	39,2	
	295	307	45	Tr 530x6	0,31	2,2	3,1	2,1	567	63,1	
	340	363	32	Tr 500x5	0,37	1,8	2,69	1,76	595	51,5	
	364	376	52	Tr 530x6	0,4	1,68	2,5	1,64	914	82,1	
480	162	172	32	Tr 520x6	0,16	4,28	6,37	4,19	161	28	
	209	221	40	Tr 540x6	0,22	3	4,3	2,9	272	42,5	
	313	325	47	Tr 550x6	0,31	2,1	3	2	670	70,9	
	360	383	35	Tr 530x6	0,37	1,8	2,69	1,76	735	57	
	393	405	54	Tr 550x6	0,35	1,95	2,9	1,91	1105	94,6	
500	175	185	37	Tr 550x6	0,18	3,66	5,46	3,58	202	43,4	

Pendelrollenlager auf Abziehhülse
Spherical Roller Bearings with Withdrawal Sleeve



Welle [mm]	Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Shaft [mm]	Boundary dimensions [mm]				Designation		Load ratings [kN]			Thermal speed ratings [rpm]	Limited speed ratings [rpm]
Ød ₁ [mm]	d	D	B	r ₁ , r ₂ min	Lager Bearing	Abziehhülse Withdrawal sleeve	C _r dyn.	C _{0r} stat.	C _u	n _{Br}	n _G
500	530	780	185	6	230/530-K-MB-W33	AH30/530	4470	9310	646	510	800
	530	870	335	7,5	241/530-K30-MB-W33	AH241/530	9372	19198	1302	190	560
530	560	750	140	5	239/560-K-MB-W33	AH39/560	3029	7228	502	490	600
	560	820	195	6	230/560-K-MB-W33	AH30/560	5110	10690	730	460	750
	560	920	355	7,5	241/560-K30-MB-W33	AH241/560	10512	21598	1445	180	500
560	600	800	150	5	239/600-K-MB-W33	AH39/600	3420	8314	566	450	560
	600	870	200	6	230/600-K-MB-W33	AH30/600	5500	11420	766	430	700
	600	980	375	7,5	241/600-K30-MB-W33	AH241/600	11631	24141	1584	160	480
600	630	850	165	6	239/630-K-MB-W33	AH39/630	4055	9794	655	410	530
	630	920	212	7,5	230/630-K-MB-W33	AH30/630	6270	13360	881	390	670
	630	1030	400	7,5	241/630-K30-MB-W33	AH241/630	12920	27231	1760	150	450
630	670	900	170	6	239/670-K-MB-W33	AH39/670	4388	10796	710	380	500
	670	980	230	7,5	230/670-K-MB-W33	AH30/670	6820	14690	951	370	600
670	710	950	180	6	239/710-K-MB-W33	AH39/710	4874	12104	782	360	480
	710	1030	236	7,5	230/710-K-MB-W33	AH30/710	7402	16453	1049	340	560
710	750	1000	185	6	239/750-K-MB-W33	AH39/750	5370	13460	856	330	480
750	800	1060	195	6	239/800-K-MB-W33	AH39/800	5644	14479	904	310	450
	800	1150	258	7,5	230/800-K-MB-W33	AH30/800	8620	19650	1210	300	480
850	900	1180	206	6	239/900-K-MB-W33	AH39/900	6803	18104	1094	260	400
	900	1280	280	7,5	230/900-K-MB-W33	AH30/900	10280	23948	1426	250	400
900	950	1250	224	7,5	239/950-K-MB-W33	AH39/950	4238	9459	562	320	360

Welle [mm] Shaft [mm] $\varnothing d_1$ [mm]	Abmessungen [mm] Dimensions [mm]				Berechnungsfaktoren Calculation factors				Gewicht [kg] Weight [kg]		
	B ₁	B ₂	C	G	e	F _a /F _r ≤ e		F _a /F _r > e	Y ₀	Lager	Abziehhülse
						Y ₁	Y ₂			Bearing	Withdrawal sleeve
500	230	242	45	Tr 560x6	0,22	3	4,3	2,9	372	61,9	
	370	394	35	Tr 550x6	0,37	1,8	2,69	1,7	820	86	
530	180	190	37	Tr 580x6	0,16	4,28	6,37	4,19	230	47,4	
	240	252	45	Tr 590x6	0,22	3,1	4,6	3	427	68,6	
	393	417	38	Tr 580x6	0,37	1,8	2,69	1,76	970	97	
560	192	202	38	Tr 625x6	0,16	4,28	6,37	4,19	277	56,1	
	245	259	45	Tr 630x6	0,22	2,9	4,2	2,8	481	75,4	
	413	439	38	Tr 630x6	0,37	1,8	2,69	1,76	1180	120	
600	210	232	40	Tr 655x6	0,16	4,28	6,37	4,19	344	62,8	
	258	272	46	Tr 670x6	0,21	3,1	4,5	2,9	576	87,7	
	440	466	40	Tr 650x6	0,37	1,8	2,69	1,76	138-0	130	
630	216	228	41	Tr 695x6	0,16	4,28	6,37	4,19	412	85,5	
	280	294	50	Tr 710x7	0,23	3	4,4	2,9	726	124	
670	228	240	43	Tr 740x7	0,16	4,28	6,37	4,19	488	102	
	286	302	50	Tr 750x7	0,21	3,2	4,77	3,13	803	135	
710	234	246	44	Tr 780x7	0,16	4,28	6,37	4,19	548	111	
750	245	257	45	Tr 830x7	0,16	4,28	6,37	4,19	653	147	
	308	326	50	Tr 850x7	0,21	3,1	4,5	3	1106	200	
850	265	277	51	Tr 930x8	0,16	4,28	6,37	4,19	605	182	
	335	355	55	Tr 950x8	0,21	3,24	4,82	3,16	1210	248	
900	282	297	50	Tr 980x8	0,16	4,28	6,37	4,19	776	206	



Axial-Rillenkugellager
Thrust Ball Bearings

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction

Axial-Rillenkugellager, zweiseitig wirkend
Thrust Ball Bearings, Double Direction



Axial-Rillenkugellager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Axial-Rillenkugellager, einseitig wirkend	DIN 711
Axial-Rillenkugellager, zweiseitig wirkend	DIN 715
Unterlagscheiben	DIN 711

Allgemeines

Axial-Rillenkugellager sind zerlegbare Axiallager, die in ein- und zweiseitig wirkender Ausführung gefertigt werden.

Die Möglichkeit, bei Axial-Rillenkugellagern Laufscheiben und Kugelkränze getrennt montieren zu können, stellt eine wesentliche Erleichterung beim Ein- und Ausbau dar.

Axial-Rillenkugellager eignen sich zur Aufnahme hoher Axiallasten, nehmen jedoch keine radial wirkenden Kräfte auf.

Aufgrund ihrer kinematischen Besonderheiten eignen sich Axial-Rillenkugellager für eher geringe bis mittlere Drehzahlen. Zur Sicherstellung einer optimalen Funktion ist darüber hinaus eine Mindest-Axialbelastung erforderlich.

Da Axial-Rillenkugellager keinerlei Schiefstellung vertragen, sind Axial-Rillenkugellager auch mit **kugeligen Gehäusescheiben** bzw. mit **kugeligen Gehäusescheiben** und **Unterlagscheiben** zum Ausgleich von Schiefstellungen und Fluchtungsfehlern erhältlich.

Thrust Ball Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Thrust ball bearings, single direction	DIN 711
Thrust ball bearings, double direction	DIN 715
Seating washers	DIN 711

General

Thrust ball bearings are separable axial bearings that are produced in both single and double direction acting design.

To assist in simple effective mounting or dismounting the bearing washers, seatings, and cage and ball assemblies, may be individually mounted in their arrangement location.

Thrust ball bearings may accommodate comparatively high axial loads but they must not be exposed to any radial forces.

Due to their specific kinematic behaviour, thrust ball bearings are only suitable for low to medium operating speeds.

Furthermore, they require minimum axial loads for their optimum function.

Since thrust ball bearings do not compensate any misalignment, they are also frequently used in conjunction with **sphered housing washers** or with both **sphered housing washers** and **seating washers**.

Bauformen

Axial-Rillenkugellager werden in **ein-** und **zweiseitig** wirkender Ausführung gefertigt. Die wichtigsten Bauformen sind in der Zeichnung auf nebenstehender Seite dargestellt.

Einseitig wirkende Axial-Rillenkugellager (siehe Abb. a, b und c) bestehen aus einer **Wellenscheibe**, einer **Gehäusescheibe** und dem dazwischen laufenden **Kugelkranz**.

Diese Lager können Axialkräfte nur in einer Richtung aufnehmen.

Einseitig wirkende Axial-Rillenkugellager der Reihen **511**, **512**, **513** und **514** haben ebene Gehäusescheiben, siehe Abb. a.

Für Anwendungsfälle, in denen mit Schiefstellungen zu rechnen ist, sind auch einseitig wirkende Axial-Rillenkugellager der Reihen **532**, **533** und **534** mit kugeligen Gehäusescheiben (Abb. b) lieferbar.

Diese können entweder in einen entsprechend kugelig geformten Gehäusesitz eingebaut werden oder, wie in Abb. c dargestellt, zusammen mit **Unterlagscheiben** der Reihen **U2**, **U3** bzw. **U4** verwendet werden.

Im Gegensatz zu den einseitig wirkenden Lagern führen **zweiseitig wirkende Axial-Rillenkugellager** (Abb. d, e und f) die Welle in beiden Richtungen.

Dazu bestehen diese Lager aus je **zwei Gehäusescheiben**, **zwei Kugelkranzen** und einer zentral dazwischen angeordneten **Wellenscheibe**.

Auch die **zweiseitig wirkenden Axial-Rillenkugellager** sind sowohl mit **ebenen Gehäusescheiben** (Reihen **522**, **523** und **524**, Abb. d) als auch mit **kugeligen Gehäusescheiben** (Reihen **542**, **543** und **544**, siehe Abb. e) verfügbar.

Zum Ausgleich möglicher Schiefstellungen können auch die zweiseitig wirkenden Axial-Kugellager, wie in Abb. f dargestellt, gemeinsam mit **Unterlagscheiben** der Reihen **U2**, **U3** bzw. **U4** verwendet werden.

Design Variants

Thrust ball bearings are produced in both, single direction and double direction design. The most important design variants are shown on the opposite page.

Single direction thrust ball bearings consist of a **shaft washer**, a **housing washer** and a **ball and cage thrust assembly**, (see fig. a, b and c).

These bearings are able to accommodate axial loads in one direction only.

Single direction thrust ball bearings of series **511**, **512**, **513** and **514** have plain housing washers, (see fig. a).

For applications where some misalignment may occur, single direction thrust ball bearings of the series **532**, **533** and **534** are also available with sphered housing washers, (see fig. b).

These bearings may be applied either direct to sphered shaped bearing seats or, they may be used together with **seating washers** of series **U2**, **U3** or **U4** (see fig. c).

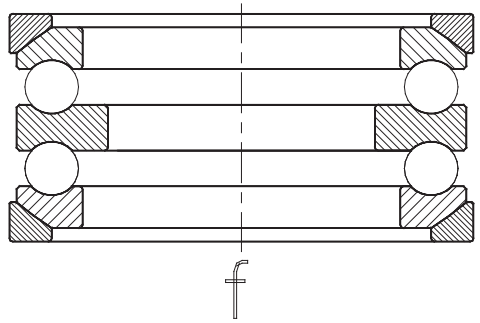
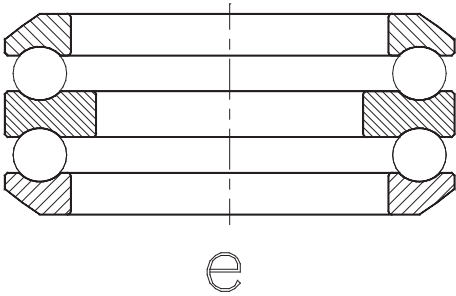
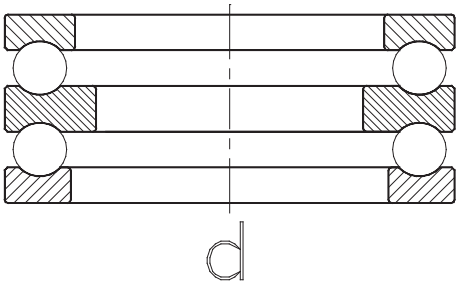
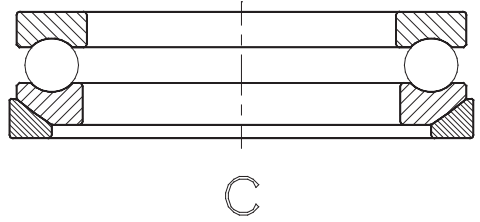
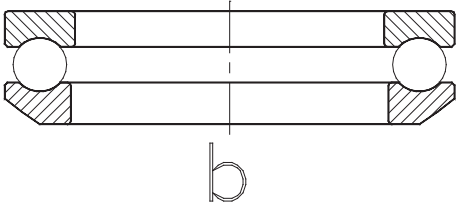
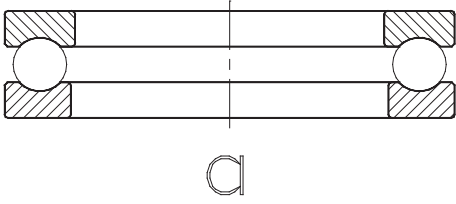
Unlike single direction thrust ball bearing types, **double direction thrust ball bearings** are suitable to guide the shaft in both directions (see fig. d, e and f).

These bearings consist of **two housing washers**, **two ball and cage thrust assemblies** with one common **shaft washer** located centrally in between.

Double direction thrust ball bearings are also available in both designs, with **flat housing washers** (series **522**, **523** and **524**, see fig. d) and with **sphered housing washers** (series **542**, **543** and **544**, see fig. e).

For compensation of possible aligning errors the double direction thrust ball bearings may be used in conjunction with **Seating Washers** (series **U2**, **U3** and **U4**, see fig. f).

Axial-Rillenkugellager
Thrust Ball Bearings



Schiefstellung

Axial-Rillenkugellager mit ebenen Gehäusescheiben vertragen grundsätzlich keine Schiefstellungen.

Die Anlageflächen von Wellen- und Gehäusescheiben müssen daher parallel sein.

Winkelfehler können nur mit Axial-Rillenkugellagern mit **kugeligen Gehäusescheiben** ausgeglichen werden.

Käfige

NKE Axial-Rillenkugellager werden standardmäßig mit Stahlblechkäfigen gefertigt. Ausgenommen davon sind größere Axial-Rillenkugellager, die mit Massivkäfigen aus Messing (Nachsetzzeichen **MP**) oder Stahl (Nachsetzzeichen **FP**) ausgestattet sind.

Toleranzen

Axial-Rillenkugellager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 52.

Misalignment

All thrust ball bearing types with flat housing washers do not allow any misalignment.

The contacting surfaces of both shaft and housing seats must be parallel.

Misalignments can only be accommodated by using thrust ball bearings with **sphered housing washers**.

Cages

NKE thrust ball bearings are normally fitted with pressed steel cages as standard.

For larger thrust ball bearings solid brass cages, (suffix **MP**), or solid steel cages, (suffix **FP**), are fitted as standard.

Tolerances

Thrust ball bearings are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**.

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 237.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Axial-Rillenkugellager muss die Mindestaxialbelastung 4% der dynamischen Tragzahl betragen.

Äquivalente dynamische Lagerbelastung

Axial-Rillenkugellager sind reine Axiallager und können keine Radialkräfte aufnehmen.

daher gilt:

$$P = F_a$$

Äquivalente statische Lagerbelastung

Für Axial-Rillenkugellager gilt:

$$P_0 = F_a$$

Anschlussmaße für Axial-Rillenkugellager

Die Radien der Kantenverrundung der Laufscheiben dürfen nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anschlussstellen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_1 , r_2) der Lagerscheiben (siehe Zeichnung bei Tabelle auf der Folgeseite).

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE thrust ball bearings the minimum axial load must be 4% of the dynamic load rating.

Equivalent Dynamic Bearing Load

Thrust ball bearings are pure axial bearings; they are not able to accommodate any radial loads, therefore:

$$P = F_a$$

Equivalent Static Bearing Load

For thrust ball bearings:

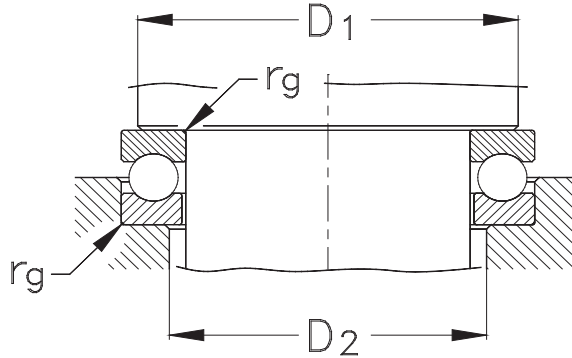
$$P_0 = F_a$$

Abutment and Fillet Dimensions for Thrust Ball Bearings

The bearing washer must contact adjacent parts with their face sides only. The radii of bearing corners must not touch the shoulder fillet radii of the shaft or housing shoulders.

Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_1 , r_2) as listed in the bearing tables.

Anschlussmaße für Axial-Rillenkugellager der Reihen 511, 512, 513 und 514 [mm]
Abutment and Fillet Dimensions for Thrust Ball Bearings of Series 511, 512, 513 and 514 [mm]

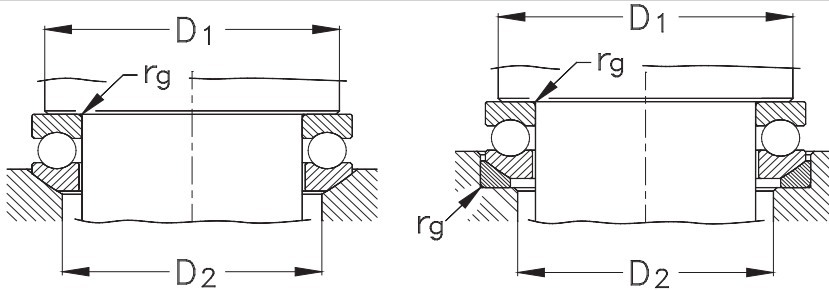


Welle Shaft $\varnothing d$ [mm]	Bohrungs- kennzahl Bore reference number	Lagerreihe / Bearing series											
		511			512			513			514		
		D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max
10	00	18	16	0,3	20	16	0,6	--	--	--	--	--	--
12	01	20	18	0,3	22	18	0,6	--	--	--	--	--	--
15	02	23	20	0,3	25	22	0,6	--	--	--	--	--	--
17	03	25	22	0,3	28	24	0,6	--	--	--	--	--	--
20	04	29	26	0,3	32	28	0,6	--	--	--	--	--	--
25	05	35	32	0,6	38	34	0,6	41	36	1	46	39	1
30	06	40	37	0,6	43	39	0,6	48	42	1	54	46	1
35	07	45	42	0,6	51	46	1	55	48	1	62	53	1
40	08	52	48	0,6	57	51	1	63	55	1	70	60	1
45	09	57	53	0,6	62	56	1	69	61	1	78	67	1
50	10	62	58	0,6	67	61	1	77	68	1	86	74	1,5
55	11	69	64	0,6	76	69	1	85	75	1	94	81	1,5
60	12	75	70	1	81	74	1	90	80	1	102	88	1,5
65	13	80	75	1	86	79	1	95	85	1	110	95	2
70	14	85	80	1	91	84	1	103	92	1	118	102	2
75	15	90	85	1	96	89	1	111	99	1,5	126	109	2
80	16	95	90	1	101	94	1	116	104	1,5	134	116	2,1
85	17	100	95	1	109	101	1	124	111	1,5	142	123	2,1
90	18	108	102	1	117	108	1	129	116	1,5	150	130	2,1
100	20	121	114	1	130	120	1	142	128	1,5	166	144	2,5
110	22	131	124	1	140	130	1	158	142	2	182	158	2,5
120	24	141	134	1	150	140	1	174	156	2,1	198	172	3
130	26	154	146	1	166	154	1,5	187	168	2,1	214	186	3
140	28	164	156	1	176	164	1,5	200	180	2,1	224	196	3
150	30	174	166	1	189	176	1,5	210	190	2,1	240	210	3

Anschlussmaße für Axial-Rillenkugellager der Reihen 511, 512 und 513 [mm]
Abutment and Fillet Dimensions for Thrust Ball Bearings of Series 511, 512 and 513 [mm]

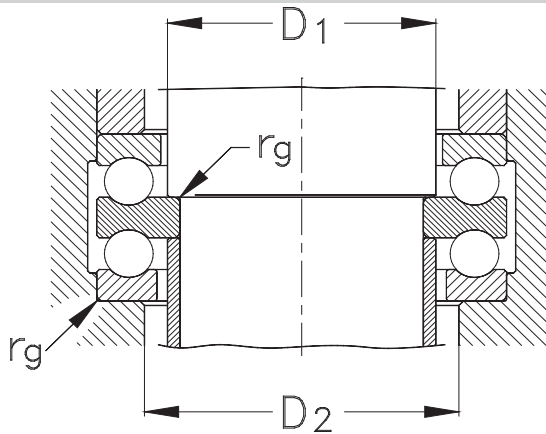
Welle Shaft Ød [mm]	Bohrungs- kennzahl Bore reference number	Lagerreihe / Bearing series								
		511			512			513		
		D ₁ min	D ₂ max	r _g max	D ₁ min	D ₂ max	r _g max	D ₁ min	D ₂ max	r _g max
160	32	184	176	1	199	186	1,5	226	204	2,5
170	34	197	188	1	212	198	1,5	236	214	2,5
180	36	207	198	1	222	208	1,5	252	228	2,5
190	38	220	210	1	238	222	2	268	242	3
200	40	230	220	1	248	232	2	284	256	3
220	44	250	240	1	268	252	2	--	--	--
240	48	276	264	1,5	300	280	2,1	--	--	--
260	52	296	284	1,5	320	300	2,1	--	--	--
280	56	322	308	1,5	340	320	2,1	--	--	--
300	60	348	332	2	372	348	2,5	--	--	--
320	64	368	352	2	392	368	2,5	--	--	--
340	68	388	372	2	412	388	2,5	--	--	--
360	72	408	392	2	444	416	3	--	--	--
380	76	428	412	2	--	--	--	--	--	--
400	80	448	432	2	--	--	--	--	--	--
420	84	468	452	2	--	--	--	--	--	--
440	88	500	480	2,1	--	--	--	--	--	--
460	92	520	500	2,1	--	--	--	--	--	--
480	96	540	520	2,1	--	--	--	--	--	--
500	/500	560	540	2,1	--	--	--	--	--	--
530	/530	596	574	2,5	--	--	--	--	--	--
560	/560	626	604	2,5	--	--	--	--	--	--

Anschlussmaße für Axial-Rillenkugellager der Reihen 532, 533 und 534 [mm]
Abutment and Fillet Dimensions for Thrust Ball Bearings of Series 532, 533 and 534 [mm]



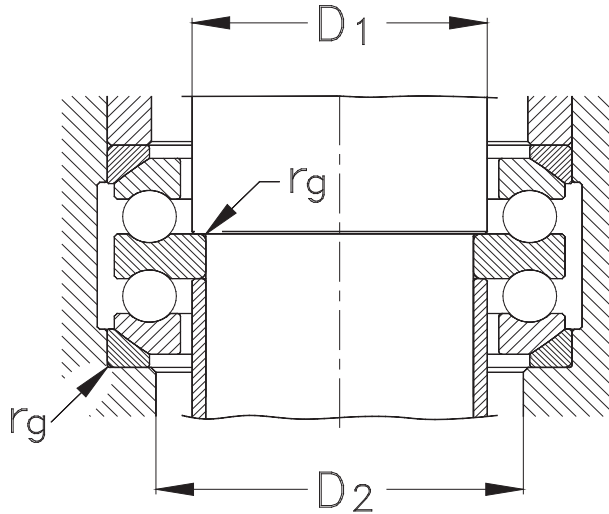
Welle Shaft $\varnothing d$ [mm]	Bohrungs- kennzahl Bore reference number	Lagerreihe / Bearing series								
		532			533			534		
		D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max
10	00	20	18	0,6	--	--	--	--	--	--
12	01	22	20	0,6	--	--	--	--	--	--
15	02	25	24	0,6	--	--	--	--	--	--
17	03	28	26	0,6	--	--	--	--	--	--
20	04	32	30	0,6	--	--	--	--	--	--
25	05	38	36	0,6	41	38	1	46	42	1
30	06	43	42	0,6	48	45	1	54	50	1
35	07	51	48	1	55	52	1	62	58	1
40	08	57	55	1	63	60	1	70	65	1
45	09	62	60	1	69	65	1	78	72	1
50	10	67	62	1	77	72	1	86	80	1,5
55	11	76	72	1	85	80	1	94	88	1,5
60	12	81	78	1	90	85	1	102	95	1,5
65	13	86	82	1	95	90	1	110	100	2
70	14	91	88	1	103	98	1	118	110	2
75	15	96	92	1	111	105	1,5	126	115	2
80	16	101	98	1	116	110	1,5	134	125	2,1
85	17	109	105	1	124	115	1,5	142	130	2,1
90	18	117	110	1	129	120	1,5	150	140	2,1
100	20	130	125	1	142	135	1,5	166	155	2,5
110	22	140	135	1	158	150	2	182	170	2,5
120	24	150	145	1	174	165	2	198	185	3
130	26	166	160	1,5	187	177	2,1	214	200	3
140	28	176	170	1,5	200	190	2,1	--	--	--
150	30	189	180	1,5	210	200	2,1	--	--	--
160	32	199	190	1,5	--	--	--	--	--	--
170	34	212	200	1,5	--	--	--	--	--	--
180	36	222	210	1,5	--	--	--	--	--	--
190	38	238	230	2	--	--	--	--	--	--

Anschlussmaße für Axial-Rillenkugellager der Reihen 522, 523 und 524 [mm]
Abutment and Fillet Dimensions for Thrust Ball Bearings of Series 522, 523 and 524 [mm]



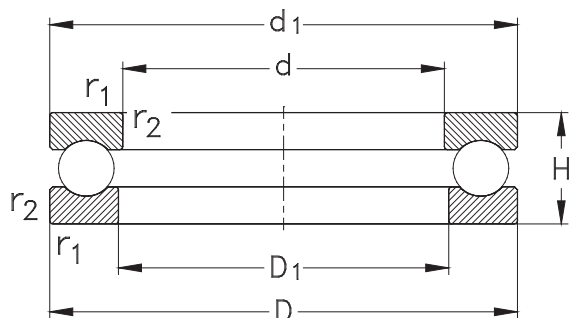
Welle Shaft Ød [mm]	Bohrungs- kennzahl Bore reference number	Lagerreihe / Bearing series												
		522				523				524				
		D ₁ min	D ₂ max	r _g max	r _{g1} max	D ₁ min	D ₂ max	r _g max	r _{g1} max	Welle Shaft	D ₁ min	D ₂ max	r _g max	r _{g1} max
10	02	15	22	0,6	0,3	--	--	--	--	--	--	--	--	--
15	04	20	28	0,6	0,3	--	--	--	--	--	--	--	--	--
20	05	25	34	0,6	0,3	25	36	1	0,3	15	25	39	1	0,6
25	06	30	39	0,6	0,3	30	42	1	0,3	20	30	46	1	0,6
30	07	35	46	1	0,3	35	48	1	0,3	25	35	53	1	0,6
30	08	40	51	1	0,6	40	55	1	0,6	30	40	60	1	0,6
35	09	45	56	1	0,6	45	61	1	0,6	35	45	67	1	0,6
40	10	50	61	1	0,6	50	68	1	0,6	40	50	74	1,5	0,6
45	11	55	69	1	0,6	55	75	1	0,6	45	55	81	1,5	0,6
50	12	60	74	1	0,6	60	80	1	0,6	50	60	88	1,5	0,6
55	13	65	79	1	0,6	65	85	1	0,6	50	65	95	2	1
55	14	70	84	1	1	70	92	1	1	55	70	102	2	1
60	15	75	89	1	1	75	99	1,5	1	60	75	109	2	1
65	16	80	94	1	1	80	104	1,5	1	65	80	116	2,1	1
70	17	85	101	1	1	85	111	1,5	1	65	85	123	2,1	1
75	18	90	108	1	1	90	116	1,5	1	70	90	130	2,1	1
85	20	100	120	1	1	100	128	1,5	1	80	100	144	2,5	1
95	22	110	130	1	1	110	142	2	1	--	--	--	--	--
100	24	120	140	1	1	120	156	2,1	1	--	--	--	--	--
110	26	130	154	1,5	1	130	168	2,1	1	--	--	--	--	--
120	28	140	164	1,5	1	140	180	2,1	1	--	--	--	--	--
130	30	150	176	1,5	1	150	190	2,1	1	--	--	--	--	--
140	32	160	186	1,5	1	--	--	--	--	--	--	--	--	--
150	34	170	198	1,5	1	--	--	--	--	--	--	--	--	--

Anschlussmaße für Axial-Rillenkugellager der Reihen 542, 543 und 544 [mm]
Abutment and Fillet Dimensions for Thrust Ball Bearings of Series 542, 543 and 544 [mm]



Welle Shaft $\varnothing d$ [mm]	Bohrungs- kennzahl Bore reference number	Lagerreihe / Bearing series												
		542				543				544				
		D_1 min	D_2 max	r_g max	r_{g1} max	D_1 min	D_2 max	r_g max	r_{g1} max	Welle Shaft	D_1 min	D_2 max	r_g max	r_{g1} max
10	02	15	24	0,6	0,3	--	--	--	--	--	--	--	--	--
15	04	20	30	0,6	0,3	--	--	--	--	--	--	--	--	--
20	05	25	36	0,6	0,3	25	38	1	0,3	15	25	42	1	0,6
25	06	30	42	0,6	0,3	30	45	1	0,3	20	30	50	1	0,6
30	07	35	48	1	0,3	35	52	1	0,3	25	35	58	1	0,6
30	08	40	55	1	0,6	40	60	1	0,6	30	40	65	1	0,6
35	09	45	60	1	0,6	45	65	1	0,6	35	45	72	1	0,6
40	10	50	62	1	0,6	50	72	1	0,6	40	50	80	1,5	0,6
45	11	55	72	1	0,6	55	80	1	0,6	45	55	88	1,5	0,6
50	12	60	78	1	0,6	60	85	1	0,6	50	60	95	1,5	0,6
55	13	65	82	1	0,6	65	90	1	0,6	50	65	100	2	1
55	14	70	88	1	1	70	98	1	1	55	70	110	2	1
60	15	75	92	1	1	75	105	1,5	1	60	75	115	2	1
65	16	80	98	1	1	80	110	1,5	1	65	80	125	2,1	1
70	17	85	105	1	1	85	115	1,5	1	65	85	130	2,1	1
75	18	90	110	1	1	90	120	1,5	1	70	90	140	2,1	1
85	20	100	125	1	1	100	135	1,5	1	80	100	155	2,5	1
95	22	110	135	1	1	110	150	2	1	--	--	--	--	--
100	24	120	145	1	1	120	165	2,1	1	--	--	--	--	--
110	26	130	160	1,5	1	--	--	--	--	--	--	--	--	--

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

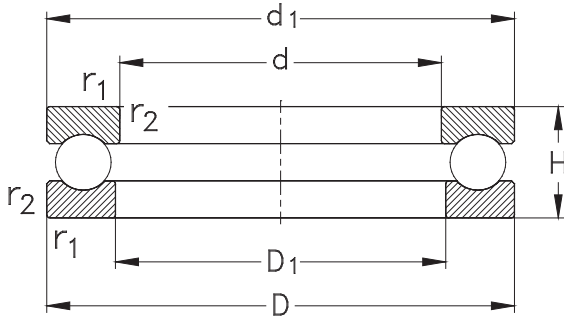
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min		C _a dyn.	C _{0a} stat.	C _u	n _G
10	24	9	0,3	51100	10	14	0,5	13000
	26	11	0,6	51200	12,7	17	0,6	11000
12	26	9	0,3	51101	10,4	15,3	0,6	13000
	28	11	0,6	51201	13,2	19	0,7	11000
15	28	9	0,3	51102	10,4	15,3	0,6	12000
	32	12	0,6	51202	16,6	25	0,9	10000
17	30	9	0,3	51103	9,65	15,3	0,6	12000
	35	12	0,6	51203	17,3	27,5	1,0	9500
20	35	10	0,3	51104	12,7	20,8	0,8	10000
	40	14	0,6	51204	22,4	37,5	1,4	8000
25	42	11	0,6	51105	15,6	29	1,1	9000
	47	15	0,6	51205	28	50	1,9	7500
	52	18	1	51305	34,5	55	2,0	6300
	60	24	1	51405	56	90	3,3	5000
30	47	11	0,6	51106	16,6	33,5	1,2	8500
	52	16	0,6	51206	25,5	47,5	1,8	6700
	60	21	1	51306	38	65,5	2,4	5300
	70	28	1	51406	72	125	4,6	4300
35	52	12	0,6	51107	17,6	37,5	1,4	7500
	62	18	1	51207	35,5	67	2,5	5600
	68	24	1	51307	50	88	3,3	4500
	80	32	1,1	51407	86,5	156	5,8	3800

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

d	Abmessungen [mm]		Gewicht [kg]
	d₁	D₁	m
	<i>Dimensions [mm]</i>		<i>Weight [kg]</i>
10	24	11	0,02
	26	12	0,03
12	26	13	0,02
	28	14	0,03
15	28	16	0,02
	32	17	0,05
17	30	18	0,03
	35	19	0,05
20	35	21	0,04
	40	22	0,08
25	42	26	0,06
	47	27	0,12
	52	27	0,17
30	60	27	0,36
	47	32	0,07
	52	32	0,13
35	60	32	0,26
	70	32	0,58
	52	37	0,09
	62	37	0,22
	68	37	0,38
	80	37	0,96

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

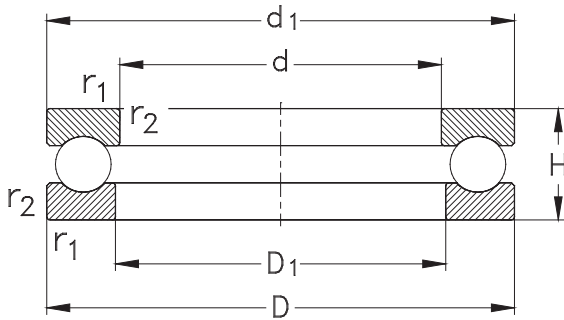
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min		C _a dyn.	C _{0a} stat.	C _u	n _G
40	60	13	0,6	51108	23,2	50	1,9	7000
	68	19	1	51208	46,5	98	3,6	5300
	78	26	1	51308	61	112	4,1	4300
	90	36	1,1	51408	112	204	7,6	3400
45	65	14	0,6	51109	24,5	57	2,1	6300
	73	20	1	51209	39	80	3,0	5000
	85	28	1	51309	75	140	5,2	4000
	100	39	1,1	51409	129	245	9,1	3000
50	70	14	0,6	51110	25,5	63	2,3	6300
	78	22	1	51210	50	106	3,9	4500
	95	31	1,1	51310	88	173	6,4	3600
	110	43	1,5	51410	156	310	11,5	2800
55	78	16	0,6	51111	31	78	2,9	5300
	90	25	1	51211	61	134	5,0	4000
	105	35	1,1	51311	102	208	7,7	3200
	120	48	1,5	51411	180	360	13,3	2400
60	85	17	1	51112	36,5	93	3,4	5000
	95	26	1	51212	62	140	5,2	3800
	110	35	1,1	51312	102	208	7,7	3000
	130	51	1,5	51412	200	400	14,8	2200
65	90	18	1	51113	37,5	98	3,6	4800
	100	27	1	51213	64	150	5,6	3600

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

d	Abmessungen [mm]		Gewicht [kg]
	d₁	D₁	m
	<i>Dimensions [mm]</i>		<i>Weight [kg]</i>
40	60	42	0,13
	68	42	0,28
	78	42	0,53
	90	42	1,17
45	65	47	0,15
	73	47	0,3
	85	47	0,61
	100	47	1,6
50	70	52	0,17
	78	52	0,37
	95	52	0,94
	110	52	2,18
55	78	57	0,25
	90	57	0,59
	105	57	1,3
	120	57	2,91
60	85	62	0,33
	95	62	0,65
	110	62	1,37
	130	62	3,7
65	90	67	0,36
	100	67	0,74

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

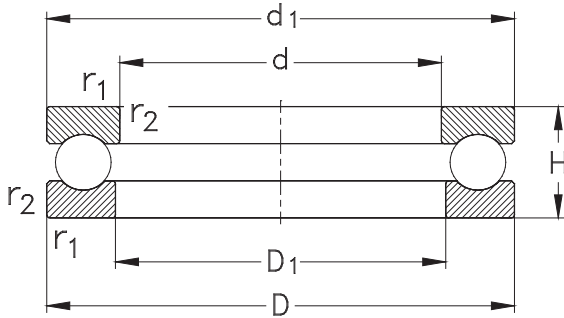
Hauptabmessungen [mm]			Lagertypen Designation	Tragzahlen			Grenzdrehzahlen [min ⁻¹]	
Boundary dimensions [mm]				Load ratings [kN]			Limited speed ratings [rpm]	
d	D	H	r ₁ , r ₂ min	C _a dyn.	C _{0a} stat.	C _u	n _G	
65	115	36	1,1	51313	106	220	8,1	3000
	140	56	2	51413	216	450	16,7	2200
70	95	18	1	51114	37,5	104	3,9	4500
	105	27	1	51214	65,5	160	5,9	3600
	125	40	1,1	51314	137	300	11,1	2600
	150	60	2	51414	236	500	18,5	2000
75	100	19	1	51115	44	137	5,1	4300
	110	27	1	51215	67	170	6,3	3400
	135	44	1,5	51315	163	360	13,3	2400
	160	65	2	51415	250	560	20,7	1800
80	105	19	1	51116	45	140	5,2	4300
	115	28	1	51216	75	190	7,0	3400
	140	44	1,5	51316	160	360	13,3	2400
	170	68	2,1	51416	270	620	23,0	1700
85	110	19	1	51117	45,5	150	5,6	4300
	125	31	1	51217	98	150	5,6	3000
	150	49	1,5	51317	190	425	15,7	2200
	180	72	2,1	51417	290	680	25,2	1600
90	120	22	1	51118	60	190	7,0	3800
	135	35	1,1	51218	120	300	11,1	2800
	155	50	1,5	51318	196	465	17,2	2200
	190	77	2,1	51418	305	750	27,7	1500

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

d	Abmessungen [mm]		Gewicht [kg]
	d₁	D₁	m
	<i>Dimensions [mm]</i>		<i>Weight [kg]</i>
65	115	67	1,49
	140	68	4,67
70	95	72	0,39
	105	72	0,78
	125	72	1,91
	150	73	5,72
75	100	77	0,52
	110	77	0,83
	135	77	2,61
	160	78	7,06
80	105	82	0,56
	115	82	0,91
	140	82	2,71
	170	83	8,23
85	110	87	0,6
	125	88	1,22
	150	88	3,53
	177	88	9,79
90	120	92	0,88
	135	93	1,68
	155	93	3,57
	187	93	11,6

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

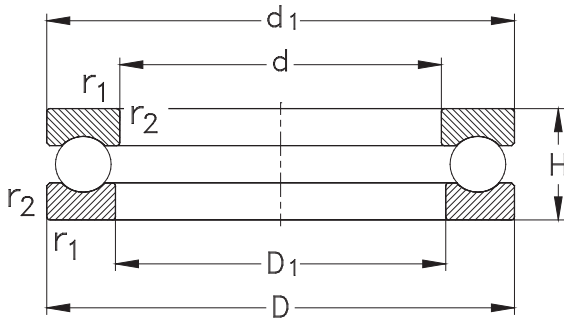
Hauptabmessungen [mm]				Lagertypen Designation	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min		C _a dyn.	C _{0a} stat.	C _u	n _G
100	135	25	1	51120	85	270	10,0	3200
	150	38	1,1	51220	122	320	11,9	2400
	170	55	1,5	51320	232	560	20,7	1900
	210	85	3	51420	365	965	35,7	1400
110	145	25	1	51122	86,5	290	10,7	3200
	160	38	1,1	51222	129	360	13,3	2400
	190	63	2	51322	275	720	26,7	1700
	230	95	3	51422	415	1140	42,2	1300
120	155	25	1	51124	90	310	11,5	3000
	170	39	1,1	51224	140	400	14,8	2200
	210	70	2,1	51324	325	915	33,8	1500
	250	102	4	51424	425	1220	45,2	1100
130	170	30	1	51126	112	390	14,4	2600
	190	45	1,5	51226	183	540	20,0	2000
	225	75	2,1	51326-MP	360	1060	39,3	2400
	270	110	4	51426-MP	520	1600	59,3	1000
140	180	31	1	51128	112	400	14,8	2600
	200	46	1,5	51228	190	570	21,1	1900
	240	80	2,1	51328-MP	400	1220	45,2	1300
150	190	31	1	51130-MP	110	400	14,8	2400
	215	50	1,5	51230-MP	236	735	27,2	1800
	250	80	2,1	51330-MP	405	1290	47,8	1300

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

d	Abmessungen [mm]		Gewicht [kg]
	d₁	D₁	m
	<i>Dimensions [mm]</i>		<i>Weight [kg]</i>
100	135	102	1,3
	150	103	2,22
	170	103	4,95
	205	103	15,4
110	145	112	1,45
	160	113	2,41
	187	113	7,7
	225	113	20,8
120	155	122	1,59
	170	123	2,67
	205	123	10,7
	245	123	26,5
130	170	132	2,37
	187	133	3,99
	220	134	13
	265	134	32,8
140	178	142	2,59
	197	143	4,33
	235	144	15,7
150	188	152	2,26
	212	153	6,09
	245	154	16,4

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

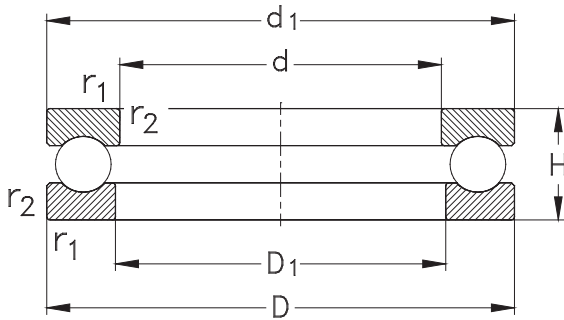
Hauptabmessungen [mm]			Lagertypen Designation	Tragzahlen			Grenzdrehzahlen [min ⁻¹]	
Boundary dimensions [mm]				Load ratings [kN]			Limited speed ratings [rpm]	
d	D	H	r ₁ , r ₂ min	C _a dyn.	C _{0a} stat.	C _u	n _G	
150	300	120	4	51430-MP	560	1800	66,7	950
160	200	31	1	51132-MP	112	430	15,9	2400
	225	51	1,5	51232-MP	245	780	28,9	1700
	270	87	3	51332-MP	455	1500	55,6	1200
170	215	34	1,1	51134-MP	132	500	18,5	2200
	240	55	1,5	51234-MP	285	930	34,4	1800
	280	87	3	51334-MP	465	1630	60,4	1100
180	225	34	1,1	51136-MP	134	530	19,6	2200
	250	56	1,5	51236-MP	290	1000	37,0	1500
	300	95	3	51336-MP	520	1830	67,8	1100
190	240	37	1,1	51138-MP	170	655	24,3	2000
	270	62	2	51238-MP	335	1160	43,0	1400
	320	105	4	51338-MP	600	2200	81,5	950
200	250	37	1,1	51140-MP	170	655	24,3	1900
	280	62	2	51240-MP	340	1220	45,2	1400
	340	110	4	51340-MP	620	2400	88,9	900
220	270	37	1,1	51144-MP	176	735	27,2	1900
	300	63	2	51244-MP	355	1340	49,6	1300
240	300	45	1,5	51148-MP	232	965	35,7	1600
	340	78	2,1	51248-MP	465	1860	68,9	1100
260	320	45	1,5	51152-MP	236	1020	37,8	1500
	360	79	2,1	51252-MP	475	2000	74,1	1100

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

d	Abmessungen [mm]		Gewicht [kg]
	d₁	D₁	m
	<i>Dimensions [mm]</i>		<i>Weight [kg]</i>
150	295	154	43,1
160	198	162	2,39
	222	163	6,56
	265	164	21,3
170	213	172	3,08
	237	173	8,12
	275	174	22,5
180	222	183	3,17
	245	183	8,7
	295	184	28,3
190	237	193	4,08
	265	194	11,7
	315	195	35,7
200	245	203	4,26
	275	204	12
	335	205	44,3
220	265	223	4,64
	295	224	13,2
240	297	243	7,69
	335	244	23
260	317	263	8,25
	355	264	25,2

Axial-Rillenkugellager, einseitig wirkend
Thrust Ball Bearings, Single Direction



511/512/513/514

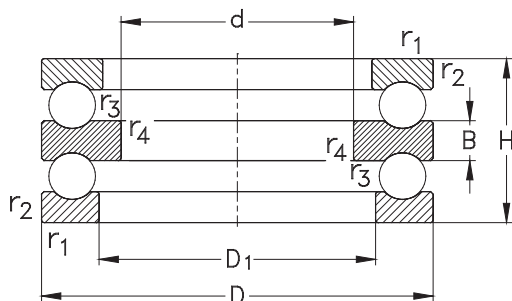
Hauptabmessungen [mm]				Lagertyp	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation	Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min		C _a dyn.	C _{0a} stat.	C _u	n _G
280	350	53	1,5	51156-MP	315	1340	49,6	1300
	380	80	2,1	51256-MP	490	2160	80,0	1000
300	380	62	2	51160-MP	365	1600	59,3	1200
	420	95	3	51260-MP	610	2750	101,9	850
320	400	63	2	51164-MP	375	1700	63,0	1100
	440	95	3	51264-FP	620	2900	107,4	850
340	420	64	2	51168-MP	380	1800	66,7	1100
	460	96	3	51268-FP	640	3150	116,7	800
360	440	65	2	51172-FP	405	2000	74,1	1100
	500	110	4	51272-FP	765	3900	144,4	750
380	460	65	2	51176-FP	430	2240	83,0	1000
400	480	65	2	51180-FP	440	2320	85,9	1000
420	500	65	2	51184-FP	440	2450	90,7	1000
460	560	80	2,1	51192-FP	530	3100	114,8	800
500	600	80	2,1	511/500-FP	550	3350	124,1	800
530	640	85	3	511/530-FP	620	3900	144,4	750
560	670	85	3	511/560-FP	630	4150	153,7	700
600	710	85	3	511/600-FP	640	3650	135,2	700
630	750	95	3	511/630-FP	720	4250	157,4	630
670	800	105	4	511/670-FP	800	4800	177,8	560
710	850	112	4	511/710-FP	865	5500	203,7	490

Anschlussmaße siehe Seite 803

*Abutment and fillet dimensions
see on page 803*

Abmessungen [mm] <i>Dimensions [mm]</i>			Gewicht [kg] <i>Weight [kg]</i>
d	d₁	D₁	m
280	347	283	12,5
	375	284	26,7
300	376	304	17,7
	415	304	42,3
320	396	324	19,1
	435	325	44,2
340	416	344	20,5
	455	345	47
360	436	364	21,5
	495	365	69,5
380	456	384	22,4
400	476	404	23,5
420	495	424	24,4
460	555	464	42
500	595	505	44,9
530	635	535	54,8
560	665	565	58
600	705	605	63
630	745	635	81
670	795	675	104
710	845	715	128

Axial-Rillenkugellager, zweiseitig wirkend
Thrust Ball Bearings, Double Direction



522/523/524

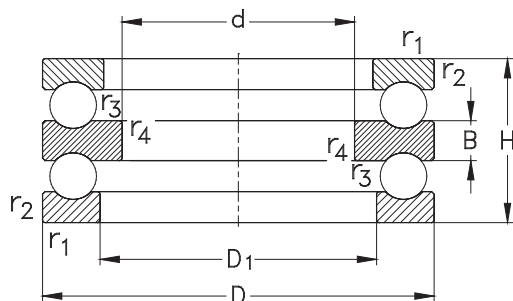
Hauptabmessungen [mm]					Lagertyp	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min		C _a dyn.	C _{0a} stat.	C _u	n _G
10	32	22	0,6	0,3	52202	16,6	25	0,9	10000
15	40	26	0,6	0,3	52204	22,4	37,5	1,4	8000
	60	45	1	0,6	52405	56	90	3,3	6000
20	47	28	0,6	0,3	52205	28	50	1,9	7500
	52	34	1	0,3	52305	34,5	55	2	6300
	70	52	1	0,6	52406	72	125	4,6	5000
25	52	29	0,6	0,3	52206	25,5	47,5	1,8	6700
	60	38	1	0,3	52306	38	65,5	2,4	5300
	80	59	1,1	0,6	52407	86,5	156	5,8	4300
30	62	34	1	0,3	52207	35,5	67	2,5	5600
	68	36	1	0,6	52208	46,5	98	3,6	5300
	68	44	1	0,3	52307	50	88	3,3	4500
	78	49	1	0,6	52308	61	112	4,1	4300
	90	65	1,1	0,6	52408	112	204	7,6	3400
35	73	37	1	0,6	52209	39	80	3	5000
	85	52	1	0,6	52309	75	140	5,2	4000
	100	72	1,1	0,6	52409	129	245	9,1	3000
40	78	39	1	0,6	52210	50	106	3,9	4500
	95	58	1,1	0,6	52310	88	173	6,4	3600
	110	78	1,5	0,6	52410	156	310	11,5	2500
45	90	45	1	0,6	52211	61	134	5	4000
	105	64	1,1	0,6	52311	102	208	7,7	3200

Anschlussmaße siehe Seite 806

*Abutment and fillet dimensions
see on page 806*

d	Abmessungen [mm] <i>Dimensions [mm]</i>		Gewicht [kg] <i>Weight [kg]</i>
	D ₁	B	[m]
10	17	5	0,08
15	22	6	0,15
	27	11	0,59
20	27	7	0,22
	27	8	0,32
	32	12	0,92
25	32	7	0,25
	32	9	0,47
	37	14	1,35
30	37	8	0,41
	42	9	0,55
	37	10	0,68
	42	12	1,01
	42	15	1,92
35	47	9	0,6
	47	12	1,25
	47	17	2,55
40	52	9	0,71
	52	14	1,77
	52	18	3,43
45	57	10	1,1
	57	15	2,38

Axial-Rillenkugellager, zweiseitig wirkend
Thrust Ball Bearings, Double Direction



522/523/524

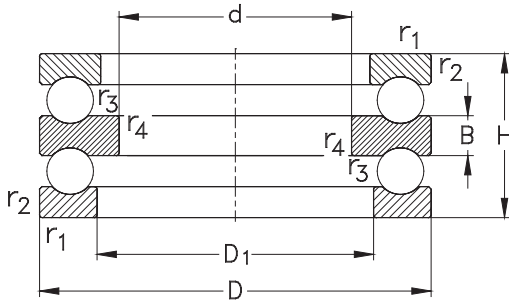
Hauptabmessungen [mm]					Lagertyp	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min		C _a dyn.	C _{0a} stat.	C _u	n _G
45	120	87	1,5	0,6	52411	180	360	13,3	2400
50	95	46	1	0,6	52212	62	140	5,2	3000
	110	64	1,1	0,6	52312	102	208	7,7	2200
	130	93	1,5	0,6	52412	200	400	14,8	2200
55	140	101	2	1	52413	216	450	16,7	2000
	100	47	1	0,6	52213	64	150	5,6	3600
	105	47	1	1	52214	65,5	160	5,9	3600
	115	65	1,1	0,6	52313	106	220	8,1	3000
	125	72	1,1	1	52314	137	300	11,1	2600
60	150	107	2	1	52414	236	500	18,29	2000
	110	47	1	1	52215	67	170	6,3	3400
	135	79	1,5	1	52315	163	360	13,3	2400
65	160	115	2	1	52415	250	560	19,78	1500
	115	48	1	1	52216	75	190	7	3400
	140	79	1,5	1	52316	160	360	13,17	2400
	170	120	2,1	1	52416-MP	270	620	21,18	1000
70	180	128	2,1	1,1	52417-MP	290	680	22,76	1000
	125	55	1	1	52217	98	250	9,3	3000
	150	87	1,5	1	52317	190	425	15,01	2200
75	190	135	2,1	1,1	52418-MP	305	750	24,36	2800
	135	62	1,1	1	52218	120	300	10,84	2800
	155	88	1,5	1	52318	196	465	16,06	2000

Anschlussmaße siehe Seite 806

*Abutment and fillet dimensions
see on page 806*

d	Abmessungen [mm] <i>Dimensions [mm]</i>		Gewicht [kg] <i>Weight [kg]</i>
	D ₁	B	[m]
45	57	20	4,52
50	62	10	1,21
	62	15	2,53
	62	21	5,72
55	68	23	7,18
	67	10	1,34
	72	10	1,47
	67	15	2,73
60	72	16	3,66
	73	24	8,76
	77	10	1,57
	77	18	4,8
65	78	26	10,8
	82	10	1,72
	82	18	4,94
70	83	27	12,7
	88	29	15,1
	88	12	2,39
	88	19	6,35
75	93	30	17,8
	93	14	3,22
	93	19	6,8

Axial-Rillenkugellager, zweiseitig wirkend
Thrust Ball Bearings, Double Direction



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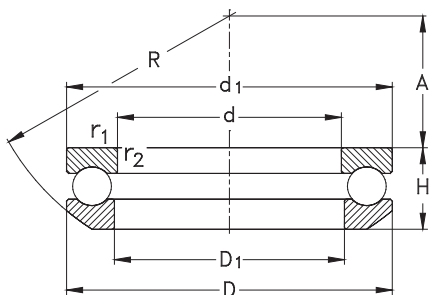
Hauptabmessungen [mm]					Lagertypen	Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]						Designation	Load ratings [kN]		
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min			C _a dyn.	C _{0a} stat.	C _u
80	210	150	3	1,1	52420-MP	365	965	29,68	2600
85	150	67	1,1	1	52220	122	320	10,93	2400
	170	97	1,5	1	52320	232	560	18,37	19000
95	160	67	1,1	1	52222	129	360	11,81	2400
	190	110	2	1	52322-MP	275	720	22,34	1700
100	170	68	1,1	1,1	52224-MP	140	400	12,75	2200
	210	123	2,1	1,1	52324-MP	325	915	27,22	1600
110	190	80	1,5	1,1	52226-MP	183	540	16,33	2000
	225	130	2,1	1,1	52326-MP	360	1060	30,33	1500
120	200	81	1,5	1,1	52228-MP	190	570	16,69	1900
	240	140	2,1	1,1	52328-MP	400	1220	33,68	1400
130	215	89	1,5	1,1	52230-MP	236	735	20,73	1800
140	225	90	1,5	1,1	52232-MP	245	780	21,38	1700
150	240	97	1,5	1,1	52234-MP	285	930	24,67	1600
160	270	109	2	2	52238-MP	335	980	24,75	1500
170	280	109	2	2	52240-MP	340	1020	25,19	1400
190	300	110	2	2	52244-MP	355	1120	26,5	1300

Anschlussmaße siehe Seite 806

*Abutment and fillet dimensions
see on page 806*

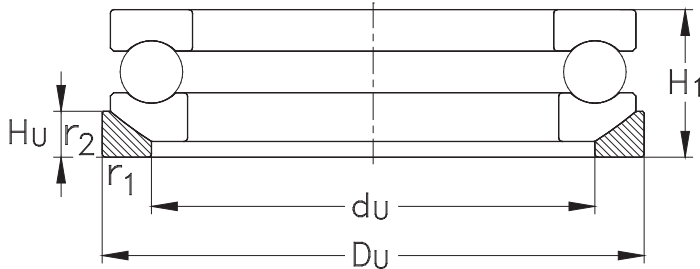
d	D ₁	Abmessungen [mm] <i>Dimensions [mm]</i>		Gewicht [kg] <i>Weight [kg]</i>
		B		[m]
80	103	33		23,8
85	103	15		4,21
	103	21		8,94
95	113	15		4,63
	113	24		13,9
100	123	15		5,23
	123	27		19,4
110	133	18		7,99
	134	30		23,4
120	143	18		8,66
	144	31		28,2
130	153	20		11,4
140	163	20		12,1
150	173	21		14,9
160	194	24		21,7
170	204	24		22,7
190	300	24		24,9

Axial-Rillenkugellager, einseitig wirkend mit kugeliger Gehäusescheibe
Thrust Ball Bearings, Single Direction, with Sphered Housing Washer



532/533/534

Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	Lager Bearing	Unterlagscheibe Seating washer	dyn. C _a	stat. C _{0a}	C _u	n _G
10	26	11,6	0,6	53200	U200	12,7	17	0,6	11500
12	28	11,4	0,6	53201	U201	13,2	19	0,7	11000
15	32	13,3	0,6	53202	U202	16,6	25	0,9	10000
17	35	13,2	0,6	53203	U203	17,3	27,5	1	9500
20	40	14,7	0,6	53204	U204	22,4	37,5	1,4	8000
25	47	16,7	0,6	53205	U205	28	50	1,9	7500
	52	19,8	1	53305	U305	34,5	55	2	5500
	60	26,4	1	53405	U405	56	90	3,3	4500
30	52	17,8	0,6	53206	U206	25,5	47,5	1,8	6700
	60	22,6	1	53306	U306	38	65,5	2,4	5300
	70	30,1	1	53406	U406	72	125	4,6	4000
35	62	19,9	1	53207	U207	35,5	67	2,5	5600
	68	25,6	1	53307	U307	50	88	3,3	4500
	80	34	1,1	53407	U407	86,5	156	5,8	4000
40	68	20,3	1	53208	U208	46,5	98	3,6	5300
	78	28,5	1	53308	U308	61	112	4,1	4300
	90	38,2	1,1	53408	U408	112	204	7,6	3400
45	73	21,3	1	53209	U209	39	80	3	5000
	85	30,1	1	53309	U309	75	140	5,2	4000
	100	42,4	1,1	53409	U409	129	245	9,1	3000
50	78	23,5	1	53210	U210	50	106	3,9	4500
	95	34,3	1,1	53310	U310	88	173	6,4	3600

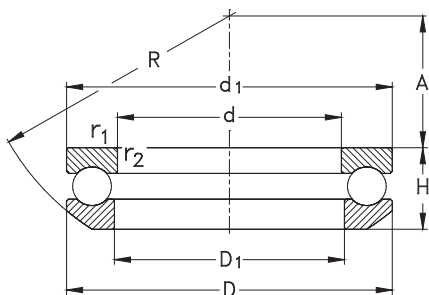


Anschlussmaße siehe Seite 805

Abutment and fillet dimensions
see on page 805

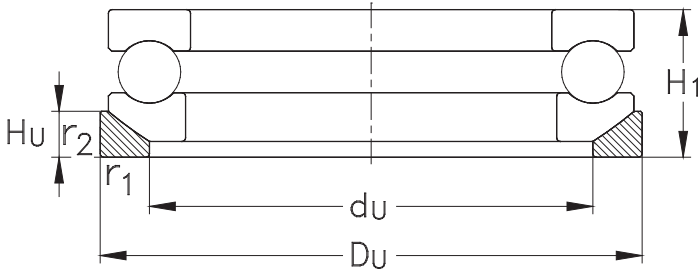
Abmessungen [mm] Dimensions [mm]									Gewicht [kg] Weight [kg]	
d	D ₁	d ₁	R	A	d _u	D _u	H _u	H ₁	Lager Bearing	Unterlagscheibe Seating washer
10	12	26	22	8,5	18	28	3,5	13	0,03	0,01
12	14	28	25	11,5	20	30	3,5	13	0,03	0,012
15	17	32	28	12	24	35	4	15	0,05	0,014
17	19	35	32	16	26	38	4	15	0,06	0,015
20	22	40	36	18	30	42	5	17	0,08	0,02
25	27	47	40	19	36	50	5,5	19	0,12	0,032
	27	52	45	21	38	55	6	22	0,18	0,044
	27	60	50	19	42	62	8	29	0,41	0,072
30	32	52	45	22	42	55	5,5	20	0,16	0,038
	32	60	50	22	45	62	7	25	0,27	0,056
	32	70	56	20	50	75	9	33	0,63	0,13
35	37	62	50	24	48	65	7	22	0,22	0,057
	37	68	56	24	52	72	7,5	28	0,38	0,084
	37	80	64	23	58	85	10	37	0,92	0,17
40	42	68	56	28,5	55	72	7	23	0,27	0,07
	42	78	64	28	60	82	8,5	31	0,55	0,12
	42	90	72	26	65	95	12	42	1,3	0,25
45	47	73	56	26	60	78	7,5	24	0,3	0,087
	47	85	64	25	65	90	10	33	0,66	0,17
	47	100	80	29	72	105	12,5	46	1,77	0,32
50	52	78	64	32,5	62	82	7,5	26	0,37	0,098
	52	95	72	28	72	100	11	37	0,97	0,23

Axial-Rillenkugellager, einseitig wirkend mit kugeligter Gehäusescheibe
Thrust Ball Bearings, Single Direction, with Sphered Housing Washer



532/533/534

Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	Lager Bearing	Unterlagscheibe Seating washer	dyn. C _a	stat. C _{0a}	C _u	n _G
50	110	45,6	1,5	53410	U410	156	310	11,5	2800
55	90	27,3	1	53211	U211	61	134	5	4000
	105	39,3	1,1	53311	U311	102	208	7,7	3200
	120	50,5	1,5	53411	U411	180	360	13,3	2400
60	95	28	1	53212	U212	62	140	5,2	3800
	110	38,3	1,1	53312	U312	102	208	7,7	3000
	130	54	1,5	53412-MP	U412	200	400	14,8	2200
65	100	28,7	1	53213	U213	64	150	5,6	3600
	115	39,4	1,1	53313	U313	106	220	8,1	3000
	140	60,2	2	53413-MP	U413	216	450	16,46	2000
70	105	28,8	1	53214	U214	65,5	160	5,9	3600
	125	44,2	1,1	53314	U314	137	300	11,1	2600
	150	63,6	2	53414-MP	U414	236	500	17,66	2000
75	110	28,3	1	53215	U215	67	170	6,3	3400
	135	48,1	1,5	53315	U315	163	360	13,01	2400
	160	69	2	53415-MP	U415	250	560	19,13	1800
80	115	29,5	1	53216	U216	75	190	7	3400
	140	47,6	1,5	53316	U316	160	360	12,71	2400
	170	72,2	2,1	53416-MP	U416	270	620	20,54	1700
85	125	33,1	1	53217	U217	98	250	9,04	3000
	150	53,1	1,5	53317	U317	190	425	14,52	2200
	180	77	2,1	53417	U417	290	680	21,88	1600

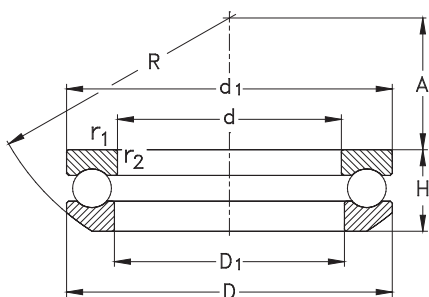


Anschlussmaße siehe Seite 805

*Abutment and fillet dimensions
see on page 805*

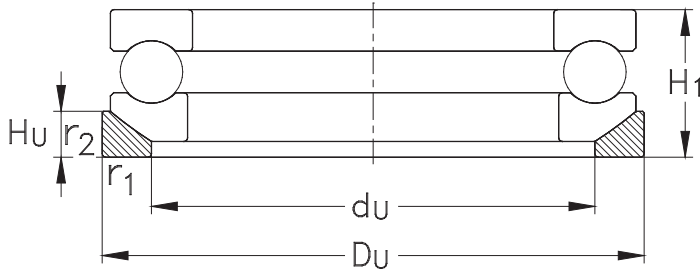
Abmessungen [mm] <i>Dimensions [mm]</i>									Gewicht [kg] <i>Weight [kg]</i>	
d	D ₁	d ₁	R	A	d _u	D _u	H _u	H ₁	Lager <i>Bearing</i>	Unterlagscheibe <i>Seating washer</i>
50	52	110	90	35	80	115	14	50	2,33	0,41
55	57	90	72	35	72	95	9	30	0,6	0,152
	57	105	80	30	80	110	11,5	42	1,38	0,28
	57	120	90	28	88	125	15,5	55	3,08	0,53
60	62	95	72	32,5	78	100	9	31	0,66	0,16
	62	110	90	41	85	115	11,5	42	1,41	0,31
	62	130	100	34	95	135	16	58	3,94	0,71
65	67	100	80	40	82	105	9	32	0,73	0,18
	67	115	90	38,5	90	120	12,5	43	1,53	0,34
	68	140	112	40	100	145	17,5	65	5,05	0,81
70	72	105	80	38	88	110	9	32	0,78	0,185
	72	125	100	43	98	130	13	48	2,1	0,41
	73	150	112	34	110	155	19,5	69	6,09	0,99
75	77	110	90	49	92	115	9,5	32	0,81	0,21
	77	135	100	37	105	140	15	52	2,67	0,55
	78	160	125	42	115	165	21	75	7,54	1,23
80	82	115	90	46	98	120	10	33	0,9	0,22
	82	140	112	50	110	145	15	52	2,77	0,57
	83	170	125	36	125	175	22	78	8,93	1,38
85	88	125	100	52	105	130	11	37	1,22	0,29
	88	150	112	43	115	155	17,5	58	3,53	0,81
	88	177	140	47	130	185	23	83	10,6	1,64

Axial-Rillenkugellager, einseitig wirkend mit kugeliger Gehäusescheibe
Thrust Ball Bearings, Single Direction, with Sphered Housing Washer



532/533/534

Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	Lager Bearing	Unterlagscheibe Seating washer	dyn. C _a	stat. C _{0a}	C _u	n _G
90	135	38,5	1,1	53218	U218	120	300	10,48	2800
	155	54,6	1,5	53318	U318	196	465	15,56	2200
	190	81,2	2,1	53418-MP	U418	305	750	23,48	1500
100	150	40,9	1,1	53220	U220	122	320	10,6	2400
	170	59,2	1,5	53320	U320	232	560	17,85	1900
	210	90	3	53420-MP	U420	365	965	28,71	1400
110	160	40,2	1,1	53222	U222	129	360	11,48	2400
	190	67,2	2	53322-MP	U322	275	720	21,77	1700
	230	99,7	3	53422-MP	U422	415	1140	32,38	1300
120	170	40,8	1,1	53224	U224	140	400	12,3	2200
	210	74,1	2,1	53324-MP	U324	325	915	26,38	1500
	250	107,3	4	53424-MP	U424	425	1220	33,22	1200
130	190	47,9	1,5	53226	U226	183	540	15,81	2000
	225	80,3	2,1	53326-MP	U326	360	1060	29,47	1300
	270	115,2	4	53426-MP	U426	520	1600	41,9	1100
140	200	48,6	1,5	53228	U228	190	570	16,19	1900
	240	84,9	2,1	53328	U328	400	1220	32,78	1200
150	215	53,3	1,5	53230	U230	236	735	20,15	1800
	250	83,7	2,1	53330	U330	405	1290	33,78	1100
160	225	54,7	1,5	53232	U232	245	780	20,82	1600
170	240	58,7	1,5	53234	U234	285	930	24,06	1400
180	250	58,2	1,5	53236	U236	290	1000	25,26	1200

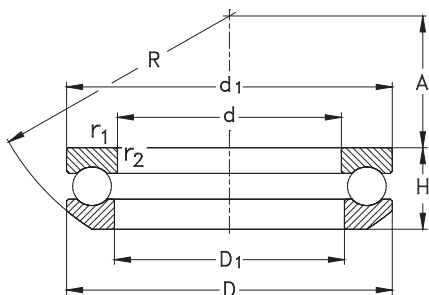


Anschlussmaße siehe Seite 805

*Abutment and fillet dimensions
see on page 805*

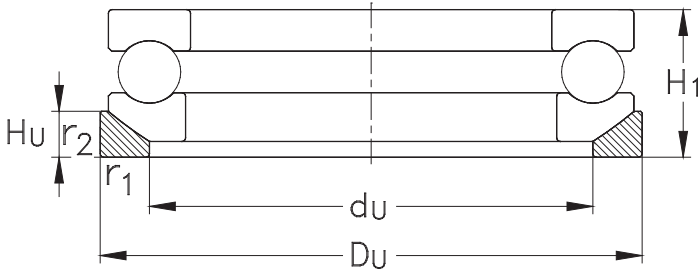
d	Abmessungen [mm] <i>Dimensions [mm]</i>							Gewicht [kg] <i>Weight [kg]</i>		
	D ₁	d ₁	R	A	d _u	D _u	H _u	H ₁	Lager <i>Bearing</i>	Unterlagscheibe <i>Seating washer</i>
90	93	135	100	45	110	140	13,5	42	1,7	0,42
	93	155	112	40	120	160	18	59	3,83	0,84
	93	187	140	40	140	195	25,5	88	12,3	1,9
100	103	150	112	52	125	155	14	45	2,22	0,5
	103	170	125	46	135	175	18	64	4,98	0,95
	103	205	160	50	155	220	27	98	16,4	2,9
110	113	160	125	65	135	165	14	45	2,37	0,56
	113	187	140	51	150	195	20,5	72	7,83	1,28
	113	225	180	59	170	240	29	109	22	3,7
120	123	170	125	61	145	175	15	46	2,57	0,65
	123	205	160	63	165	220	22	80	10,6	2
	123	245	200	70	185	260	32	118	28,1	4,7
130	133	187	140	67	160	195	17	53	3,93	0,9
	134	220	160	53	177	235	26	86	12,9	2,5
	134	265	200	58	200	280	38	128	34,6	6,4
140	143	197	160	87	170	210	17	55	4,27	1,22
	144	235	180	68	190	250	26	92	15,6	2,9
150	153	212	160	79	180	225	20,5	60	5,81	1,69
	154	245	200	89,5	200	260	26	92	16,1	3,1
160	163	222	160	74	190	235	21	61	6,44	1,81
170	173	237	180	91	200	250	21,5	65	7,91	2,14
180	183	245	200	112	210	260	21,5	66	8,19	1,06

Axial-Rillenkugellager, einseitig wirkend mit kugeliger Gehäusescheibe
Thrust Ball Bearings, Single Direction, with Sphered Housing Washer



532/533/534

Hauptabmessungen [mm]				Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]				Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	Lager Bearing	Unterlagscheibe Seating washer	dyn. C _a	stat. C _{0a}	C _u	n _G
190	270	65,7	2	53238	U238	335	1160	28,33	1000

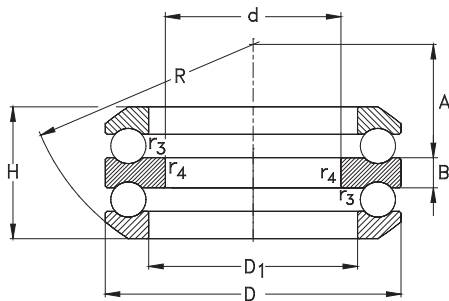


Anschlussmaße siehe Seite 805

*Abutment and fillet dimensions
see on page 805*

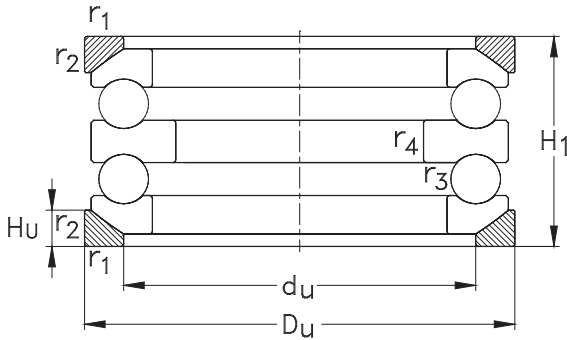
Abmessungen [mm] <i>Dimensions [mm]</i>									Gewicht [kg] <i>Weight [kg]</i>	
d	D ₁	d ₁	R	A	d _u	D _u	H _u	H ₁	Lager <i>Bearing</i>	Unterlagscheibe <i>Seating washer</i>
190	195	265	200	98	230	280	23	73	11,5	2,6

Axial-Rillenkugellager, zweiseitig wirkend mit kugeligen Gehäusescheiben
Thrust Ball Bearings, Double Direction, with Sphered Housing Washers



542/543/544

Hauptabmessungen [mm]					Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min	Lager Bearing	Unterlagscheibe Seating washer	C _a dyn.	C _{0a} stat.	C _u	n _G
10	32	24,6	0,6	0,3	54202	U202	16,6	25	0,9	9000
15	40	27,4	0,6	0,3	54204	U204	22,4	37,5	1,4	7500
	60	49,7	1	0,6	54405	U405	56	90	3,3	7000
20	47	31,4	0,6	0,3	54205	U205	28	50	1,9	6700
	52	37,6	1	0,3	54305	U305	34,5	55	2	5300
	70	56,2	1	0,6	54406	U406	72	125	4,6	5000
25	52	32,6	0,6	0,3	54206	U206	25,5	47,5	1,8	6300
	60	41,3	1	0,3	54306	U306	38	65,5	2,4	5300
	80	63,1	1,1	0,6	54407	U407	86,5	156	5,8	4500
30	62	37,8	1	0,3	54207	U207	35,5	67	2,5	5600
	68	38,6	1	0,6	54208	U208	46,5	98	3,6	5300
	68	47,2	1	0,3	54307	U307	50	88	3,3	4500
	78	54,1	1	0,6	54308	U308	61	112	4,1	4300
	90	69,5	1,1	0,6	54408	U408	112	204	7,6	4000
35	73	39,6	1	0,6	54209	U209	39	80	3	5000
	85	56,3	1	0,6	54309	U309	75	140	5,2	4000
	100	78,9	1,1	0,6	54409	U409	129	245	9,1	3000
40	78	42	1	0,6	54210	U210	50	106	3,9	4300
	95	64,7	1,1	0,6	54310	U310	88	173	6,4	3600
	110	83,2	1,5	0,6	54410	U410	156	310	11,5	2800
45	90	49,6	1	0,6	54211	U211	61	134	5	4000
	105	72,6	1,1	0,6	54311	U311	102	208	7,7	3500

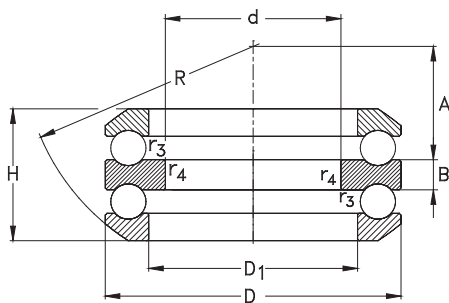


Anschlussmaße siehe Seite 807

Abutment and fillet dimensions
see on page 807

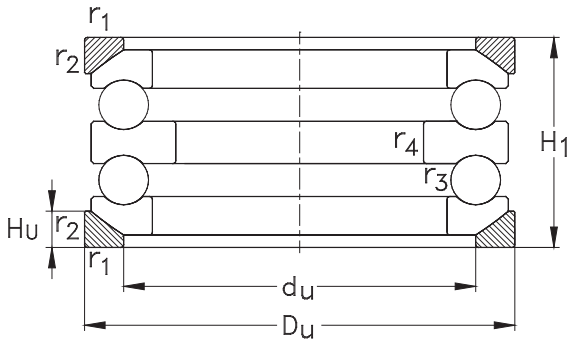
Abmessungen [mm] Dimensions [mm]									Gewicht [kg] Weight [kg]	
d	D ₁	B	R	A	d _u	D _u	H _u	H ₁	Lager Bearing	Unterlagscheibe Seating washer
10	17	5	28	10,5	24	35	4	28	0,09	0,01
15	22	6	36	16	30	42	5	32	0,15	0,02
	27	11	50	15	42	62	8	55	0,5	0,07
20	27	7	40	16,5	36	50	5,5	36	0,23	0,03
	27	8	45	18	38	55	6	42	0,32	0,04
	32	12	56	16	50	75	9	62	0,73	0,13
25	32	7	45	20	42	55	5,5	37	0,27	0,04
	32	9	50	19,5	45	62	7	46	0,47	0,06
	37	14	64	18,5	58	85	10	69	1,08	0,17
30	37	8	50	21	48	65	7	42	0,42	0,06
	42	9	56	25	55	72	7	44	0,56	0,07
	37	10	56	21	52	72	7,5	52	0,68	0,08
	42	12	64	23,5	60	82	8,5	59	1,06	0,12
	42	15	72	22	65	95	12	77	1,51	0,25
35	47	9	56	23	60	78	7,5	45	0,6	0,09
	47	12	64	21	65	90	10	62	1,24	0,17
	47	17	80	23,5	72	105	12,5	86	2,08	0,32
40	52	9	64	30,5	62	82	7,5	47	0,7	0,1
	52	14	72	23	72	100	11	70	1,83	0,23
	52	18	90	30	80	115	14	92	2,68	0,41
45	57	10	72	32,5	72	95	9	55	1,13	0,15
	57	15	80	25,5	80	110	11,5	78	2,54	0,28

Axial-Rillenkugellager, zweiseitig wirkend mit kugeligen Gehäusescheiben
Thrust Ball Bearings, Double Direction, with Sphered Housing Washers



542/543/544

Hauptabmessungen [mm]					Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min	Lager Bearing	Unterlagscheibe Seating washer	C _a dyn.	C _{0a} stat.	C _u	n _G
45	120	92	1,5	0,6	54411	U411	180	360	13,3	3200
50	95	50	1	0,6	54212	U212	62	140	5,2	3800
	110	70,7	1,1	0,6	54312-MP	U312	102	208	7,7	3200
	130	99	1,5	0,6	54412-MP	U412	200	400	14,8	3000
	140	109,4	2	1	54413-MP	U413	216	450	16,7	3000
55	100	50,4	1	0,6	54213-MP	U213	64	150	5,6	3000
	105	50,6	1	1	54214-MP	U214	65,5	160	5,9	3200
	115	71,9	1,1	0,6	54313-MP	U313	106	220	8,1	3000
	125	80,3	1,1	1	54314-MP	U314	137	300	11,1	2800
	150	114,1	2	1	54414-MP	U414	236	500	18,29	2800
60	110	49,6	1	1	54215-MP	U215	67	170	6,3	3400
	135	87,2	1,5	1	54315-MP	U315	163	360	13,3	2400
	160	123	2	1	54415-MP	U415	250	560	19,78	2400
65	115	51	1	1	54216-MP	U216	75	190	7	3400
	140	86,1	1,5	1	54316-MP	U316	160	360	13,17	2400
	170	128,5	2,1	1	54416-MP	U416	270	620	21,18	2400
	180	138	2,1	1,1	54417-MP	U417	290	680	22,76	2400
70	125	59,2	1	1	54217-MP	U217	98	250	9,3	2200
	150	95,2	1,5	1	54317-MP	U317	190	425	15,01	2200
	190	143,5	2,1	1,1	54418-MP	U418	305	750	24,36	2000
75	135	69	1,1	1	54218-MP	U218	120	300	10,84	2800
	155	97,1	1,5	1	54318-MP	U318	196	465	16,06	2000

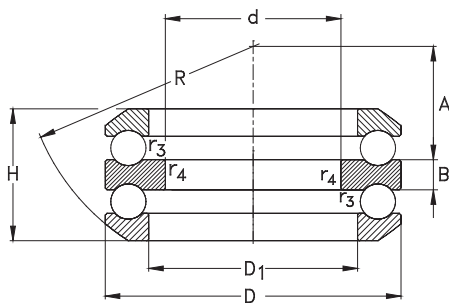


Anschlussmaße siehe Seite 807

Abutment and fillet dimensions
see on page 807

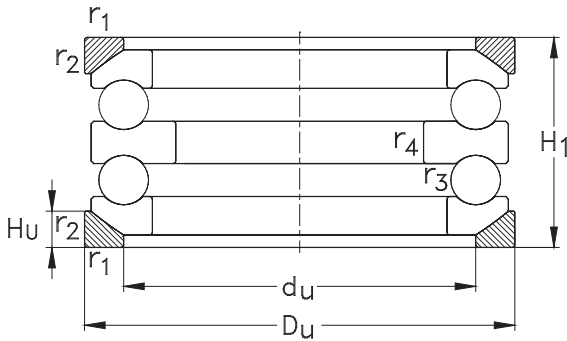
Abmessungen [mm] Dimensions [mm]									Gewicht [kg] Weight [kg]	
d	D ₁	B	R	A	d _u	D _u	H _u	H ₁	Lager Bearing	Unterlagscheibe Seating washer
45	57	20	90	22,5	88	125	15,5	101	3,49	0,53
50	62	10	72	30,5	78	100	9	56	1,22	0,16
	62	15	90	36,5	85	115	11,5	78	2,62	0,31
	62	21	100	28	95	135	16	107	4,41	0,71
55	68	23	112	34	100	145	17,5	119	5,67	0,81
	67	10	80	38,5	82	105	9	57	1,33	0,18
	72	10	80	36,5	88	110	9	57	1,47	0,19
	67	15	90	34,5	90	120	12,5	79	2,82	0,34
60	72	16	100	39	98	130	13	88	3,87	0,41
	73	24	112	28,5	110	155	19,5	125	6,77	0,99
	77	10	90	47,5	92	115	9,5	57	1,54	0,21
65	77	18	100	32,5	105	140	15	95	4,92	0,55
	78	26	125	36,5	115	165	21	135	8,33	1,23
	82	10	90	45	98	120	10	58	1,7	0,22
70	82	18	112	45,5	110	145	15	95	5,05	0,57
	83	27	125	30,5	125	175	22	140	9,76	1,38
	88	29	140	40,5	130	185	23	150	8,64	1,64
75	88	12	100	49,5	105	130	11	67	2,39	0,29
	88	19	112	39	115	155	17,5	105	6,36	0,81
	93	30	140	34,5	140	195	25,2	157	13,6	1,9
75	93	14	100	42	110	140	13,5	76	3,27	0,42
	93	19	112	36,5	120	160	18	106	6,86	0,84

Axial-Rillenkugellager, zweiseitig wirkend mit kugeligen Gehäusescheiben
Thrust Ball Bearings, Double Direction, with Sphered Housing Washers



542/543/544

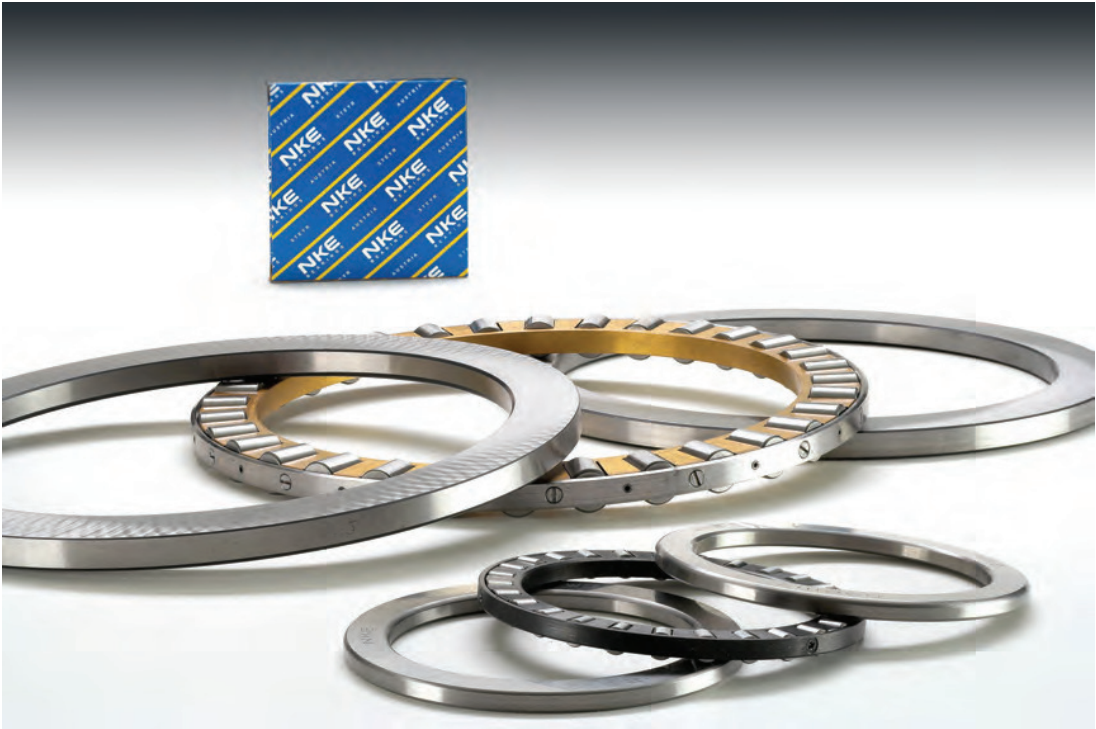
Hauptabmessungen [mm]					Bezeichnung		Tragzahlen			Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation		Load ratings [kN]			Limited speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	r ₃ , r ₄ min	Lager Bearing	Unterlagscheibe Seating washer	C _a dyn.	C _{0a} stat.	C _u	n _G
80	210	159,9	3	1,1	54420-MP	U420	365	965	29,68	1900
85	150	72,8	1,1	1	54220-MP	U220	122	320	10,93	2600
	170	105,4	1,5	1	54320-MP	U320	232	560	18,37	1900
95	160	71,4	1,1	1	54222-MP	U222	129	360	11,81	1700
	190	118,4	2	1	54322-MP	U322	275	720	22,34	1700
100	170	71,6	1,1	1,1	54224-MP	U224	140	400	12,75	1600
	210	131,2	2,1	1,1	54324-MP	U324	325	915	27,22	1600
110	190	85,8	1,5	1,1	54226-MP	U226	183	540	16,33	1500



Anschlussmaße siehe Seite 807

*Abutment and fillet dimensions
see on page 807*

d	Abmessungen [mm] <i>Dimensions [mm]</i>								Gewicht [kg] <i>Weight [kg]</i>	
	D ₁	B	R	A	d _u	D _u	H _u	H ₁	Lager <i>Bearing</i>	Unterlagscheibe <i>Seating washer</i>
80	103	33	160	43,5	155	220	27	176	18,2	2,9
85	103	15	112	49	125	155	14	81	4,23	0,5
	103	21	125	42	135	175	18	115	8,99	0,95
95	113	15	125	62	135	165	14	81	4,57	0,56
	113	24	140	55	150	195	20,5	128	12,1	1,28
100	123	15	125	58,5	145	175	15	82	5,05	0,65
	123	27	160	58	165	220	22	143	19,1	2
110	133	18	140	63	160	195	17	96	7,78	0,9



Axial-Zylinderrollenlager
Cylindrical Roller Thrust Bearings



Axial-Zylinderrollenlager

Normen, Hauptabmessungen

Maßpläne	DIN 616
Axial-Zylinderrollenlager	DIN 722

Allgemeines

Axial-Zylinderrollenlager der Reihen 811 und 812 sind einseitig wirkende, zerlegbare Axiallager.

Axial-Zylinderrollenlager sind stoßunempfindlich und haben eine wesentlich höhere Tragfähigkeit als Axial-Rillenkugellager. Sie nehmen sehr hohe axiale Kräfte, aber keine Radiallasten auf. Daher ergeben sie sehr starre, axial hochbelastbare Lagerungen bei geringer Baubreite.

Axial-Zylinderrollenlager (siehe Abbildung auf der nächsten Seite) bestehen aus zwei Ebenen, bordlosen Scheiben, einer Wellenscheibe (WS) und einer Gehäusescheibe (GS) und einem dazwischen laufenden Rollenkranz (K).

Bei allen Axial-Zylinderrollenlagern tritt im Betrieb an den Enden der Zylinderrollen verstärkt Gleitreibung auf.

Daher werden die NKE Axial-Zylinderrollenlager mit größerer Querschnittsbreite mit mehreren kurzen Zylinderrollen je Käfigtasche anstatt einer längeren ausgeführt.

Aufgrund dieser kinematischen Besonderheiten eignen sich Axial-Zylinderrollenlager für eher geringe Drehzahlen.

Zur Sicherstellung einer optimalen Funktion ist eine Mindest-Axialbelastung erforderlich.

Cylindrical Roller Thrust Bearings

Standards, Boundary Dimensions

Standard plans	DIN 616
Cylindrical roller thrust bearings	DIN 722

General

Cylindrical roller thrust bearings series 811 and 812 are single direction acting, separable axial bearings.

Cylindrical roller thrust bearings are insensitive to shock loading and feature much higher load carrying capacity compared to thrust ball bearings. They accommodate very high axial loads but no radial forces. They provide a very rigid bearing assembly for high thrust loading with less space requirement.

Cylindrical roller thrust bearings are of simple design, they consist of a shaft washer (WS), a housing washer (GS), and a cylindrical roller and cage thrust assembly (K), see Fig. 1.

With all cylindrical roller thrust bearings, increased sliding friction can occur at the end of the cylindrical rollers.

In order to minimise this negative effect, NKE cylindrical roller thrust bearings with wider sectional widths are produced using several short rollers in each cage pocket instead of using individual longer rollers.

Due to their specific kinematic behaviour, cylindrical roller thrust bearings are only suitable for low speed applications only.

Furthermore, they require minimum axial loads for their optimum function.

Bauformen

NKE Axial-Zylinderrollenlager werden standardmäßig nur in einseitig wirkender Ausführung gefertigt, siehe Abb. 1a.

Für zweiseitig wirkende Lagerungen lassen sich die entsprechenden Komponenten einseitig wirkender Axial-Zylinderrollenlager mit Zwischenscheiben ZS kombinieren, siehe Abb. 1b.

Zwischenscheiben gehören zum NKE Bedarfsprogramm und sind auf Anfrage lieferbar.

Bei beengten Platzverhältnissen können Rollenkränze von Axial-Zylinderrollenlagern auch ohne Lagerscheiben verwendet werden, sofern die Stirnflächen der Anschlusssteile als Laufbahnen ausgeführt, d. h. gehärtet und geschliffen werden.

Da Komponenten von Axial-Zylinderrollenlagern häufig auch separat verwendet werden, beispielsweise für Axial-Nadelkränze, sind die einzelnen Bestandteile auch separat erhältlich.

Design Variants

NKE cylindrical roller thrust bearings are produced in single direction design only as standard (see Fig. 1a).

Double direction acting cylindrical roller thrust bearings are built using a combination of components from single direction acting cylindrical roller thrust bearings together with intermediate washers ZS (see Fig. 1b).

Such intermediate washers are part of NKE supplementary product range and are available on request.

For application designs with space restrictions the cylindrical roller and cage thrust assemblies may be used without washers providing the contact faces of adjacent machine parts are machined as bearing raceways, (e.g. hardened and ground, etc).

The components of cylindrical roller thrust bearings are frequently used either separately or in conjunction with other components in several applications (e.g. to build needle roller thrust assemblies) therefore, they are available as loose parts.

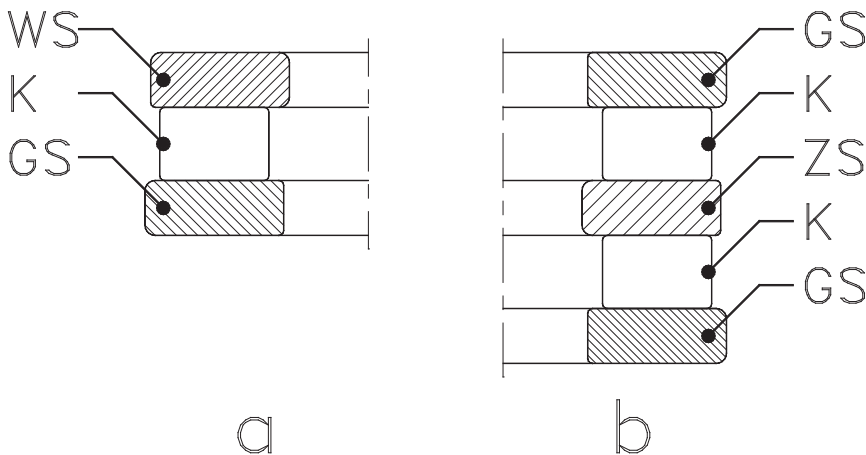


Abb. 1
Fig. 1

Schiefstellung

Axial-Zylinderrollenlager vertragen grundsätzlich keine Schiefstellungen.

Die Anlageflächen von Wellen- und Gehäuse-scheiben müssen dazu parallel sein.

Käfige

Kleinere NKE Axial-Zylinderrollenlager werden standardmäßig mit wellengeführten Polyamid-Massivkäfigen gefertigt. Polyamidkäfige eignen sich für Betriebstemperaturen bis **+120°C**.

Größere Axial-Zylinderrollenlager werden entweder mit Messing-Massivkäfigen (Nachsetzzeichen **MB**) oder auch mit Stahl-Massivkäfigen, Nachsetzzeichen **FB**, produziert.

Toleranzen

Axial-Zylinderrollenlager werden standardmäßig in Normaltoleranz (**PN**) gefertigt. Auf Anfrage können diese auch mit eingeeengten Toleranzen in den Toleranzklassen **P6** und **P5** gefertigt werden.

Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 64.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Axial-Zylinderrollenlager muss die Mindestaxialbelastung 5% der dynamischen Tragzahl betragen.

Misalignment

All cylindrical roller thrust bearing types do not allow any misalignment.

The contacting surfaces of both shaft and housing seats must be parallel.

Cages

Small NKE cylindrical roller thrust bearings are fitted with shaft-centred polyamide cages as standard.

Polyamide cages are suitable for operating temperatures up to **+120°C (+248°F)**.

Large cylindrical roller thrust bearings are produced with either solid brass cages (suffix **MB**), or with solid steel cages (suffix **FB**).

Tolerances

Cylindrical roller thrust bearings are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**,

Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data /Tolerances**” page 249.

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE cylindrical roller thrust bearings the minimum axial load must be 5% of the dynamic load rating.

Dynamisch äquivalente Lagerbelastung

Axial-Zylinderrollenlager sind reine Axiallager und können keine Radialkräfte aufnehmen.

daher gilt:

$$P = F_a$$

Äquivalente statische Lagerbelastung

Für Axial-Zylinderrollenlager gilt:

$$P_0 = F_a$$

Gestaltung der Anschlusssteile

Bei einer Verwendung von **Axial-Rollenkränzen** ohne Laufscheiben müssen die Anschlusssteile der Umgebungsstruktur in geeigneter Weise ausgeführt, d.h. gehärtet und geschliffen sein.

Entsprechende Informationen dazu finden Sie im Kapitel „**Gestaltung der Lagerstelle**“, ab Seite **97**.

Der maximal zulässige **Axialschlag**, der als Laufbahnen ausgeführten Anschlusssteile, muss den Werten der Lagerscheiben entsprechen.

Die Bohrungsdurchmesser der **NKE Axial-Rollenkränze** haben eine Toleranz nach **E11**, die Toleranz des Außendurchmessers der Rollenkränze liegt im Toleranzfeld **a13**.

Bei höheren Drehzahlen ist auf eine ausreichende Führung des Rollenkranzes zu achten.

Zur Vermeidung übermäßigen Verschleißes sind die Führungsflächen dabei zu schleifen.

Equivalent Dynamic Bearing Load

Cylindrical roller thrust bearings are pure axial bearings; they are not able to accommodate any radial loads, therefore:

$$P = F_a$$

Equivalent Static Bearing Load

For cylindrical roller thrust bearings:

$$P_0 = F_a$$

Design of Adjacent Machine Parts

When **cylindrical roller and cage thrust assemblies** are used without washers, adjacent machine parts must be designed and machined as bearing raceways (e.g. hardened and ground etc).

The maximum permissible axial runout of the adjacent surfaces acting as raceway must also meet the requirements of the respective washers.

For detailed information see chapter “**Design of bearing location**”, page **282**.

The bore diameters of **NKE cylindrical roller and cage thrust assemblies** have tolerances according to ISO Tolerance field (**E11**), whilst the tolerance of their outer diameters lies in the tolerance field **a13**.

Cylindrical roller and cage thrust assemblies require an effective guidance when operating at higher speeds.

To avoid excessive wear at higher speeds, the guiding surfaces must be ground.

Lagersitze bei Axial-Zylinderrollenlager

Bei der Gestaltung von Lagersitzen für Axial-Zylinderrollenlager haben sich folgende Passungen bewährt:

Bearing Seats for Cylindrical Roller Thrust Bearings

For the design of cylindrical roller thrust bearing seats the following of tolerance fields have proven to be satisfactory in practice:

	Toleranzfeld / Tolerance field		
	bei Zentrierung Centred at	Welle Shaft	Gehäuse Housing
Axial-Zylinderrollenkranz <i>Cylindrical roller and cage thrust assembly</i>		h8	--
Wellenscheibe <i>Shaft washer</i>		h8	--
Gehäusescheibe <i>Housing washer</i>		--	H9

Anschlussmaße für Axial-Zylinderrollenlager

Bei Axial-Zylinderrollenlagern müssen die Anschlusssteile so ausgeführt sein, dass die Wellen- und Gehäusescheiben auf der gesamten Laufbahnbreite unterstützt werden.

Dabei dürfen die Radien der Kantenverrundung der Laufscheiben jedoch nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anschlussstellen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerscheiben (siehe Zeichnung bei Tabelle auf der Folgeseite).

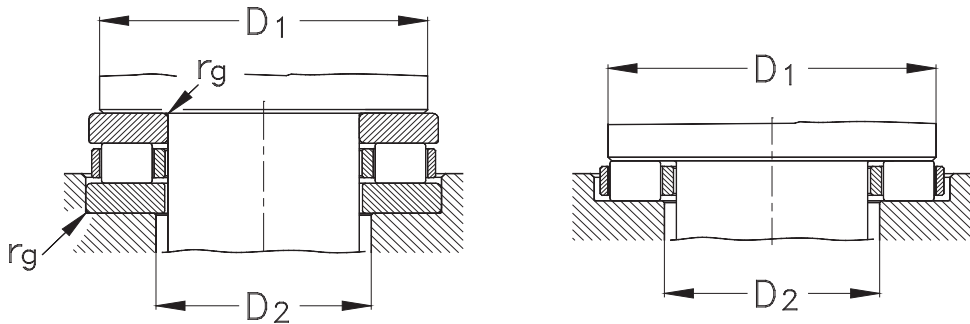
Abutment and Fillet Dimensions for Cylindrical Roller Thrust Bearings

In the case of cylindrical roller thrust bearings, an effective support of the bearing washers over the total width of their raceways by adjacent machine parts is necessary.

The bearing washer must contact adjacent parts with their side face only. The fillet radii of bearing corners must not touch the shoulder fillet radii of the shaft or housing shoulders.

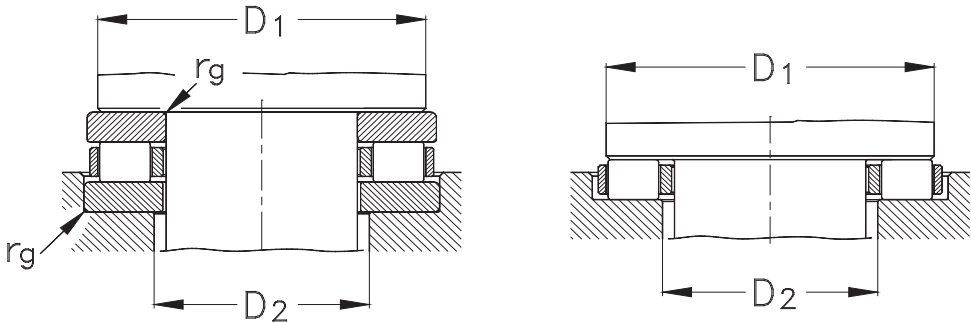
Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the following tables.

Anschlussmaße für Axial-Zylinderrollenlager, Reihen 811 und 812 [mm]
Abutment and Fillet Dimensions for Cylindrical Roller Thrust Bearings, Series 811 and 812 [mm]



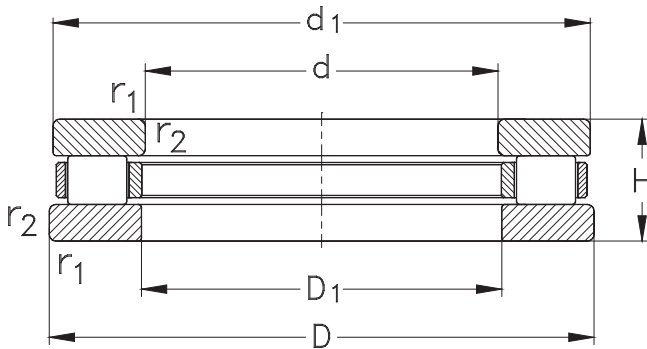
Welle Shaft $\varnothing d$ [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing series					
		D_1 min	811 D_2 max	r_g max	812 D_1 min	D_2 max	r_g max
15	02	25	18	0,3	--	--	--
17	03	27	20	0,3	--	--	--
20	04	32	23	0,3	--	--	--
25	05	39	28	0,6	--	--	--
30	06	44	33	0,6	49	33	0,6
35	07	49	38	0,6	56	41	1
40	08	56	44	0,6	63	45	1
45	09	61	49	0,6	68	50	1
50	10	66	54	0,6	73	55	1
55	11	73	60	0,6	84	61	1
60	12	80	65	1	89	66	1
65	13	85	70	1	94	71	1
70	14	90	75	1	99	76	1
75	15	95	80	1	104	81	1
80	16	100	85	1	109	86	1
85	17	105	90	1	117	93	1
90	18	114	96	1	127	98	1
100	20	129	106	1	140	110	1
110	22	139	116	1	150	120	1
120	24	149	126	1	160	130	1
130	26	162	138	1	179	141	1,5
140	28	172	148	1	189	151	1,5
150	30	182	158	1	204	161	1,5

Anschlussmaße für Axial-Zylinderrollenlager, Reihen 811 und 812 [mm]
Abutment and Fillet dimensions for Cylindrical Roller Thrust Bearings, Series 811 and 812 [mm]

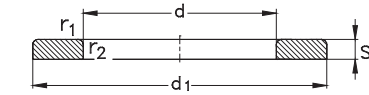


Welle Shaft $\varnothing d$ [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing series					
		811			812		
		D_1 min	D_2 max	r_g max	D_1 min	D_2 max	r_g max
160	32	192	168	1	214	171	1,5
170	34	207	178	1	227	183	1,5
180	36	217	188	1	237	193	1,5
190	38	230	200	1	256	204	2
200	40	240	210	1	266	214	2
220	44	260	230	1	286	234	2
240	48	288	252	1,5	322	258	2,1
260	52	308	272	1,5	342	278	2,1
280	56	337	293	1,5	362	298	2,1
300	60	365	315	2	398	322	2,5
320	64	385	335	2	418	342	2,5
340	68	405	355	2	438	362	2,5
360	72	425	375	2	475	385	3
380	76	445	395	2	495	405	3
400	80	465	415	2	515	425	3
420	84	485	435	2	552	448	4
440	88	522	458	2,1	572	468	4
460	92	542	478	2,1	592	488	4
480	96	562	498	2,1	621	509	4
500	/500	582	518	2,1	641	529	4
530	/530	619	551	2,5	680	560	4
560	/560	649	581	2,5	715	595	4
600	/600	689	621	2,5	764	636	4

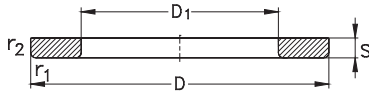
Axial-Zylinderrollenlager
Cylindrical Roller Thrust Bearings



Hauptabmessungen [mm]				Lagertypen	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min			C _a dyn.	C _{0a} stat.	C _u	n _{gr}
30	47	11	0,6	81106-TVPB	26,56	77	8,7	3100	6000
	52	16	0,6	81206-TVPB	47,01	124	16,97	2700	4800
35	52	12	0,6	81107-TVPB	26,6	94	12,59	2600	5600
	62	18	1	81207-TVPB	52	149	19,36	2600	4000
40	60	13	0,6	81108-TVPB	40,42	127	16,37	2300	5000
	68	19	1	81208-TVPB	70	196	24,75	2200	3800
45	65	14	0,6	81109-TVPB	43,31	143	17,9	2100	4500
	73	20	1	81209-TVPB	73	214	26,29	2000	3600
50	70	14	0,6	81110-TVPB	45,87	158	19,37	1900	4300
	78	22	1	81210-TVPB	80	149	29,93	2400	3400
55	78	16	0,6	81111-TVPB	48,15	174	20,66	1900	3800
	90	25	1	81211-TVPB	105	319	36,91	1700	2800
60	85	17	1	81112-TVPB	67	235	27,17	1600	3600
	95	26	1	81212-TVPB	116	373	42,21	1500	2800
65	90	18	1	81113-TVPB	72	260	29,44	1500	3400
	100	27	1	81213-TVPB	120	399	44,39	1400	2600
70	95	18	1	81114-TVPB	73	272	30,26	1400	3200
	105	27	1	81214-TVPB	126	426	46,52	1300	2600
75	100	19	1	81115-TVPB	78	297	32,44	1300	3200
	110	27	1	81215-TVPB	130	453	48,61	1200	2400
80	105	19	1	81116-TVPB	80	322	34,56	1200	3000
	115	28	1	81216-TVPB	133	479	51	1100	2400



WS 8...



GS 8...



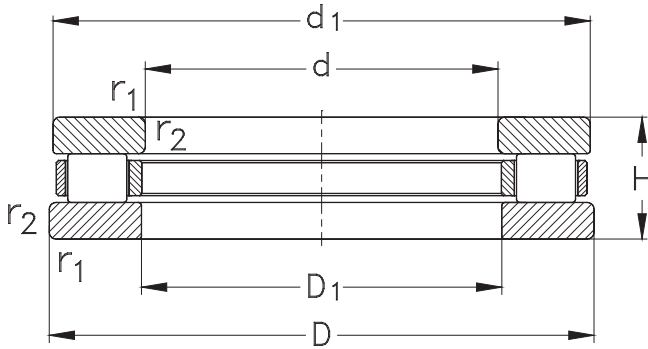
K 8...

Anschlussmaße siehe Seite 847

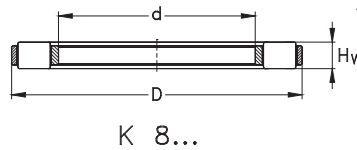
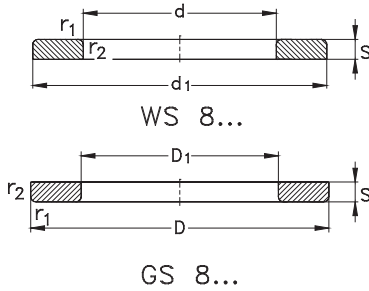
Abutment and fillet dimensions
see on page 847

Abmessungen [mm] Dimensions [mm]				Bezeichnung der Lagerteile Designation of bearing components			Gewicht [kg] Weight [kg]
d	d ₁	D ₁	S	Rollensatz Cylindrical roller and cage thrust assembly	Wellenscheibe Shaft washer	Gehäusescheibe Housing washer	m
30	47	32	3	K 81106-TVPB	WS 81106	GS 81106	0,06
	52	32	4,25	K 81206-TVPB	WS 81206	GS 81206	0,13
35	52	37	3,5	K 81107-TVPB	WS 81107	GS 81107	0,08
	62	37	5,25	K 81207-TVPB	WS 81207	GS 81207	0,23
40	60	42	3,5	K 81108-TVPB	WS 81108	GS 81108	0,12
	68	42	5	K 81208-TVPB	WS 81208	GS 81208	0,27
45	65	47	4	K 81109-TVPB	WS 81109	GS 81109	0,14
	73	47	5,5	K 81209-TVPB	WS 81209	GS 81209	0,31
50	70	52	4	K 81110-TVPB	WS 81110	GS 81110	0,16
	78	52	6,5	K 81210-TVPB	WS 81210	GS 81210	0,38
55	78	57	5	K 81111-TVPB	WS 81111	GS 81111	0,23
	90	57	7	K 81211-TVPB	WS 81211	GS 81211	0,6
60	85	62	4,75	K 81112-TVPB	WS 81112	GS 81112	0,28
	95	62	7,5	K 81212-TVPB	WS 81212	GS 81212	0,74
65	90	67	5,25	K 81113-TVPB	WS 81113	GS 81113	0,33
	100	67	8	K 81213-TVPB	WS 81213	GS 81213	0,82
70	95	72	5,25	K 81114-TVPB	WS 81114	GS 81114	0,36
	105	72	8	K 81214-TVPB	WS 81214	GS 81214	0,87
75	100	77	5,75	K 81115-TVPB	WS 81115	GS 81115	0,43
	110	77	8	K 81215-TVPB	WS 81215	GS 81215	0,92
80	105	82	5,75	K 81116-TVPB	WS 81116	GS 81116	0,46
	115	82	8,5	K 81216-TVPB	WS 81216	GS 81216	1,02

Axial-Zylinderrollenlager
Cylindrical Roller Thrust Bearings



Hauptabmessungen [mm]				Lagertypen	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min			C _a dyn.	C _{0a} stat.	C _u	n _{gr}
85	110	19	1	81117-TVPB	83	334	35,33	1100	3000
	125	31	1	81217-TVPB	150	539	56	1200	2200
90	120	22	1	81118-TVPB	109	428	44,23	1100	2600
	135	35	1,1	81218-TVPB	194	690	70	1000	2000
100	135	25	1	81120-TVPB	148	586	59	1000	2400
	150	38	1,1	81220-TVPB	231	842	83	1000	1800
110	145	25	1	81122-TVPB	158	639	62	890	2200
	160	38	1,1	81222-TVPB	236	891	85	900	1700
120	155	25	1	81124-TVPB	163	692	66	820	2200
	170	39	1,1	81224-TVPB	250	990	93	820	1600
130	170	30	1	81126-TVPB	192	824	77	790	1900
	190	45	1,5	81226-TVPB	358	1350	123	720	1400
140	180	31	1	81128-TVPB	203	888	81	720	1800
	200	46	1,5	81228-MB	360	1400	129	690	1400
150	190	31	1	81130-TVPB	207	950	85	670	1700
	215	50	1,5	81230-MB	465	1900	170	580	1300
160	200	31	1	81132-TVPB	217	1014	89	630	1700
	225	51	1,5	81232-MB	480	2000	176	550	1200
170	215	34	1,1	81134-TVPB	269	1250	108	590	1600
	240	55	1,5	81234-MB	540	2280	200	520	1100
180	225	34	1,1	81136-MB	270	1270	110	560	1500
	250	56	1,5	81236-MB	550	2400	204	490	1100

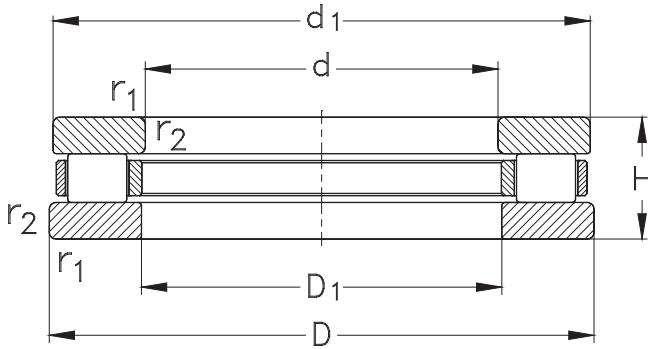


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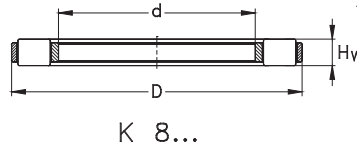
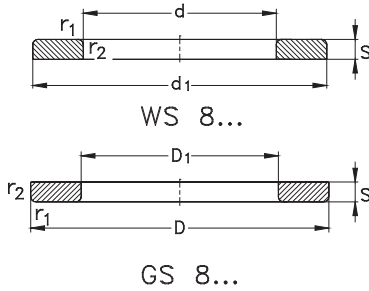
Abutment and fillet dimensions
see on page 847

Abmessungen [mm] <i>Dimensions [mm]</i>				Bezeichnung der Lagerteile <i>Designation of bearing components</i>			Gewicht [kg] <i>Weight [kg]</i>
d	d ₁	D ₁	S	Rollensatz <i>Cylindrical roller and cage thrust assembly</i>	Wellenscheibe <i>Shaft washer</i>	Gehäusescheibe <i>Housing washer</i>	m
85	110	87	5,75	K 81117-TVPB	WS 81117	GS 81117	0,48
	125	88	9,5	K 81217-TVPB	WS 81217	GS 81217	1,36
90	120	92	6,5	K 81118-TVPB	WS 81118	GS 81118	0,72
	135	93	10,5	K 81218-TVPB	WS 81218	GS 81218	1,85
100	135	102	7	K 81120-TVPB	WS 81120	GS 81120	1,07
	150	103	11,5	K 81220-TVPB	WS 81220	GS 81220	2,45
110	145	112	7	K 81122-MB	WS 81122	GS 81122	1,12
	160	113	11,5	K 81222-MB	WS 81222	GS 81222	2,7
120	155	122	7	K 81124-MB	WS 81124	GS 81124	1,25
	170	123	12	K 81224-MB	WS 81224	GS 81224	2,98
130	170	132	9	K 81126-MB	WS 81126	GS 81126	1,72
	187	133	13	K 81226-MB	WS 81226	GS 81226	4,37
140	178	142	9,5	K 81128-MB	WS 81128	GS 81128	2,02
	197	143	13,5	K 81228-MB	WS 81228	GS 81228	4,76
150	188	152	9,5	K 81130-MB	WS 81130	GS 81130	2,15
	212	153	14,5	K 81230-MB	WS 81230	GS 81230	6,04
160	198	162	9,5	K 81132-MB	WS 81132	GS 81132	2,28
	222	163	15	K 81232-MB	WS 81232	GS 81232	6,52
170	213	172	10	K 81134-MB	WS 81134	GS 81134	3,01
	237	173	16,5	K 81234-MB	WS 81234	GS 81234	8,12
180	222	183	10	K 81136-MB	WS 81136	GS 81136	3,07
	247	183	17	K 81236-MB	WS 81236	GS 81236	8,69

Axial-Zylinderrollenlager
Cylindrical Roller Thrust Bearings



Hauptabmessungen [mm]				Lagertypen	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min		C _a dyn.	C _{0a} stat.	C _u	n _{gr}	n _G
190	240	37	1,1	81138-MB	310	1460	125	550	1400
	270	62	2	81238-MB	695	2900	250	460	1000
200	250	37	1,1	81140-MB	310	1500	127	530	1400
	280	62	2	81240-MB	720	3100	255	430	1000
220	270	37	1,1	81144-MB	335	1700	137	470	1300
	300	63	2	81244-MB	750	3350	275	390	950
240	300	45	1,5	81148-MB	475	2450	196	410	1100
	340	78	2,1	81248-MB	1100	4900	390	330	800
260	320	45	1,5	81152-MB	490	2600	200	380	1100
	360	79	2,1	81252-MB	1140	5300	415	300	750
280	350	53	1,5	81156-MB	680	3550	275	330	950
	380	80	2,1	81256-MB	1160	5500	425	280	750
300	380	62	2	81160-MB	850	4400	335	290	850
	420	95	3	81260-MB	1530	7200	540	250	630
360	440	65	2	81172-MB	900	4900	355	250	750
	500	110	4	81272-MB	2160	10400	750	200	500
380	460	65	2	81176-MB	930	5300	375	230	750
	520	112	4	81276-MB	2000	9500	471	210	450



Anschlussmaße siehe Seite 847

Abutment and fillet dimensions
see on page 847

Abmessungen [mm] Dimensions [mm]				Bezeichnung der Lagerteile Designation of bearing components			Gewicht [kg] Weight [kg]
d	d ₁	D ₁	S	Rollensatz Cylindrical roller and cage thrust assembly	Wellenscheibe Shaft washer	Gehäusescheibe Housing washer	m
190	237	193	11	K 81138-MB	WS 81138	GS 81138	3,99
	267	194	18	K 81238-MB	WS 81238	GS 81238	11,7
200	247	203	11	K 81140-MB	WS 81140	GS 81140	4,17
	277	204	18	K 81240-MB	WS 81240	GS 81240	12,2
220	267	223	11	K 81144-MB	WS 81144	GS 81144	4,65
	297	224	18,5	K 81244-MB	WS 81244	GS 81244	13,4
240	297	243	13,5	K 81148-MB	WS 81148	GS 81148	7,43
	335	244	23	K 81248-MB	WS 81248	GS 81248	23,1
260	317	263	13,5	K 81152-MB	WS 81152	GS 81152	7,99
	355	264	23,5	K 81252-MB	WS 81252	GS 81252	25,1
280	347	283	15,5	K 81156-MB	WS 81156	GS 81156	12
	375	284	24	K 81256-MB	WS 81256	GS 81256	27,1
300	376	304	18,5	K 81160-MB	WS 81160	GS 81160	17,2
	415	304	28,5	K 81260-MB	WS 81260	GS 81260	42,5
360	436	364	20	K 81172-MB	WS 81172	GS 81172	21,4
	495	365	32,5	K 81272-MB	WS 81272	GS 81272	68,7
380	456	384	20	K 81176-MB	WS 81176	GS 81176	22,4
	515	385	33,5	K 81276-MB	WS 81276	GS 81276	73,3



Axial-Pendelrollenlager
Spherical Roller Thrust Bearings



Axial-Pendelrollenlager

Normen, Hauptabmessungen

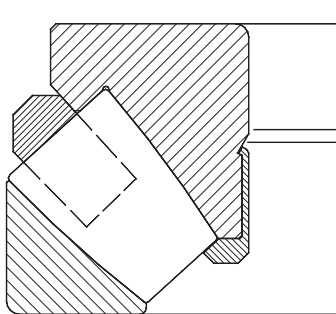
Axial-Pendelrollenlager DIN 728

Allgemeines

Axial-Pendelrollenlager sind einseitig wirkende, zerlegbare Axiallager.

Durch die Tonnenrollen, die in der hohlkugeligen Laufbahn der Gehäusescheibe laufen, sind Axial-Pendelrollenlager winkeleinstellbar. Dadurch sind diese Lager unempfindlich gegen Fluchtungsfehler und gleichen Wellendurchbiegungen sehr gut aus.

Axial-Pendelrollenlager übertragen die wirkenden Kräfte in einem Winkel zur Mittelachse und können daher neben hohen axialen Belastungen auch Radialkräfte aufnehmen, wobei allerdings die wirkende Radialkraftkomponente nicht größer als etwa **55%** der **Axialbelastung** sein darf.



M/EM

Spherical Roller Thrust Bearings

Standards, Boundary Dimensions

Spherical roller thrust bearings DIN 728

General

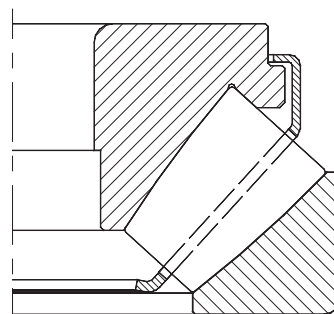
Spherical roller thrust bearings are separable single direction acting axial bearings (see sketch below).

Spherical roller thrust bearings are self-aligning as their spherical rollers run on the spheroid raceways of shaft and housing washers.

Therefore they are well able to accommodate errors of misalignment and some shaft bending in an optimum way.

Spherical roller thrust bearings transmit forces via a contact angle towards the centre axis. Thus, they are able to accommodate some radial forces along with high axial loads.

But, it must be considered that the acting radial forces must not exceed approximately **55%** of the applied axial forces.



- E (J)

Toleranzen

NKE Axial-Pendelrollenlager werden standardmäßig in Normaltoleranz (**PN**) gefertigt.

Auf Anfrage kann auch mit eingengter Toleranz, wie der Toleranzklasse **P6** gefertigt werden. Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „Lagerdaten / Toleranzen“, Seite 52.

Schiefstellung

Axial-Pendelrollenlager sind zum Ausgleich von Schiefstellungen optimal geeignet.

Die Größe der maximal zulässigen Verkippung um die Mittelachse Ψ hängt dabei sowohl von der jeweiligen Lagerreihe als auch von der Belastung des Lagers ab.

Unter **normalen** Betriebsbedingungen (bei rotierender Wellenscheibe und konstanter Schiefstellung) können folgende Richtwerte angenommen werden:

Maximal zulässige Schiefstellung bei NKE Axial-Pendelrollenlagern Maximum Permissible Misalignment for NKE Spherical Roller Thrust Bearings

Lagerreihe Bearing series	Maximal zulässige Schiefstellung Ψ Maximum permissible misalignment Ψ	
	bei if	$P(P_0) \leq 0,05 \cdot C_{0a}$
292 / 292 E		1,5°
293 / 293 E		2,5°
294 / 294 E		3°

Tolerances

NKE spherical roller thrust bearings are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, **P6**. Detailed tolerance values are listed in the tables shown in the chapter “**Bearing Data / Tolerances**” page 237.

Misalignment

Spherical roller thrust bearings are optimum to compensate for misalignments.

The permissible amount of misalignment from the centre position (Ψ), however, is dependant on both the bearing series and the applied loading.

Under **normal** operating conditions, such as a rotating shaft washer and permanent misalignment, the following values may be assumed:

Käfige

Kleinere und mittelgroße NKE Axial-Pendelrollenlager werden sowohl mit Messing-Massivkäfigen (**MB**), als auch mit Stahlblech-Käfigen (**J**) gefertigt.

Größere Axial-Pendelrollenlager werden nur mit Messing-Massivkäfigen (Nachsetzzeichen **MB**) produziert. Eine abweichende Käfigausführung ist möglich.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

Für NKE Axial-Pendelrollenlager muss die Mindestaxialbelastung **5%** der dynamischen Tragzahl betragen.

Äquivalente dynamische Lagerbelastung

Für dynamisch belastete Axial-Pendelrollenlager gilt, sofern $F_r \leq 0,55 * F_a$:

$$P = F_a + 1,2 * F_r$$

Äquivalente statische Lagerbelastung

Für statisch belastete Axial-Pendelrollenlager gilt, sofern $F_r \leq 0,55 * F_a$:

$$P_0 = F_a + 2,7 * F_r$$

Cages

Small and medium-size NKE spherical roller thrust bearings are available with either solid brass cages (suffix **MB**) or pressed steel cages (suffix **J**).

Large spherical roller thrust bearings are produced with solid brass cages (suffix **MB**) as standard. Other cages variants are possible.

Minimum Load:

Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE spherical roller thrust bearings the minimum axial load must be **5%** of the dynamic load rating.

Equivalent Dynamic Bearing Load

For spherical roller thrust bearings, when $F_r \leq 0,55 * F_a$:

$$P = F_a + 1,2 * F_r$$

Equivalent static bearing load

For spherical roller thrust bearings, when $F_r \leq 0,55 * F_a$:

$$P_0 = F_a + 2,7 * F_r$$

Achtung:

Bei Axial-Pendelrollenlagern muss die statische Tragsicherheit S_0 höher als bei anderen Lagerbauformen sein.

(Die **statische Tragsicherheit S_0** repräsentiert das Verhältnis von der tatsächlich auf ein Lager wirkender statischer Belastung zu dessen jeweiliger statischer Tragzahl).

allgemein gilt:
$$S_0 = \frac{C_{0a}}{P_0}$$

wobei

- S_0 = statische Tragsicherheit
- C_{0a} = statische Tragzahl [kN]
- P_0 = maximale statische Belastung [kN]

Für Axial-Pendelrollenlager gilt:

- bei Ausführung der Anschlusssteile gemäß den Empfehlungen auf der Folgeseite

$$S_{0min} \geq 8$$

- bei **voller axialer Unterstützung** der Wellen- und Gehäusescheiben über deren gesamte Breite sowie bei zusätzlicher radialer Unterstützung der Gehäusescheibe :

$$S_{0min} \geq 4$$

Please note:

In the case of spherical roller thrust bearings, the static carrying safety S_0 must be higher than other rolling bearing types for reasons of strength.

(The **static carrying safety S_0** indicates the ratio of the actual static load acting on the bearing compared to its static load rating, C_0).

general formula:
$$S_0 = \frac{C_{0a}}{P_0}$$

where

- S_0 = static carrying safety
- C_{0a} = static load rating [kN]
- P_0 = maximum static load [kN]

For spherical roller thrust bearings:

- if the adjacent parts are designed according to the recommendations on following pages:

$$S_{0min} \geq 8$$

- if both the housing and shaft washers have **full axial support** over their total width and the housing washer has satisfactory radial support, then:

$$S_{0min} \geq 4$$

Schmierung

Axial-Pendelrollenlager sollten vorzugsweise mit Öl geschmiert werden.

Fettschmierung sollte lediglich bei geringen Belastungen und niedrigen Drehzahlen verwendet werden, wobei besonders auf eine ausreichende Versorgung der Berührflächen zwischen Rollen und dem Führungsbord mit Schmierstoff zu achten ist. Auf eine regelmäßige Nachschmierung ist besonders zu achten.

Anschlussmaße

Die Anschlusssteile müssen so ausgeführt sein, dass sowohl die Wellen- als auch die Gehäuse-scheiben der Axialpendelrollenlager ausreichend unterstützt werden.

Dabei dürfen die Radien der Kantenverrundung der Laufscheiben jedoch nicht an den Hohlkehlen von Wellenbund oder Gehäuse anliegen.

Daher muss der größte Hohlkehlradius an den Anschlusssteilen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerscheiben (siehe Zeichnung bei Tabelle auf der Folgeseite).

Damit bei größeren Schiefstellungen ein Berühren der Rollen am Gehäuse vermieden wird, muss die Gehäusebohrung entsprechend den empfohlenen Abmessungen ausgeführt werden.

Lubrication

Oil lubrication is preferred for spherical roller thrust bearings.

Grease lubrication is adequate only for applications where low loads and low speeds occur.

Particular attention must be paid to ensure a sufficient grease supply to the contacting areas between the roller ends and guide flange. Frequent re-lubrication is necessary.

Abutment and Fillet Dimensions

In the case of spherical roller thrust bearings, an effective support of both bearing washers is necessary.

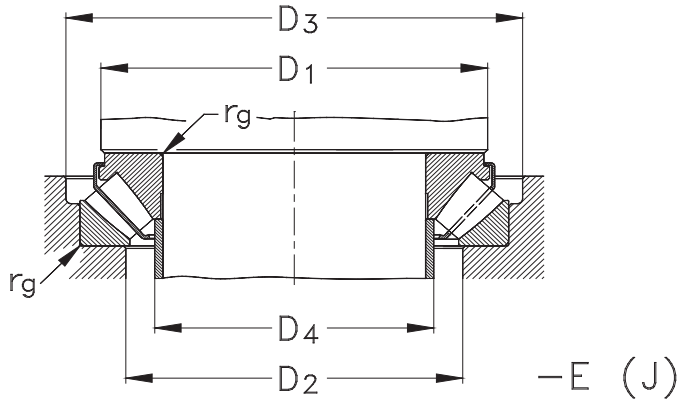
The bearing washer must contact adjacent parts with their face sides only.

The fillet radii of bearing corners must not touch the shoulder fillet radii of the shaft or the housing shoulders.

Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the bearing rings (r_s) as listed in the bearing tables (please see the following pages).

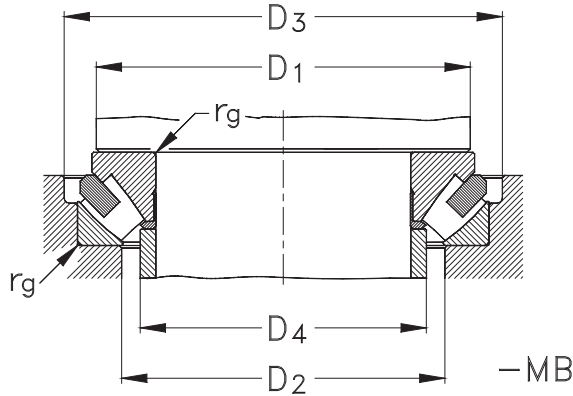
To avoid any contact between rollers and the housing with high misalignments, the housing bore must be designed according to the recommendations listed in the tables on the following pages.

Anschlussmaße für Axial-Pendelrollenlager [mm] Abutment and Fillet Dimensions for Spherical Roller Thrust Bearings [mm]



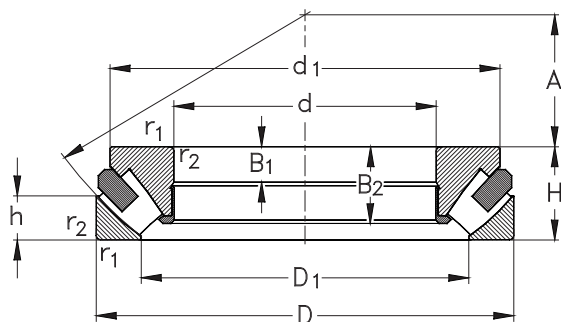
Welle Shaft Ød [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing series														
		292 / 292E					293 / 293E					294 / 294E				
		D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max	D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max	D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max
60	12	--	--	--	--	--	--	--	--	--	90	107	133	70	1,5	
65	13	--	--	--	--	--	--	--	--	--	100	115	143	73	2	
70	14	--	--	--	--	--	--	--	--	--	105	124	153	80	2	
75	15	--	--	--	--	--	--	--	--	--	115	132	163	86	2	
80	16	--	--	--	--	--	--	--	--	--	120	141	173	91	2,1	
85	17	--	--	--	--	--	115	129	153	93	1,5	130	150	183	97	2,1
90	18	--	--	--	--	--	118	135	163	99	1,5	135	158	193	103	2,1
100	20	--	--	--	--	--	132	148	173	109	1,5	150	175	214	112	2,5
110	22	--	--	--	--	--	145	165	193	119	2	165	192	234	125	2,5
120	24	--	--	--	--	--	160	182	213	132	2,1	180	210	254	135	3
130	26	--	--	--	--	--	170	195	228	141	2,1	195	227	275	151	3
140	28	--	--	--	--	--	185	208	244	152	2,1	205	237	285	158	3
150	30	--	--	--	--	--	195	220	254	163	2,1	220	253	306	171	3
160	32	--	--	--	--	--	210	236	274	174	2,5	230	271	326	181	4
170	34	--	--	--	--	--	220	247	284	184	2,5	245	288	346	191	4
180	36	--	--	--	--	--	235	263	304	193	2,5	260	305	366	202	4
190	38	--	--	--	--	--	250	281	325	206	3	275	322	386	214	4
200	40	235	258	284	211	2	265	298	348	215	3	290	338	406	225	4
220	44	260	277	304	229	2	285	316	368	235	3	310	360	428	243	5
240	48	285	311	344	251	2,1	300	337	390	256	3	330	381	448	265	5
260	52	305	331	365	272	2,1	330	372	430	277	4	360	419	488	291	5
280	56	325	351	385	291	2,1	350	394	450	298	4	390	446	530	310	5

Anschlussmaße für Axial-Pendelrollenlager [mm]
Abutment and Fillet Dimensions for Spherical Roller Thrust Bearings [mm]



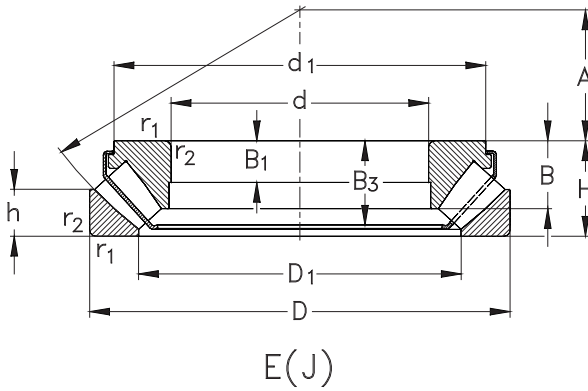
Welle Shaft Ød [mm]	Bohrungs kennzahl Bore reference number	Lagerreihe / Bearing series														
		292 / 292E					293 / 293E					294 / 294E				
		D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max	D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max	D ₁ min	D ₂ max	D ₃ min	D ₄ max	r _g max
300	60	355	386	426	317	2,5	380	429	490	320	4	410	471	550	326	5
320	64	375	406	450	336	2,5	400	449	510	340	4	435	507	590	354	6
340	68	395	427	470	353	2,5	430	484	550	364	4	465	541	630	373	6
360	72	420	461	510	380	3	450	504	572	384	4	485	560	650	391	6
380	76	440	480	530	395	3	480	538	612	404	5	510	587	682	415	6
400	80	460	500	550	415	3	500	557	634	424	5	540	622	722	441	6
420	84	490	534	590	437	4	525	585	664	447	5	560	643	742	455	6
440	88	510	554	610	458	4	548	614	695	470	5	595	684	794	486	8
460	92	530	575	632	477	4	575	638	726	487	5	615	704	815	502	8
480	96	555	603	662	508	4	593	660	746	507	5	645	744	865	521	8
500	/500	575	622	682	527	4	615	683	768	532	5	670	765	886	542	8
530	/530	611	661	722	560	4	650	724	818	561	6	700	810	937	573	8
560	/560	645	697	762	586	4	691	770	868	595	6	750	860	997	606	10
600	/600	690	744	814	633	4	735	815	920	633	6	800	900	1055	653	10
630	/630	730	789	864	657	5	839	856	970	665	8	840	960	1115	681	10
670	/670	775	836	915	710	5	819	906	1020	706	8	880	1015	1175	729	12
710	/710	820	882	966	743	5	869	962	1082	752	8	925	1073	1250	768	12
750	/750	863	930	1017	798	5	915	1015	1142	795	8	--	--	--	--	--
800	/800	918	987	1078	837	6	970	1070	1202	842	8	--	--	--	--	--
850	/850	973	1043	1138	881	6	1028	1137	1273	896	10	--	--	--	--	--
900	/900	1025	1101	1198	933	6	1090	1203	1343	947	10	--	--	--	--	--

Axial-Pendelrollenlager
Spherical Roller Thrust Bearings



M/EM

Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	-M	C _a dyn.	C _{0a} stat.	C _u	n _{gr}	n _G
60	130	42	1,5	29412-M	287	809	99	2900	5000
	130	42	1,5	29412-EJ	382	1004	122	2700	5000
65	140	45	2	29413-M	340	973	118	2700	4800
	140	45	2	29413-EJ	434	1155	140	2600	4800
70	150	48	2	29414-M	371	1070	127	2600	4300
	150	48	2	29414-EJ	464	1268	150	2500	4300
75	160	51	2	29415-M	429	1250	145	2500	4000
	160	51	2	29415-EJ	524	1465	170	2300	4000
80	170	54	2,1	29416-M	464	1370	156	2400	3800
	170	54	2,1	29416-EJ	570	1430	163	2300	3800
85	180	58	2,1	29417-M	527	1570	176	2200	3600
	180	58	2	29417-EJ	692	1745	218	2100	3600
90	190	60	2,1	29418-M	578	1780	196	2100	3400
100	210	67	3	29420-M	705	2170	232	2000	3000
110	190	48	2	29322-M	442	1420	153	2000	3200
	190	48	2	29322-EJ	570	1760	190	1800	3200
	230	73	3	29422-M	817	2600	270	1800	2800
120	210	54	2,1	29324-M	560	1830	192	1800	2800
	250	78	4	29424-M	934	3000	304	1700	2600
130	225	58	2,1	29326-M	628	2070	213	1700	2600
	225	58	2,1	29326-EJ	765	2950	303	1400	2600
	270	85	4	29426-M	1090	3540	351	1500	2400

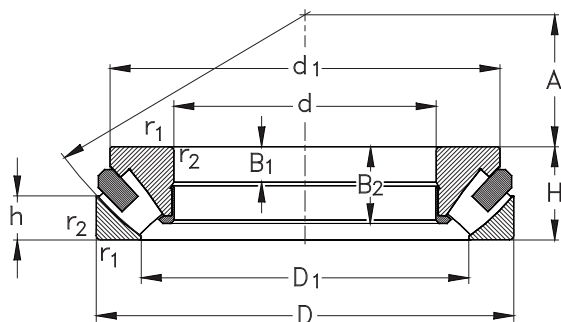


Anschlussmaße siehe Seite 863-864

Abutment and fillet dimensions
see on page 863-864

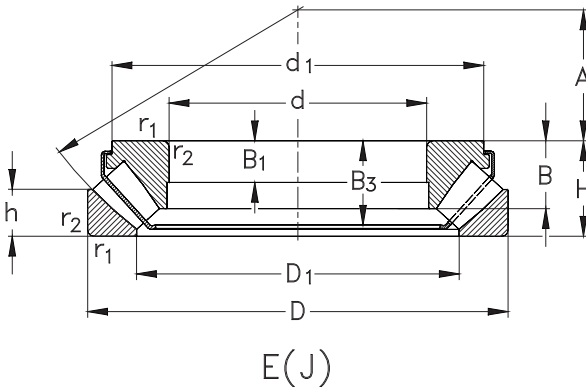
d	Abmessungen [mm] Dimensions [mm]							A	Gewicht [kg] Weight [kg]
	D ₁	d ₁	h	B	B ₁	B ₂	B ₃		
60	88	118	20	28	15	39,5	35,5	38	2,60
	87	118	20	27	27	--	37	38	2,47
65	96,5	128	21	30	16	42,5	38	42	3,30
	93	128	21	29,5	16	--	39	42	3,26
70	102	137	23	32	17	45,5	42	44	4,00
	101	137	23	31	17	--	42,5	44	3,98
75	109	146	24	34,5	18	48	44,5	47	4,90
	108	146	24	33,5	18	--	47	47	4,9
80	116	155	24	36	19	51	46,5	50	5,80
	116	155	24	36	19	--	46,5	50	5,8
85	125	164	28	38	21	55	49	54	6,90
	123	164	28	37	21	--	50	54	6,67
90	130	174	29	--	22	57	--	56	8,1
100	144,5	193	32	--	24	64	--	62	11,8
110	143	176	23	--	16	45,5	--	64	5,5
	143	176	23	--	16	--	42	64	5,4
	160	212	35	--	26	69	--	69	14,5
120	157,5	194	26	--	18	51	--	70	7,6
	172	229	37	--	29	74	--	74	18,1
130	170	205	28	37	19	55	50,5	76	9,3
	165,7	201,5	30,1	--	21	--	49,6	76	9,08
	188	247	41	55,5	31	81	72	81	22,5

Axial-Pendelrollenlager
Spherical Roller Thrust Bearings



M/EM

Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	-M	C _a dyn.	C _{0a} stat.	C _u	n _{gr}	n _G
130	270	85	4	29426-EJ	1395	4300	426	1400	2400
140	240	60	2,1	29328-M	675	2310	232	1600	2600
	280	85	4	29428-M	1130	3750	366	1500	2400
150	250	60	2,1	29330-M	697	2430	241	1500	2400
	300	90	4	29430-M	1280	4270	408	1400	2200
160	270	67	3	29332-M	807	2810	272	1400	2200
	320	95	5	29432-M	1460	4810	451	1300	2000
170	280	67	3	29334-M	835	2950	282	1300	2200
	340	103	5	29434-M	1620	5380	495	1200	1900
180	300	73	3	29336-M	984	3530	331	1300	2000
	360	109	5	29436-M	1800	6010	544	1200	1800
190	320	78	4	29338-M	1120	4010	369	1300	1900
	380	115	5	29438-M	1960	6610	589	1100	1700
200	340	85	4	29340-M	1300	4740	429	1200	1700
	340	85	4	29340-EJ	1620	5480	496	1000	1700
	400	122	5	29440-M	2210	7510	659	1000	1600
220	360	85	4	29344-M	1340	4970	440	1100	1700
	420	122	6	29444-M	2260	7970	686	1000	1500
240	340	60	2,1	29248-M	770	3450	306	1200	1800
	380	85	4	29348-M	1340	5190	541	1000	1600
	440	122	6	29448-M	2340	8420	711	900	1500
260	360	60	2,1	29252-M	801	3650	317	1100	1700

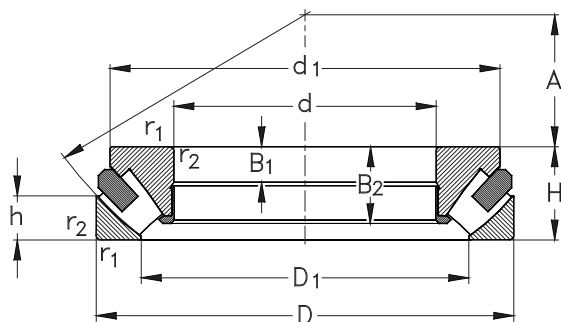


Anschlussmaße siehe Seite 863-864

Abutment and fillet dimensions
see on page 863-864

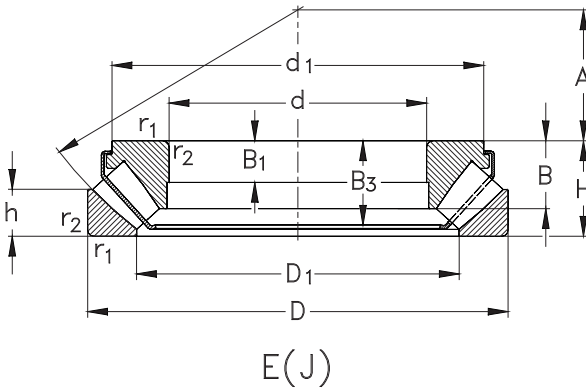
Abmessungen [mm] Dimensions [mm]									Gewicht [kg] Weight [kg]
d	D ₁	d ₁	h	B	B ₁	B ₂	B ₃	A	
130	188	245	41	--	31	--	74	81	21,6
140	183	219	29	--	20	57	--	82	11
	197,5	257	41	--	31	81	--	86	24,2
150	193	229	29	--	20	57	--	87	11,5
	211,5	276	44	--	32	86	--	92	29,4
160	207	248	32	--	23	64	--	92	15,2
	226	306	45	--	34	91	--	99	35,5
170	215	258	32	--	23	64	--	96	16
	240	324	50	--	37	99	--	104	43,7
180	231	277	35	--	25	69	--	103	20,3
	255	342	52	--	39	105	--	110	52
190	246	308	38	--	27	74	--	110	24,8
	270	360	55	--	41	110	--	117	60
200	261	325	41	--	29	81	--	116	30,8
	253,6	302,8	40	--	29	--	73	116	28,9
	284	380	59	--	43	117	--	122	69
220	280	345	41	--	29	81	--	125	32,8
	305	400	58	--	43	117	--	132	74
240	283	330	30	--	19	57	--	130	16,7
	300	365	41	--	29	81	--	135	35,3
	321	420	59	--	43	117	--	142	79
260	302	350	30	--	19	57	--	139	18,5

Axial-Pendelrollenlager
Spherical Roller Thrust Bearings



M/EM

Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	-M	C _a dyn.	C _{0a} stat.	C _u	n _{gr}	n _G
260	420	95	5	29352-M	1780	6820	576	930	1400
	480	132	6	29452-M	2730	9870	813	840	1300
280	380	60	2,1	29256-M	847	3950	337	1000	1700
	440	95	5	29356-M	1780	7100	590	860	1400
	520	145	6	29456-M	3230	11840	953	750	1200
300	420	73	3	29260-M	1030	4670	338	1000	1400
	480	109	5	29360-M	2180	8500	689	800	1200
	540	145	6	29460-M	3220	11850	940	730	1200
320	440	73	3	29264-M	1070	4930	403	930	1400
	500	109	5	29364-M	2180	8850	707	760	1200
	580	155	7,5	29464-M	3890	14690	1141	650	1100
340	540	122	5	29368-M	2460	10550	825	710	1100
	620	170	7,5	29468-M	4350	16410	1250	620	1000
360	500	85	4	29272-M	1400	6600	520	830	1200
	560	122	5	29372-M	2650	11030	851	670	1100
380	520	85	4	29276-M	1550	7510	583	760	1100
	670	175	7,5	29476-EM	4700	19100	1416	540	900
400	540	85	4	29280-M	1600	7900	606	720	1100
	620	132	6	29380-M	3290	14120	1056	580	950
420	650	140	6	29384-M	3410	14700	1084	570	900
	730	185	7,5	29484-EM	6850	31020	2238	400	850
440	680	145	6	29388-M	3860	16850	1226	520	850

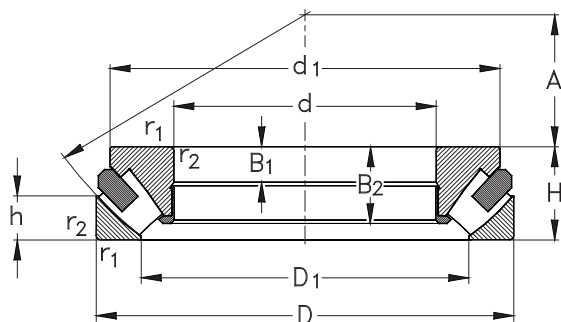


Anschlussmaße siehe Seite 863-864

Abutment and fillet dimensions
see on page 863-864

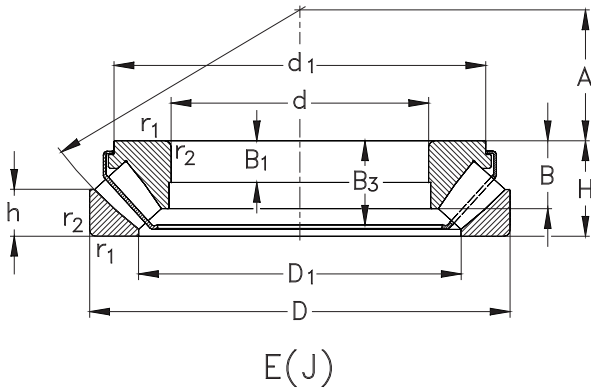
Abmessungen [mm] Dimensions [mm]									Gewicht [kg] Weight [kg]
d	D ₁	d ₁	h	B	B ₁	B ₂	B ₃	A	
260	325	405	45	--	32	91	--	148	48,5
	346	460	64	--	48	127	--	154	105
280	323	370	30	--	19	57	--	150	19,5
	345	423	46	--	32	91	--	158	52,5
	380	495	68	--	52	140	--	166	132
300	355	405	38	--	21	69	--	172	30,5
	375	460	50	--	37	105	--	168	74
	398	515	70	--	52	140	--	175	140
320	375	430	38	--	21	69	--	172	32,9
	395	482	53	--	37	105	--	180	77
	430	555	75	--	55	149	--	191	175
340	424	520	59	--	41	117	--	192	103
	452	590	82	--	61	164	--	201	218
360	420	485	44	--	25	81	--	194	51,8
	444	540	59	--	41	117	--	202	107
380	440	505	42	--	27	81	--	202	52,8
	510	640	85	--	63	168	--	222	254
400	460	526	42	--	27	81	--	212	55,3
	494	596	64	--	44	127	--	225	150
420	520	626	68	--	48	135	--	235	170
	546	700	89	--	67	178	--	244	323
440	546	655	70	--	49	140	--	245	190

Axial-Pendelrollenlager
Spherical Roller Thrust Bearings



M/EM

Hauptabmessungen [mm]				Bezeichnung	Tragzahlen			Referenzdrehzahlen [min ⁻¹]	Grenzdrehzahlen [min ⁻¹]
Boundary dimensions [mm]					Designation	Load ratings [kN]			Thermal speed ratings [rpm]
d	D	H	r ₁ , r ₂ min	-M	C _a dyn.	C _{0a} stat.	C _u	n _{gr}	n _G
440	780	206	9,5	29488-M	6280	24650	1747	480	750
500	670	103	5	292/500-M	2400	12120	870	570	900
	750	150	6	293/500-M	4220	18660	1313	470	800
530	800	160	7,5	293/530-M	5130	22730	1570	430	750
630	850	132	6	292/630-M	4250	22500	1505	420	670
670	900	140	6	292/670-EM	5489	24740	1757	400	630
710	950	145	6	292/710-M	5300	28000	1279	370	600
750	1000	150	6	292/750-EM	6046	31623	2173	340	560
800	1060	155	7,5	292/800-EM	6624	35260	2380	320	530
850	1120	160	7,5	292/850-EM	6875	36799	2441	310	500



Anschlussmaße siehe Seite 863-864

*Abutment and fillet dimensions
see on page 863-864*

d	Abmessungen [mm] <i>Dimensions [mm]</i>							A	Gewicht [kg] <i>Weight [kg]</i>
	D ₁	d ₁	h	B	B ₁	B ₂	B ₃		
440	576	745	100	--	74	199	--	260	407
500	574	654	55	--	33	99	--	268	101
	611	725	74	--	51	144	--	280	220
530	648	772	76	--	54	154	--	295	286
630	724	820	67	--	42	127	--	338	211
670	773	880	74	--	45	135	--	364	257
710	815	930	75	--	46	140	--	380	294
750	861	967	81	--	48	144	--	406	329
800	915	1035	149	--	50	149	--	426	384
850	966	1095	154	--	51	154	--	453	434



Laufrollen
Cam Rollers

Laufrollen, zweireihig
Cam Rollers, Double Row



Laufrollen

Normen, Hauptabmessungen

Maßpläne DIN 616

Allgemeines:

Laufrollen sind nicht zerlegbare Radiallager und stellen Sonderbauformen der Radial-Rillenkugellager bzw. der zweireihigen Schrägkugellager dar.

Sie laufen üblicherweise direkt auf einer Führungsschiene oder einer dazu ausgeführten Lauffläche und weisen dazu einen besonders dickwandig ausgeführten Außenring auf.

Durch ihren dickwandigen Außenring können Laufrollen bei einem direkten Abrollen des Außenringes auf einer Gegenfläche hohe radiale Kräfte, aber auch stoßartige Belastungen übertragen.

Da Laufrollen öfters Verkantungen ausgesetzt werden, werden sie bevorzugt auch mit einem balligen Außendurchmesser eingesetzt.

Laufrollen werden zumeist außerhalb einer Maschine verwendet und laufen häufig unter sehr rauen Betriebsbedingungen, wie etwa unter staubiger Umgebung usw.

Daher sind sie serienmäßig mit berührenden Dichtungen ausgestattet, einige Typen zweireihiger Laufrollen sind aber auch mit Deckscheiben erhältlich.

Bauformen

Laufrollen sind in mehreren Ausführungen verfügbar. Die wichtigsten Bauformen sind in den Abbildungen auf den folgenden Seiten dargestellt.

Cam Rollers

Standards, Boundary Dimensions

Standard plans DIN 616

General:

Cam rollers are non-separable radial bearings. They are special variants of either radial deep groove ball bearings or double row angular contact ball bearings.

Cam rollers run either directly on a guide track or against a surface that has been machined for a guidance.

To achieve this cam rollers feature an extra thick-walled outer ring this enables cam rollers to accept high radial forces, including shock loads.

As cam rollers often run misaligned they are generally used with crowned outer ring surfaces.

Cam rollers normally run outside the machine compartment, under extreme operating conditions, in the presence of heavy contaminations (i.e. dust and dirt, etc.).

For this reason, cam rollers are produced and fitted with contacting seals.

Some types of the double row cam rollers are also available with shields.

Design Variants

Cam rollers are readily available in several design variants. For the most common designs see drawings on following pages.

Einreihige Laufrollen (nur auf Anfrage)

NKE Laufrollen der schmalen Baureihen (Baureihen **3612..** bzw **3612..-R**) basieren hinsichtlich deren Innenaufbauten auf den bewährten abgedichteten einreihigen Rillenkugellagern der Ausführung **-2RSR**.

NKE Laufrollen der Baureihen **3612..** bzw **3612..-R** sind serienmäßig mit berührenden Dichtungen der Ausführung **-2RSR** ausgestattet, die auch unter rauen Einsatzbedingungen eine gute Abdichtung der Lager gegen ein Eindringen von Verunreinigungen sicherstellt.

Die schmalen NKE Laufrollen der Baureihen **3612** werden standardmäßig entweder mit zylindrischem Außendurchmesser (ohne Nachsetzzeichen) sowie mit balligem Außendurchmesser (Nachsetzzeichen **R**) gefertigt.

Der Radius der Balligkeit beträgt für alle Laufrollen der Reihe **3612..-R** einheitlich 400 mm.

Zweireihige Laufrollen

Die Innenkonstruktion der **zweireihigen NKE Laufrollen** der Baureihen **305..** und **306..** beruhen auf zweireihigen Schrägkugellagern der Reihe **32..** (Baureihe **305**) bzw. der Reihe **33..** (Baureihe **306**).

Zweireihige NKE Laufrollen haben Polyamidkäfige und einen Druckwinkel von **25°**. Die zweireihigen Laufrollen werden standardmäßig mit beidseitiger Blechabdeckung (Nachsetzzeichen **-2Z**) hergestellt, sind aber auch mit berührender **-2RSR**-Dichtung verfügbar.

Auch die **zweireihigen NKE Laufrollen** werden standardmäßig mit zylindrischem sowie mit balligem Außendurchmesser gefertigt.

Auch bei den zweireihigen Laufrollen beträgt der **Radius der Balligkeit einheitlich R = 400 mm**.

Single Row Cam Rollers (Available on Request)

Cam rollers of the narrow series (series **3612..** and **3612..-R**, are based on the proven sealed single row deep groove ball bearings, (suffix **-2RSR**) for their internal design.

The NKE cam rollers series **3612..** and **3612..-R** are produced with **-2RSR**-type contacting seals as standard. These seals provide a very effective and efficient sealing of the bearing compartment against penetration by foreign particles even under unfavourable operating conditions.

The narrow NKE cam rollers, series **3612** are available with either cylindrical (without suffix) or crowned outer ring outer diameter (suffix **R**) as standard.

The radius of crowning on single row cam rollers for the series **3612..-R**, is standardised at **R = 400 mm, irrespective of their outer diameter**.

Double Row Cam Rollers

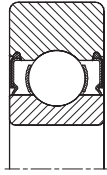
The internal design of **NKE double row cam rollers** (series **305** and **306**) are based on the double row angular contact ball bearings of the series **32..** (for series **305**) or **33..** (for series **306** cam rollers), respectively.

NKE double row cam rollers have contact angles of **25°** they also feature polyamide cages as standard.

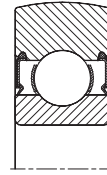
Double row cam rollers are widely used with pressed steel shields, (suffix **-2Z**), they are also available with **contacting seals** (suffix **-2RSR**) as standard.

As for single row cam rollers, **NKE double row cam rollers** are produced with either a cylindrical or sphered outer ring diameters.

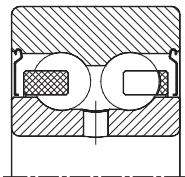
The radius of crowning of double row cam roller outer diameter is also **standardised at R = 400 mm**.



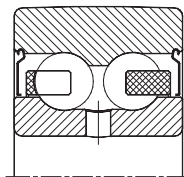
3612..



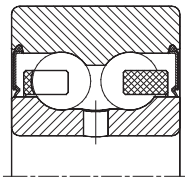
3612..R



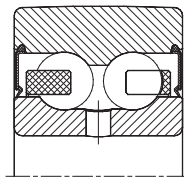
3057...2Z
3067...2Z



3058...2Z
3068...2Z



3057...2RSR
3067...2RSR



3058...2RSR
3068...2RSR

Dichtungswerkstoff

Für die berührenden Dichtungen abgedichteter **NKE Laufrollen** (Nachsetzzeichen **-2RSR**) wird standardmäßig ein verschleißfester synthetischer Kautschuk (**NBR**) verwendet.

Dieser Dichtungswerkstoff ist für Betriebstemperaturen von **-30°C** bis ca. **+120°C** geeignet.

Auf Anfrage können NKE Laufrollen auch mit Dichtungen aus anderen Werkstoffen, wie beispielsweise mit berührenden Dichtungen aus **FPM** für Hochtemperaturanwendungen, geliefert werden.

Material of Seals

For the contacting seal of sealed **NKE cam rollers** (suffix **-2RSR**) a wear-resistant synthetic rubber (**NBR**) is used as standard material.

This seal material is suitable for operating temperatures of **-30°C** up to **+120°C** (**-22°F** up to **+248°F**).

On request, the NKE cam rollers are supplied with alternative seal materials, such as high-temperature **FPM**-contacting seals.

Fettfüllung

Alle mit Dicht- oder Deckscheiben gelieferten **NKE Laufrollen** werden bereits werksseitig mit einem qualitativ hochwertigen Wälzlagerfett befüllt. Dieser Schmierstoff ist für Betriebstemperaturen von etwa **-30°C** bis ca. **+110°C** geeignet.

Obwohl Laufrollen unter normalen Betriebsbedingungen praktisch wartungsfrei sind, kann unter erschwerten Betriebsbedingungen, wie etwa beim Vorliegen starker Staubbelastung, bei hohen Drehzahlen, bei permanenten Betriebstemperaturen von mehr als **70°C** oder unter dem Einfluß erhöhter Feuchtigkeit, eine regelmäßige Nachschmierung erforderlich sein.

Zu diesem Zweck weisen alle zweireihigen NKE Laufrollen serienmäßig eine Schmierbohrung im Innenring auf, um bei Bedarf eine Nachschmierung der Laufrollen zu ermöglichen.

Bei einer Nachschmierung ist, neben der Verwendung eines geeigneten Schmierstoffes, auf ein langsames Nachschmieren zu achten, da ansonsten die Dicht- oder Deckscheiben aus dem Lager gedrückt werden können.

Auf Anfrage können NKE Laufrollen auch mit Sonderfetten nach Kundenspezifikationen geliefert werden.

Käfige

Einreihige NKE Laufrollen werden standardmäßig mit Stahlblechkäfigen gefertigt, die zweireihigen Laufrollen sind grundsätzlich mit Polyamidkäfigen ausgestattet.

Toleranzen

NKE Laufrollen werden mit Ausnahme der Durchmessertoleranz des Außenring-Außendurchmessers bei Laufrollen mit balligem Außenring, in Normaltoleranz (PN) gefertigt. Die Toleranz des Außenring-Außendurchmessers bei Laufrollen mit balligem Außendurchmesser beträgt das Doppelte des Normalwertes.

Auf Anfrage können kleinere Laufrollen auch mit eingengten Toleranzen, wie beispielsweise in den Toleranzklassen **P6** oder **P5** gefertigt werden.

Grease Filling

NKE cam rollers incorporating either seals or shields are supplied grease filled from the factory with a proven high quality rolling bearing grease suitable for operating temperatures of **-30°C** up to **+110°C** (**-22°F** up to **+230°F**).

Although cam rollers, operating under normal conditions, run generally maintenance free. Some application require additional lubrication where high speeds, heavy dust, permanent operating temperatures over **+70°C** (**+158°F**) exist.

Double row cam rollers only feature a lubrication hole in the inner rings to provide a simple and effective re-lubricating method.

Where re-lubrication is necessary, it is emphasised that, undue pressure by the regreasing method may cause unnecessary damage to either the seals or shields.

NKE cam rollers are be supplied with special grease fills according to customer specification or with different grease fill volumes than the standard.

Cages

Single row NKE cam rollers are standard fitted with pressed steel cages as standard. Double row cam rollers feature solid polyamide cages as standard.

Tolerances

NKE cam rollers with cylindrical outer ring diameter are produced to normal class tolerance (PN) as standard. For cam rollers with sphered out ring diameters, the outer ring diameter tolerance is double the standard value.

Some of the smaller cam rollers may also be produced to tolerance classes (e.g. **P6** or **P5**) on request.

Lagerluft

NKE Laufrollen werden standardmäßig in **Normalluft** (Luftgruppe **CN** nach DIN 620) geliefert.

Auf Anfrage können NKE Laufrollen auch mit anderen Lagerluftwerten gefertigt werden.

Belastbarkeit

Im Unterschied zu normalen Wälzlagern berührt bei den Laufrollen der Außenring lediglich mit einem sehr kleinen Bereich die Gegenstücke.

Diese Berührung verursacht Verformungen im Außenring, die durch die in den Produkttabellen neben den üblichen Tragzahlen angegebenen Maximalwerte der zulässigen dynamischen bzw. statischen Radialbelastung berücksichtigt werden.

Äquivalente dynamische Belastung

Bei einer Berechnung von Laufrollen als Wälzlager gilt:

$$P = F_r$$

wobei jedoch $P \leq F_r$ **zul** sein muss.
(F_r , **zul** siehe Produkttabellen)

Äquivalente statische Lagerbelastung

Für Laufrollen gilt:

$$P_0 = F_r$$

wobei jedoch $P_0 \leq F_{0r}$ **zul**
(F_{0r} , **zul** siehe Produkttabellen)

Internal Clearance

NKE cam rollers are produced with **normal internal clearance** group (**CN**) as standard according to DIN 620.

NKE cam rollers are also produced to other internal clearances.

Load Carrying Capability:

Unlike the "normal" rolling element bearings, the outer ring of cam rollers contact their adjacent mating surface on a very small contacting area; this causes deformations of the outer ring.

These deformations are considered by the recommended maximum values for the permissible dynamic and static radial loads as shown in by the product tables.

Equivalent Dynamic Load

Cam rollers must be calculated as rolling element bearings:

$$P = F_r$$

But, P must be $\leq F_r$ **zul**
(for F_r , **zul** see product tables)

Equivalent Static Bearing Load

For cam rollers:

$$P_0 = F_r$$

But, P_0 must be $\leq F_{0r}$ **zul**
(for F_{0r} , **zul** see product tables)

Anschlussmaße bei Laufrollen

Die Radien der Kantenverrundung an den Innenringen dürfen nicht an den Hohlkehlen am Wellenbund anliegen.

Dazu muss der größte Hohlkehlradius an den Anschlussstellen (r_g) kleiner sein als der kleinste Radius für die Kantenverrundung (r_s) der Lagerschalen.

Da bei Laufrollen üblicherweise Punktlast am Innenring vorliegt, kann der Wellensitz eine lose Passung, beispielsweise nach g6, h6 oder j6 aufweisen.

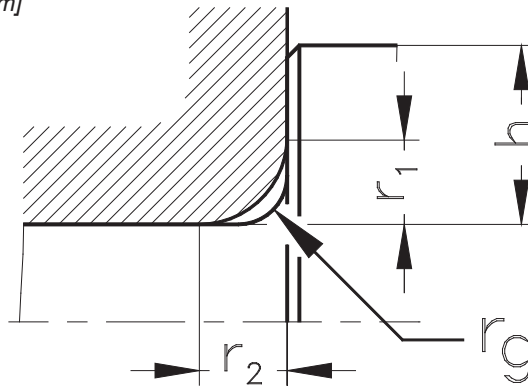
Abutment and Fillet Dimensions for Cam Rollers

The bearing inner ring must contact adjacent surfaces with their side faces only. The radius of inner ring corners must not touch the fillet radius of the shaft shoulder.

Therefore, the largest fillet radius (r_g) must be smaller than the minimum fillet dimension of the cam roller inner rings (r_s) as listed in the product tables.

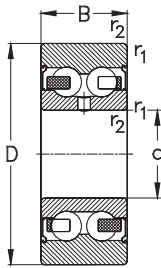
Since cam rollers normally have point loaded inner rings, their shaft fits may be rather loose, (i.e. according to ISO-tolerance fields g6, h6 or j6).

Alle Abmessungen in [mm]
All Dimensions are in [mm]

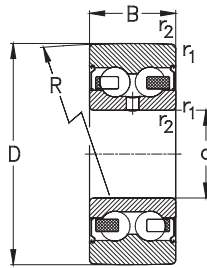


$r_1, r_2 \text{ min}$	$r_g \text{ max}$	h_{min}
0,6	0,6	2,1
1	1	2,8
1,1	1	3,5
1,5	1,5	4,5
2	2	5,5

Laufrollen, zweireihig
Cam Rollers, Double Row



3057...2Z
 3067...2Z



3058...2Z
 3068...2Z

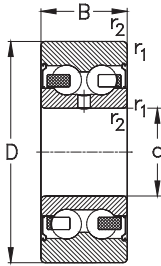
Hauptabmessungen [mm]					Bezeichnung	
Boundary dimensions [mm]					Designation	
D	d	B	R	r ₁ , r ₂ min	mit zylindrischem Außenring <i>with cylindrical outer ring</i>	mit balligem Außenring <i>with sphered outer ring</i>
32	10	14	400	0,6	305700-2Z	305800-2Z
	10	14	400	0,6	305700-2RSR	305800-2RSR
35	12	15,9	400	0,6	305701-2Z	305801-2Z
	12	15,9	400	0,6	305701-2RSR	305801-2RSR
40	15	15,9	400	0,6	305702-2Z	305802-2Z
	15	15,9	400	0,6	305702-2RSR	305802-2RSR
47	17	17,5	400	0,6	305703-2Z	305803-2Z
	17	17,5	400	0,6	305703-2RSR	305803-2RSR
	15	19	400	1	306702-2Z	306802-2Z
	15	19	400	1	306702-2RSR	306802-2RSR
52	20	20,6	400	1	305704-2Z	305804-2Z
	20	20,6	400	1	305704-2RSR	305804-2RSR
	17	22,2	400	1	306703-2Z	306803-2Z
	17	22,2	400	1	306703-2RSR	306803-2RSR
62	25	20,6	400	1	305705-2Z	305805-2Z
	25	20,6	400	1	305705-2RSR	305805-2RSR
	20	22,2	400	1,1	306704-2Z	306804-2Z
	20	22,2	400	1,1	306704-2RSR	306804-2RSR
72	30	23,8	400	1	305706-2Z	305806-2Z
	30	23,8	400	1	305706-2RSR	305806-2RSR
	25	25,4	400	1,1	306705-2Z	306805-2Z
	25	25,4	400	1,1	306705-2RSR	306805-2RSR

Anschlussmaße siehe Seite 881

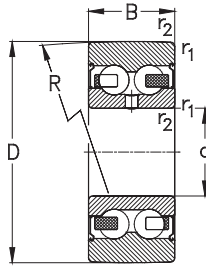
*Abutment and fillet dimensions
see on page 881*

D	Richtdrehzahl Speed rating	Tragzahlen [kN]		Maximal zulässige Radiallast [kN]		Gewicht [kg]
	[min ⁻¹]	Load ratings [kN]		max. permissible radial load [kN]		m
		C _r dyn.	C _{0r} stat.	F _{r max} dyn.	F _{0r max} stat.	
32	13000	7,4	4,1	4,25	6	0,062
	8500	7,4	4,1	4,25	6	0,062
35	11000	10	5,2	3,9	5,6	0,078
	7300	10	5,2	3,9	5,6	0,078
40	10000	11,1	6,4	6	8,5	0,1
	6500	11,1	6,4	6	8,5	0,1
47	9000	13,8	8,3	9,5	13,4	0,16
	6000	13,8	8,3	9,5	13,4	0,16
	10000	14,6	9,2	--	--	0,15
	6500	14,6	9,2	--	--	0,15
52	8000	18,2	11	8,3	12	0,22
	5300	18,2	11	8,3	12	0,22
	9500	17,2	11	--	--	0,2
	6300	17,2	11	--	--	0,2
62	7000	19,9	13,4	15,3	22	0,32
	4500	19,9	13,4	15,3	22	0,32
	9000	21,1	14,5	--	--	0,34
	6000	21,1	14,5	--	--	0,34
72	6000	27,6	18,6	17,3	24,5	0,49
	4000	27,6	18,6	17,3	24,5	0,49
	7900	27,5	19,5	--	--	0,5
	5200	27,5	19,5	--	--	0,5

Laufrollen, zweireihig
Cam Rollers, Double Row



3057...2Z
 3067...2Z



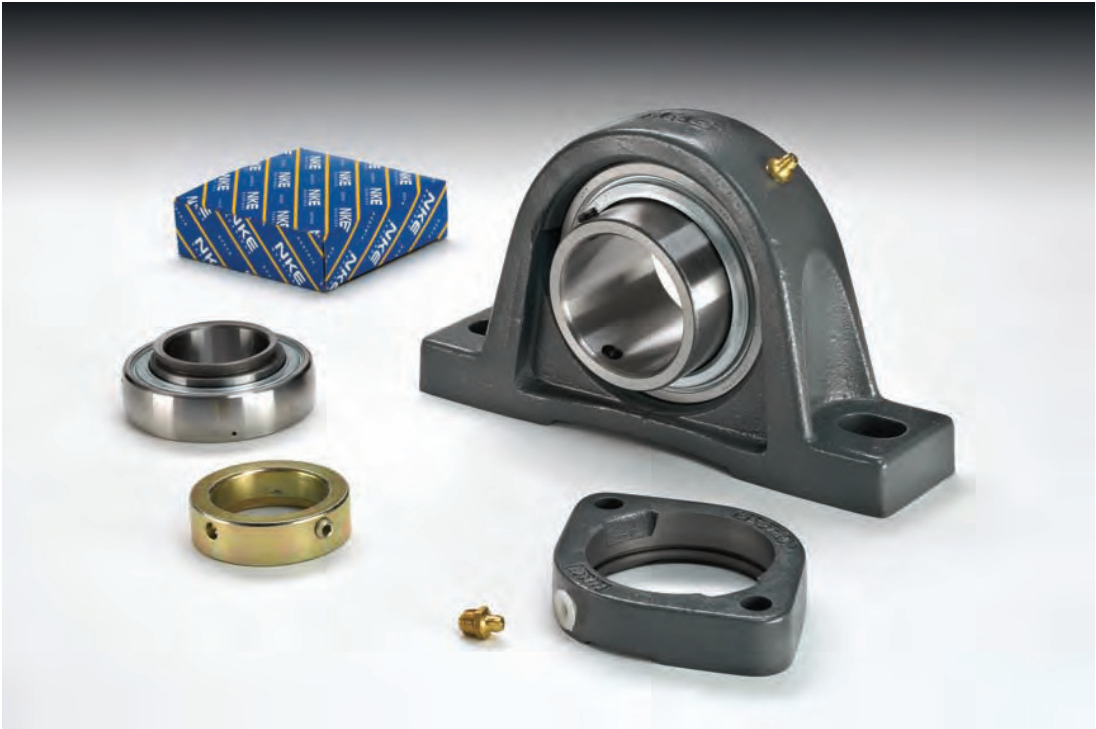
3058...2Z
 3068...2Z

Hauptabmessungen [mm]					Bezeichnung	
Boundary dimensions [mm]					Designation	
D	d	B	R	r ₁ , r ₂ min	mit zylindrischem Außenring <i>with cylindrical outer ring</i>	mit balligem Außenring <i>with sphered outer ring</i>
80	35	27	400	1,1	305707-2Z	305807-2Z
	35	27	400	1,1	305707-2RSR	305807-2RSR
	30	30,2	400	1,1	306706-2Z	306806-2Z
	30	30,2	400	1,1	306706-2RSR	306806-2RSR
85	40	30,2	400	1,1	305708-2Z	305808-2Z
	40	30,2	400	1,1	305708-2RSR	305808-2RSR
90	35	34,9	400	1,5	306707-2Z	306807-2Z
	35	34,9	400	1,5	306707-2RSR	306807-2RSR
100	40	36,5	400	1,5	306708-2Z	306808-2Z
	40	36,5	400	1,5	306708-2RSR	306808-2RSR

Anschlussmaße siehe Seite 881

*Abutment and fillet dimensions
see on page 881*

D	Richtdrehzahl Speed rating	Tragzahlen [kN]		Maximal zulässige Radiallast [kN]		Gewicht [kg]
	[min ⁻¹]	Load ratings [kN]		max. permissible radial load [kN]		m
		C _r dyn.	C _{0r} stat.	F _{r max} dyn.	F _{0r max} stat.	≈
80	5300	35,1	24	16,6	24	0,65
	3500	35,1	24	16,6	24	0,65
	6200	36,5	26,5	--	--	0,67
	4100	36,5	26,5	--	--	0,67
85	5000	34,5	22,5	--	--	0,75
	5000	34,5	22,5	--	--	0,75
90	5100	44,5	33	--	--	0,95
	3400	44,5	33	--	--	0,95
100	4700	56	42	--	--	1,2
	4700	56	42	--	--	1,2



Gehäuselagereinheiten
Bearing Units

Gehäuselager
Insert Bearings

Stehlagereinheiten, Grauguss
Plummer Block Units, Cast Iron

Zweilochflanscheinheiten, Grauguss
Oval Flanged Units, Cast Iron

Vierlochflanscheinheiten, Grauguss
Square Flanged Units, Cast Iron

Runde Flanscheinheiten, Grauguss
Round Flanged Units, Cast Iron

Spannlagereinheiten, Grauguss
Take Up Units, Cast Iron

Stehlagereinheiten, Stahlblech
Plummer Block Units, Pressed Steel

Zweilochflanscheinheiten, Stahlblech
Oval Flanged Units, Pressed Steel



Gehäuselagereinheiten

Allgemeines

Mit den standardmäßig in mehreren Bauformen einbaufertig verfügbaren **NKE Gehäuse-lagereinheiten** lassen sich auf konstruktiv einfachste Weise in wirtschaftlicher und technischer Hinsicht optimale Lagerungen verwirklichen.

Die Einheiten bestehen aus einem gegossenen oder aus Stahlblech gestanzten **Gehäuse**, welches mit mehreren unterschiedlichen **Lagereinsätzen** kombiniert werden kann.

Durch die sphärische Ausführung des Lager-Außendurchmessers sowie des Innendurchmessers des Gehäuses weisen diese Einheiten eine Selbsteinstellfunktion auf, wodurch z.B. die bei geschweißten Stahlkonstruktionen unvermeidlichen Fluchtungsfehler bei der Montage kompensiert werden können (statische Fluchtungsfehler).

Die **Gehäuselager** sind in unterschiedlichen Bauformen und Dichtungsvarianten verfügbar.

Bearing Units

General

NKE bearing units are produced in several different designs as standard. They offer simple, effective and reliable technical solutions with the minimum design work requirements.

NKE bearing units consist of a **housing** which is made from either cast iron or pressed steel. These housings may be combined with several different types of **insert bearings**.

These insert bearings have a self-aligning feature due to their spherical outer diameters and the corresponding design of the bearing housing. This feature allows for any static misalignment, which can, e.g. frequently occur in the case of welded framework and large transmissions, etc.

Insert bearings are produced and available in several different designs to meet various technical demands.

Gehäuse

Je nach erforderlichem Einbaufall stehen **gestanzte Stahlblechgehäuse** oder **gegossene Gehäuse** in mehreren Bauformen zur Verfügung.

Dabei wird primär zwischen **Stehlagergehäusen** und **Flanschlagerngehäusen** unterschieden, siehe Abb. 1 und 2.

Housings

Depending upon the individual application requirements, there are different housing designs available in either **cast iron** or **pressed steel** material (see fig. 1 and 2).

For the primary distinction between **plummer block housings** and **flanged housings**, see fig. 1 and 2.

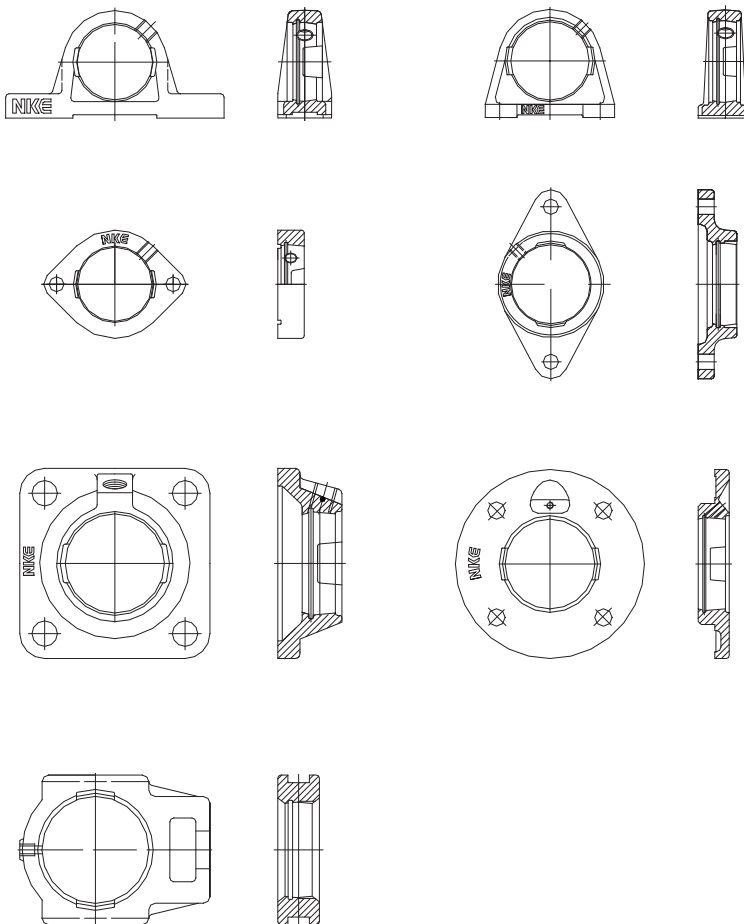


Abb. 1: Grundbauformen der NKE Standard-Gußgehäuse
Fig. 1: Basic designs of NKE standard cast iron housings

Gegossene NKE Gehäuse bestehen aus **Grauguss GG20** mit einer Mindestzugfestigkeit $\sigma_{min} \geq 200 \text{ N/mm}^2$.

Diese Gehäuse weisen eine hohe Steifigkeit gegen Verformung auf und sind daher zur Aufnahme mittlerer bis hoher Belastungen optimal geeignet.

Für lediglich gering beanspruchte Konstruktionen stehen auch einige Typen von gestanzten und verzinkten **Stahlblechgehäuse** zur Verfügung, die eine im Vergleich zu den gegossenen Gehäusen erheblich leichtere Bauweise ermöglichen (siehe Abb. 2).

Diese Stahlblechgehäuse zeichnen sich darüber hinaus durch eine sehr einfache Montage aus.

NKE cast housings are made from **ductile cast iron GG20** with a minimum tensile resistance of $\sigma_{min} \geq 200 \text{ N/mm}^2$.

These cast iron housings provide a high stiffness against deformation and thus are capable of accepting medium to high loads in an optimum way.

For less demanding applications, however, there are also several types of **pressed steel housings** available, see fig. 2.

These housings are made from zinc plated pressed steel and enable lighter weight designs. Such housings enable considerable savings in terms of weight and/or mass when compared to cast iron housings.

These housings also offer a very simple, effective and efficient way of mounting.

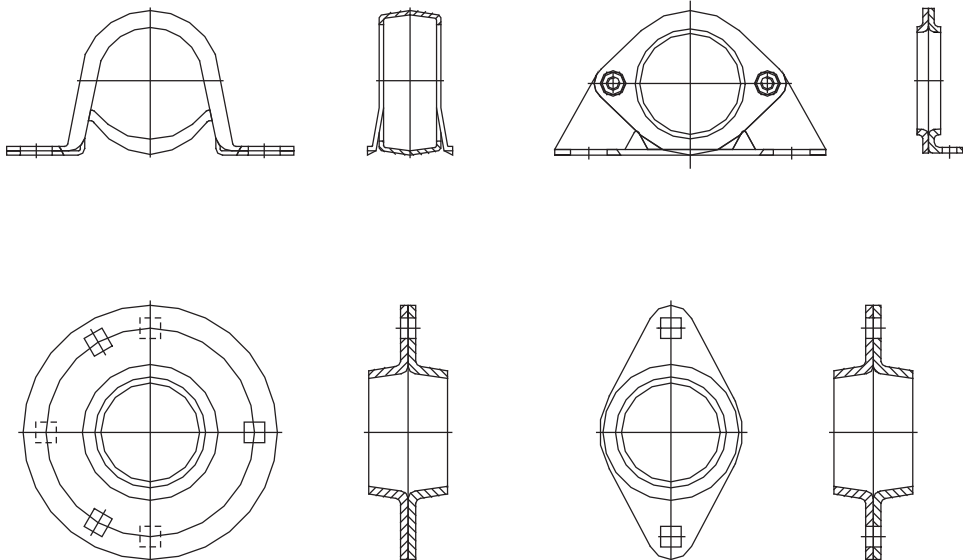


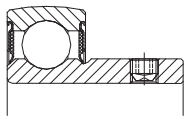
Abb. 2: NKE Standardprogramm Stahlblechgehäuse
Fig. 2: NKE standard types pressed steel housings

Gehäuselager

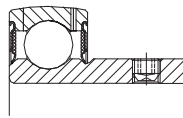
Zur Ausstattung der Gehäuse stehen standardmäßig mehrere unterschiedliche Varianten von Gehäuselagern zur Verfügung, siehe Abb. 3:

Insert Bearings

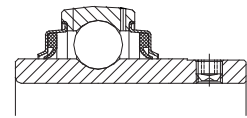
There are different design variants of insert bearings available as standard in order to fit the housings in an optimum way, see fig. 3:



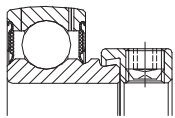
AY..-NPPB



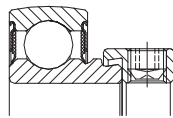
GAY..-NPPB



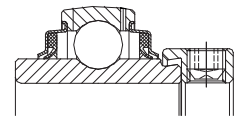
GYE..-KRRB



GRAE..-NPPB



RAE..-NPPB



GE..-KRRB

Abb. 3: NKE Standard-Gehäuselagertypen
Fig. 3: NKE standard types of insert bearings

Alle **Gehäuselager** weisen einen **sphärisch geformten** Aussenring (Nachsetzzeichen **B**) auf. Dadurch wird eine – allerdings je nach Lagerbauform unterschiedlich grosse – Kompensation von Schiefstellungen bzw. Fluchtungsfehlern ermöglicht.

All insert bearings feature a **spherical outer ring** (suffix **B**) which compensates for misalignment and off-set position within a certain amount.

The ability to compensate for misalignments, however, depends on the individual insert bearing type.

Alle NKE **Gehäuselager** werden bereits werksseitig mit einem hochwertigen lithiumverseiften Standard-Wälzlagerfett auf Mineralölbasis, Klasse **K3K-30** nach DIN 51825 befüllt.

Nähere Informationen zur Fettfüllung der NKE Lager bzw. Informationen zur Wälzlagerschmierung im Allgemeinen finden Sie im Abschnitt „**Schmierung von Wälzlagern**“ ab Seite 145.

Verschiedene Gehäuselagertypen stehen auch mit mehreren unterschiedlichen **Abdichtungen** zur Verfügung, welche auch unter ungünstigen Betriebsbedingungen eine optimale Abdichtung des Lagers gegen Umwelteinflüsse garantieren.

Grundbauformen der Gehäuselager

Um ein möglichst umfassendes Spektrum an Anwendungsmöglichkeiten abdecken zu können, sind **NKE Gehäuselager** in mehreren unterschiedlichen Ausführungen verfügbar.

Die wichtigsten Standardbauformen werden im Folgenden vorgestellt.

Gehäuselager, Bauformen AY und GAY

NKE Gehäuselager der Bauform **AY** bzw. **GAY** (siehe Abb. 4) weisen einen einseitig verlängerten Innenring auf.

Diese Bauformen eignen sich primär für Standardanwendungen auch bei wechselnder Drehrichtung.

Bei Gehäuselagern der Bauform **GAY** ist eine Nachschmierung der Lager durch in den Außenring integrierte Schmierbohrungen möglich, während die Bauform **AY** nicht nachschmierbar ist.

All NKE **insert bearings** are supplied grease filled during manufacture with a proven high-quality medium temperature mineral oil based, lithium soaped rolling bearing grease, class **K3K-30** according to DIN 51825 as standard.

Further information about the grease filling of NKE bearings and general information about the lubrication of rolling bearings can be found in the chapter “**Lubrication of Rolling Bearings**”, on page 330.

Several types of insert bearings are also available with different **seal arrangements** in order to offer optimum protection of the bearing against the environment even under harsh operating conditions.

Basic Design Variants of Insert Bearings

NKE insert bearings are produced in several different design variations as standard. This allows the selection of the optimum bearing type from a defined standard product range.

The most common designs are introduced in the following:

Insert Bearings, AY and GAY Design

NKE insert bearings of **AY** and **GAY** design, respectively, feature an inner ring which is extended on one side.

These bearings are primarily suitable for standard applications also with changing rotational direction.

GAY design insert bearings enable a regreasing through lubricating holes in their outer rings, whilst insert bearings of the **AY** design totally lack a regreasing possibility.

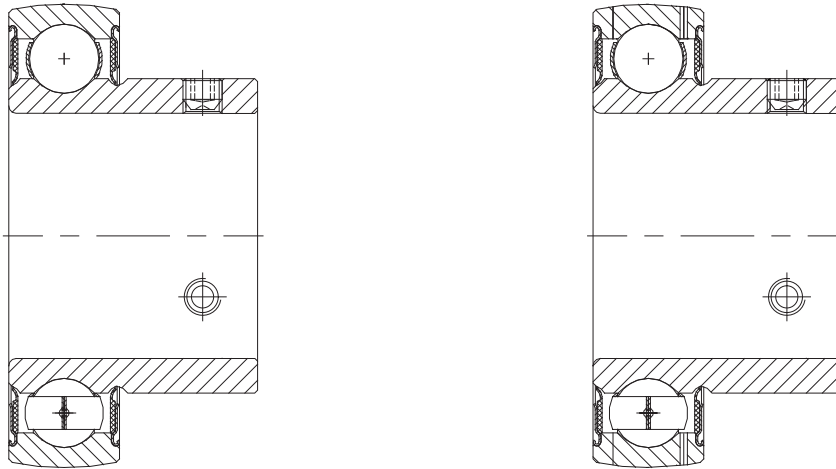


Abb. 4: NKE Gehäuselager, Bauformen **AY** und **GAY**
Fig. 4: NKE insert bearings, **AY** and **GAY** design

Bei den Gehäuselagern der Bauformen **AY** und **GAY** erfolgt die Fixierung des Innenringes auf der Welle mittels zweier in den Innenring integrierter, um 120° zueinander versetzter Gewindestifte mit Ringschneiden.

Diese Befestigungsmethode ermöglicht eine rasche und kostengünstige Montage der Lager auf die Welle.

Lediglich wenn die Lager nur geringen Drehzahlen und Belastungen ausgesetzt sind, können Gehäuselager dieser Bauformen auch bei wechselnder Drehrichtung eingesetzt werden.

NKE Gehäuselager der Bauformen **AY** bzw. **GAY** werden standardmäßig mit **P**-Dichtungen gefertigt; Nachsetzzeichen **NPP**.

The inner ring of the Insert Bearings of the **AY** and **GAY** design is fixed onto the shaft by means of two grub screws spaced 120° to each other.

This fastening system enables a quick, effective and economical mounting of the bearing to the shaft.

It is only recommended to use insert bearings of this design under reverse rotations in applications where the bearings are exposed to moderate loads and speeds.

NKE insert bearings of **AY** and **GAY** design, respectively, are manufactured with **P**-type seals as a standard, identified by the suffix **NPP**.

Gehäuselager, Bauform GYE

NKE Gehäuselager der Bauform **GYE** weisen einen auf beiden Seiten verlängerten Innenring auf, siehe Abb. 5.

Insert Bearings, GYE Design

NKE **GYE**-type insert bearings feature an inner ring which is extended on both sides, see fig. 5.

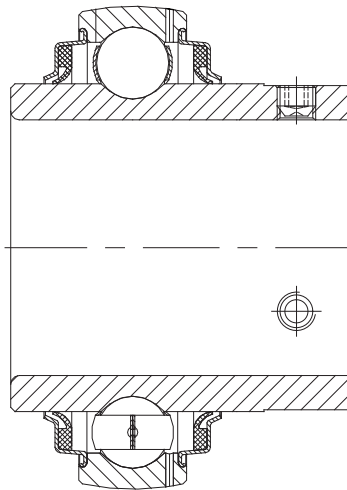


Abb. 5: NKE Gehäuselager, Bauform GYE
Fig. 5: NKE insert bearing, GYE design

Dadurch können Gehäuselager der Bauform **GYE** zum einen mit einer effizienteren Dichtungsbauf orm (Nachsetzzeichen KRRB) ausgestattet werden und weisen dadurch einen wesentlich größeren Fettraum auf, was wiederum eine verlängerte Gebrauchsdauer des Lagers auch unter schwierigen Betriebsbedingungen ermöglicht.

Auch bei dieser Bauform erfolgt die Fixierung des Innenringes auf der Welle mittels zweier in den Innenring integrierter, um 120° zueinander versetzter Gewindestifte mit Ringschneiden.

Damit gelten auch für die Gehäuselager der Baureihe GYE die für die Bauform GAY genannten Einschränkungen hinsichtlich der Einsatzbedingungen.

This allows the **GYE**-type insert bearings to be fitted with a more effective sealing arrangement (indicated by a suffix KRRB).

Additionally the GYE-type insert bearings have a larger internal space which acts as an extra grease reservoir in order to provide extended service life even under difficult operating conditions.

GYE-type insert bearings are fixed onto the shaft by means of two grub screws located in the inner ring, spaced 120° to each other.

Thus, the insert bearings of the GYE design are also subjected to the same limitations in terms of optimum operating conditions as for insert bearings of the GAY-design.

Gehäuselager, Bauform GE

Insert Bearings, GE Design

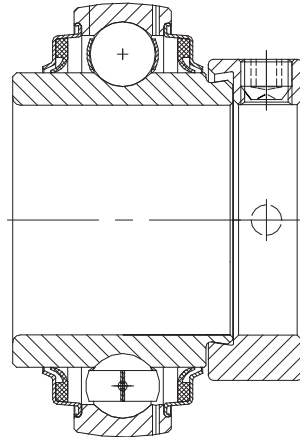


Abb. 6: NKE Gehäuselager, Bauform GE
Fig. 6: NKE insert bearing, GE design

NKE Gehäuselager der Bauform GE unterscheiden sich von den bisher beschriebenen Gehäuselagern durch die **Exzenterringbefestigung**.

Dabei wird ein separater Spannring mit einer exzentrischen Ausdrehung an einer Stirnfläche gegen den entsprechend geformten Innenring verdreht.

Dadurch wird der Innenring gegen die Welle fixiert.

Der Exzenterring wird abschließend durch einen in den Ring integrierten Gewindestift mit Ringschneide in gespannter Position fixiert.

Durch die Exzenterringbefestigung ist eine sehr rasche und einfache Befestigung der Lager möglich.

Darüber hinaus ist diese Methode auch sehr schonend für die Welle.

Gehäuselager mit Exzenterringbefestigung eignen sich primär für Anwendungen mit gleich bleibender Drehrichtung.

GE type insert bearings are different from the previously described insert bearing designs by having an **eccentric locking collar** for fixing the bearing onto the shaft.

With this method, a separate locking collar having an off/centre turned groove in one side face is mated against a correspondingly shaped inner ring.

Thus, the inner ring is locked in position on the shaft seat.

Following its mounting, the eccentric locking collar is fixed in the engaged position by tightening a grub screw which is incorporated in the locking collar.

The fixing of insert bearings by means of eccentric locking collars enables a very quick, effective and simple mounting of bearings onto the shafts.

Furthermore, this method protects the shaft more than the grub screws.

Durch den auf beiden Seiten verlängerten Innenring können NKE Gehäuselager der Bauform **GE** zum einen mit einer effizienteren Dichtungsbauform (Nachsetzzeichen KRR) ausgestattet werden und weisen weiters auch einen wesentlich größeren Fettraum auf, was wiederum eine verlängerte Gebrauchsdauer des Lagers auch unter schwierigen Betriebsbedingungen ermöglicht.

Gehäuselager, Bauformen RAE und GRAE

NKE Gehäuselager der Bauformen **RAE** und **GRAE**, siehe Abb. 7, weisen einen einseitig verlängerten Innenring auf und werden mittels Exzenterring auf der Welle montiert.

Gehäuselager der Bauformen **RAE** und **GRAE** eignen sich primär für Anwendungen mit gleichbleibender Drehrichtung.

Bei Gehäuselagern der Bauform **GRAE** ist eine Nachschmierung der Lager durch in den Außenring integrierte Schmierbohrungen möglich, während die Bauform **RAE** nicht nachschmierbar ist.

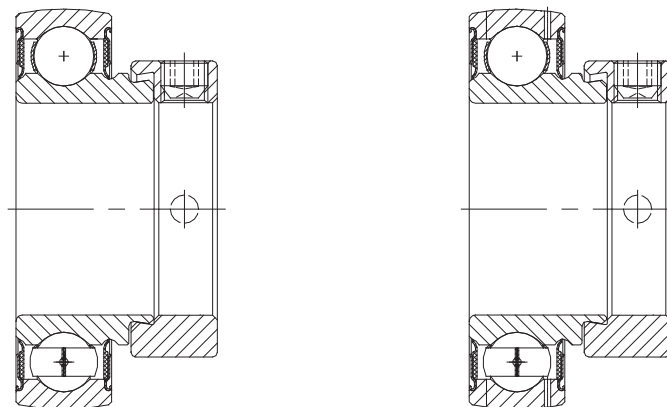


Abb. 7: NKE Gehäuselager, Bauformen RAE und GRAE
Fig. 7: NKE insert bearings, RAE and GRAE design

Insert bearings that are fixed by eccentric locking collars are primarily suitable for applications with a constant rotational direction.

Due to the inner ring being extended on both sides, the NKE GE-type insert bearings can be fitted with a more effective sealing arrangement (indicated by a suffix KRR). Additionally, the **GE**-type insert bearings also have a larger internal space which acts as an extra grease reservoir in order to provide extended service life even under difficult operating conditions.

Insert Bearings, RAE and GRAE Designs

NKE insert bearings of **RAE** and **GRAE** design, respectively, (see fig. 7) feature an inner ring which is extended on one side. They are fixed on the shafts by means of an eccentric locking collar.

RAE and **GRAE** type insert bearings are primarily suitable for applications with a constant rotational direction.

GRAE design insert bearings enable a regreasing through lubricating holes in their outer rings, whilst insert bearings of the **RAE** design totally lack a re-greasing possibility.

NKE Gehäuselager der Bauformen **RAE** und **GRAE** werden standardmäßig mit **P**-Dichtungen geliefert, Nachsetzzeichen **NPP**.

Dichtungsbauformen

Alle NKE Gehäuselager werden serienmäßig mit definierten Standarddichtungen gefertigt. Dabei handelt es sich um Dichtungsbauformen, die sich unter normalen Einsatz- und Umweltbedingungen optimal bewährt haben.

Mehrere Gehäuselagerbauarten sind darüber hinaus auf Wunsch auch mit anderen Dichtungsbauformen verfügbar, um spezifischen Anforderungen gerecht zu werden.

P-Dichtung

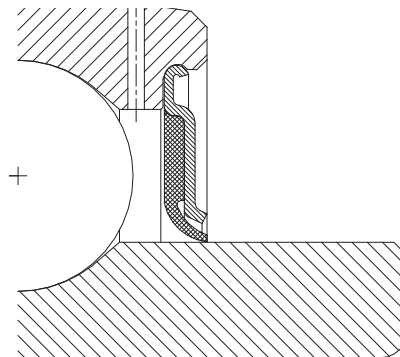


Abb. 8: NKE Gehäuselagerdichtung, Bauform **P**
Fig. 8: NKE insert bearing seal, P design

Die NKE Gehäuselagerdichtung der Bauform **P**, siehe Abb. 8, besteht aus einer außen liegenden verzinkten Stahlblechscheibe, auf welche eine einlippige NBR-Dichtung aufvulkanisiert ist.

Die außen liegende Stahlblechscheibe dient der Versteifung der Dichtlippe und bietet darüber hinaus einen guten Schutz gegen eine mechanische Beschädigung der Dichtung.

NKE **RAE** and **GRAE** type insert bearings are manufactured with **P**-type seals as a standard, indicated by the suffix **NPP**.

Sealing Systems

All NKE insert bearings are manufactured to defined standard sealing arrangements.

These seals are to designs historically proven to be the optimum solution when operating under "normal" operating conditions.

Several types of insert bearings are also available upon request with alternative seals to provide optimum protection even under harsh and unfavourable operating conditions.

P Seal

NKE **P** type insert bearing seals consist of a zinc plated pressed steel shield on the outer side with a single vulcanized NBR-lip seal (see fig. 8).

The external pressed steel shield acts as a carrier to support the seal lip. Furthermore, the steel carrier also protects the rubber seal lip against mechanical damage.

Die **P-Dichtung** stellt eine sehr gute Dichtung für normale Betriebsbedingungen dar und zeichnet sich durch eine geringe Baubreite aus.

Daher wurde die **P-Dichtung** als Standarddichtung bei den NKE Gehäuselagern der Bauformen **AY**, **GAY** und **RAE**, **GRAE** dar.

R-Dichtung

Bei den Gehäuselagerdichtungen der Bauform R, siehe Abb. 9, wurde die außen liegende verzinkte Stahlblechscheibe abgesetzt ausgeführt, um ein größeres Fettreservoir zu ermöglichen.

P-seals perform very well under normal operating conditions and require only limited space.

Thus, the P seal is selected as the standard sealing design for NKE insert bearings of both **AY**, **GAY** and **RAE**, **GRAE** design.

R Seal

The pressed steel shields of the **R-type** insert bearing seals, see Fig. 9, have a “stepped” design in order to create extra space for accommodating extra grease.

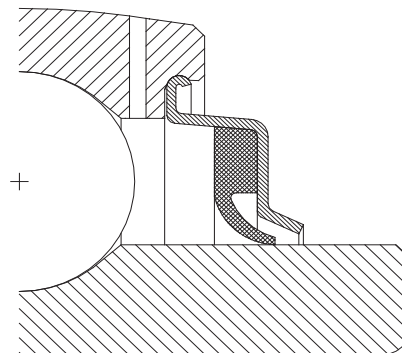


Abb. 9: NKE Gehäuselagerdichtung, Bauform R
Fig. 9: NKE insert bearing seal, R design

Zum Schutz der Dichtlippe wurde die Stahlblechscheibe möglichst weit herabgezogen.

Die Dichtlippe der aufvulkanisierten einlippigen NBR-Dichtung weist eine radiale Vorspannung auf, wodurch eine wesentlich verbesserte Dichtwirkung erreicht wird.

Die **R-Dichtung** stellt die Standarddichtungsbauf orm bei den NKE Gehäuselagern der Bauformen **GYE** und **GE** dar.

The steel shield is extended as far as possible in order to protect the sealing lip from damage.

The single sealing lip of the vulcanized NBR - rubber seal has a radial preload that ensures significant improvement of the sealing efficiency.

Thus, the **R-type** seal is defined as the standard seal for NKE insert bearings of both **GYE** and **GE** type.

P3-Dichtung

P3 Seal

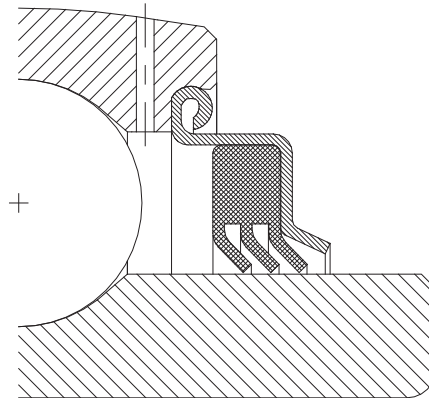


Abb. 10: NKE Gehäuselagerdichtung, Bauform P3
Fig. 10: NKE insert bearing seal, P3 design

NKE Gehäuselagerdichtungen der Bauform P3, siehe Abb. 10, weisen eine **Dreilippendichtung** auf, um auch extremen Beanspruchungen zu genügen.

Die **P3**-Dichtung stellt eine sehr effiziente Dichtungsbauf orm dar, welche auch beim Vorhandensein starker Verunreinigungen eine gute Leistungsfähigkeit aufweist.

NKE Gehäuselager mit **P3**-Dreilippendichtung werden nur auftragsbezogen gefertigt. Die P3-Dichtung kann auf Wunsch bei NKE Gehäuselagern der Bauformen **GYE** und **GE** eingebaut werden.

Da bei der Verwendung dieser sehr leistungsfähigen Dichtung naturgemäß auch die Reibung stark ansteigt, sind die mit dieser Dichtung ausgestatteten Lager nur für geringe Drehzahlen geeignet.

NKE insert bearing seals of the P3 design (see fig. 10) feature a **triple-lip** sealing arrangement suitable for use even under very tough operating conditions and harsh environment.

The **P3** seal provides a very effective sealing of the bearing which features a superior performance even under the presence of heavy contamination.

NKE Insert bearings with **P3** triple-lip seals are manufactured to customer order only. NKE insert bearings of both the **GYE** and **GE** designs can also be fitted with **P3** triple-lip seals to customer orders.

This very effective sealing system also causes the internal friction of the bearings to increase, therefore the bearings fitted with triple-lip seals are only suitable for comparatively low operational speeds.

L-Dichtung

L-Seal

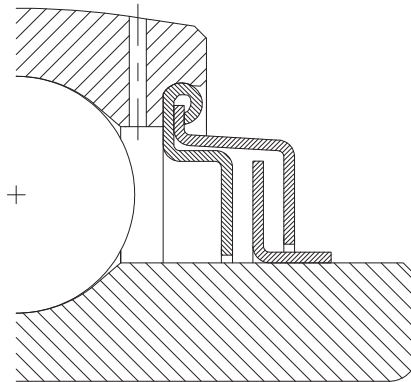


Abb. 11: NKE Gehäuselagerdichtung, Bauform L
Fig. 11: NKE insert bearing seal, L design

Bei der NKE Gehäuselagerdichtungen der Bauform L handelt es sich um eine dreiteilige berührungslose Labyrinthdichtung aus verzinktem Stahlblech.

Dabei bilden zwei in eine Haltnut im Außenring eingepresste Stahlblechscheiben den Labyrinthkörper, während eine dritte, auf den Innenring aufgepresste Blechscheibe mit L-förmigem Querschnitt das Labyrinth formt.

Die L-Dichtung ist eine berührungslose Dichtungsbauf orm und weist daher keine zusätzliche Reibung auf.

Daher werden L-Dichtungen primär für Anwendungen mit hohen Drehzahlen verwendet.

NKE **Gehäuselager** mit L-Dichtungen werden nur auftragsbezogen gefertigt. Diese Dichtungsbauf orm kann bei NKE Gehäuselagern der Bauformen **GYE** und **GE** verwendet werden.

The non-contacting NKE labyrinth insert bearing seals of the **L** design consist of a triple arrangement of zinc plated pressed steel shields. Two shields are pressed into a corresponding circular groove on the outer ring which forms the seal body whilst a third L-shaped pressed steel shield, located on the inner ring forms the labyrinth gap.

Since the **L**-type insert bearing seal is a non-contacting seal it does not create extra friction. Thus this seal design is mainly for higher operating speeds.

NKE **insert bearings** with **L**-type non-contacting seals are manufactured to customer order only. NKE **insert bearings** of both the **GYE** and **GE** design can be equipped with **L**-type seals to individual customer orders.

Dichtungswerkstoffe

Für die schleifenden Dichtungen der NKE **Gehäuselager** (Dichtungsbauformen **P**, **R** und **P3**) wird standardmäßig ein verschleißfester synthetischer Kautschuk (**NBR**) verwendet.

Dieser Dichtungswerkstoff ist für Betriebstemperaturen von **-30°C** bis ca. **+120°C** geeignet. Die Stahlblechteile der Dichtungen sind verzinkt, um gegen Korrosion geschützt zu sein.

Auf Anfrage können **NKE Gehäuselager** auch mit Dichtungen aus anderen Werkstoffen, wie beispielsweise mit berührenden Dichtungen aus **FPM** für Hochtemperaturanwendungen, geliefert werden.

Wellenschutzkappen

Zur Abdeckung der umlaufenden Wellenenden bei Gehäuselagereinheiten liefert NKE Kunststoffschutzkappen, welche in eine Nut im Gehäuse einrasten.

Diese Wellenschutzkappen schützen vor Verletzungen durch umlaufende Wellen und dienen auch als zusätzlicher Schutz der Lager vor Verunreinigung.

Die Gehäusebaureihen, für welche Wellenschutzkappen geliefert werden können, sind in den Produkttabellen angegeben.

Zur Befestigung der Wellenschutzkappen haben die dafür vorgesehenen Gehäuse auf der Seite der Einführtasche eine Ringnut. Gehäuse dieser Bauart werden durch das Nachsetzzeichen "N" gekennzeichnet.

NKE Wellenschutzkappen bestehen aus flexiblem Kunststoff und sind für Betriebstemperaturen von **-20°C** bis **+80°C** geeignet.

Wellenschutzkappen gehören zum NKE Zubehörprogramm und müssen separat bestellt werden.

Seal Materials

For the contacting seal of **NKE insert bearings** (seal designs **P**, **R** and **P3**) a wear resistant **synthetic rubber (NBR)** is used as the standard seal material.

This seal material is suitable for operating temperatures of **-30°C (-22°F)** up to **+120°C (248°F)**.

Pressed steel components of the seals are zinc plated in order to prevent corrosion formation.

Upon request, the **NKE insert bearings** can also be supplied with alternative seal materials, such as high-temperature **FPM** contacting seals.

Housing End Caps

To safeguard the rotating shaft ends at bearing units, NKE housing end caps are available. These housing end caps snap into a groove machined into the bearing housing.

NKE housing end caps protect from possible injury due to rotating shaft ends and additionally provide extra protection to the bearings against contamination.

The housing types for which end caps are available are listed in the product tables.

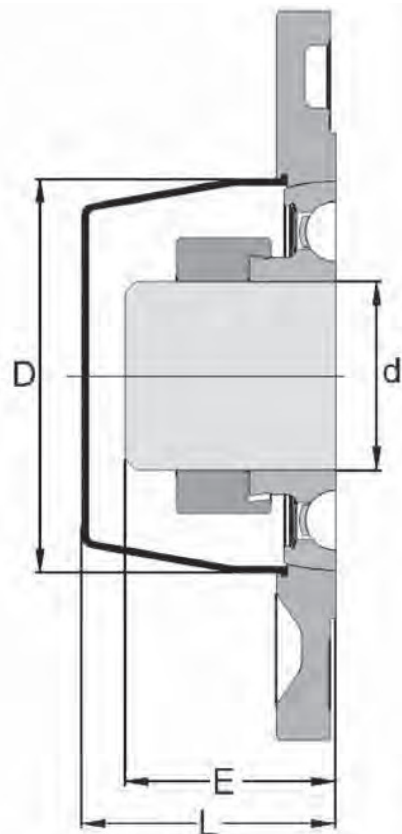
For affixing the housing end caps to the bearing housings, a groove has been machined into the side face allowing the fitment of the end caps. Bearing housings featuring such grooves are identified by a suffix "N".

NKE housing end caps are made from flexible synthetic material and can be used for operating temperatures from **-20°C** to **+80°C**.

NKE housing end caps belong to the NKE accessories range and must be ordered separately.

Wellenschutzkappen <i>Housing end caps</i>	Abmessungen / Dimensions			
	Ø d	Ø D	L	E max.
CUP04	20	48	36	30
CUP05	25	54	38	30
CUP06	30	63	44	35
CUP07	35	73	47	39
CUP08	40	82	50	41
CUP10	50	92	55	45
CUP12	60	112	65	55

Tabelle 1: Wellenschutzkappen für NKE Gehäuselagereinheiten
Table 1: Housing end caps for NKE bearing units



Fettfüllung der Gehäuselager

Alle **NKE Gehäuselager** werden bereits werksseitig mit einem qualitativ hochwertigen lithiumverseiften Wälzlagerfett befüllt.

Dieser Schmierstoff ist für Betriebstemperaturen von etwa **-30°C** bis ca. **+120°C** geeignet.

Obwohl **NKE Gehäuselager** unter normalen Betriebsbedingungen praktisch wartungsfrei laufen, kann unter erschwerten Betriebsbedingungen, wie etwa beim Vorliegen starker Staubbelastung, bei hohen Drehzahlen, bei permanenten Betriebstemperaturen von mehr als 70°C oder unter dem Einfluss erhöhter Feuchtigkeit, eine regelmäßige Nachschmierung erforderlich sein.

Zu diesem Zweck werden bestimmte **NKE Gehäuselager** wie z.B. die Lager der Baureihen **GAY, GYE, GE** und **GRAE** bereits serienmässig mit Schmierbohrungen im Außenring gefertigt, um eine Nachschmierung zu ermöglichen.

Bei einer Nachschmierung ist, neben der Verwendung eines geeigneten und mit der Originalbefüllung verträglichen Schmierstoffes auch auf ein langsames Nachschmieren zu achten, da ansonsten die Dichtscheiben aus dem Lager gedrückt werden können.

Auf Anfrage können alle **NKE Gehäuselager** auch mit Sonderfetten nach Kundenspezifikationen geliefert werden.

Achtung:

Bitte beachten Sie, dass auch bei einer Verwendung von nachschmierbar ausgelegten NKE Gehäuselagern eine Nachschmierbarkeit der Lagereinheiten nur dann gewährleistet ist, wenn auch die gewählten Gehäusebauformen nachschmierbar sind.

Bei der Verwendung von Stahlblechgehäusen ist daher die unter den jeweiligen Betriebsbedingungen erzielbare Schmierstoff-Gebrauchsdauer zu beachten!

Grease Filling of Insert Bearings

NKE insert bearings are supplied grease filled with a proven high quality lithium soap based rolling bearing grease suitable for operating temperatures of **-30°C (-22°F)** up to **+120°C (248°F)**.

NKE insert bearings, operating under normal conditions, generally run maintenance free.

Some applications require additional regular relubrication when operating at high speeds, heavy dust and constant temperatures over **70°C (158°F)**.

For these reasons, several **NKE insert bearings**, namely series **GAY, GYE, GE** and **GRAE**, feature lubrication holes in their outer rings as standard to provide a simple and effective relubricating method.

Where relubrication is necessary, it must be stated any undue pressure by the regreasing method may cause unnecessary damage to either the seals or shields.

It must also be taken into consideration that only greases that are fully compatible with the initial grease fill may be used.

NKE insert bearings are also supplied, according to customer specification, with special grease fill.

Important:

Please note that – even when using NKE insert bearings of a re-greaseable design – a regreasing of the completed unit is only possible when selecting a regeaseable housing design, e.g. a cast iron housing type.

Therefore, the service life of the grease used in the insert bearings under known operating conditions must be taken into consideration when used in pressed steel housings.

Ausführliche Informationen zur Bestimmung der voraussichtlichen Schmierstoff-Gebrauchsdauer unter Berücksichtigung der tatsächlich vorliegenden Betriebsbedingungen finden Sie im Kapitel Abschnitt „**Auswahl und Dimensionierung von Wälzlagern**“, ab Seite 82.

For comprehensive detailed guidelines and technical information, including the determination of the probable grease service life is provided chapter “**Selection of Bearing Type and Size**”, on page 270.

Käfige

Alle NKE **Gehäuselager** werden standardmäßig mit Stahlblechkäfigen gefertigt.

Auf Anfrage können NKE Gehäuselager auch mit anderen Käfigausführungen nach Kundenspezifikationen geliefert werden.

Cages

NKE **insert bearings** are fitted with pressed steel cages as standard.

NKE **insert bearings** can also be supplied with special cages according to customer specification.

Toleranzen

NKE **Gehäuselager** werden standardmäßig in Normaltoleranz (**PN**) gefertigt.

Auf Anfrage können diese auch mit eingengeren Toleranzen, wie beispielsweise in den Toleranzklassen **P6** und **P5** gefertigt werden. Detaillierte Werte für die einzelnen Toleranzklassen entnehmen Sie bitte den Tabellen im Abschnitt „**Lagerdaten / Toleranzen**“, Seite 52.

Tolerances

NKE **insert bearings** are produced to normal tolerance class (**PN**) as standard.

On request these bearings are also produced to closer tolerances, such as tolerance classes **P6** and **P5**. Detailed tolerance values are listed in the tables shown in the chapter “**Bearing data / Tolerances**” page 237.

Normaltoleranzen für den Innenring

Alle Maße in [mm]
 Toleranzwerte in [µm]

Normal tolerances for the inner rings

All dimensions shown in [mm]
 Tolerances in [µm]

Nennmaß der Lagerbohrung Nominal bore diameter	∅ d	> ≤	12 18	18 24	24 30	30 40	40 50	50 60	60 90	90 120
Bohrung, zylindrisch Abweichung Bore, cylindrical deviation	Δdmp	max min	+18 0	+18 0	+18 0	+18 0	+18 0	+18 0	+25 0	+30 0

Tabelle 2: Normaltoleranzen für **Innenringe** von NKE **Gehäuselagern**
 Table 2: Normal tolerances for the **inner rings** of NKE **insert bearings**

Normaltoleranzen für den **Außenring**

Alle Maße in [mm]
Toleranzwerte in [µm]

Normal tolerances for the **outer rings**

All dimensions shown in [mm]
Tolerances in [µm]

Nennmaß des Außendurchmessers Nominal outer diameter	∅ D	> ≤	30 50	50 80	80 120	120 150	150 180	180 250
Außendurchmesser, Abweichung Outer diameter deviation	ΔDmp	max min	0 -11	0 -13	0 -15	0 -18	0 -25	0 -30

Tabelle 3: Normaltoleranzen für **Außenringe** von NKE **Gehäuselagern**
*Table 3: Normal tolerances for the **outer rings** of NKE **insert bearings***

Lagerluft

NKE Gehäuselager werden aufgrund der spezifischen Anforderungen standardmäßig mit Radialluftklasse C3, d.h. mit einer größeren Lagerluft als normal geliefert.

Genauere Lagerluftwerte sind in der folgenden Tabelle 4 angegeben.

Alle Maße in [mm]

Lagerluftwerte in [µm]

Internal Clearance

Due to their characteristic requirements, NKE insert bearings are produced with radial clearance group C3 (i.e. a larger internal radial clearance than normal) as standard.

The values of the internal radial clearance are provided in table 4 below.

All dimensions shown in [mm]

Values of radial internal clearance shown in [µm]

Nennmaß der Lagerbohrung Nominal bore diameter	∅ d	> ≤	10 18	18 24	24 30	30 40	40 50	50 65	65 80	80 100	100 120
Radiale Lagerluft Radial internal clearance		min max	11 25	13 28	13 28	15 33	18 36	23 43	25 51	30 58	36 66

Tabelle 4: Radiale Lagerluft der NKE **Gehäuselager** (Lagerluftklasse **C3** nach DIN620)
*Table 4: Radial internal clearance of NKE **insert bearings** (Clearance Group **C3** according to DIN 620)*

Auf Anfrage können NKE **Gehäuselager** auch mit anderen Lagerluftwerten gefertigt werden.

NKE **insert bearings** are, upon request, also produced to other internal clearances.

Mindestbelastung:

Zum kinematisch korrekten Betrieb benötigen Wälzlager in allen Betriebszuständen eine Mindestbelastung.

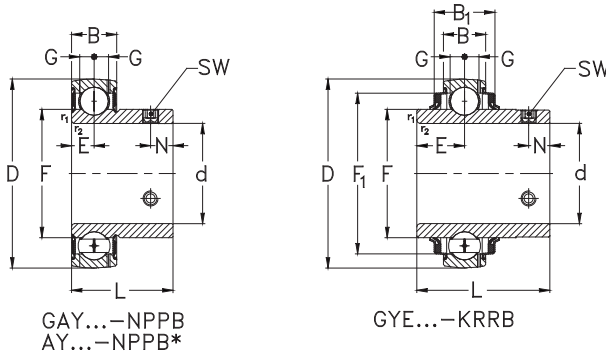
Für NKE Gehäuselager muss die Mindestbelastung **1%** der dynamischen Tragzahl betragen.

Minimum Load:

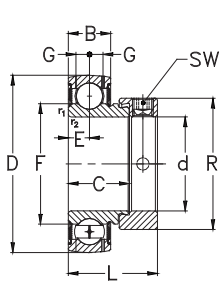
Bearings require a minimum load under all operating conditions to ensure kinematically correct rolling element function.

For NKE insert bearings the minimum load must be **1%** of the dynamic load rating.

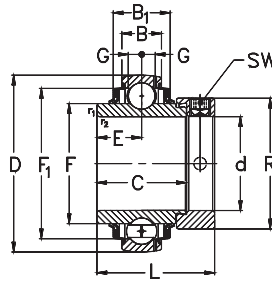
Gehäuselager
Insert bearings



d	Hauptabmessungen [mm] Boundary dimensions [mm]				Gehäuselager Insert bearing	Hauptabmessungen [mm] Boundary dimensions [mm]			
	D	B	B ₁	C		E	F	F ₁	G
12	40	12	--	19	GRAE12-NPPB	6.5	23	--	3.3
	40	12	--	19	RAE12-NPPB	6.5	23	--	--
	40	12	--	--	AY12-NPPB	6	23.9	--	--
	40	12	--	--	GAY12-NPPB	6	23.9	--	3.3
	40	12	16.6	--	GYE12-KRRB	11.5	23.9	31.6	3.3
15	40	12	--	19	GRAE15-NPPB	6.5	23	--	3.3
	40	12	--	19	RAE15-NPPB	6.5	23	--	--
	40	12	--	--	AY15-NPPB	6	23.9	--	--
	40	12	--	--	GAY15-NPPB	6	23.9	--	3.3
	40	12	16.6	--	GYE15-KRRB	11.5	23.9	31.6	3.3
16	40	12	16.6	--	GYE16-KRRB	11.5	23.9	31.6	3.3
17	40	12	--	19	GRAE17-NPPB	6.5	23	--	3.3
	40	12	--	19	RAE17-NPPB	6.5	23	--	--
	40	12	16.6	19	GE17-KRRB	13.9	23.9	31.6	3.3
	40	12	--	--	AY17-NPPB	6	23	--	--
	40	12	--	--	GAY17-NPPB	6	23.9	--	3.3
20	40	12	16.6	--	GYE17-KRRB	11.5	23.9	31.6	3.3
	47	14	--	21.4	GRAE20-NPPB	7.5	26.9	--	3.7
	47	14	--	21.4	RAE20-NPPB	7.5	26.9	--	--
	42	12	--	16.7	RALE20-NPPB	6	25.4	--	--
	47	14	16.6	34.1	GE20-KRRB	17.1	27.6	37.4	3.7
47	14	--	--	AY20-NPPB	7	28.3	--	--	



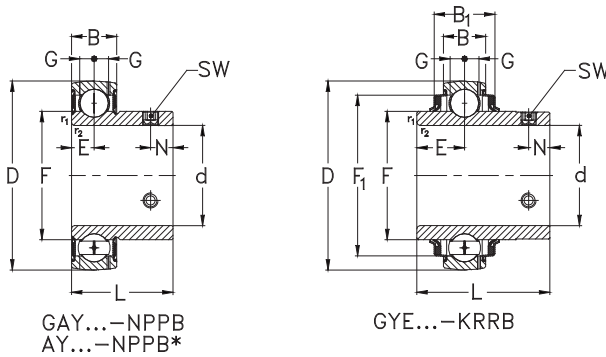
GRAE...-NPPB
RALE...-NPPB*
RAE...-NPPB*



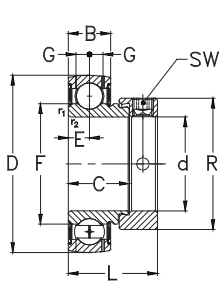
GE...-KRRB
GNE...-KRRB*

d	Hauptabmessungen [mm] Boundary dimensions [mm]				Tragzahlen [kN] Load ratings [kN]			Gewicht [kg] Weight [kg] m
	N	L	SW	R _{max}	C _r [kN]	C _{0r} [kN]	C _u	
12	--	28.6	3	28	9.6	4.8	0.2	0.12
	--	28.6	3	28	9.6	4.8	0.2	0.12
	4	22	2.5	--	9.6	4.8	0.2	0.1
	4	22	2.5	--	9.6	4.8	0.2	0.1
	4	27.4	2.5	--	9.6	4.8	0.2	0.11
15	--	28.6	3	28	9.6	4.8	0.2	0.12
	--	28.6	3	28	9.6	4.8	0.2	0.12
	4	22	2.5	--	9.6	4.8	0.2	0.09
	4	22	2.5	--	9.6	4.8	0.2	0.09
	4	27.4	2.5	--	9.6	4.8	0.2	0.1
16	4	27.4	2.5	--	9.6	4.8	0.2	0.1
17	--	37.3	3	28	9.6	4.8	0.2	0.12
	--	28.6	3	28	9.6	4.8	0.2	0.12
	--	28.6	3	28	9.6	4.8	0.2	0.16
	4	22	2.5	--	9.6	4.8	0.2	0.08
	4	22	2.5	--	9.6	4.8	0.2	0.08
4	27.4	2.5	--	9.6	4.8	0.2	0.09	
20	--	31	3	33	12.8	6.7	0.3	0.16
	--	31	3	33	12.8	6.7	0.3	0.16
	--	24.6	3	30	9.4	5	0.2	0.09
	--	43.7	2.5	33	12.8	6.7	0.3	0.2
	4.5	25	2.5	--	12.8	6.7	0.3	0.13

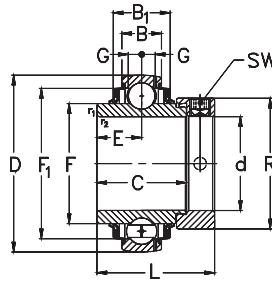
Gehäuselager
Insert bearings



d	Hauptabmessungen [mm]				Gehäuselager	Hauptabmessungen [mm]			
	D	B	B ₁	C		E	F	F ₁	G
	Boundary dimensions [mm]				Insert bearing	Boundary dimensions [mm]			
20	47	14	--	--	GAY20-NPPB	7	28.3	--	3.7
	47	14	16.6	--	GYE20-KRRB	12.7	27.6	37.4	3.7
25	52	15	--	21.4	GRAE25-NPPB	7.5	30.5	--	3.9
	52	15	--	21.4	RAE25-NPPB	7.5	30.5	--	--
	47	12	--	17.5	RALE25-NPPB	6	30	--	--
	52	15	16.7	34.9	GE25-KRRB	17.5	33.8	42.5	3.9
	52	15	--	--	AY25-NPPB	7.5	33.5	--	--
	52	15	--	--	GAY25-NPPB	7.5	33.5	--	3.9
	52	15	16.7	--	GYE25-KRRB	14.3	33.8	42.5	3.9
30	62	18	--	23.8	GRAE30-NPPB	9	37.4	--	5
	62	18	--	23.8	RAE30-NPPB	9	37.4	--	--
	55	13	--	18.5	RALE30-NPPB	6.5	35.7	--	--
	62	18	20.7	36.5	GE30-KRRB	18.3	40.2	52	5
	72	20	24	36.5	GNE30-KRRB	17.5	44	60.2	6.2
	62	18	--	--	AY30-NPPB-1	9	39.4	--	--
	62	18	--	--	GAY30-NPPB	9	39.4	--	5
	62	18	20.7	--	GYE30-KRRB	15.9	40.2	52	5
35	72	19	--	25.4	GRAE35-NPPB	9.5	44.6	--	5.7
	72	19	--	25.4	RAE35-NPPB	9.5	44.6	--	--
	72	19	22.5	37.7	GE35-KRRB	18.8	46.8	60.3	5.7
	80	22	25	38.1	GNE35-KRRB	18.3	48	66.6	7
	72	19	--	--	GAY35-NPPB	9.5	46.9	--	5.7



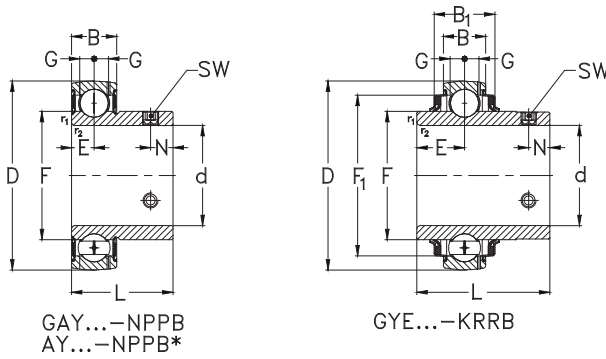
GRAE...-NPPB
RALE...-NPPB*
RAE...-NPPB*



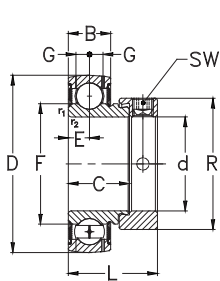
GE...-KRRB
GNE...-KRRB*

d	Hauptabmessungen [mm]				Tragzahlen [kN]			Gewicht [kg]
	N	L	SW	R_{max}	C_r [kN]	C_{0r} [kN]	C_u	
<i>Boundary dimensions [mm]</i>								
<i>Load ratings [kN]</i>								
<i>Weight [kg]</i>								
20	4.5	25	2.5	--	12.8	6.7	0.3	0.13
	4.5	31	2.5	--	12.8	6.7	0.3	0.17
25	--	31	3	37.5	14	7.9	0.4	0.19
	--	31	3	37.5	14	7.9	0.4	0.19
	--	25.4	3	36	10.1	5.9	0.3	0.12
	--	44.4	2.5	37.5	14	7.9	0.4	0.25
	5	27	2.5	--	14	7.9	0.4	0.16
	5	27	2.5	--	14	7.9	0.4	0.16
	5	34.1	2.5	--	14	7.9	0.4	0.2
30	--	35.7	4	44	19.5	11.3	0.5	0.31
	--	35.7	4	44	19.5	11.3	0.5	0.31
	--	26.5	2.5	42.5	13.2	8.3	0.4	0.17
	--	48.4	4	--	19.5	11.3	0.5	0.38
	--	50	5	51	27	15.2	0.7	0.54
	5	30	3	--	19.5	11.3	0.5	0.25
	5	30	3	--	19.5	11.3	0.5	0.25
	5	38.1	3	--	19.5	11.3	0.5	0.33
35	--	38.9	5	51	25.7	15.3	0.7	0.48
	--	38.9	5	51	25.7	15.3	0.7	0.48
	--	51.1	5	51	25.7	15.3	0.7	0.55
	--	51.6	5	55	19.5	11.3	0.5	0.73
	6	35	3	--	25.7	15.3	0.7	0.39

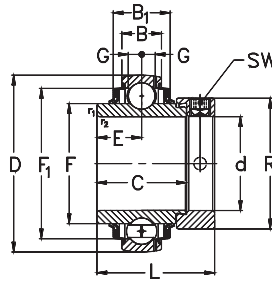
Gehäuselager
Insert bearings



d	Hauptabmessungen [mm] Boundary dimensions [mm]				Gehäuselager Insert bearing	Hauptabmessungen [mm] Boundary dimensions [mm]			
	D	B	B ₁	C		E	F	F ₁	G
35	72	19	22.5	--	GYE35-KRRB	17.5	46.8	60.3	5.7
40	80	21	--	30.2	GRAE40-NPPB	11	49.4	--	6.2
	80	21	--	30.2	RAE40-NPPB	11	49.4	--	--
	80	21	23.5	42.9	GE40-KRRB	21.4	52.3	68.3	6.2
	90	23	26	41	GNE40-KRRB	18	53.8	74.5	7.5
	80	21	--	--	GAY40-NPPB	10.5	52.4	--	6.2
	80	21	23.5	--	GYE40-KRRB	19	52.3	68.3	6.2
45	85	22	--	30.2	GRAE45-NPPB	11	54.5	--	6.4
	85	22	26.4	42.9	GE45-KRRB	21.4	57.9	72.3	6.4
	85	22	--	--	GAY45-NPPB	11	57	--	6.4
	85	22	26.4	--	GYE45-KRRB	19	57.9	72.3	6.4
50	90	22	--	30.2	GRAE50-NPPB	11	59.4	--	6.9
	90	22	--	30.2	RAE50-NPPB	11	59.4	--	--
	90	22	26.4	49.2	GE50-KRRB	24.6	62.8	77.3	6.9
	110	29	31	49.2	GNE50-KRRB	24.6	68.8	92.7	9.1
	90	22	--	--	GAY50-NPPB	11	62	--	6.5
	90	22	26.4	--	GYE50-KRRB	19	62.8	77.3	6.5
55	100	24	--	32.5	GRAE55-NPPB	12	66	--	7
	100	25	29	55.5	GE55-KRRB	27.8	69.8	85.9	7
	100	25	29	--	GYE55-KRRB	22	69.8	85.9	7
60	110	24	--	37.1	GRAE60-NPPB	13.5	72	--	7.6
	110	24	29	61.9	GE60-KRRB	31	76.5	94.5	7.6



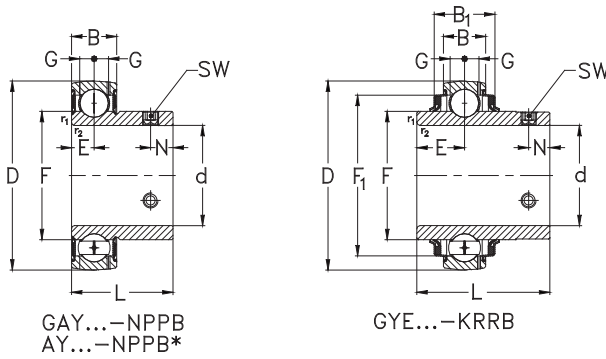
GRAE...-NPPB
RALE...-NPPB*
RAE...-NPPB*



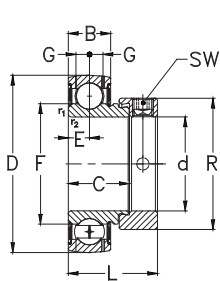
GE...-KRRB
GNE...-KRRB*

d	Hauptabmessungen [mm] Boundary dimensions [mm]				Tragzahlen [kN] Load ratings [kN]			Gewicht [kg] Weight [kg]
	N	L	SW	R _{max}	C _r [kN]	C _{0r} [kN]	C _u	m
35	6	42.9	3	--	25.7	15.3	0.7	0.49
40	--	43.7	5	58	29.5	18.2	0.8	0.62
	--	43.7	5	58	29.5	18.2	0.8	0.62
	--	56.3	5	58	29.5	18.2	0.8	0.74
	--	54.6	5	63	40.8	24	1.1	1.09
	8	39.5	4	--	29.5	18.2	0.8	0.51
	8	49.2	4	--	29.5	18.2	0.8	0.65
45	--	43.7	5	63	31.7	20.7	0.9	0.69
	--	56.3	5	63	31.7	20.7	0.9	0.81
	8	41.5	4	--	31.7	20.7	0.9	0.55
	8	49.2	4	--	31.7	20.7	0.9	0.7
50	--	43.7	5	69	35.1	23.2	1.1	0.77
	--	43.7	5	69	35.1	23.2	1.1	0.77
	--	62.7	5	69	35.1	23.2	1.1	1
	--	66.7	5	75.8	61.9	38	1.7	1.87
	9	43	4	--	35.1	23.2	1.1	0.62
	8.5	51.6	4	--	35.1	23.2	1.1	0.8
55	--	48.4	5	76	43.5	29.2	1.3	0.81
	--	71.4	5	76	43.3	29.2	1.3	1.42
	9	55.6	5	--	43.5	29.2	1.3	1.1
60	--	53.1	5	84	47.7	33	1.5	1.4
	--	77.8	5	84	47.7	33	1.5	1.84

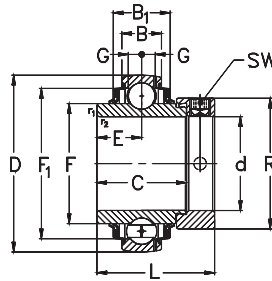
Gehäuselager
Insert bearings



d	Hauptabmessungen [mm] Boundary dimensions [mm]				Gehäuselager Insert bearing	Hauptabmessungen [mm] Boundary dimensions [mm]			
	D	B	B ₁	C		E	F	F ₁	G
60	130	33	37.2	52	GNE60-KRRB	23	79.4	109	11.2
	110	24	--	--	GAY60-NPPB	13	76	--	7.6
	110	24	29	--	GYE60-KRRB	25.4	76.5	94.5	7.6
65	125	28	32	48.5	GE65-KRRB	21.5	85.2	109	8.9
	125	28	32	48.5	GYE65-KRRB	30.2	85.2	109	8.9
70	125	28	32	48.5	GE70-KRRB	21.5	85.2	109	8.9
	150	37	41	58	GNE70-KRRB	26	92.2	127	12.3
	125	28	32	--	GYE70-KRRB	30.2	85.2	109	8.9
75	130	28	30.5	49.5	GE75-KRRB	21.5	90	113	8.5
	130	28	30.5	--	GYE75-KRRB	33.3	90	113	8.5
80	140	30	38	53.2	GE80-KRRB	23.4	97	120	8.8
	170	41	51	73	GNE80-KRRB	34	109	142.8	13.2
	140	30	38	--	GYE80-KRRB	33.3	97	120	8.8
90	160	32	35	52	GE90-KRRB	23	109.4	138	10
	190	45	52.6	77.5	GNE90-KRRB	35.5	122.2	161.3	14.3
	160	32	35	--	GYE90-KRRB	39.7	109.4	138	10
100	180	36	39	57.5	GE100-KRRB	25.5	122.2	155.5	11.2
	215	49	59.4	86	GNE100-KRRB	39.5	137.1	182.8	16.7

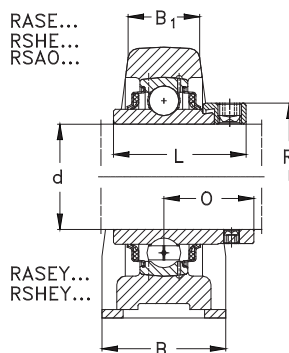
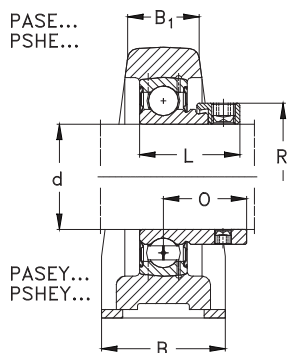


GRAE...-NPPB
RALE...-NPPB*
RAE...-NPPB*

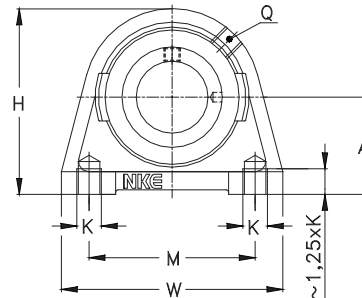
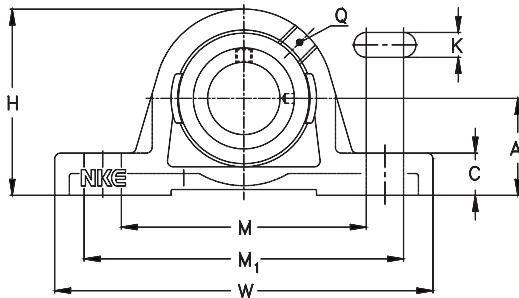


GE...-KRRB
GNE...-KRRB*

d	Hauptabmessungen [mm]				Tragzahlen [kN]			Gewicht [kg]
	N	L	SW	R _{max}	C _r [kN]	C _{0r} [kN]	C _u	Weight [kg] m
<i>Boundary dimensions [mm]</i>								
60	--	68.4	5	89	81.8	52	2.4	2.97
	10	47	5	--	47.7	33	1.5	1.07
	10	65.1	5	--	47.7	33	1.5	1.32
65	--	66.1	6	96	61	45.1	2.1	2.71
	--	74.6	5	--	61	45.1	2.1	2.25
70	--	66.1	6	96	61	45.1	2.1	2.45
	--	75.4	6	102	104	68.1	3	4.37
	12	74.6	1.95	--	61	45.1	2.1	1.95
75	--	67.1	6	100	66	49.5	2.2	2.65
	12	77.8	5	--	66	49.5	2.2	2.19
80	--	71	6	108	72	54	2.3	2.95
	--	93.7	6	118	123	87	3.5	7.1
	12	82.6	5	--	72	54	2.3	2.93
90	--	69.5	6	118	96	72	2.9	3.72
	--	101	6	132	143	107	4.1	9.3
	12	96	6	--	96	72	2.9	4.2
100	--	75	6	132	122	93	3.6	4.65
	--	109.5	6	145	173	141	5.1	12.3

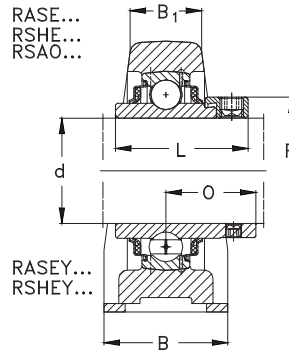
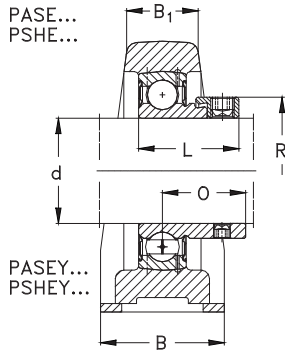


Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		
d	A	W	H	Lagereinheit Bearing Unit	Gehäuse Housing	Gehäuselager Insert Bearing
12	30,2	125	57	PASE12	ASE03	GRAE12-NPPB
	30,2	125	57	PASEY12	ASE03	GAY12-NPPB
	30,2	125	57	RASEY12	ASE03	GYE12-KRRB
	30,2	63	57	PSHE12	SHE03	GRAE12-NPPB
	30,2	63	57	PSHEY12	SHE03	GAY12-NPPB
	30,2	63	57	RSHEY12	SHE03	GYE12-KRRB
15	30,2	125	57	PASE15	ASE03	GRAE15-NPPB
	30,2	125	57	PASEY15	ASE03	GAY15-NPPB
	30,2	125	57	RASEY15	ASE03	GYE15-KRRB
	30,2	63	57	PSHE15	SHE03	GRAE15-NPPB
	30,2	63	57	PSHEY15	SHE03	GAY15-NPPB
	30,2	63	57	RSHEY15	SHE03	GYE15-KRRB
16	30,2	125	57	RASEY16	ASE03	GYE16-KRRB
17	30,2	125	57	PASE17	ASE03	GRAE17-NPPB
	30,2	125	57	RASE17	ASE03	GE17-KRRB
	30,2	125	57	PASEY17	ASE03	GAY17-NPPB
	30,2	125	57	RASEY17	ASE03	GYE17-KRRB
	30,2	63	57	PSHE17	SHE03	GRAE17-NPPB
	30,2	63	57	RSHE17	SHE03	GE17-KRRB
	30,2	63	57	PSHEY17	SHE03	GAY17-NPPB
30,2	63	57	RSHEY17	SHE03	GYE17-KRRB	
20	33,3	130	64	PASE20-N	ASE04-N	GRAE20-NPPB

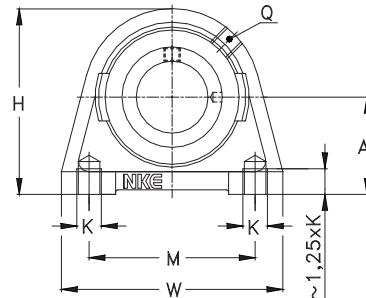
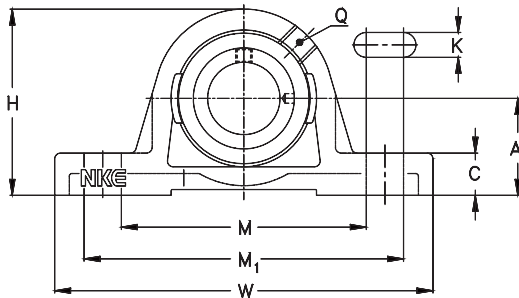


PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
12	30	18	10	11	28,6	87	103	22,1	M6	28	0,46
	30	18	10	11	22	87	103	16	M6	--	0,44
	30	18	10	11	27,4	87	103	15,9	M6	--	0,45
	30	18	--	M 8	28,6	47	--	22,1	M6	28	0,44
	30	18	--	M 8	22	47	--	16	M6	--	0,42
	30	18	--	M 8	27,4	47	--	15,9	M6	--	0,43
15	30	18	10	11	28,6	87	103	22,1	M6	28	0,46
	30	18	10	11	22	87	103	16	M6	--	0,43
	30	18	10	11	27,4	87	103	15,9	M6	--	0,45
	30	18	--	M 8	28,6	47	--	22,1	M6	28	0,44
	30	18	--	M 8	22	47	--	16	M6	--	0,41
	30	18	--	M 8	27,4	47	--	15,9	M6	--	0,42
16	30	18	10	11	27,4	87	103	15,9	M6	--	0,45
17	30	18	10	11	28,6	87	103	22,1	M6	28	0,46
	30	18	10	11	37,3	87	103	23,4	M6	28	0,5
	30	18	10	11	22	87	103	16	M6	--	0,42
	30	18	10	11	27,4	87	103	15,9	M6	--	0,45
	30	18	--	M 8	28,6	47	--	22,1	M6	28	0,44
	30	18	--	M 8	37,3	47	--	23,4	M6	28	0,48
30	18	--	M 8	22	47	--	16	M6	--	0,4	
30	18	--	M 8	27,4	47	--	15,9	M6	--	0,41	
20	32	19	14,5	11	31	89,5	105	23,5	R1/8"	33	0,55

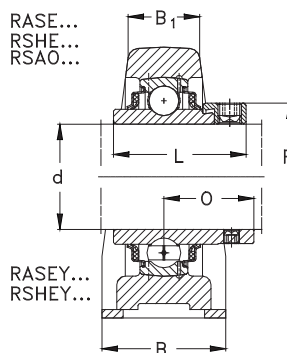
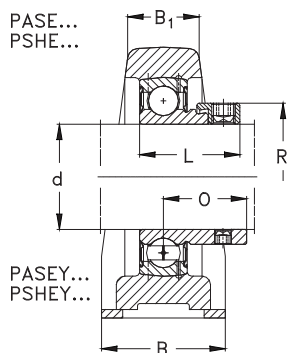


Hauptabmessungen [mm]				Bezeichnung		
Boundary dimensions [mm]				Designation		
d	A	W	H	Lagereinheit <i>Bearing Unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert Bearing</i>
20	33,3	130	64	RASE20-N	ASE04-N	GE20-KRRB
	33,3	130	64	PASEY20-N	ASE04-N	GAY20-NPPB
	33,3	130	64	RASEY20-N	ASE04-N	GYE20-KRRB
	33,3	65	64	PSHE20-N	SHE04-N	GRAE20-NPPB
	33,3	65	64	RSHE20-N	SHE04-N	GE20-KRRB
	33,3	65	64	PSHEY20-N	SHE04-N	GAY20-NPPB
	33,3	65	64	RSHEY20-N	SHE04-N	GYE20-KRRB
	25	36,5	130	70	PASE25-N	ASE05-N
36,5		130	70	RASE25-N	ASE05-N	GE25-KRRB
36,5		130	70	PASEY 25-N	ASE05-N	GAY25-NPPB
36,5		130	70	RASEY25-N	ASE05-N	GYE25-KRRB
36,5		70	70	PSHE25-N	SHE05-N	GRAE25-NPPB
36,5		70	70	RSHE25-N	SHE05-N	GE25-KRRB
36,5		70	70	PSHEY25-N	SHE05-N	GAY25-NPPB
36,5		70	70	RSHEY25-N	SHE05-N	GYE25-KRRB
30	42,9	158	82	PASE30-N	ASE06-N	GRAE30-NPPB
	42,9	158	82	RASE30-N	ASE06-N	GE30-KRRB
	42,9	158	82	PASEY30-N	ASE06-N	GAY30-NPPB
	42,9	158	82	RASEY30-N	ASE06-N	GYE30-KRRB
	42,9	98	82	PSHE30-N	SHE06-N	GRAE30-NPPB
	42,9	98	82	RSHE30-N	SHE06-N	GE30-KRRB
	42,9	98	82	PSHEY30-N	SHE06-N	GAY30-NPPB

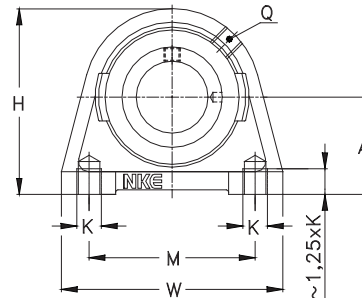
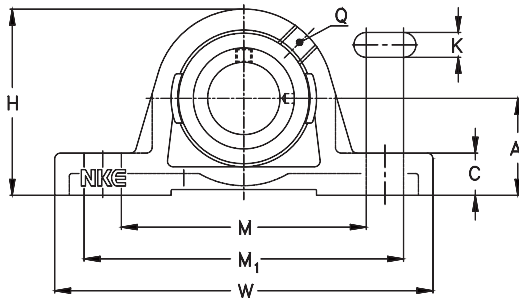


PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
20	32	19	14,5	11	43,7	89,5	105	26,6	R1/8"	33	0,59
	32	19	14,5	11	25	89,5	105	18	R1/8"	--	0,52
	32	19	14,5	11	31	89,5	105	18,3	R1/8"	--	0,56
	32	19	--	M 8	31	50,8	--	23,5	R1/8"	33	0,51
	32	19	--	M 8	43,7	50,8	--	26,6	R1/8"	33	0,55
	32	19	--	M 8	25	50,8	--	18	R1/8"	--	0,48
	32	19	--	M 8	31	50,8	--	18,3	R1/8"	--	0,52
25	36	21	14,5	11	31	94,5	110,5	23,5	R1/8"	37,5	0,64
	36	21	14,5	11	44,4	94,5	110,5	26,9	R1/8"	37,5	0,7
	36	21	14,5	11	27	94,5	110,5	19,5	R1/8"	--	0,61
	36	21	14,5	11	34,1	94,5	110,5	19,6	R1/8"	--	0,65
	36	21	--	M10	31	50,8	--	23,5	R1/8"	37,5	0,6
	36	21	--	M10	44,4	50,8	--	26,9	R1/8"	37,5	0,66
	36	21	--	M10	27	50,8	--	19,5	R1/8"	--	0,57
30	40	25	17	14	35,7	109,5	125,5	26,7	R1/8"	44	1,04
	40	25	17	14	48,4	109,5	125,5	30,1	R1/8"	44	1,11
	40	25	17	14	30	109,5	125,5	21	R1/8"	--	0,98
	40	25	17	14	38,1	109,5	125,5	22,2	R1/8"	--	1,06
	40	25	--	M10	35,7	76,2	--	26,7	R1/8"	44	1,05
	40	25	--	M10	48,4	76,2	--	30,1	R1/8"	44	1,12
	40	25	--	M10	30	76,2	--	21	R1/8"	--	0,99

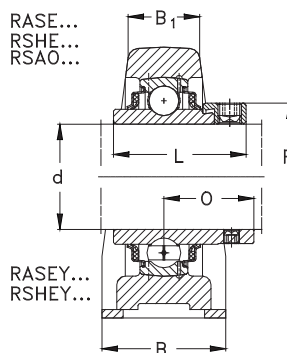
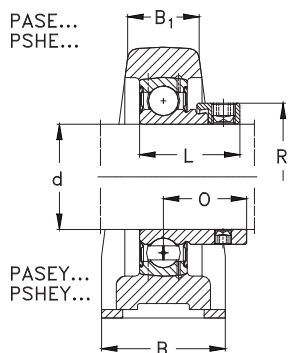


Hauptabmessungen [mm]				Bezeichnung		
Boundary dimensions [mm]				Designation		
d	A	W	H	Lagereinheit <i>Bearing Unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert Bearing</i>
30	42,9	98	82	RSHEY30-N	SHE06-N	GYE30-KRRB
	50	180	95	RSOA30-N	SAO06-N	GNE30-KRRB
35	47,6	163	93	PASE35-N	ASE07-N	GRAE35-NPPB
	47,6	163	93	RASE35-N	ASE07-N	GE35-KRRB
	47,6	163	93	PASEY35-N	ASE07-N	GAY35-NPPB
	47,6	163	93	RASEY35-N	ASE07-N	GYE35-KRRB
	47,6	103	93	PSHE35-N	SHE07-N	GRAE35-NPPB
	47,6	103	93	RSHE35-N	SHE07-N	GE35-KRRB
	47,6	103	93	PSHEY35-N	SHE07-N	GAY35-NPPB
	47,6	103	93	RSHEY35-N	SHE07-N	GYE35-KRRB
	56	210	106	RSOA35-N	SAO07-N	GNE35-KRRB
40	49,2	179	99	PASE40-N	ASE08-N	GRAE40-NPPB
	49,2	179	99	RASE40-N	ASE08-N	GE40-KRRB
	49,2	179	99	PASEY40-N	ASE08-N	GAY40-NPPB
	49,2	179	99	RASEY40-N	ASE08-N	GYE40-KRRB
	49,2	116	99	PSHE40-N	SHE08-N	GRAE40-NPPB
	49,2	116	99	RSHE40-N	SHE08-N	GE40-KRRB
	49,2	116	99	PSHEY40-N	SHE08-N	GAY40-NPPB
	49,2	116	99	RSHEY40-N	SHE08-N	GYE40-KRRB
60	220	116	RSOA40-N	SAO08-N	GNE40-KRRB	
45	54	192	107	PASE45	ASE09	GRAE45-NPPB
	54	192	107	RASE45	ASE09	GE45-KRRB

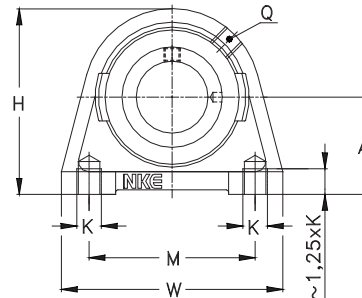
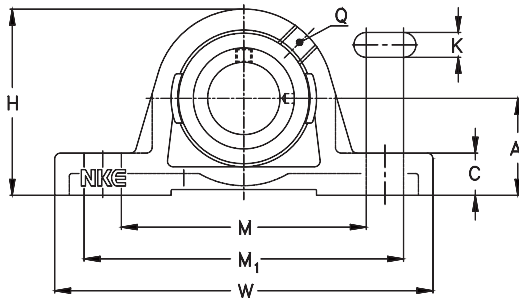


PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
30	40	25	--	M10	38,1	76,2	--	22,2	R1/8"	--	1,07
	50	28	18	17,5	50	137	143	32,5	R1/8"	51	1,8
35	45	27	19	14	38,9	119,5	132,5	29,4	R1/8"	51	1,58
	45	27	19	14	51,1	119,5	132,5	32,3	R1/8"	51	1,6
	45	27	19	14	35	119,5	132,5	25,5	R1/8"	--	1,44
	45	27	19	14	42,9	119,5	132,5	25,4	R1/8"	--	1,54
	45	27	--	M10	38,9	82,6	--	29,4	R1/8"	51	1,44
	45	27	--	M10	51,1	82,6	--	32,3	R1/8"	51	1,51
	45	27	--	M10	35	82,6	--	25,5	R1/8"	--	1,35
	45	27	--	M10	42,9	82,6	--	25,4	R1/8"	--	1,45
	56	30	20	17,5	51,6	152	168	33,4	R1/8"	55	2,75
40	48	30	19	14	43,7	126,5	150	32,7	R1/8"	58	1,71
	48	30	19	14	56,3	126,5	150	34,9	R1/8"	58	1,83
	48	30	19	14	39,5	126,5	150	29	R1/8"	--	1,6
	48	30	19	14	49,2	126,5	150	30,2	R1/8"	--	1,74
	48	30	--	M12	43,7	88,9	--	32,7	R1/8"	58	1,84
	48	30	--	M12	56,3	88,9	--	34,9	R1/8"	58	1,96
	48	30	--	M12	39,5	88,9	--	29	R1/8"	--	1,73
	48	30	--	M12	49,2	88,9	--	30,2	R1/8"	--	1,87
60	31	22	17,5	54,6	160	180	36,6	R1/8"	63	3,18	
45	48	32	21,5	14	43,7	135	164,3	32,7	R1/8"	63	2,09
	48	32	21,5	14	56,3	135	164,3	34,9	R1/8"	63	2,21

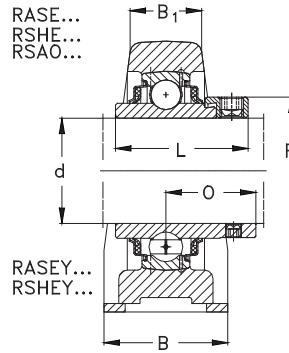
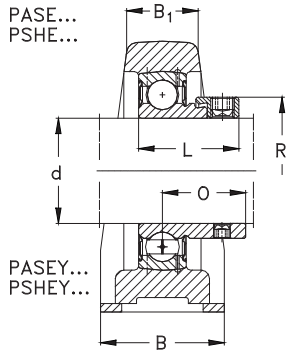


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	W	H	Lagereinheit <i>Bearing Unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert Bearing</i>
45	54	192	107	PASEY45	ASE09	GAY45-NPPB
	54	192	107	RASEY45	ASE09	GYE45-KRRB
	54	120	107	PSHE45	SHE09	GRAE45-NPPB
	54	120	107	RSHE45	SHE09	GE45-KRRB
	54	120	107	PSHEY45	SHE09	GAY45-NPPB
	54	120	107	RSHEY45	SHE09	GYE45-KRRB
50	57,2	200	115	PASE 50-N	ASE10-N	GRAE50-NPPB
	57,2	200	115	RASE 50-N	ASE10-N	GE50-KRRB
	57,2	200	115	PASEY 50-N	ASE10-N	GAY50-NPPB
	57,2	200	115	RASEY 50-N	ASE10-N	GYE50-KRRB
	57,2	135	115	PSHE50-N	SHE10-N	GRAE50-NPPB
	57,2	135	115	RSHE50-N	SHE10-N	GE50-KRRB
	57,2	135	115	PSHEY50-N	SHE10-N	GAY50-NPPB
	57,2	135	115	RSHEY50-N	SHE10-N	GYE50-KRRB
	75	275	143	RSAO50-N	SAO10-N	GNE50-KRRB
55	63,5	222	124,5	PASE55	ASE11	GRAE55-NPPB
	63,5	222	124,5	RASE55	ASE11	GE55-KRRB
	63,5	222	124,5	RASEY55	ASE11	GYE55-KRRB
	64	150	125	PSHE55	SHE11	GRAE55-NPPB
	64	150	125	RSHE55	SHE11	GE55-KRRB
	64	150	125	RSHEY55	SHE11	GYE55-KRRB
60	69,9	240	140	PASE60-N	ASE12-N	GRAE60-NPPB

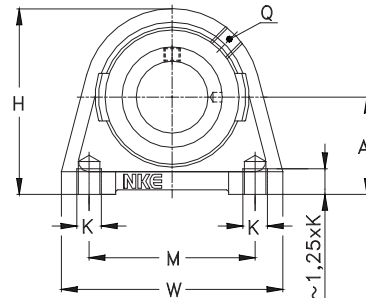
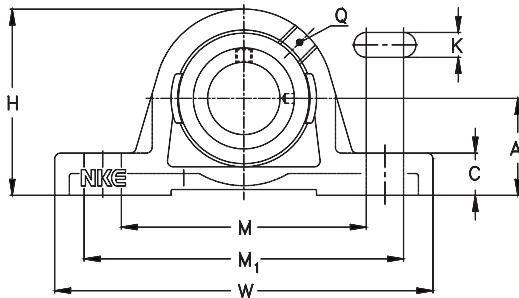


PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
45	48	32	21,5	14	41,5	135	164,3	30,5	R1/8"	--	1,95
	48	32	21,5	14	49,2	135	164,3	30,2	R1/8"	--	2,1
	48	32	--	M12	43,7	95,3	--	32,7	R1/8"	63	2,14
	48	32	--	M12	56,3	95,3	--	34,9	R1/8"	63	2,26
	48	32	--	M12	41,5	95,3	--	30,5	R1/8"	--	2
	48	32	--	M12	49,2	95,3	--	30,2	R1/8"	--	2,15
50	54	34	21,5	18	43,7	153	163	32,7	R1/8"	69	2,47
	54	34	21,5	18	62,7	153	163	38,1	R1/8"	69	2,7
	54	34	21,5	18	43	153	163	32	R1/8"	--	2,32
	54	34	21,5	18	51,6	153	163	32,6	R1/8"	--	2,5
	54	34	--	M16	43,7	101,6	--	32,7	R1/8"	69	2,79
	54	34	--	M16	62,7	101,6	--	38,1	R1/8"	69	3,02
	54	34	--	M16	43	101,6	--	32	R1/8"	--	2,64
	54	34	--	M16	51,6	101,6	--	32,6	R1/8"	--	2,82
	75	39	27	20	66,7	197	227	42,1	R1/8"	75,8	6,1
55	60	35	22,5	18	48,4	164,5	187,5	36,4	R1/8"	76	2,79
	60	35	22,5	18	71,4	164,5	187,5	43,6	R1/8"	76	3,4
	60	35	22,5	18	55,6	164,5	187,5	33,4	R1/8"	--	3,08
	60	35	--	M16	48,4	118	--	36,4	R1/8"	76	2,91
	60	35	--	M16	71,4	118	--	43,6	R1/8"	76	3,52
	60	35	--	M16	55,6	118	--	33,4	R1/8"	--	3,2
60	60	42	25	18	53,1	180	200	39,6	R1/8"	84	4,35



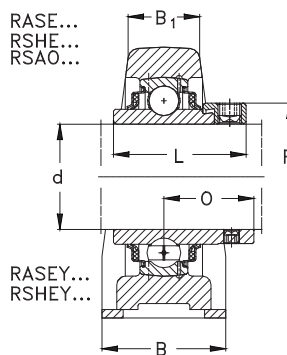
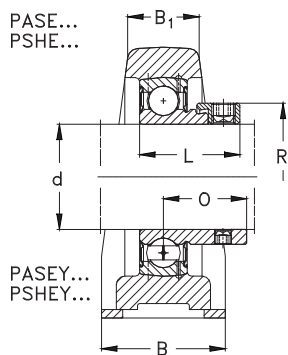
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	W	H	Lagereinheit <i>Bearing Unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert Bearing</i>
60	69,9	240	140	RASE60-N	ASE12-N	GE60-KRRB
	69,9	240	140	PASEY60-N	ASE12-N	GAY60-NPPB
	69,9	240	140	RASEY60-N	ASE12-N	GYE60-KRRB
	69,9	150	140	PSHE60-N	SHE12-N	GRAE60-NPPB
	69,9	150	140	RSHE60-N	SHE12-N	GE60-KRRB
	69,9	150	140	PSHEY60-N	SHE12-N	GAY60-NPPB
	69,9	150	140	RSHEY60-N	SHE12-N	GYE60-KRRB
65	85	330	165	RSAO60	SAO12	GNE60-KRRB
	79,4	260	156	RASE65	ASE14	GE65-KRRB
	79,4	260	156	RASEY65	ASE14	GYE65-KRRB
70	79,4	260	156	RASE70	ASE14	GE70-KRRB
	79,4	260	156	RASEY70	ASE14	GYE70-KRRB
	95	360	187	RSAO70	SAO14	GNE70-KRRB
75	82,5	265	164	RASE75	ASE15	GE75-KRRB
	82,5	265	164	RASEY75	ASE15	GYE75-KRRB
80	89	290	175	RASE80	ASE16	GE80-KRRB
	89	290	175	RASEY80	ASE16	GYE80-KRRB
	116	390	226	RSAO80	SAO16	GNE80-KRRB
90	101,6	330	200	RASE90	ASE18	GE90-KRRB
	101,6	330	200	RASEY90	ASE18	GYE90-KRRB
	130	410	250	RSAO90	SAO18	GNE90-KRRB
100	115	380	225	RASE100	ASE20	GE100-KRRB



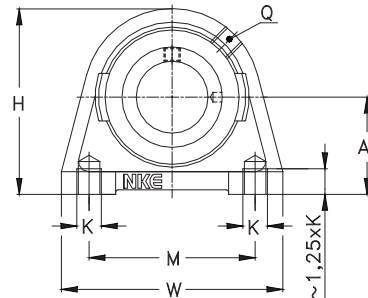
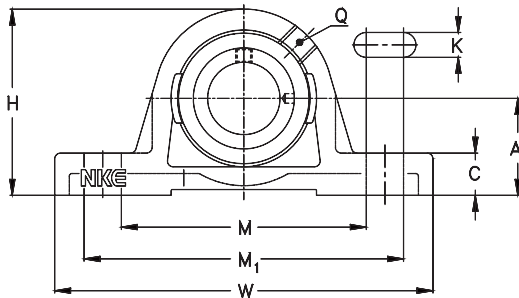
PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
60	60	42	25	18	77,8	180	200	46,8	R1/8"	84	4,79
	60	42	25	18	47	180	200	34	R1/8"	--	4,02
	60	42	25	18	65,1	180	200	39,7	R1/8"	--	4,27
	60	42	--	M16	53,1	118	--	39,6	R1/8"	84	4,1
	60	42	--	M16	77,8	118	--	46,8	R1/8"	84	4,54
	60	42	--	M16	47	118	--	34	R1/8"	--	3,37
	60	42	--	M16	65,1	118	--	39,7	R1/8"	--	4,02
65	85	46	32	25	68,4	237	263	45,4	R1/8"	89	9
	65	44	27,5	22	66,1	196,5	208,5	44,6	R1/8"	96	6,41
70	65	44	27,5	22	74,6	196,5	208,5	44,4	R1/8"	--	5,95
	65	44	27,5	22	74,6	196,5	208,5	44,4	R1/8"	--	5,65
75	90	54	35	27	75,4	267	297	49,4	R1/8"	102	11
	75	48	27,5	22	67,1	202	218	45,6	R1/8"	100	7,65
	75	48	27,5	22	77,8	202	218	44,5	R1/8"	--	7,19
80	78	55	30	26	71	224	240	47,6	R1/8"	108	8,65
	78	55	30	26	82,6	224	240	49,3	R1/8"	--	8,63
	110	76	50	25,5	93,7	296	334	59,7	R1/8"	118	22,5
90	85	55	35	27	69,6	260	276	46,6	R1/8"	118	12,1
	85	55	35	27	96	260	276	56,3	R1/8"	--	12,6
	120	84	57	28	101	314	366	65,5	R1/8"	132	29,5
100	95	62	40	30	75	300	316	49,5	R1/8"	132	15,9

Stehlagereinheiten, Grauguss
Plummer Block Units, Cast Iron



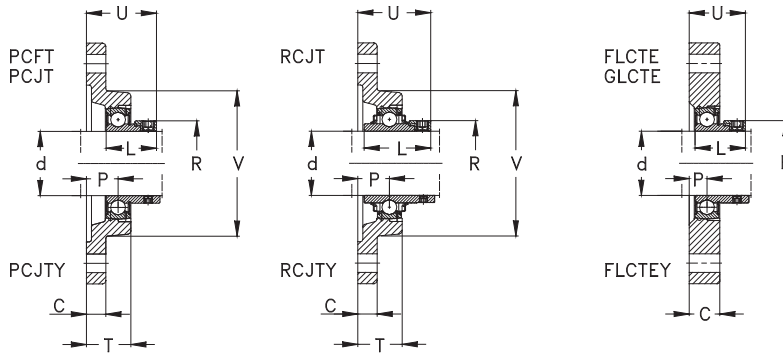
Hauptabmessungen [mm]				Bezeichnung		
Boundary dimensions [mm]				Designation		
d	A	W	H	Lagereinheit <i>Bearing Unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert Bearing</i>
100	145	440	280	RSAO100	SAO20	GNE100-KRRB
120	135	440	265	RASE120	ASE24	GE120-KRRB



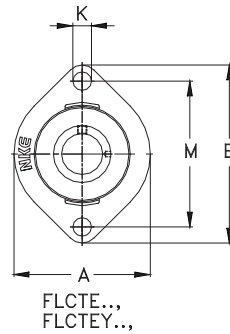
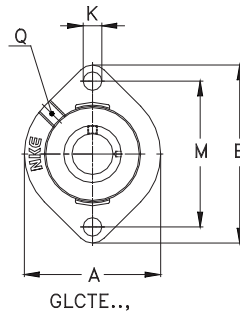
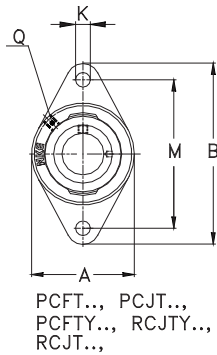
PSHE..., PSHEY...,
RSHE..., PSHEY..

Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]
d	B	B ₁	C	K	L	M	M ₁	O	Q	R _{max}	[m]
100	130	94	65	32	109,5	360	390	70	R1/8"	145	41
120	105	70	45	33	81	350	366	52,5	R1/8"	152	25,5

Zweilochflascheinheiten, Grauguss
Oval Flanged Units, Cast Iron

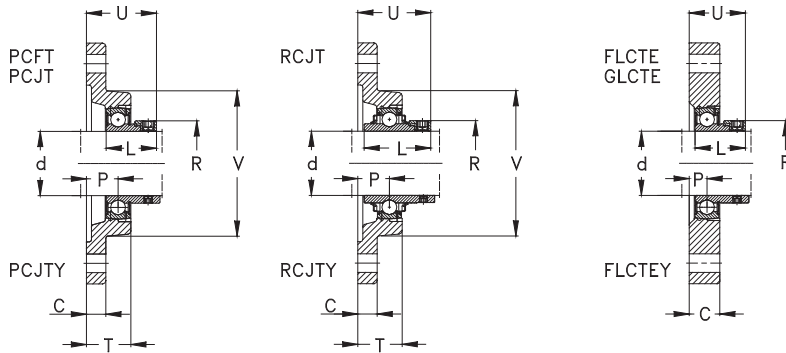


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
12	58,7	81	15	FLCTE12	LCTE03	RAE12-NPPB
	58,7	81	15	GLCTE12	GLCTE03	GRAE12-NPPB
	58,7	81	15	FLCTEY12	LCTE03	AY12-NPPB
	57	99	9,5	PCFT12	CFT03	GRAE12-NPPB
	57	99	9,5	PCJT12	CJT03	GRAE12-NPPB
	57	99	9,5	PCJTY12	CJT03	GAY12-NPPB
	57	99	9,5	RCJTY12	CJT03	GYE12-KRRB
15	58,7	81	15	FLCTE15	LCTE03	RAE15-NPPB
	58,7	81	15	GLCTE15	GLCTE03	GRAE15-NPPB
	58,7	81	15	FLCTEY15	LCTE03	AY15-NPPB
	57	99	9,5	PCFT15	CFT03	GRAE15-NPPB
	57	99	9,5	PCJT15	CJT03	GRAE15-NPPB
	57	99	9,5	PCJTY15	CJT03	GAY15-NPPB
	57	99	9,5	RCJTY15	CJT03	GYE15-KRRB
16	57	99	9,5	RCJTY16	CJT03	GYE 16-KRRB
17	58,7	81	15	FLCTE17	LCTE03	RAE17-NPPB
	58,7	81	15	GLCTE17	GLCTE03	GRAE17-NPPB
	58,7	81	15	FLCTEY17	LCTE03	AY17-NPPB
	57	99	9,5	PCFT17	CFT03	GRAE17-NPPB
	57	99	9,5	PCJT17	CJT03	GRAE17-NPPB
	57	99	9,5	PCJTY17	CJT03	GAY17-NPPB
	57	99	9,5	RCJT17	CJT03	GE17-KRRB

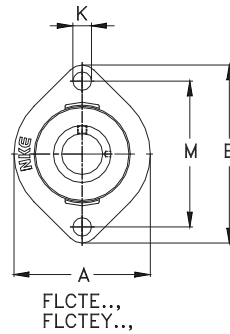
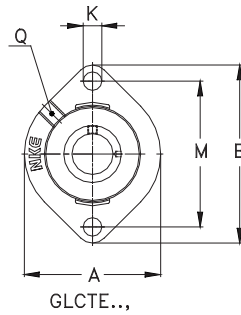
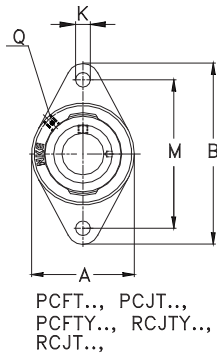


d [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
	V	K	L	M	P	Q	R _{max}	T	U	[m]
12	--	6,6	28,6	63,5	8,4	--	28	--	30,5	0,3
	--	6,6	28,6	63,5	8,4	M6	28	--	30,5	0,3
	--	6,6	22	63,5	8,4	--	--	--	26	0,28
57	11,5	28,6	76,5	10	M6	28	18	32,1	0,39	
	11,5	28,6	76,5	17	M6	28	25	39,1	0,37	
	11,5	22	76,5	17	M6	--	25	33	0,35	
	11,5	27,4	76,5	17	M6	--	25	32,9	0,36	
15	--	6,6	28,6	63,5	8,4	--	28	--	30,5	0,3
	--	6,6	28,6	63,5	8,4	M6	28	--	30,5	0,3
	--	6,6	22	63,5	8,4	--	--	--	26	0,27
	57	11,5	28,6	76,5	10	M6	28	18	32,1	0,39
	57	11,5	28,6	76,5	17	M6	28	25	39,1	0,37
	57	11,5	22	76,5	17	M6	--	25	33	0,34
57	11,5	27,4	76,5	17	M6	--	25	32,9	0,35	
	16	57	11,5	27,4	76,5	17	M6	--	25	32,9
17	--	6,6	28,6	63,5	8,4	--	28	--	30,5	0,3
	--	6,6	28,6	63,5	8,4	M6	28	--	30,5	0,3
	--	6,6	22	63,5	8,4	--	--	--	26	0,26
	57	11,5	28,6	76,5	10	M6	28	18	32,1	0,39
	57	11,5	28,6	76,5	17	M6	28	25	39,1	0,37
	57	11,5	22	76,5	17	M6	--	25	33	0,33
	57	11,5	37,3	76,5	17	M6	28	25	40,4	0,41

Zweilochflascheinheiten, Grauguss
Oval Flanged Units, Cast Iron

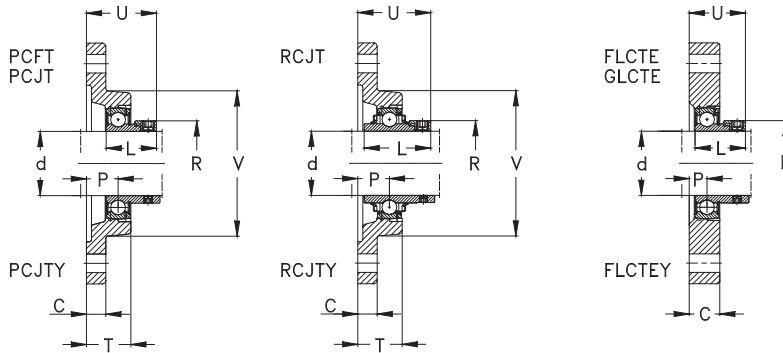


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
17	57	99	9,5	PCJTY17	CJT03	GAY17-NPPB
	57	99	9,5	RCJT17	CJT03	GE17-KRRB
	57	99	9,5	RCJTY17	CJT03	GYE17-KRRB
20	66,5	90,5	17	FLCTE20	LCTE04	RAE20-NPPB
	66,5	90,5	17	GLCTE20	GLCTE04	GRAE20-NPPB
	66,5	90,5	17	FLCTEY20	LCTE04	AY20-NPPB
	61	112	10	PCFT20	CFT04	GRAE20-NPPB
	61	112	10	PCJT20-N	CJT04-N	GRAE20-NPPB
	61	112	10	PCJTY20-N	CJT04-N	GAY20-NPPB
	61	112	10	RCJT20-N	CJT04-N	GE020-KRRB
	61	112	10	RCJTY20-N	CJT04-N	GYE20-KRRB
25	71	97	17,5	FLCTE25	LCTE05	RAE25-NPPB
	71	97	17,5	GLCTE25	GLCTE05	GRAE25-NPPB
	71	97	17,5	FLCTEY25	LCTE05	AY25-NPPB
	70	124	11	PCFT25	CFT05	GRAE25-NPPB
	70	124	11	PCJT25-N	CJT05-N	GRAE25-NPPB
	70	124	11	PCJTY25-N	CJT05-N	GAY25-NPPB
	70	124	11	RCJT25-N	CJT05-N	GE25-KRRB
	70	124	11	RCJTY25-N	CJT05-N	GYE25-KRRB
30	84	112,5	20,5	FLCTE30	LCTE06	RAE30-NPPB
	84	112,5	20,5	GLCTE30	GLCTE06	GRAE30-NPPB
	84	112,5	20,5	FLCTEY30	LCTE06	AY30-NPPB

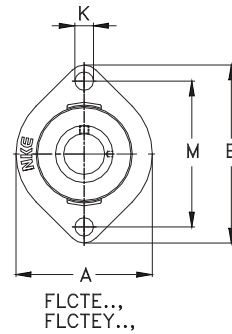
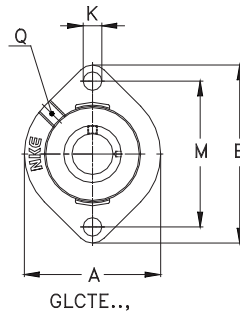
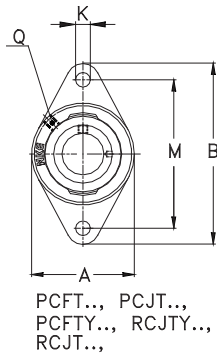


d [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
	V	K	L	M	P	Q	R _{max}	T	U	[m]
17	57	11,5	22	76,5	17	M6	--	25	33	0,33
	57	11,5	37,3	76,5	17	M6	28	25	40,4	0,41
	57	11,5	27,4	76,5	17	M6	--	25	32,9	0,34
20	--	9	31	71,4	9,5	--	33	--	33	0,39
	--	9	31	71,4	9,5	R1/8	33	--	33	0,39
	--	9	25	71,4	9,5	--	--	--	27	0,36
	61	11,5	31	90	10,5	R1/8"	33	17,5	34	0,45
	61	11,5	31	90	19	R1/8"	33	28	42,5	0,48
	61	11,5	25	90	19	R1/8"	--	28	37	0,45
25	61	11,5	43,7	90	19	R1/8"	33	28	45,6	0,52
	61	11,5	31	90	19	R1/8"	--	28	37,3	0,49
	--	9	31	76,2	9,9	--	37,5	--	33,4	0,47
	--	9	31	76,2	9,9	R1/8"	37,5	--	33,4	0,47
	--	9	27	76,2	9,9	--	--	--	29,4	0,44
	70	11,5	31	99	12,5	R1/8"	37,5	20	36	0,52
30	70	11,5	31	99	19	R1/8"	37,5	29	42,5	0,56
	70	11,5	27	99	19	R1/8"	--	29	38,5	0,48
	70	11,5	44,4	99	19	R1/8"	37,5	29	45,9	0,62
	70	11,5	34,1	99	19	R1/8"	--	29	38,8	0,57
30	--	11,5	35,7	90,5	11,4	--	44	--	38,1	0,76
	--	11,5	35,7	90,5	11,4	R1/8"	44	--	38,1	0,76
	--	11,5	29	90,5	11,4	--	--	--	32,4	0,7

Zweilochflascheinheiten, Grauguss
Oval Flanged Units, Cast Iron

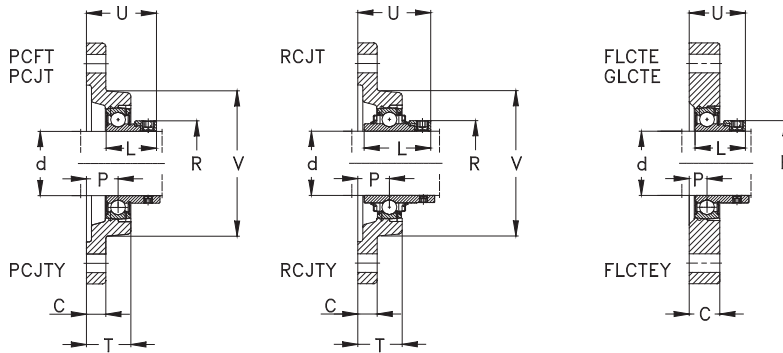


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
30	84	112,5	20,5	GLCTE30	GLCTE06	GRAE30-NPPB
	84	112,5	20,5	FLCTEY30	LCTE06	AY30-NPPB
	80	142	12	PCFT30	CFT06	GRAE30-NPPB
	80	142	12	PCJT30-N	CJT06-N	GRAE30-NPPB
	80	142	12	PCJTY30-N	CJT06-N	GAY30-NPPB
	80	142	12	RCJT30-N	CJT06-N	GE30-KRRB
	80	142	12	RCJTY30-N	CJT06-N	GYE30-KRRB
35	94	126	22	FLCTE35	LCTE07	RAE35-NPPB
	94	126	22	GLCTE35	GLCTE07	GRAE35-NPPB
	94	126	22	FLCTEY35	LCTE07	AY35-NPPB
	92	155	12,5	PCFT35	CFT07	GRAE35-NPPB
	92	155	12,5	PCJT35-N	CJT07-N	GRAE35-NPPB
	92	155	12,5	PCJTY35-N	CJT07-N	GAY35-NPPB
	92	155	12,5	RCJT35-N	CJT07-N	GE35-KRRB
40	100	150	24	FLCTE40	LCTE08	RAE40-NPPB
	100	150	24	GLCTE40	GLCTE08	GRAE40-NPPB
	100	150	24	FLCTEY40	LCTE08	AY40-NPPB
	105	172	13	PCFT40	CFT08	GRAE40-NPPB
	105	172	13	PCJT40-N	CJT08-N	GRAE40-NPPB
	105	172	13	PCJTY40-N	CJT08-N	GAY40-NPPB
	105	172	13	RCJT40-N	CJT08-N	GE40-KRRB

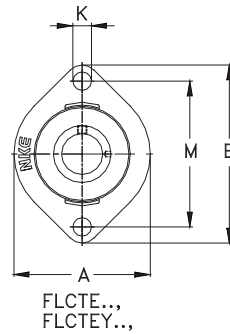
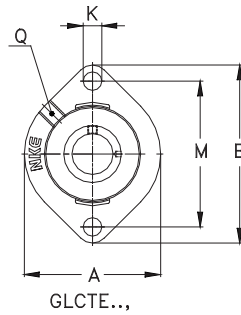
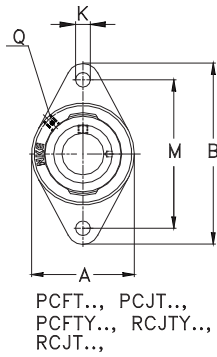


d [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
	V	K	L	M	P	Q	R _{max}	T	U	[m]
30	--	11,5	35,7	90,5	11,4	R1/8"	44	--	38,1	0,76
	--	11,5	29	90,5	11,4	--	--	--	32,4	0,7
80	11,5	35,7	116,5	13,3	R1/8"	44	22,3	40	0,77	
80	11,5	35,7	116,5	20	R1/8"	44	29	46,7	0,81	
80	11,5	30	116,5	20	R1/8"	--	29	41	0,75	
80	11,5	48,4	116,5	20	R1/8"	44	29	50,1	0,88	
80	11,5	38,1	116,5	20	R1/8"	--	29	42,2	0,75	
35	--	11,5	38,9	100	12,4	--	51	--	41,8	1,02
	--	11,5	38,9	100	12,4	R1/8"	51	--	41,8	1,02
--	11,5	35	100	12,4	--	--	--	37,9	0,93	
92	14	38,9	130	15,5	R1/8"	51	25	44,9	1,08	
92	14	38,9	130	21	R1/8"	51	30,5	50,4	1,12	
92	14	35	130	21	R1/8"	--	30,5	46,5	1,03	
92	14	51,1	130	21	R1/8"	51	30,5	53,3	1,19	
92	14	42,9	130	21	R1/8"	--	30,5	46,4	1,13	
40	100	14	43,7	119	13,5	--	58	--	46,2	1,27
	100	14	43,7	119	13,5	R1/8"	58	--	46,2	1,27
100	14	39,5	119	13,5	--	--	--	42,5	1,18	
105	14	43,7	143,5	18,3	R1/8"	58	28,8	51	1,42	
105	14	43,7	143,5	24	R1/8"	58	34,5	56,7	1,54	
105	14	39,5	143,5	24	R1/8"	--	34,5	53	1,43	
105	14	56,3	143,5	24	R1/8"	58	34,5	58,9	1,66	

Zweilochflascheinheiten, Grauguss
Oval Flanged Units, Cast Iron

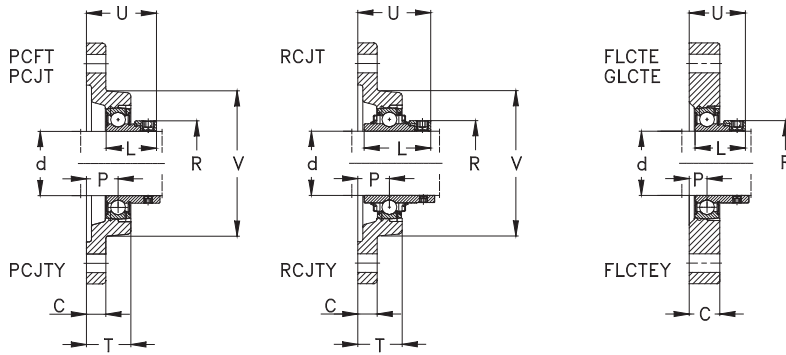


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
40	105	172	13	PCJTY40-N	CJT08-N	GAY40-NPPB
	105	172	13	RCJT40-N	CJT08-N	GE40-KRRB
	105	172	13	RCJTY40-N	CJT08-N	GYE40-KRRB
45	111	180	13	PCFT40	CFT09	GRAE45-NPPB
	111	180	13	PCJT45	CJT09	GRAE45-NPPB
	111	180	13	PCJTY45	CJT09	GAY45-NPPB
	111	180	13	RCJT45	CJT09	GE45-KRRB
	111	180	13	RCJTY45	CJT09	GYE45-KRRB
50	116	190	13	PCFT50	CFT10	GRAE50-NPPB
	116	190	13	PCJT50-N	CJT10-N	GRAE50-NPPB
	116	190	13	PCJTY50-N	CJT10-N	GAY50-NPPB
	116	190	13	RCJT50-N	CJT10-N	GE50-KRRB
	116	190	13	RCJTY50-N	CJT10-N	GYE50-KRRB
55	134	222	15	PCJT55	CJT11	GRAE55-NPPB (RRB)
	134	222	15	RCJT55	CJT11	GE55-KRRB
	134	222	15	RCJTY55	CJT11	GYE55-KRRB
60	138	238	16	PCJT60-N	CJT12-N	GRAE60-NPPB
	138	238	16	PCJTY60-N	CJT12-N	GAY60-NPPB
	138	238	16	RCJT60-N	CJT12-N	GE60-KRRB
	138	238	16	RCJTY60-N	CJT12-N	GYE60-KRRB
65	160	258	18	RCJT65	CJT13	GE65-KRRB
	160	258	18	RCJTY65	CJT13	GYE65-KRRB

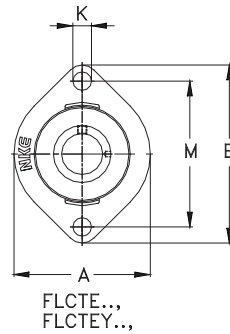
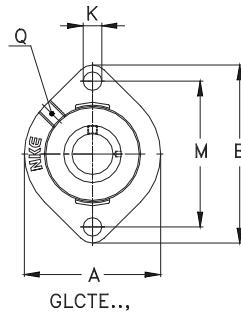
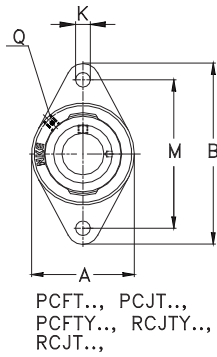


d [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
	V	K	L	M	P	Q	R _{max}	T	U	[m]
40	105	14	39,5	143,5	24	R1/8"	--	34,5	53	1,43
	105	14	56,3	143,5	24	R1/8"	58	34,5	58,9	1,66
	105	14	49,2	143,5	24	R1/8"	--	34,5	54,2	1,57
45	111	14	43,7	148,5	19,2	R1/8"	63	30,2	51,9	1,59
	111	14	43,7	148,5	24	R1/8"	63	35	56,7	1,69
	111	14	41,5	148,5	24	R1/8"	--	35	54,5	1,55
	111	14	56,3	148,5	24	R1/8"	63	35	58,9	1,81
	111	14	49,2	148,5	24	R1/8"	--	35	54,2	1,7
50	116	14	43,7	157	19,2	R1/8"	69	30,2	51,9	1,82
	116	18	43,7	157	28	R1/8"	69	39	60,7	1,97
	116	18	43	157	28	R1/8"	--	39	60	1,82
	116	18	62,7	157	28	R1/8"	69	39	66,1	2,2
	116	18	51,6	157	28	R1/8"	--	39	60,6	2
55	134	18	48,4	184	31	R1/8"	76	43,5	67,4	2,31
	134	18	71,4	184	31	R1/8"	76	43,5	74,6	2,92
	134	18	55,6	184	31	R1/8"	--	43,5	64,4	2,6
60	138	18	53,1	202	34	R1/8"	84	46	73,6	3,25
	138	18	47	202	34	R1/8"	--	46	68	2,92
	138	18	77,8	202	34	R1/8"	84	46	80	3,69
	138	18	65,1	202	34	R1/8"	--	46	73,7	3,17
65	160	21	66,1	216	38	R1/8"	96	57	82,6	6,41
	160	21	74,6	216	38	R1/8"	--	57	82,4	5,95

Zweilochflascheinheiten, Grauguss
Oval Flanged Units, Cast Iron

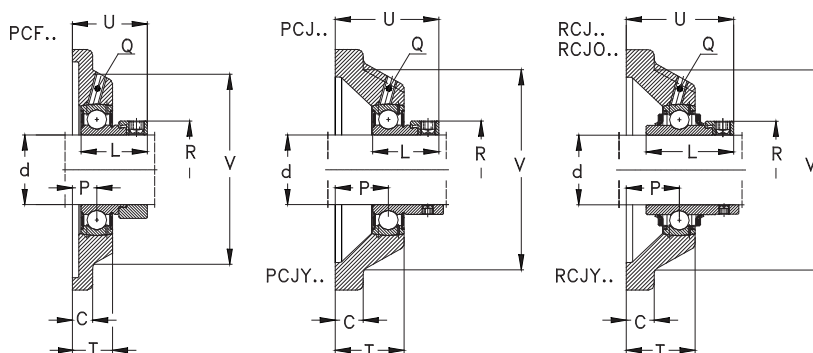


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
65	160	258	18	RCJT65	CJT13	GE65-KRRB
	160	258	18	RCJTY65	CJT13	GYE65-KRRB
70	160	258	18	RCJT70	CJT14	GE70-KRRB
	160	258	18	RCJTY70	CJT14	GYE70-KRRB
75	160	258	18	RCJT75	CJT15	GE75-KRRB
	160	258	18	RCJTY75	CJT15	GYE75-KRRB

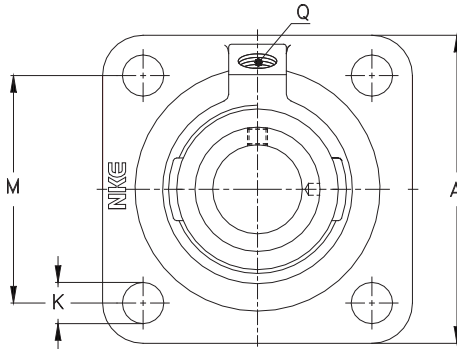


d [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
	V	K	L	M	P	Q	R _{max}	T	U	[m]
65	160	21	66,1	216	38	R1/8"	96	57	82,6	6,41
	160	21	74,6	216	38	R1/8"	--	57	82,4	5,95
70	160	21	66,1	216	38	R1/8"	96	57	82,6	6,15
	160	21	74,6	216	38	R1/8"	--	57	82,4	5,65
75	160	21	67,1	216	38	R1/8"	100	57	83,6	6
	160	21	77,8	216	38	R1/8"	--	57	82,5	5,54

Vierlochflanscheinheiten, Grauguss
Square Flanged Units, Cast Iron



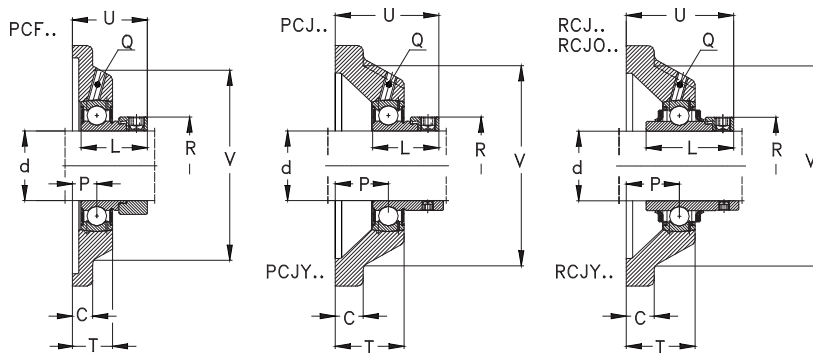
Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		
d	A	U	C	Lagereinheit Bearing unit	Gehäuse Housing	Gehäuselager Insert bearing
12	76	39,1	9,5	PCJ12	CJ03	GRAE12-NPPB
	76	33	9,5	PCJY12	CJ03	GAY12-NPPB
	76	32,9	9,5	RCJY12	CJ03	GYE12-KRRB
15	76	39,1	9,5	PCJ15	CJ03	GRAE15-NPPB
	76	33	9,5	PCJY15	CJ03	GAY15-NPPB
	76	32,9	9,5	RCJY15	CJ03	GYE15-KRRB
16	76	32,9	9,5	RCJY16	CJ03	GYE16-KRRB
17	76	39,1	9,5	PCJ17	CJ03	GRAE17-NPPB
	76	40,4	9,5	RCJ17	CJ 03	GE17-KRRB
	76	33	9,5	PCJY17	CJ03	GAY17-NPPB
	76	32,9	9,5	RCJY17	CJ03	GYE17-KRRB
20	86	34	10	PCF20	CF04	GRAE20-NPPB
	86	42,5	10	PCJ20-N	CJ04-N	GRAE20-NPPB
	86	45,6	10	RCJ20-N	CJ04-N	GE20-KRRB
	86	37	10	PCJY20-N	CJ04-N	GAY20-NPPB
	86	37,3	10	RCJY20-N	CJ04-N	GYE20-KRRB
25	95	36	11	PCF25	CF05	GRAE25-NPPB
	95	42,5	11	PCJ25-N	CJ05-N	GRAE25-NPPB
	95	45,9	11	RCJ25-N	CJ05-N	GE25-KRRB
	95	38,5	11	PCJY25-N	CJ05-N	GAY25-NPPB
	95	38,8	11	RCJY25-N	CJ05-N	GYE25-KRRB
30	108	40	12	PCF30	CF06	GRAE30-NPPB



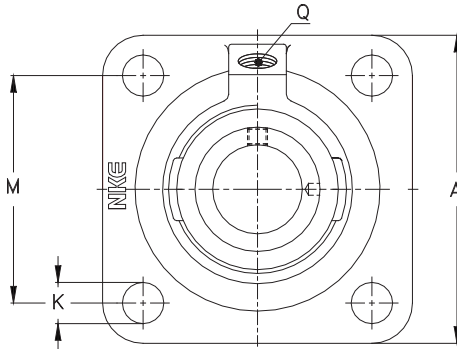
PCF..., RCJ...,
PCJY..., PCJ...,
RCJO..., RCJY...

Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	T	V	[m]
12	11,5	28,6	54	17	28	M6	27	58	0,52
	11,5	22	54	17	--	M6	27	58	0,5
	11,5	27,4	54	17	--	M6	27	58	0,51
15	11,5	28,6	54	17	28	M6	27	58	0,52
	11,5	22	54	17	--	M6	27	58	0,49
	11,5	27,4	54	17	--	M6	27	58	0,51
16	11,5	27,4	54	17	--	M6	27	58	0,51
17	11,5	28,6	54	17	28	M6	27	58	0,52
	11,5	37,3	54	17	28	M6	27	58	0,56
	11,5	22	54	17	--	M6	27	58	0,48
	11,5	27,4	54	17	--	M6	27	58	0,51
20	11,5	31	63,5	10,5	33	R1/8"	20	68	0,55
	11,5	31	63,5	19	33	R1/8"	29	68	0,61
	11,5	43,7	63,5	19	33	R1/8"	29	68	0,65
	11,5	25	63,5	19	--	R1/8"	29	68	0,58
	11,5	31	63,5	19	--	R1/8"	29	68	0,62
25	11,5	31	70	12,5	37,5	R1/8"	22	74	0,71
	11,5	31	70	19	37,5	R1/8"	29	74	0,76
	11,5	44,4	70	19	37,5	R1/8"	29	74	0,82
	11,5	27	70	19	--	R1/8"	29	74	0,73
	11,5	34,1	70	19	--	R1/8"	29	74	0,77
30	11,5	35,7	82,5	13,3	44	R1/8"	22,3	85	1,01

Vierlochflanscheinheiten, Grauguss
Square Flanged Units, Cast Iron

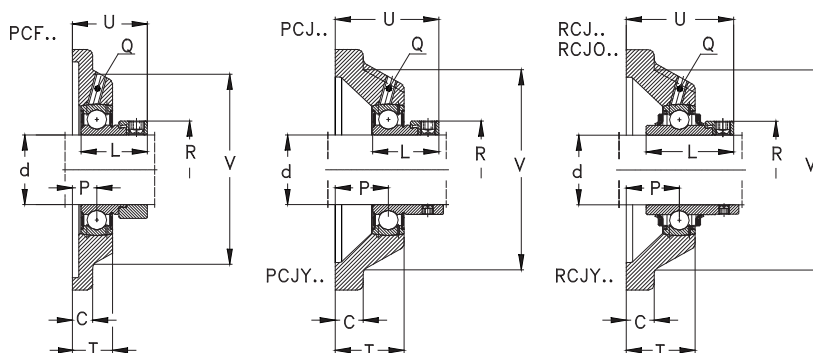


Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		
d	A	U	C	Lagereinheit Bearing unit	Gehäuse Housing	Gehäuselager Insert bearing
30	108	46,7	12	PCJ30-N	CJ06-N	GRAE30-NPPB
	108	50,1	12	RCJ30-N	CJ06-N	GE30-KRRB
	108	41	12	PCJY30-N	CJ06-N	GAY30-NPPB
	108	42,2	12	RCJY30-N	CJ06-N	GYE30-KRRB
	125	53,1	15	RCJO30	CJO06	GNE30-KRRB
35	118	44,9	12,5	PCF35	CF07	GRAE35-NPPB
	118	50,4	12,5	PCJ35-N	CJ07-N	GRAE35-NPPB
	118	53,3	12,5	RCJ35-N	CJ07-N	GE35-KRRB
	118	46,5	12,5	PCJY35-N	CJ07-N	GAY35-NPPB
	118	46,4	12,5	RCJY35-N	CJ07-N	GYE35-KRRB
40	135	53,4	16	RCJO35	CJO07	GNE35-KRRB
	130	51	13	PCF40	CF08	GRAE40-NPPB
	130	56,7	13	PCJ40-N	CJ08-N	GRAE40-NPPB
	130	58,9	13	RCJ40-N	CJ08-N	GE40-KRRB
	130	53	13	PCJY40-N	CJ08-N	GAY40-NPPB
45	130	54,2	13	RCJY40-N	CJ08-N	GYE40-KRRB
	150	59,6	17	RCJO40	CJO08	GNE40-KRRB
	137	51,9	13	PCF45	CF09	GRAE45-NPPB
	137	56,7	13	PCJ45	CJ09	GRAE45-NPPB
	137	58,9	13	RCJ45	CJ09	GE45-KRRB
45	137	54,5	13	PCJY45	CJ09	GAY45-NPPB
	137	54,2	13	RCJY45	CJ09	GYE45-KRRB

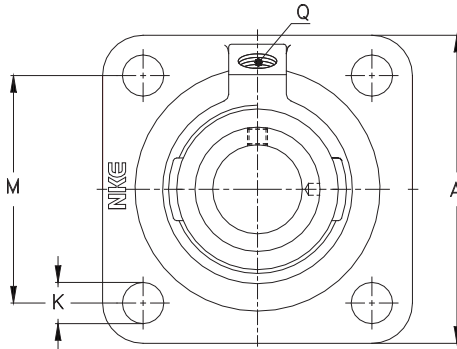


PCF..., RCJ...,
PCJY..., PCJ...,
RCJO..., RCJY...

Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	T	V	[m]
30	11,5	35,7	82,5	20	44	R1/8"	29	85	1,09
	11,5	48,4	82,5	20	44	R1/8"	29	85	1,16
	11,5	30	82,5	20	--	R1/8"	29	85	1,03
	11,5	38,1	82,5	20	--	R1/8"	29	85	1,11
	14,5	50	95	20,6	51	R1/8"	30,6	98	1,75
35	14	38,9	92	15,5	51	R1/8"	25	100	1,37
	14	38,9	92	21	51	R1/8"	30,5	100	1,4
	14	51,1	92	21	51	R1/8"	30,5	100	1,47
	14	35	92	21	--	R1/8"	30,5	100	1,31
	14	42,9	92	21	--	R1/8"	30,5	100	1,41
	19	51,6	100	20	55	R1/8"	31	104	2,55
40	14	43,7	101,5	18,3	58	R1/8"	28,8	110	1,72
	14	43,7	101,5	24	58	R1/8"	34,5	110	1,9
	14	56,3	101,5	24	58	R1/8"	34,5	110	2,02
	14	39,5	101,5	24	--	R1/8"	34,5	110	1,79
	14	49,2	101,5	24	--	R1/8"	34,5	110	1,93
	19	54,6	112	23	63	R1/8"	34,5	121	3,1
45	14	43,7	105	19,2	63	R1/8"	30,2	116	1,99
	14	43,7	105	24	63	R1/8"	35	116	2,22
	14	56,3	105	24	63	R1/8"	35	116	2,26
	14	41,5	105	24	--	R1/8"	35	116	2
	14	49,2	105	24	--	R1/8"	35	116	2,15



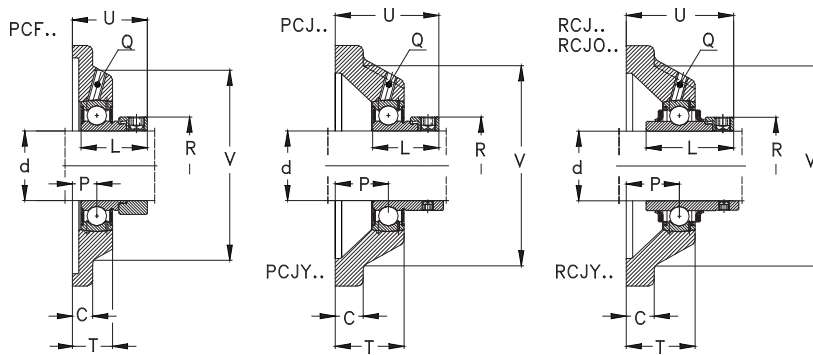
Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		
d	A	U	C	Lagereinheit Bearing unit	Gehäuse Housing	Gehäuselager Insert bearing
50	143	51,4	13	PCF50	CF10	GRAE50-NPPB
	143	60,7	13	PCJ50-N	CJ10-N	GRAE50-NPPB
	143	66,1	13	RCJ50-N	CJ10-N	GE50-KRRB
	143	60	13	PCJY50-N	CJ10-N	GAY50-NPPB
	143	60,6	13	RCJY50-N	CJ10-N	GYE50-KRRB
	175	70,1	19	RCJO50	CJO10	GNE50-KRRB
55	162	67,4	15	PCJ55	CJ11	GRAE55-NPPB
	162	74,6	15	RCJ55	CJ11	GE55-KRRB
	162	64,4	15	RCJY55	CJ11	GYE55-KRRB
60	175	73,6	16	PCJ60-N	CJ12-N	GRAE60-NPPB
	175	80,8	16	RCJ60-N	CJ12-N	GE60-KRRB
	175	68	16	PCJY60-N	CJ12-N	GAY60-NPPB
	175	73,7	16	RCJY60-N	CJ12-N	GYE60-KRRB
	195	78,4	22	RCJO60	CJO12	GNE60-KRRB
65	188	82,6	18	RCJ65	CJ14	GE65-KRRB
	188	82,4	18	RCJY65	CJ14	GYE65-KRRB
70	188	82,6	18	RCJ70	CJ14	GE70-KRRB
	188	82,4	18	RCJY70	CJ14	GYE70-KRRB
	226	85,4	25	RCJO70	CJO14	GNE70-KRRB
75	197	86,9	20	RCJ75	CJ15	GE75-KRRB
	197	85,8	20	RCJY75	CJ15	GYE75-KRRB
80	197	88,9	20	RCJ80	CJ16	GE80-KRRB



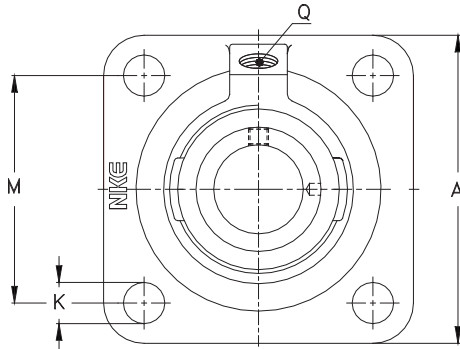
PCF..., RCJ...,
PCJY..., PCJ...,
RCJO..., RCJY...

Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	T	V	[m]
50	14	43,7	111	19,2	69	R1/8"	30,2	125	2,2
	18	43,7	111	28	69	R1/8"	39	125	2,3
	18	62,7	111	28	69	R1/8"	39	125	2,53
	18	43	111	28	--	R1/8"	39	125	2,15
	18	51,6	111	28	--	R1/8"	39	125	2,33
	23	66,7	132	28	75,8	R1/8"	42,5	144	4,9
55	18	48,4	130	31	76	R1/8"	43,5	140	2,91
	18	71,4	130	31	76	R1/8"	43,5	140	3,52
	18	55,6	130	31	--	R1/8"	43,5	140	3,2
60	18	53,1	143	34	84	R1/8"	46	150	4,1
	18	77,8	143	34	84	R1/8"	46	150	4,54
	18	47	143	34	--	R1/8"	46	150	4,02
	18	65,1	143	34	--	R1/8"	46	150	4,22
	23	68,4	150	33	89	R1/8"	49,5	170	6,8
65	18	66,1	150	38	96	R1/8"	52	165	6,11
	18	74,6	150	38	--	R1/8"	52	165	5,65
70	18	66,1	150	38	96	R1/8"	52	165	5,85
	18	74,6	150	38	--	R1/8"	52	165	5,35
	25	75,4	178	36	102	R1/8"	54,5	196	10
75	23	67,1	153	41,3	100	R1/8"	55,8	170	6,5
	23	77,8	153	41,3	--	R1/8"	55,8	170	6,04
80	23	71	153	41,3	108	R1/8"	55,8	180	6,85

Vierlochflanscheinheiten, Grauguss
Square Flanged Units, Cast Iron



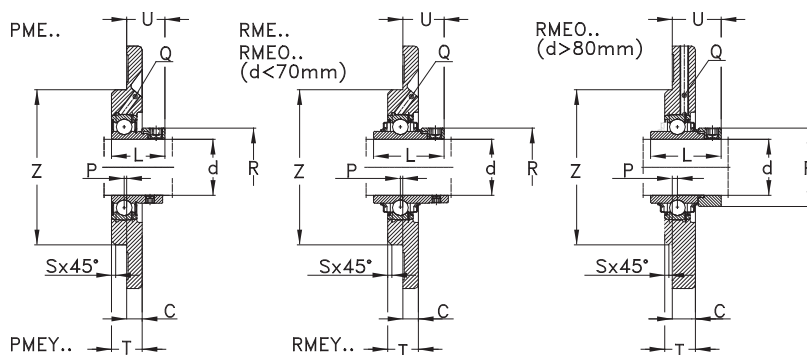
Hauptabmessungen [mm] Boundary dimensions [mm]				Bezeichnung Designation		
d	A	U	C	Lagereinheit Bearing unit	Gehäuse Housing	Gehäuselager Insert bearing
80	197	90,6	20	RCJY80	CJ16	GYE80-KRRB
	250	109,7	25	RCJO80	CJO 16	GNE80-KRRB
90	235	70,3	22	RCJ90	CJ18	GE90-KRRB
	235	80,1	22	RCJY90	CJ18	GYE90-KRRB
	280	114	28,5	RCJO90	CJO18	GNE90-KRRB
100	265	77,5	25	RCJ100	CJ20	GE100-KRRB
	310	125	32	RCJO100	CJO20	GNE100-KRRB
120	305	83	28	RCJ120	CJ24	GE120-KRRB



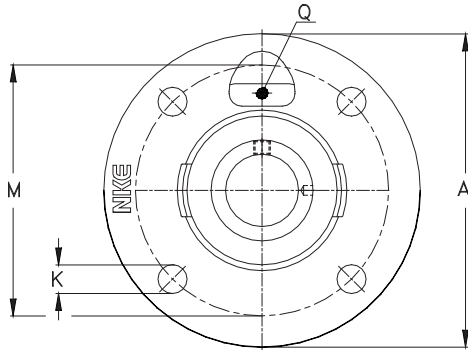
PCF..., RCJ...,
PCJY..., PCJ...,
RCJO..., RCJY...

Hauptabmessungen [mm] Boundary dimensions [mm]									Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	T	V	[m]
80	23	82,6	153	41,3	--	R1/8"	55,8	180	6,82
	28	93,7	196	50	118	R1/8"	80	210	17,15
90	23	69,5	187	23,8	118	R1/8"	39,8	200	9
	23	96	187	23,8	--	R1/8"	39,8	200	9,48
	28	101	216	48,5	132	R1/8"	85	230	21,6
100	27	75	210	28	132	R1/8"	46	230	12,25
	32	109,5	242	55	145	R1/8"	97	268	33,6
120	30	81	240	31	152	R1/8"	51	270	18

Runde Flanscheinheiten, Grauguss
Round Flanged Units, Cast Iron



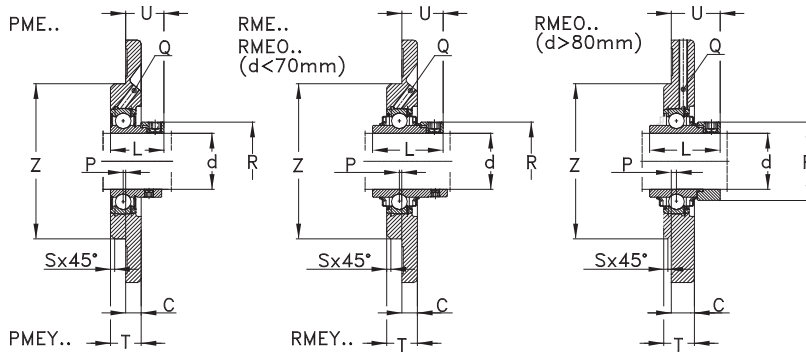
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	U	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
20	100	21,5	8	PME20-N	ME04-N	GRAE20-NPPB
	100	24,6	8	RME20-N	ME04-N	GE20-KRRB
	100	16	8	PMEY20-N	ME04-N	GAY20-NPPB
	100	16,3	8	RMEY20-N	ME04-N	GYE20-KRRB
25	115	21	9	PME25-N	ME05-N	GRAE25-NPPB
	115	24,4	9	RME25-N	ME05-N	GE25-KRRB
	115	17	9	PMEY25-N	ME05-N	GAY25-NPPB
	115	17,3	9	RMEY25-N	ME05-N	GYE25-KRRB
30	125	24,7	9,5	PME30-N	ME06-N	GRAE30-NPPB
	125	28,1	9,5	RME30-N	ME06-N	GE30-KRRB
	125	19	9,5	PMEY30-N	ME06-N	GAY30-NPPB
	125	20,2	9,5	RMEY30-N	ME06-N	GYE30-KRRB
	162	34,5	15	RME030	ME006	GNE30-KRRB
35	135	28,4	10	PME35-N	ME07-N	GRAE35-NPPB
	135	31,3	10	RME35-N	ME07-N	GE35-KRRB
	135	24,5	10	PMEY35-N	ME07-N	GAY35-NPPB
	135	24,4	10	RMEY35-N	ME07-N	GYE35-KRRB
	174	25,4	16	RME035	ME007	GNE35-KRRB
40	145	31,7	11,5	PME40-N	ME08-N	GRAE40-NPPB
	145	33,9	11,5	RME40-N	ME08-N	GE40-KRRB
	145	28	11,5	PMEY40-N	ME08-N	GAY40-NPPB
	145	29,2	11,5	RMEY40-N	ME08-N	GYE40-KRRB



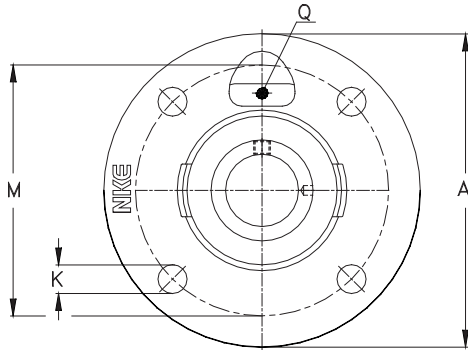
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RME..., RMEY...,
RMEO..

Hauptabmessungen [mm] Boundary dimensions [mm]										Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	S	T	Z _{h8}	[m]
20	9	31	78	2	33	M6	2	17	62	0,53
	9	43,7	78	2	33	M6	2	17	62	0,57
	9	25	78	2	--	M6	2	17	62	0,5
	9	31	78	2	--	M6	2	17	62	0,54
25	9	31	90	2,5	37,5	M6	2	19	70	0,74
	9	44,4	90	2,5	37,5	M6	2	19	70	0,8
	9	27	90	2,5	--	M6	2	19	70	0,71
	9	34,1	90	2,5	--	M6	2	19	70	0,75
30	11,5	35,7	100	2	44	M6	2	20,5	80	0,97
	11,5	48,4	100	2	44	M6	2	20,5	80	1,04
	11,5	30	100	2	--	M6	2	20,5	80	0,91
	11,5	38,1	100	2	--	M6	2	20,5	80	0,99
	14,5	50	134	2	51	M6	2	23	90	1,7
35	11,5	38,9	110	1	51	M6	2	20,5	90	1,27
	11,5	51,1	110	1	51	M6	2	20,5	90	1,34
	11,5	35	110	1	--	M6	2	20,5	90	1,18
	11,5	42,9	110	1	--	M6	2	20,5	90	1,28
	19	51,6	141	2	55	M6	2	25	100	2,4
40	11,5	43,7	120	1	58	M6	2	23	100	1,62
	11,5	56,3	120	1	58	M6	2	23	100	1,74
	11,5	39,5	120	1	--	M6	2	23	100	1,51
	11,5	49,2	120	1	--	M6	2	23	100	1,65

Runde Flanscheinheiten, Grauguss
Round Flanged Units, Cast Iron



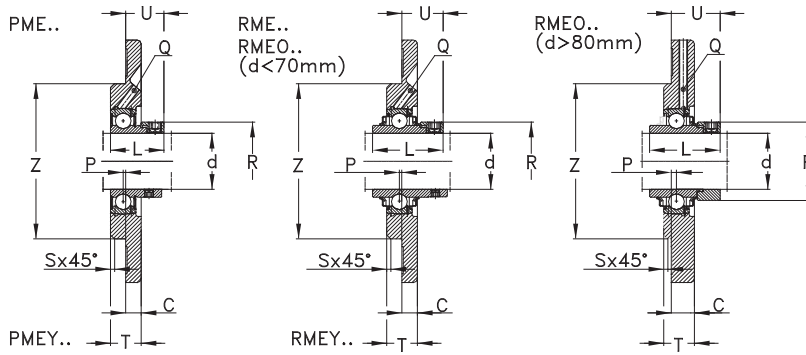
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	U	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
40	194	39,1	17	RME040	ME008	GNE40-KRRB
45	155	30,7	12	PME45	ME09	GRAE45-NPPB
	155	32,9	12	RME45	ME09	GE45-KRRB
	155	28,5	12	PMEY45	ME09	GAY45-NPPB
	155	28,2	12	RMEY45	ME09	GYE45-KRRB
50	165	31,7	13	PME50-N	ME10-N	GRAE50-NPPB
	165	37,1	13	RME50-N	ME10-N	GE50-KRRB
	165	31	13	PMEY50-N	ME10-N	GAY50-NPPB
	165	31,6	13	RMEY50-N	ME10-N	GYE50-KRRB
	230	44,6	19	RME050	ME010	GNE50-KRRB
55	185	36,4	15	PME55	ME11	GRAE55-NPPB
	185	43,6	15	RME55	ME11	GE55-KRRB
	185	33,4	15	RMEY55	ME11	GYE55-KRRB
60	195	38,6	16	PME60-N	ME12-N	GRAE60-NPPB
	195	45,8	16	RME60-N	ME12-N	GE60-KRRB
	195	33	16	PMEY60-N	ME12-N	GAY60-NPPB
	195	38,7	16	RMEY60-N	ME12-N	GYE60-KRRB
	256	47,9	22	RME060	ME012	GNE60-KRRB
65	215	44,6	18	RME65	ME14	GE65-KRRB
	215	44,4	18	RMEY65	ME14	GYE65-KRRB
70	215	44,6	18	RME70	ME14	GE70-KRRB
	215	44,4	18	RMEY70	ME14	GYE70-KRRB



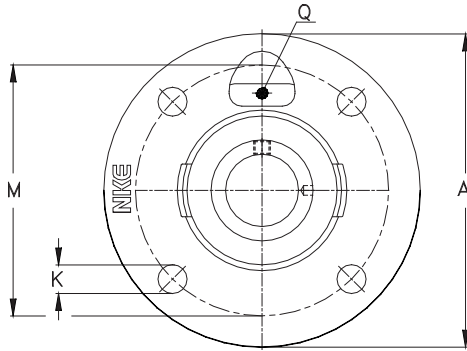
PME..., PMEY...,
RME..., RMEY...,
RMEO..

Hauptabmessungen [mm] Boundary dimensions [mm]										Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	S	T	Z _{h8}	[m]
40	19	54,6	158	2,5	63	M6	2	27	115	2,8
45	14	43,7	130	2	63	M6	2	25	105	1,93
	14	56,3	130	2	63	M6	2	25	105	2,05
	14	41,5	130	2	--	M6	2	25	105	1,79
	14	49,2	130	2	--	M6	2	25	105	1,94
50	14	43,7	135	1	69	R1/8"	3	25	110	2,3
	14	62,7	135	1	69	R1/8"	3	25	110	2,53
	14	43	135	1	--	R1/8"	3	25	110	2,15
	14	51,6	135	1	--	R1/8"	3	25	110	2,33
	23	66,7	187	2,5	75,8	R1/8"	2	31	140	4,6
55	18	48,4	150	0	76	M6	3	27,5	125	2,76
	18	71,4	150	0	76	M6	3	27,5	125	3,37
	18	55,6	150	0	--	M6	3	27,5	125	3,05
60	18	53,1	160	1	84	R1/8"	3	29	135	3,55
	18	77,8	160	1	84	R1/8"	3	29	135	3,99
	18	47	160	1	--	R1/8"	3	29	135	3,22
	18	65,1	160	1	--	R1/8"	3	29	135	3,47
	23	68,4	212	2,5	89	R1/8"	3	36	160	6
65	18	66,1	177	0	96	R1/8"	6	32	150	5,81
	18	74,6	177	0	--	R1/8"	6	32	150	5,35
70	18	66,1	177	0	96	R1/8"	6	32	150	5,55
	18	74,6	177	0	--	R1/8"	6	32	150	5,1

Runde Flanscheinheiten, Grauguss
Round Flanged Units, Cast Iron

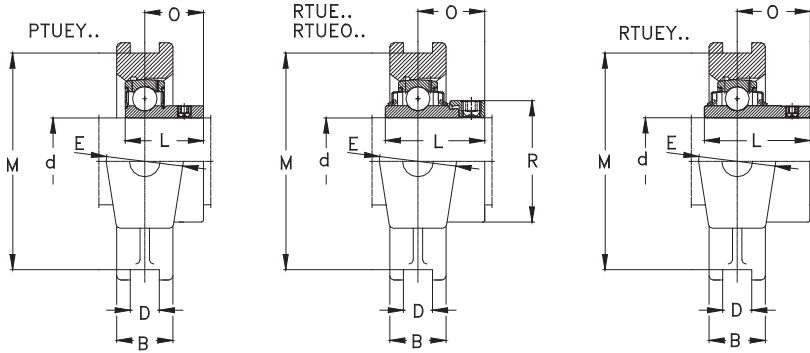


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	U	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
70	300	49,9	25	RME070	MEO14	GNE70-KRRB
75	220	45,6	18	RME75	ME15	GE75-KRRB
	220	44,5	18	RMEY75	ME15	GYE75-KRRB
80	220	49,6	18	RME80	ME16	GE80-KRRB
	220	51,3	18	RMEY80	ME16	GYE80-KRRB
	275	56,7	22	RMEO80	MEO16	GNE80-KRRB
90	265	50,5	20	RME90	ME18	GE90-KRRB
	265	60,3	20	RMEY90	ME18	GYE90-KRRB
	300	62,5	22	RMEO90	MEO18	GNE90-KRRB
100	295	53,4	22	RME100	ME20	GE100-KRRB
	340	68,5	27	RMEO100	MEO20	GNE100-KRRB
120	350	56,5	24	RME120	ME24	GE120-KRRB

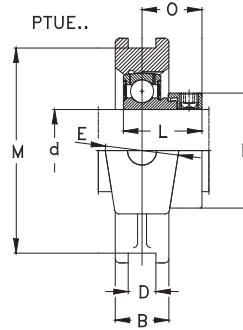
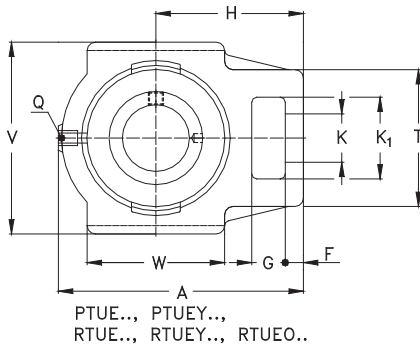


PME..., PMEY...,
RME..., RMEY...,
RMEO..

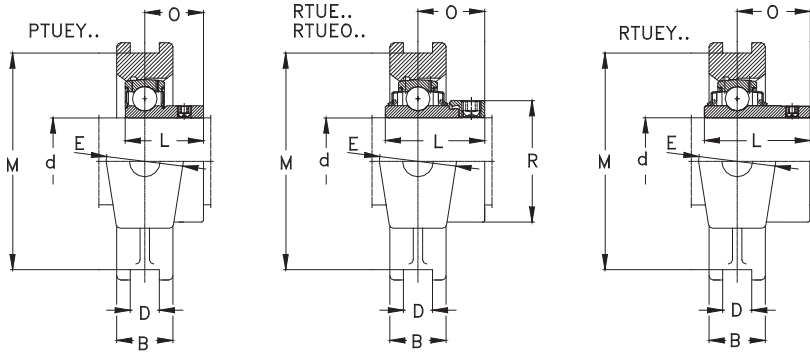
Hauptabmessungen [mm] Boundary dimensions [mm]										Gewicht [kg] Weight [kg]
d	K	L	M	P	R _{max}	Q	S	T	Z _{h8}	[m]
70	25	75,4	252	0,5	102	R1/8"	4	43	185	9
75	18	67,1	184	0	100	R1/8"	6	32	160	5,65
	18	77,8	184	0	--	R1/8"	6	32	160	5,19
80	18	71	184	-2	108	R1/8"	6	31	160	5,75
	18	82,6	184	-2	--	R1/8"	6	31	160	5,73
	22	93,7	235	-3	118	R1/8"	6	50	200	12,7
90	23	69,5	220	-4	118	R1/8"	3	32	190	8,82
	23	96	220	-4	--	R1/8"	3	32	190	9,3
	22	101	260	-3	132	R1/8"	6	50	220	12,7
100	23	75	245	-4	132	R1/8"	3	36	210	11,45
	26	109,5	295	-1,5	145	R1/8"	8	57	250	22,3
120	27	81	295	-4	152	R1/8"	3	40	250	17,43



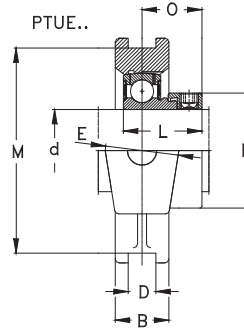
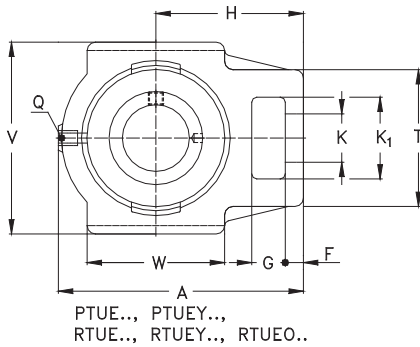
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	V	B	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
20	94,5	90	25	PTUE20	TUE04	GRAE20-NPPB
	94,5	90	25	RTUE20	TUE04	GE20-KRRB
	94,5	90	25	PTUEY20	TUE04	GAY20-NPPB
	94,5	90	25	RTUEY20	TUE04	GYE20-KRRB
25	98,5	90	25	PTUE25	TUE05	GRAE25-NPPB
	98,5	90	25	RTUE25	TUE05	GE25-KRRB
	98,5	80	25	PTUEY25	TUE05	GAY25-NPPB
	98,5	90	25	RTUEY25	TUE05	GYE25-KRRB
30	114,5	102	25	PTUE30	TUE06	GRAE30-NPPB
	114,5	102	25	RTUE30	TUE06	GE30-KRRB
	114,5	102	25	PTUEY30	TUE06	GAY30-NPPB
	114,5	102	25	RTUEY30	TUE06	GYE30-KRRB
35	131,5	102	30	PTUE35	TUE07	GRAE35-NPPB
	131,5	102	30	RTUE35	TUE07	GE35-KRRB
	131,5	102	30	PTUEY35	TUE07	GAY35-NPPB
	131,5	102	30	RTUEY35	TUE07	GYE35-KRRB
40	141	115	35	PTUE40	TUE08	GRAE40-NPPB
	141	115	35	RTUE40	TUE08	GE40-KRRB
	141	115	35	PTUEY40	TUE08	GAY40-NPPB
	141	115	35	RTUEY40	TUE08	GYE40-KRRB
45	141	115	35	PTUE45	TUE09	GRAE45-NPPB
	141	115	35	RTUE45	TUE09	GE45-KRRB



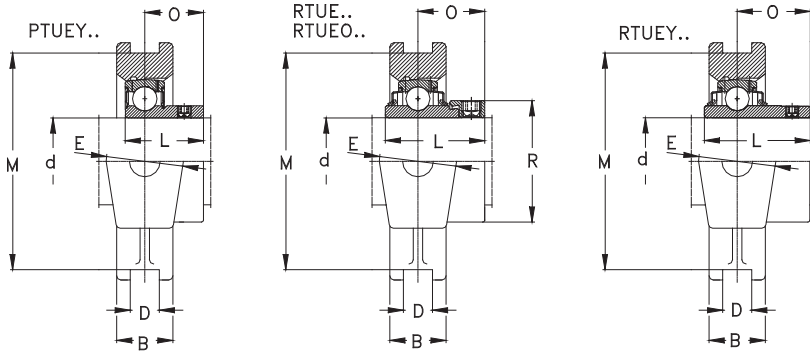
Hauptabmessungen [mm] Boundary dimensions [mm]														Gewicht [kg] Weight [kg]	
d	D _{H13}	E	F	G	H	K	K ₁	L	M	O	Q	R _{max}	T	W	[m]
20	12	37	9	18	60	19	32	31	76	23,4	R1/8"	33	51	50	0,83
	12	37	9	18	60	19	32	43,7	76	26,6	R1/8"	33	51	50	0,87
	12	37	9	18	60	19	32	25	76	18	R1/8"	--	51	50	0,8
	12	37	9	18	60	19	32	31	76	18,3	R1/8"	--	51	50	0,84
25	12	37	10	18	62	19	32	31	76	23,5	R1/8"	37,5	51	50	0,85
	12	37	10	18	62	19	32	44,4	76	26,9	R1/8"	37,5	51	50	0,91
	12	37	10	18	62	19	32	27	76	19,5	R1/8"	--	51	50	0,82
	12	37	10	18	62	19	32	34,1	76	19,8	R1/8"	--	51	50	0,86
30	12	37	10	18	70	22	36,5	35,7	89	26,7	R1/8"	44	56	57	1,17
	12	37	10	18	70	22	36,5	48,4	89	30,1	R1/8"	44	56	57	1,24
	12	37	10	18	70	22	36,5	30	89	21	R1/8"	--	56	57	1,11
	12	37	10	18	70	22	36,5	38,1	89	22,2	R1/8"	--	56	57	1,19
35	12	40	13	18	80	22	36,5	38,9	89	29,4	R1/8"	51	64	63	1,73
	12	40	13	18	80	22	36,5	51,1	89	32,3	R1/8"	51	64	63	1,8
	12	40	13	18	80	22	36,5	35	89	22,3	--	--	64	63	1,64
	12	40	13	18	80	22	36,5	42,9	89	25,4	R1/8"	--	64	63	1,74
40	16	50	16	20	88	29	49	43,7	102	32,7	R1/8"	58	82	82	2,4
	16	50	16	20	88	29	49	56,3	102	34,9	R1/8"	58	82	82	2,52
	16	50	16	20	88	29	49	39,5	102	29	--	--	82	82	2,29
	16	50	16	20	88	29	49	49,2	102	30,2	R1/8"	--	82	82	2,43
45	16	50	16	20	88	29	49	43,7	102	32,7	R1/8"	63	82	82	2,49
	16	50	16	20	88	29	49	56,3	102	34,9	R1/8"	63	82	82	2,61



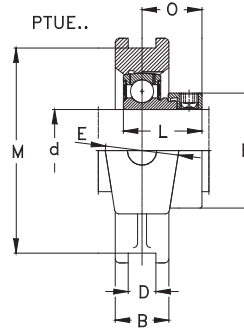
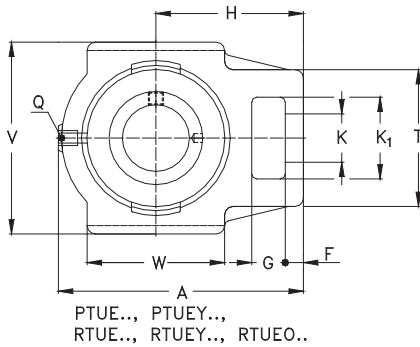
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	V	B	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
45	141	115	35	PTUEY45	TUE09	GAY45-NPPB
	141	115	35	RTUEY45	TUE09	GYE45-KRRB
50	148	115	35	PTUE50	TUE10	GRAE50-NPPB
	148	115	35	RTUE50	TUE10	GE50-KRRB
	148	115	35	PTUEY50	TUE10	GAY50-NPPB
	148	115	35	RTUEY50	TUE10	GYE-50-KRRB
55	169	145	42	PTUE55	TUE11	GRAE55-NPPB
	169	145	42	RTUE55	TUE11	GE55-KRRB
	169	145	42	RTUEY55	TUE11	GYE55-KRRB
60	186	146	44	PTUE60	TUE12	GRAE60-NPPB
	186	146	44	RTUE60	TUE12	GE60-KRRB
	186	146	44	PTUEY60	TUE12	GAY60-NPPB
	186	146	44	RTUEY60	TUE12	GYE60-KRRB
65	214	166	50	RTUE65	TUE13/14	GE65-KRRB
	214	166	50	RTUEY65	TUE13/14	GYE65-KRRB
70	214	166	50	RTUE70	TUE13/14	GE70-KRRB
	214	166	50	RTUEY70	TUE13/14	GYE70-KRRB
75	214	166	50	RTUE 75	TUE15	GE 75 KRRB
	214	166	50	RTUEY 75	TUE15	GYE 75 KRRB
80	230	184	50	RTUE 80	TUE16	GE 80 KRRB
	230	184	50	RTUEY 80	TUE16	GYE 80 KRRB
	282	230	60	RTUEO 80	TUEO16	GNE 80 KRRB



Hauptabmessungen [mm] Boundary dimensions [mm]														Gewicht [kg] Weight [kg]	
d	D _{H13}	E	F	G	H	K	K ₁	L	M	O	Q	R _{max}	T	W	[m]
45	16	50	16	20	88	29	49	41,5	102	30,5	--	82	82	2,35	
	16	50	16	20	88	29	49	49,2	102	30,2	--	82	82	2,5	
50	16	50	16	20	90	29	49	43,7	102	32,7	R1/8"	69	83	85	2,42
	16	50	16	20	90	29	49	62,7	102	38,1	R1/8"	69	83	85	2,65
	16	50	16	20	90	29	49	43	102	32	R1/8"	--	83	85	2,27
55	16	50	16	20	90	29	49	51,6	102	32,6	R1/8"	--	83	85	2,45
	22	60	17	26	104	35	63,5	48,4	130	36,4	R1/8"	76	102	95	3,99
	22	60	17	26	104	35	63,5	71,4	130	43,6	R1/8"	76	102	95	4,6
60	22	60	17	26	104	35	63,5	55,6	130	33,4	R1/8"	--	102	95	4,28
	22	60	19	32	118	35	63,5	53,1	130	39,6	R1/8"	84	102	100	4,3
	22	60	19	32	118	35	63,5	77,8	130	46,8	R1/8"	84	102	100	4,84
65	22	60	19	32	118	35	63,5	47	130	34	R1/8"	--	102	100	3,97
	22	60	19	32	118	35	63,5	65,1	130	39,7	R1/8"	--	102	100	4,22
	25	70	20	35	135	41	70	66,1	151	44,6	R1/8"	96	110	120	7,46
70	25	70	20	35	135	41	70	74,6	151	44,4	R1/8"	--	110	120	7
	25	70	20	35	135	41	70	66,1	151	44,6	R1/8"	96	110	120	7,2
75	25	70	20	35	135	41	70	74,6	151	44,4	R1/8"	--	110	120	6,7
	25	70	20	35	135	41	70	67,1	151	45,6	R1/8"	100	110	120	7,05
80	25	70	20	35	135	41	70	77,8	151	44,5	R1/8"	--	110	120	6,59
	28	70	20	35	140	41	70	71	165	47,6	R1/8"	108	110	120	8,4
	28	70	20	35	140	41	70	82,6	165	49,3	R1/8"	--	110	120	8,38
	30	102	28	42	174	53	98	93,7	204	59,7	R1/8"	118	150	150	17,25

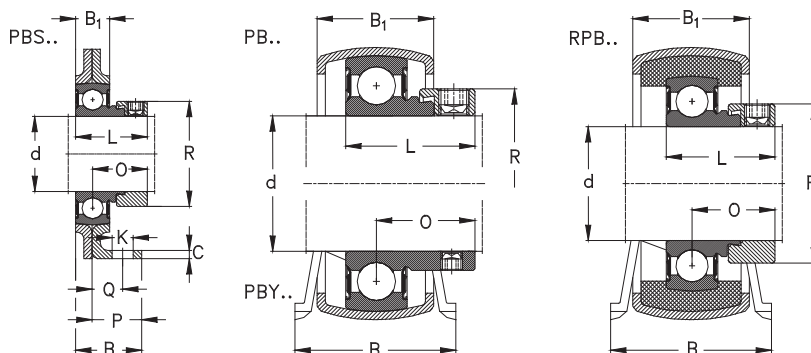


Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	V	B	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
90	275	215	55	RTUE 90	TUE18	GE 90 KRRB
	312	255	66	RTUEO 90	TUEO18	GNE 90 KRRB
100	295	240	60	RTUE 100	TUE20	GE 100 KRRB
	345	290	75	RTUEO 100	TUEO20	GNE 100 KRRB
120	345	285	70	RTUE 120	TUE24	GE 120 KRRB

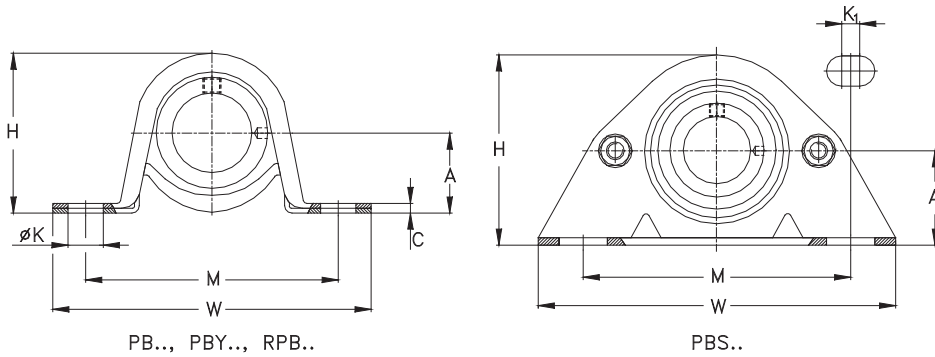


Hauptabmessungen [mm] Boundary dimensions [mm]															Gewicht [kg] Weight [kg]
d	D _{H13}	E	F	G	H	K	K ₁	L	M	O	Q	R _{max}	T	W	[m]
90	28	80	30	40	170	47	80	69,5	190	46,5	R1/8"	118	130	140	11,57
	32	110	30	46	192	57	106	101	228	65,5	R1/8"	132	160	165	22,9
100	28	90	30	40	180	47	80	75	215	49,5	R1/8"	132	130	160	14,55
	35	120	32	48	210	59	115	109	260	70	R1/8"	145	175	190	31,35
120	32	100	35	45	210	55	95	81	255	52,5	R1/8"	152	150	190	22,43

Stehlagereinheiten, Stahlblech
Plummer Block Units, Pressed Steel

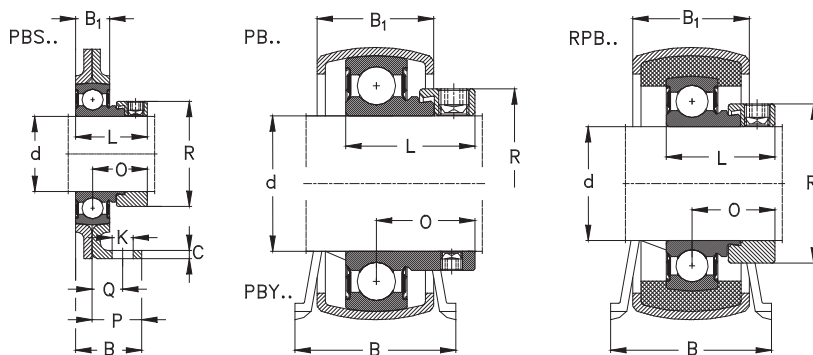


Hauptabmessungen [mm]				Bezeichnung		
Boundary dimensions [mm]				Designation		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
12	30,2	32,5	2,6	PBS12	40PBS	RAE12-NPPB
	22,2	25,4	2,6	PB12	40B/T	RAE12-NPPB
	22,2	25,4	2,6	PBY12	40B/T	AY12-NPPB
	25,4	31,8	3,3	RPB12	47B/T	RAE12-NPPB
15	30,2	32,5	2,6	PBS15	40PBS	RAE15-NPPB
	22,2	25,4	2,6	PB15	40B/T	RAE15-NPPB
	22,2	25,4	2,6	PBY15	40B/T	AY15-NPPB
	25,4	31,8	3,3	RPB15	47B/T	RAE15-NPPB
17	30,2	32,5	2,6	PBS17	40PBS	RAE17-NPPB
	22,2	25,4	2,6	PB17	40B/T	RAE17-NPPB
	22,2	25,4	2,6	PBY17	40B/T	AY17-NPPB
	25,4	31,8	3,3	RPB17	47B/T	RAE17-NPPB
20	33,6	33	3	PBS20	47PBS	RAE20-NPPB
	25,4	31,8	3,3	PB20	47B/T	RAE20-NPPB
	25,4	31,8	3,3	PBY20	47B/T	AY20-NPPB
	28,6	31,8	4	RPB20	52B/T	RAE20-NPPB
25	36,5	34,1	3,4	PBS25	52PBS	RAE25-NPPB
	28,6	31,8	4	PB25	52B/T	RAE25-NPPB
	28,6	31,8	4	PBY25	52B/T	AY25-NPPB
	33,3	38	4	RPB25	62B/T	RAE25-NPPB
30	42,9	38,9	3,4	PBS30	62PBS	RAE30-NPPB
	33,3	38	4	PB30	62B/T	RAE30-NPPB

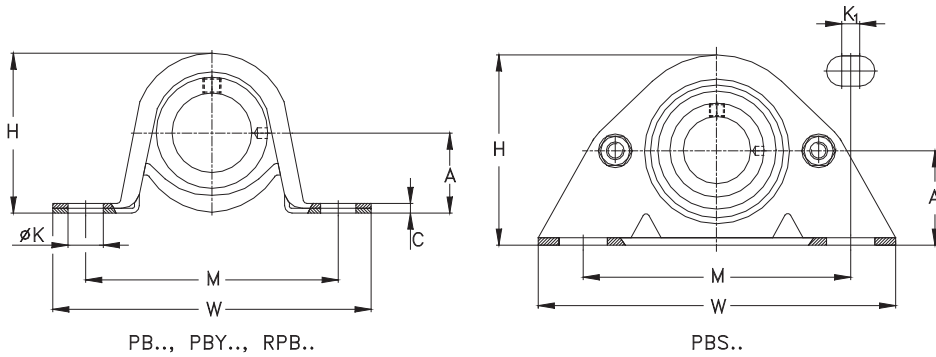


Hauptabmessungen [mm] Boundary dimensions [mm]												Gewicht [kg] Weight [kg]
d	B ₁	H	K	K ₁	L	M	P	Q	O	R _{max}	W	[m]
12	14,2	59,6	10,5	5,6	28,6	92	25,4	15	22,1	28	123,8	0,32
	18,4	43,2	9,5	--	28,6	68	--	--	22,1	28	85,7	0,17
	18,4	43,2	9,5	--	22	68	--	--	16	--	85,7	0,15
	22,3	50,1	9,5	--	28,6	76	--	--	22,1	28	98,4	0,23
15	14,2	59,6	10,5	5,6	28,6	92	25,4	15	22,1	28	123,8	0,32
	18,4	43,2	9,5	--	28,6	68	--	--	--	28	85,7	0,17
	18,4	43,2	9,5	--	22	68	--	--	16	--	85,7	0,15
	22,3	50,1	9,5	--	28,6	76	--	--	22,1	28	98,4	0,23
17	14,2	59,6	10,5	5,6	28,6	92	25,4	15	22,1	28	123,8	0,32
	18,4	43,2	9,5	--	28,6	68	--	--	22,1	28	85,7	0,17
	18,4	43,2	9,5	--	22	68	--	--	16	--	85,7	0,15
	22,3	50,1	9,5	--	28,6	76	--	--	22,1	28	98,4	0,23
20	15,8	66,8	10,5	5,6	31	97	25,4	15	23,5	33	127	0,45
	22,3	50,1	9,5	--	31	76	--	--	23,5	33	98,4	0,27
	22,3	50,1	9,5	--	25	76	--	--	18	--	98,4	0,22
	23,5	56,5	11,5	--	31	86	--	--	23,5	33	108	0,28
25	17,4	72	10,5	9,5	31	95,5	25,4	14,3	23,5	37,5	133,5	0,49
	23,5	56,5	11,5	--	31	86	--	--	23,5	37,5	108	0,3
	23,5	56,5	11,5	--	27	86	--	--	19,5	--	108	0,26
	26,5	66,1	11,5	--	31	95	--	--	23,5	37,5	117,5	0,38
30	17,4	85	13,5	8	35,7	119	30,2	16	26,7	44	159	0,79
	26,5	66,1	11,5	--	35,7	95	--	--	26,7	44	117,5	0,5

Stehlagereinheiten, Stahlblech
Plummer Block Units, Pressed Steel

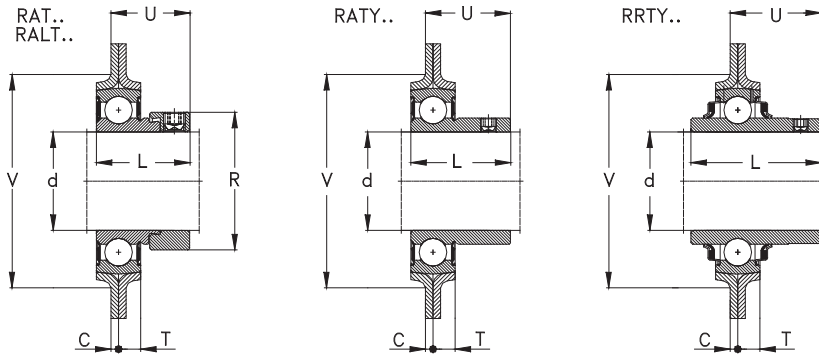


Hauptabmessungen [mm]				Bezeichnung		
Boundary dimensions [mm]				Designation		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
30	33,3	38	4	PBY30	62B/T	AY30-NPPB-1
	33,3	38	4	RPB30	62B/T	RAE30-NPPB
35	47,6	46,1	4	PBS35	72PBS	RAE35-NPPB
40	55	53,5	4	PBS40	80PBS	RAE40-NPPB

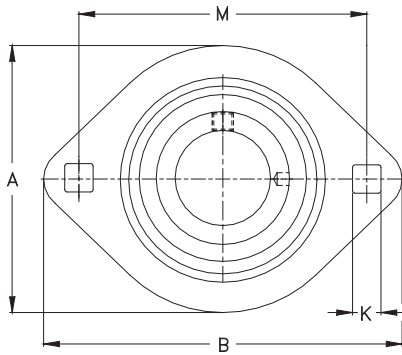


Hauptabmessungen [mm] Boundary dimensions [mm]											Gewicht [kg] Weight [kg]	
d	B ₁	H	K	K ₁	L	M	P	Q	O	R _{max}	W	[m]
30	26,5	66,1	11,5	--	30	95	--	--	21	--	117,5	0,4
	26,5	66,1	11,5	--	26,5	95	--	--	20	42,5	117,5	0,45
35	22,2	94,4	13,5	8	38,9	127	35	20,7	29,4	51	165	1,05
40	23	106	13,5	8	43,7	136,5	40	25	32,7	58	180	1,33

Zweilochflanscheinheiten, Stahlblech
Oval Flanged Units, Pressed Steel



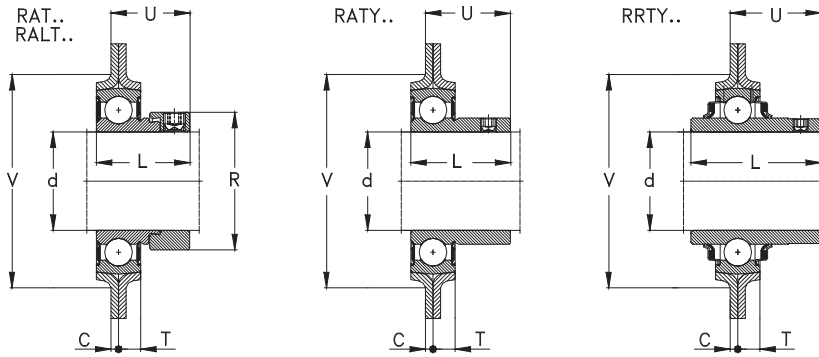
Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
12	58,7	81	2	RAT12	40MST	RAE12-NPPB
	58,7	81	2	RATY12	40MST	AY12-NPPB
	58,7	81	2	RRTY12	40MST	GYE12-KRRB
15	58,7	81	2	RAT15	40MST	RAE15-NPPB
	58,7	81	2	RATY15	40MST	AY15-NPPB
	58,7	81	2	RRTY15	40MST	GYE14-KRRB
16	58,7	81	2	RRTY16	40MST	GYE16-KRRB
17	58,7	81	2	RAT17	40MST	RAE17-NPPB
	58,7	81	2	RATY17	40MST	AY17-NPPB
	58,7	81	2	RRTY17	40MST	GYE17-KRRB
20	58,7	81	2	RALT20	42LST	RALE20-NPPB
	66	90,5	2	RAT20	47MST	RAE20-NPPB
	66	90,5	2	RATY20	47MST	AY20-NPPB
25	66	90,5	2	RRTY20	47MST	GYE20-KRRB
	71	95,2	2	RALT25	47LST	RALE25-NPPB
	71	95,2	2	RAT25	52MST	RAE25-NPPB
30	71	95,2	2	RATY25	52MST	GAY25-NPPB
	71	95,2	2	RRTY25	52MST	GYE25-KRRB
	84	112,7	2,5	RAT30	62MST	RAE30-NPPB
35	84	112,7	2,5	RATY30	62MST	AY30-NPPB
	84	112,7	2,5	RRTY30	62MST	GYE30-KRRB
35	93,7	123	2,5	RAT35	72MST	RAE35-NPPB



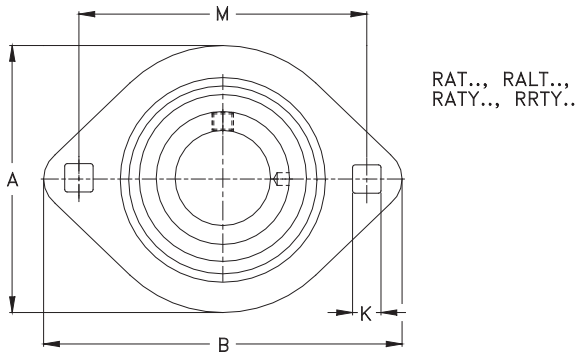
RAT..., RALT...,
RATY..., RRTY..

Hauptabmessungen [mm] Boundary dimensions [mm]								Gewicht [kg] Weight [kg]
d	K	L	M	R _{max}	T	U	V	[m]
12	7,1	28,6	63,5	28	7	24	48	0,19
	7,1	22	63,5	--	7	18	48	0,14
	7,1	27,4	63,5	--	7	17,9	48	0,17
15	7,1	28,6	63,5	28	7	24	48	0,19
	7,1	22	63,5	--	7	18	48	0,13
	7,1	27,4	63,5	--	7	17,9	48	0,16
16	7,1	27,4	63,5	--	7	17,9	48	0,16
17	7,1	28,6	63,5	28	7	24	48	0,19
	7,1	22	63,5	--	7	18	48	0,12
	7,1	27,4	63,5	--	7	17,9	48	0,15
20	7,1	24,6	63,5	30	7	20,6	48	0,21
	8,7	31	71,5	33	8	25,5	55	0,27
	8,7	25	71,5	--	8	20	55	0,22
25	8,7	31	71,5	--	8	20,6	55	0,26
	8,7	25,4	76	36	7,1	21,4	55	0,22
	8,7	31	76	37,5	8,7	25,5	60	0,34
30	8,7	27	76	--	8,7	21,5	60	0,26
	8,7	34,1	76	--	8,7	22,2	60	0,3
	10,5	35,7	90,5	44	8,7	29,2	71	0,49
35	10,5	30	90,5	--	8,7	23,5	71	0,41
	10,5	38,1	90,5	--	8,7	24,7	71	0,49
35	10,5	38,9	100	51	10,5	31,5	81	0,72

Zweilochflanscheinheiten, Stahlblech
Oval Flanged Units, Pressed Steel



Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>				Bezeichnung <i>Designation</i>		
d	A	B	C	Lagereinheit <i>Bearing unit</i>	Gehäuse <i>Housing</i>	Gehäuselager <i>Insert bearing</i>
35	93,7	123	2,5	RATY35	72MST	GAY35-NPPB
	93,7	123	2,5	RRTY35	72MST	GYE35-KRRB
40	100	148	3,5	RAT40	80MST	RAE40-NPPB
	100	148	3,5	RATY40	80MST	GAY40-NPPB
	100	148	3,5	RRTY40	80MST	GYE40-KRRB



Hauptabmessungen [mm] Boundary dimensions [mm]								Gewicht [kg] Weight [kg]
d	K	L	M	R _{max}	T	U	V	[m]
35	10,5	35	100	--	10,5	28	81	0,56
	10,5	42,9	100	--	10,5	27,9	81	0,41
40	13,5	43,7	119	58	11,5	36,2	90	0,98
	13,5	39,5	119	--	11,5	32,5	90	0,85
	13,5	49,2	119	--	11,5	33,7	90	1,01



Zubehör
Accessories

Spannhülsen
Adapter Sleeves

Abziehhülsen
Withdrawal Sleeves

Nutmuttern
Lock Nuts

Sicherungsbleche
Locking Washers



Spann- und Abziehhülsen

Allgemeines

Spann- und Abziehhülsen sind Befestigungselemente für die Befestigung von Wälzlagern mit kegeliger Bohrung auf zylindrischen Wellensitzen.

Dadurch lassen sich in vielen Fällen der Ein- und Ausbau von Lagern wesentlich vereinfachen.

Da sich sowohl Spann- als auch die Abziehhülsen bis zu einem gewissen Grade dem Wellendurchmesser anpassen können, sind größere **Durchmessertoleranzen** zulässig.

Dagegen sind die **Formtoleranzen** des Lagersitzes enger zu wählen, da Formfehler des Lagersitzes direkt die Laufgenauigkeit der gesamten Lagerung beeinflussen.

Darüber hinaus ermöglichen Spann- und Abziehhülsen die Verwendung von Wellensitzen mit lediglich gedrehter Oberfläche.

Für Anwendungsfälle mit untergeordneter Rundlaufgenauigkeit kann auch blankgezogenes Rundmaterial verwendet werden.

Als Faustregel können folgende Toleranzen verwendet werden:

Adapter and Withdrawal Sleeves

General

Adapter and withdrawal sleeves are devices using to mount and secure rolling element bearings with tapered bores onto cylindrical shaft seats.

This enables the mounting or dismounting of rolling element bearings in a simple and effective way for a variety of applications.

Since, adapter and withdrawal sleeves are able to adapt to shaft diameter variations within certain limits, larger than normal **shaft diameter tolerances** are accommodated.

The **geometrical accuracy**, however, must be more closely defined, as the form errors of the shaft affect the running accuracy of the total bearing arrangement in a direct way.

Furthermore, using adapter or withdrawal sleeves allows bearing seats with lower surface qualities, (e.g. turned surfaces) to be acceptable.

For applications where no accurate shaft guidance of bearings is required, bright drawn round bar stock may also be used.

Generally the following tolerances may be used for guidance:

Erwartete Laufgenauigkeit <i>Expected running accuracy</i>	Toleranz des Wellensitzes <i>Tolerance of shaft seat</i>	
	Durchmesser <i>Diameter tolerance</i>	Formgenauigkeit <i>Form accuracy</i>
Normal <i>normal</i>	h 7, h8, h 9	$\frac{IT\ 5}{2}$
Gering <i>low</i>	h10, h11	$\frac{IT\ 7}{2}$

Spannhülsen

Normen, Hauptabmessungen

Spannhülsen DIN 5415

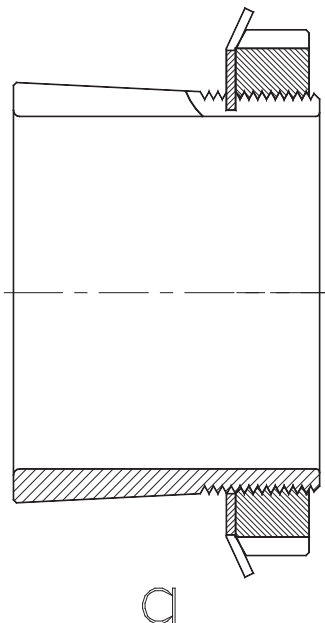
Allgemeines

Spannhülsen (siehe Abbildung unten) sind geschlitzte Stahlhülsen, die auf der einen Seite an der Mantelfläche einen Kegel 1:12 aufweisen, auf der anderen Seite haben sie ein Gewinde.

Kleinere Spannhülsen können phosphatierte Oberflächen haben, alle anderen sind blank.

NKE Spannhülsen werden komplett mit Wellenmutter und Sicherungsblech geliefert.

Neben der Standardausführung (Abb. a), stehen größere Spannhülsen mit dem Vorsetzzeichen **OH** auch mit den zur Anwendung des Druckölverfahrens erforderlichen Ölbohrungen und Ölverteilmuten zur Verfügung.



Adapter Sleeves

Standards, Boundary Dimensions

Adapter Sleeves DIN 5415

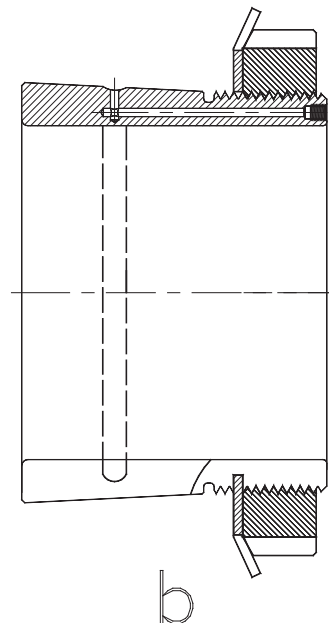
General

Adapter sleeves (see sketch below) are slotted steel sleeves that have a tapered outer diameter, taper 1:12 on one side and a thread on the opposite side.

Small adapter sleeves may have phosphated surfaces, normally they are only oil preserved.

NKE adapter sleeves are supplied complete with lock nut and locking washer as standard.

Beside the standard design (see fig. a), there are also larger adapter sleeves available with oil bores and oil distribution ducts (prefix **OH**), as required for applying the oil injection method.



Spann- und Abziehhülsen

Adapter and Withdrawal Sleeves

Spannhülsen ermöglichen eine einfache Positionierung von Lagern auf glatten Wellen in jeder beliebigen Position (siehe Abb. c unten).

Dabei darf allerdings die auf das Lager wirkende Axialkraft eine bestimmte Höhe nicht überschreiten, da diese nur durch die Reibung zwischen Spannhülse und Welle aufgenommen wird.

Beim Auftreten größerer Axialkräfte müssen die Lager zusätzliche axial durch Stützringe gesichert werden, siehe Abb. d.

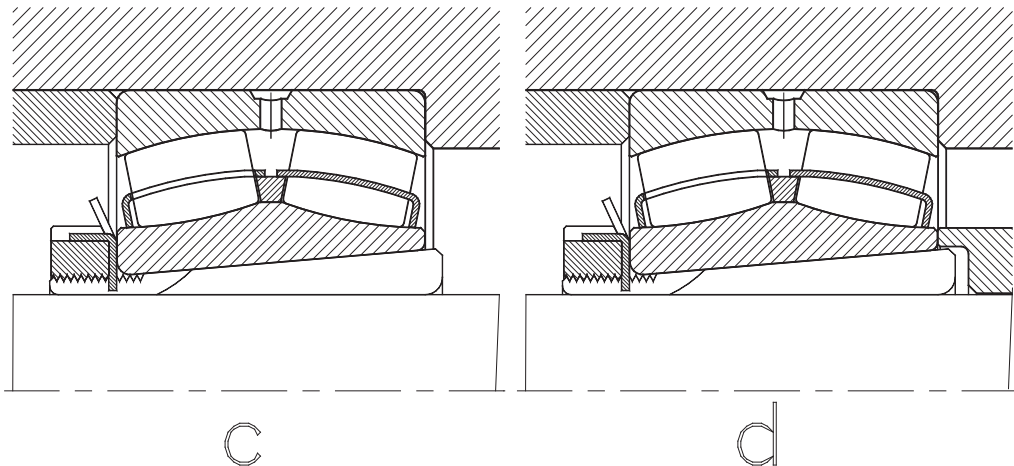
Bei einer Auslegung der Stützringe müssen allerdings die in den Produkttabellen empfohlenen Anschlußmaße beachtet werden.

On smooth straight shafts, (e.g. on a drawn round stock), adapter sleeves allow a simple positioning of bearings in any position, (see fig. c).

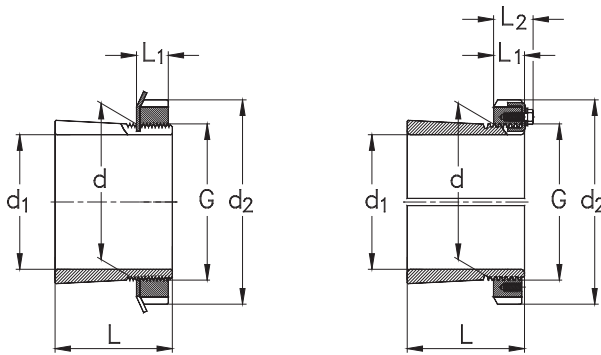
In applications where bearings with adapter sleeves are mounted on straight shafts without axial support, (see fig. c), their ability to accept axial forces is limited by the friction between the adapter sleeve and the shaft.

In the case of higher axial forces, the bearing needs to be secured additionally by **supporting rings** (see fig. d).

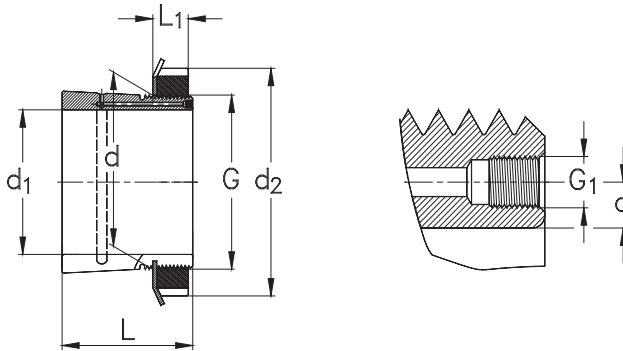
When designing such supporting rings, however, the abutment dimensions recommended by the product tables must be considered.



Spannhülsen
Adapter Sleeves

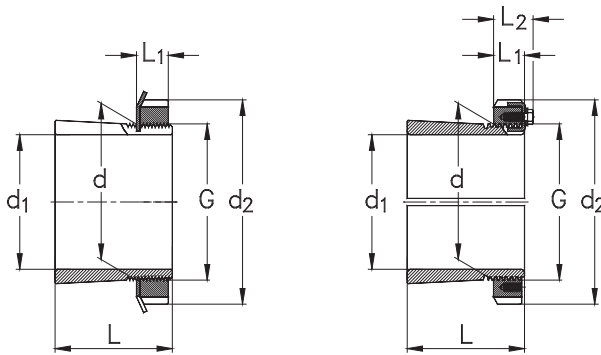


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
17	20	32	24	H204	0,04
		32	28	H304	0,04
		32	31	H2304	0,05
20	25	38	26	H205	0,06
		38	29	H305	0,07
		38	35	H2305	0,09
25	30	45	27	H206	0,09
		45	31	H306	0,1
		45	38	H2306	0,11
30	35	52	29	H207	0,12
		52	35	H307	0,14
		52	43	H2307	0,15
35	40	58	31	H208	0,16
		58	36	H308	0,18
		58	46	H2308	0,22
40	45	65	33	H209	0,21
		65	39	H309	0,23
		65	50	H2309	0,27
45	50	70	35	H210	0,24
		70	42	H310	0,27
		70	55	H2310	0,34
50	55	75	37	H211	0,28

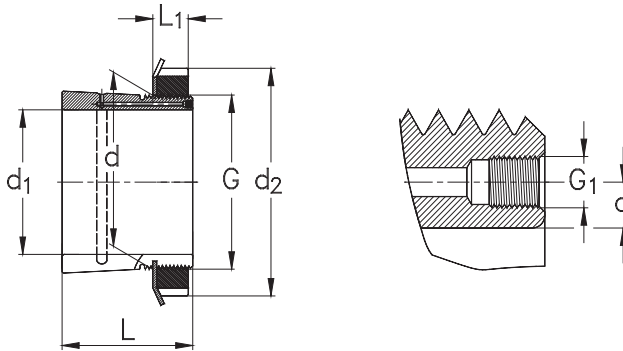


Ø Welle [mm]	Gewinde	Abmessungen [mm]				zugehörige Nutmutter	zugehörige Mutternsicherung
Shaft Ø [mm]	Thread	Dimensions [mm]				Lock nut	Locking device
d ₁	G	L ₁	L ₂	G ₁	a		
17	M20X1	7	--	--	--	KM4	MB4
	M20X1	7	--	--	--	KM4	MB4
	M20X1	7	--	--	--	KM4	MB4
20	M25X1,5	8	--	--	--	KM5	MB5
	M25X1,5	8	--	--	--	KM5	MB5
	M25X1,5	8	--	--	--	KM5	MB5
25	M30X1,5	8	--	--	--	KM6	MB6
	M30X1,5	8	--	--	--	KM6	MB6
	M30X1,5	8	--	--	--	KM6	MB6
30	M35X1,5	9	--	--	--	KM7	MB7
	M35X1,5	9	--	--	--	KM7	MB7
	M35X1,5	9	--	--	--	KM7	MB7
35	M40X1,5	10	--	--	--	KM8	MB8
	M40X1,5	10	--	--	--	KM8	MB8
	M40X1,5	10	--	--	--	KM8	MB8
40	M45X1,5	11	--	--	--	KM9	MB9
	M45X1,5	11	--	--	--	KM9	MB9
	M45X1,5	11	--	--	--	KM9	MB9
45	M50X1,5	12	--	--	--	KM10	MB10
	M50X1,5	12	--	--	--	KM10	MB10
	M50X1,5	12	--	--	--	KM10	MB10
50	M55X2	12,5	--	--	--	KM11	MB11

Spannhülsen
Adapter Sleeves

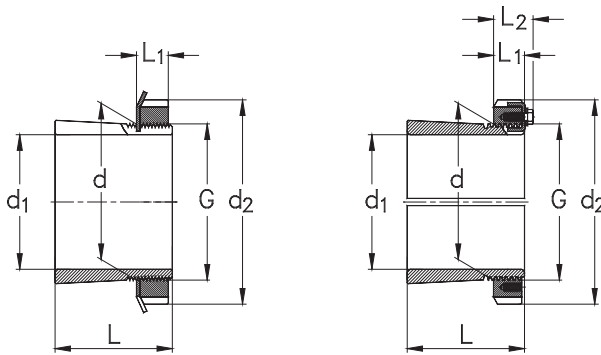


Ø Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft Ø [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d ₁	d	d ₂	L		m
50		75	45	H311	0,32
		75	59	H2311	0,39
55	60	80	38	H212	0,31
		80	47	H312	0,35
		80	62	H2312	0,45
60	65	85	40	H213	0,36
		85	50	H313	0,42
		85	65	H2313	0,52
		92	52	H314	0,68
		92	68	H2314	0,88
65	75	98	43	H215	0,66
		98	55	H315	0,78
		98	73	H2315	1,1
70	80	105	46	H216	0,81
		105	59	H316	0,95
		105	78	H2316	1,2
75	85	110	50	H217	0,94
		110	63	H317	1,1
		110	82	H2317	1,35
80	90	120	52	H218	1,1
		120	65	H318	1,3
		120	86	H2318	1,6

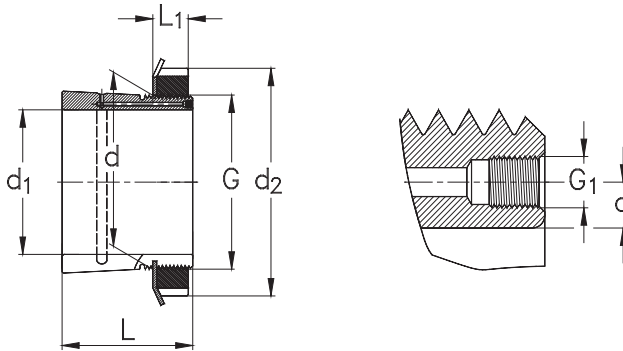


Ø Welle [mm]	Gewinde Thread	Abmessungen [mm]				zugehörige Nutmutter Lock nut	zugehörige Mutternsicherung Locking device
		L ₁	L ₂	G ₁	a		
Shaft Ø [mm]	G	L ₁	L ₂	G ₁	a		
50	M55X2	12,5	--	--	--	KM11	MB11
	M55X2	12,5	--	--	--	KM11	MB11
55	M60X2	13	--	--	--	KM12	MB12
	M60X2	13	--	--	--	KM12	MB12
60	M65X2	14	--	--	--	KM13	MB13
	M65X2	14	--	--	--	KM13	MB13
65	M70X2	14	--	--	--	KM14	MB14
	M70X2	14	--	--	--	KM14	MB14
70	M75X2	15	--	--	--	KM15	MB15
	M75X2	15	--	--	--	KM15	MB15
75	M80X2	17	--	--	--	KM16	MB16
	M80X2	17	--	--	--	KM16	MB16
80	M85X2	18	--	--	--	KM17	MB17
	M85X2	18	--	--	--	KM17	MB17
85	M90X2	18	--	--	--	KM18	MB18
	M90X2	18	--	--	--	KM18	MB18

Spannhülsen
Adapter Sleeves

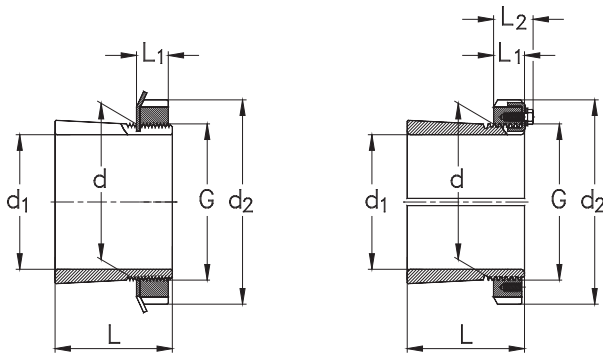


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
85	95	125	55	H219	1,25
		125	68	H319	1,4
		125	90	H2319	1,8
90	100	130	58	H220	1,4
		130	71	H320	1,6
		130	97	H2320	2
95	105	140	60	H221	1,6
		140	74	H321	1,85
		145	63	H222	1,8
100	110	145	77	H322	2,05
		145	105	H2322	2,75
		145	81	H3122	2,1
110	120	155	112	H2324	3
		145	72	H3024	1,8
		155	88	H3124	2,5
115	130	165	121	H2326	4,45
		155	80	H3026	2,8
		165	92	H3126	3,45
125	140	180	131	H2328	5,4
		165	82	H3028	3,05
		180	97	H3128	4,1

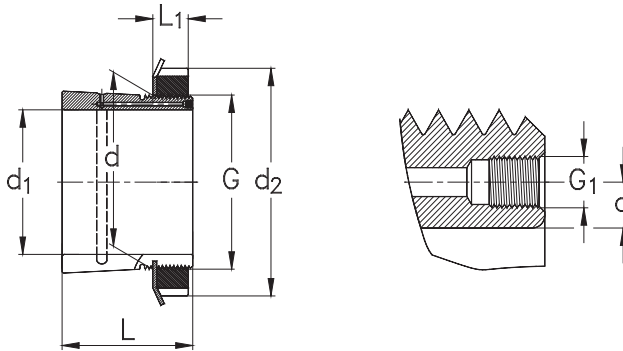


Ø Welle [mm] <i>Shaft Ø</i> [mm]	Gewinde <i>Thread</i>	Abmessungen [mm] <i>Dimensions</i> [mm]				zugehörige Nutmutter <i>Lock nut</i>	zugehörige Mutternsicherung <i>Locking device</i>
		L ₁	L ₂	G ₁	a		
85	M95X2	19	--	--	--	KM19	MB19
	M95X2	19	--	--	--	KM19	MB19
	M95X2	19	--	--	--	KM19	MB19
90	M100X2	20	--	--	--	KM20	MB20
	M100X2	20	--	--	--	KM20	MB20
	M100X2	20	--	--	--	KM20	MB20
	M100X2	20	--	--	--	KM20	MB20
95	M105X2	20	--	--	--	KM21	MB21
	M 105X2	20	--	--	--	KM21	MB21
100	M110X2	21	--	--	--	KM22	MB22
	M110X2	21	--	--	--	KM22	MB22
	M110X2	21	--	--	--	KM22	MB22
	M110X2	31	--	--	--	KM22	MB22
110	M120X2	22	--	--	--	KM24	MB24
	M120X2	22	--	--	--	KML24	MBL24
	M120X2	22	--	--	--	KM24	MB24
115	M130X2	23	--	--	--	KM26	MB26
	M130X2	23	--	--	--	KML26	MBL26
	M130X2	23	--	--	--	KM26	MB26
125	M140X2	24	--	--	--	KM28	MB28
	M140X2	24	--	--	--	KML28	MBL28
	M140X2	24	--	--	--	KM28	MB28

Spannhülsen
Adapter Sleeves

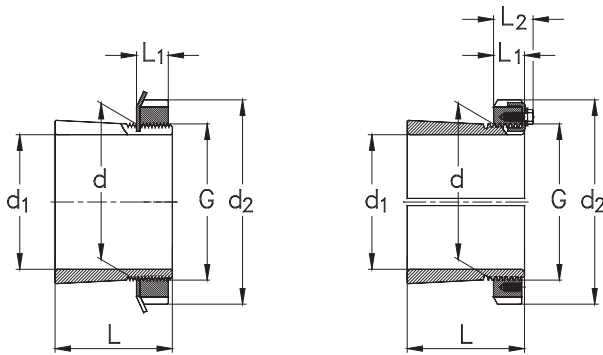


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
135	150	195	139	H2330	6,4
		180	87	H3030	3,75
		195	111	H3130	5,25
140	160	210	147	H2332	8,8
		210	147	OH2332-H	8,8
		190	93	H3032	5,1
	160	190	93	OH3032-H	5,1
		210	119	H3132	7,25
150	170	210	119	OH3132-H	7,25
		220	154	H2334	9,9
		220	154	OH2334-H	9,9
		200	101	H3034	5,8
		200	101	OH3034-H	5,8
		220	122	H3134	8,1
160	180	220	122	OH3134-H	8,1
		230	161	H2336	11
		230	161	OH2336-H	11
		210	109	H3036	6,7
		210	109	OH3036-H	6,7
		230	131	H3136	9,15
170	190	230	131	OH3136-H	9,15
		240	169	H2338	12

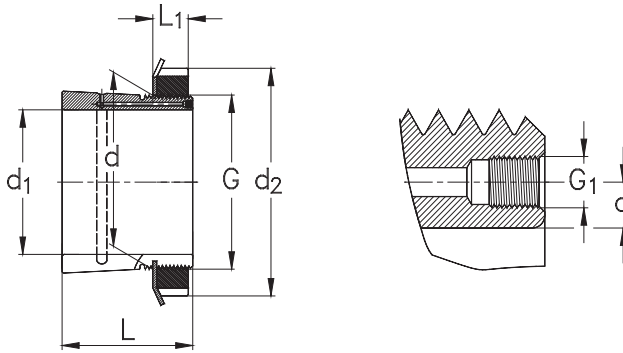


Ø Welle [mm]	Gewinde Thread	Abmessungen [mm]				zugehörige Nutmutter Lock nut	zugehörige Mutternsicherung Locking device
Shaft Ø [mm]	G	L ₁	L ₂	G ₁	a		
135	M150X2	26	--	--	--	KM30	MB30
	M150X2	26	--	--	--	KML30	MBL30
	M150X2	26	--	--	--	KM30	MB30
140	M160X3	28	--	--	--	KM32	MB32
	M160X3	28	--	M6	4,2	KM32	MB32
	M160X3	27,5	--	--	--	KML32	MBL32
	M160X3	27,5	--	M6	4,2	KML32	MBL32
	M160X3	28	--	--	--	KM32	MB32
	M160X3	28	--	M6	4,2	KM32	MB32
150	M170X3	29	--	--	--	KM34	MB34
	M170X3	29	--	M6	4,2	KM 34	MB34
	M170X3	28,5	--	--	--	KML34	MBL34
	M170X3	28,5	--	M6	4,2	KML34	MBL34
	M170X3	29	--	--	--	KM34	MB34
	M170X3	29	--	M6	4,2	KM34	MB34
160	M180X3	30	--	--	--	KM36	MB36
	M180X3	30	--	M6	4,2	KM36	MB36
	M180X3	29,5	--	--	--	KML36	MBL36
	M180X3	29,5	--	M6	4,2	KML36	MBL36
	M180X3	30	--	--	--	KM36	MB36
	M180X3	30	--	M6	4,2	KM36	MB36
170	M190X3	31	--	--	--	KM38	MB38

Spannhülsen
Adapter Sleeves

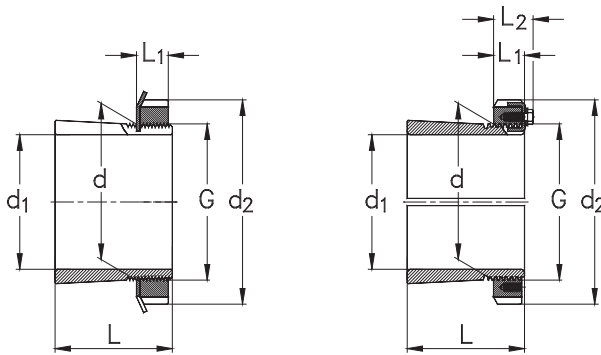


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
170		240	169	OH2338-H	12
		220	112	H3038	7,25
		220	112	OH3038-H	7,25
		240	141	H3138	10,5
		240	141	OH3138-H	10,5
180	200	250	176	H2340	13,5
		250	176	OH2340-H	13,5
	200	240	120	H3040	8,9
		240	120	OH3040-H	8,9
		250	150	H3140	12
		250	150	OH3140-H	12
200	220	280	186	H2344	17
		280	186	OH2344-H	17
		260	126	H3044	9,9
		260	126	OH3044-H	9,9
		280	161	H3144	15
		280	161	OH3144-H	15
220	240	300	199	H2348	19
		300	199	OH2348-H	19
		290	133	H3048	12
		290	133	OH3048-H	12
		300	172	H3148	16

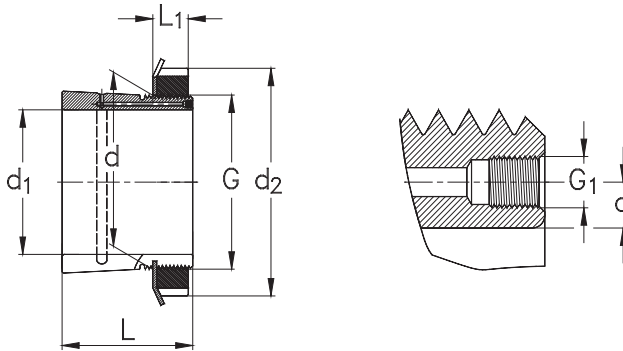


Ø Welle [mm]	Gewinde Thread	Abmessungen [mm]				zugehörige Nutmutter Lock nut	zugehörige Mutternsicherung Locking device
Shaft Ø [mm]	<i>Thread</i>	<i>Dimensions [mm]</i>				<i>Lock nut</i>	<i>Locking device</i>
d ₁	G	L ₁	L ₂	G ₁	a		
170	M190X3	31	--	M6	4,2	KM38	MB38
	M190X3	30,5	--	--	--	KML38	MBL38
	M190X3	30,5	--	M6	4,2	KML38	MBL38
	M190X3	31	--	--	--	KM38	MB38
	M190X3	31	--	M6	4,2	KM38	MB38
180	M200X3	32	--	--	--	KM40	MB40
	M200X3	32	--	M6	4,2	KM40	MB40
	M200X3	31,5	--	--	--	KML40	MBL40
	M200X3	31,5	--	M6	4,2	KML40	MBL40
	M200X3	32	--	--	--	KM40	MB40
	M200X3	32	--	M6	4,2	KM40	MB40
200	Tr220X4	35	--	--	--	H-M 44 T	MB44
	Tr220X4	35	--	M6	4,2	H-M 44 T	MB44
	Tr220X4	30	41	--	--	H-M 3044	MS3044
	Tr220X4	30	41	M6	4,2	H-M 3044	MS3044
	Tr220X4	35	--	--	--	H-M 44 T	MB44
	Tr220X4	35	--	M6	4,2	H-M 44 T	MB44
220	Tr240X4	37	--	--	--	H-M 48 T	MB48
	Tr240X4	37	--	M6	4,2	H-M 48 T	MB48
	Tr240X4	34	46	--	--	H-M 3048	MS3052-48
	Tr240X4	34	46	M6	4,2	H-M 3048	MS3052-48
	Tr240X4	37	--	--	--	H-M 48 T	MB48

Spannhülsen
Adapter Sleeves

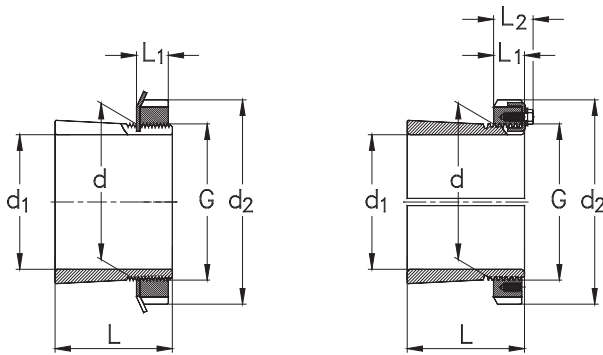


Ø Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft Ø [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d ₁	d	d ₂	L		m
220		300	172	OH3148-H	16
240	260	330	211	H2352	23
		330	211	OH2352-H	23
		310	145	H3052	13,5
		310	145	OH3052-H	13,5
		330	190	H3152	21
		330	190	OH3152-H	21
260	280	350	224	H-2356	27
		350	224	OH-2356-H	27
		330	152	H-3056	16
		330	152	OH-3056-H	16
	280	350	195	H3156	23
		350	195	OH3156-H	23
280	300	360	168	H3060	20,5
		360	168	OH3060-H	20,5
		380	208	H3160	29
		380	208	OH3160-H	29
		380	240	H3260	32
		380	240	OH3260-H	32
300	320	380	171	H3064	22
		380	171	OH3064-H	22
		400	226	H3164	32

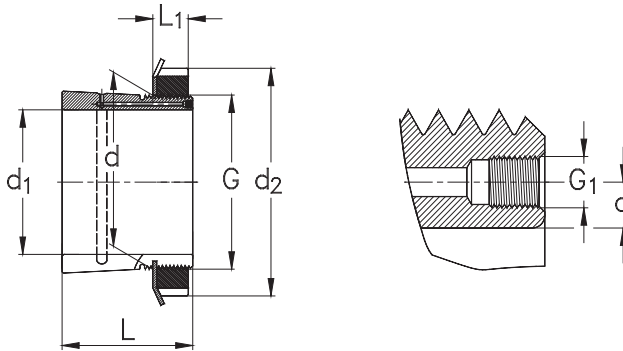


Ø Welle [mm]	Gewinde Thread	Abmessungen [mm]				zugehörige Nutmutter Lock nut	zugehörige Mutternsicherung Locking device
Shaft Ø [mm]	<i>Thread</i>	<i>Dimensions [mm]</i>				<i>Lock nut</i>	<i>Locking device</i>
d ₁	G	L ₁	L ₂	G ₁	a		
220	Tr240X4	37	--	M6	4,2	H-M 48 T	MB48
240	Tr260X4	39	--	--	--	H-M 52 T	MB52
	Tr260X4	39	--	M6	4,2	H-M 52 T	MB52
	Tr260X4	34	46	--	--	H-M 3052	MS3052-48
	Tr260X4	34	46	M6	4,2	H-M 3052	MS3052-48
	Tr260X4	39	--	--	--	H-M 52 T	MB52
	Tr260X4	39	--	M6	4,2	H-M 52 T	MB52
260	Tr280X4	41	--	--	--	H-M 56 T	MB56
	Tr280X4	41	--	M6	4,2	H-M 56 T	MB56
	Tr280X4	38	50	--	--	H-M 3056	MS3056
	Tr280X4	38	50	M6	4,2	H-M 3056	MS3056
	Tr280X4	41	--	--	--	H-M 56 T	MB 56
	Tr280X4	41	--	M 6	4,2	H-M 56 T	MB 56
280	Tr300X4	42	54	--	--	H-M 3060	MS 3060
	Tr300X4	42	54	M 6	4,2	H-M 3060	MS 3060
	Tr300X4	40	53	--	--	H-M 3160	MS 3160
	Tr300X4	40	53	M 6	4,2	H-M 3460	MS 3160
	Tr300X4	40	53	--	--	H-M 3160	MS 3160
	Tr300X4	40	53	M 6	4,2	H-M 3160	MS 3160
300	Tr320X5	42	55	--	--	H-M 3064	MS 3068-64
	Tr320X5	42	55	M 6	4	H-M 3064	MS 3068-64
	Tr320X5	42	56	--	--	H-M 3164	MS 3164

Spannhülsen
Adapter Sleeves

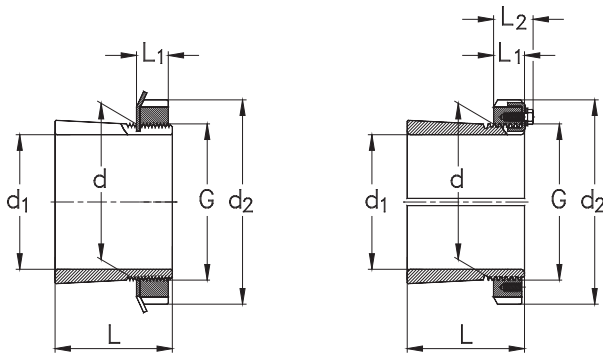


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
300		400	226	OH3164-H	32
		400	258	H3264	35
		400	258	OH3264-H	35
320	340	400	187	H3068	27
		400	187	OH3068-H	27
		440	254	H3168	50
		440	254	OH3168-H	50
		440	288	H3268	51,5
		440	288	OH3268	51,5
340	360	420	188	H3072	29
		420	188	OH3072-H	29
		460	259	H3172	56
	360	460	259	OH3172-H	56
		460	299	H3272	60,5
		460	299	OH3272-H	60,5
		450	193	H3076	35,5
360	380	450	193	OH3076-H	35,5
		490	264	H3176	61,5
		490	264	OH3176-H	61,5
		490	310	H3276	69,5
		490	310	OH3276-H	69,5
380	400	470	210	H3080	40

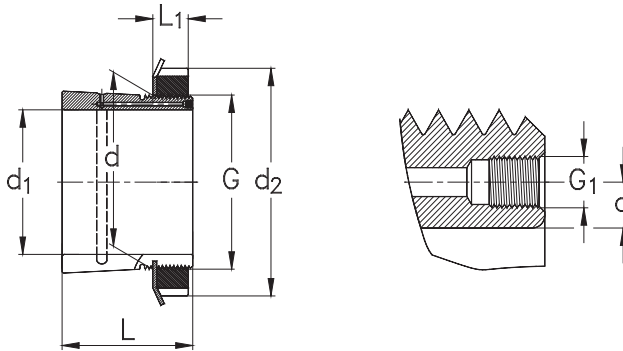


Ø Welle [mm]	Gewinde	Abmessungen [mm]				zugehörige Nutmutter	zugehörige Mutternsicherung
Shaft Ø [mm]	Thread	Dimensions [mm]				Lock nut	Locking device
d ₁	G	L ₁	L ₂	G ₁	a		
300	Tr320X5	42	56	M 6	4	H-M 3164	MS 3164
	Tr320X5	42	56	--	--	H-M 3164	MS 3164
	Tr320X5	42	56	M 6	4	H-M 3164	MS 3164
320	Tr340X5	45	58	--	--	H-M 3068	MS 3068-64
	Tr340X5	45	58	M 6	4	H-M 3068	MS 3068-64
	Tr340X5	55	72	--	--	H-M 3168	MS 3172-68
	Tr340X5	55	72	M 6	4	H-M 3168	MS 3172-68
	Tr340X5	55	72	--	--	H-M 3168	MS 3172-68
	Tr340X5	55	72	M 6	4	H-M 3168	MS 3172-68
340	Tr360X5	45	58	--	--	H-M 3072	MS 3072
	Tr360X5	45	58	M 6	4	H-M 3072	MS 3072
	Tr360X5	58	75	--	--	H-M 3172	MS 3172-68
	Tr360X5	58	75	M6	4	H-M 3172	MS 3172-68
	Tr 360 x 5	58	75	--	--	H-M 3172	MS 3172-68
	Tr 360 x 5	58	75	--	10	H-M 3172	MS 3172-68
360	Tr 380 X 5	48	62	--	--	H-M 3076	MS 3080-76
	Tr 380 X 5	48	62	M 6	4	H-M 3076	MS 3080-76
	Tr 380 X 5	60	77	--	--	H-M 3176	MS 3176
	Tr 380 X 5	60	77	M 6	4	H-M 3176	MS 3176
	Tr 380 x 5	60	77	--	--	H-M 3176	MS 3176
	Tr 380 x 5	60	77	--	10,5	H-M 3176	MS 3176
380	Tr 400 X 5	52	66	--	--	H-M 3080	MS 3080-76

Spannhülsen
Adapter Sleeves

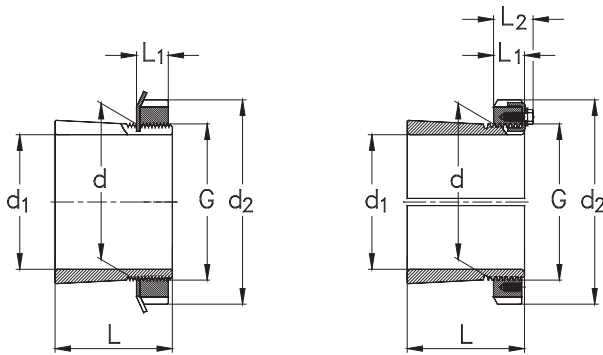


\varnothing Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft \varnothing [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d_1	d	d_2	L		m
380		470	210	OH3080-H	40
		520	272	H3180	73
		520	272	OH3180-H	73
400	420	490	212	H3084	47
		490	212	OH3084-H	47
		540	304	H3184	80
		540	304	OH3184-H	80
410	440	520	228	H3088	65
		520	228	OH3088-H	65
		560	307	H3188	95
		560	307	OH3188-H	95
430	460	540	234	H3092	71
		540	234	OH3092-H	71
	460	580	326	H3192	119
		580	326	OH3192-H	119
450	480	560	237	H3096	75
		560	237	OH3096-H	75
		620	335	H3196	135
		620	335	OH3196-H	135
470	500	580	247	H30/500	82
		580	247	OH30/500-H	82
		630	356	H31/500	145

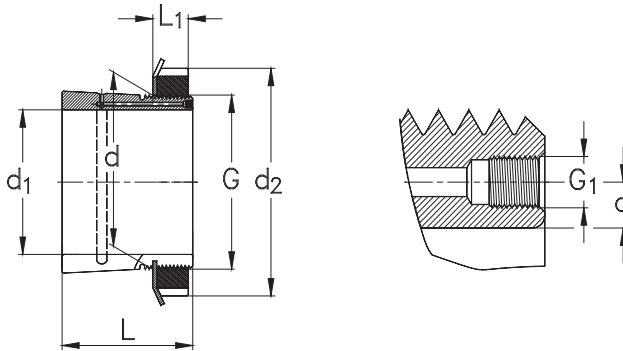


Ø Welle [mm]	Gewinde	Abmessungen [mm]				zugehörige Nutmutter	zugehörige Mutternsicherung
Shaft Ø [mm]	Thread	Dimensions [mm]				Lock nut	Locking device
d ₁	G	L ₁	L ₂	G ₁	a		
380	Tr 400 X 5	52	66	M 6	4	H-M 3080	MS 3080-76
	Tr 400 X 5	62	82	--	--	H-M 3180	MS 3184-80
	Tr 400 X 5	62	82	M 6	4	H-M 3180	MS 3184-80
400	Tr 420 X 5	52	66	--	--	H-M 3084	MS 3084
	Tr 420 X 5	52	66	M 6	4	H-M 3084	MS 3084
	Tr 420 X 5	70	90	--	--	H-M 3184	MS 3184-80
	Tr 420 X 5	70	90	M 6	4	H-M 3184	MS 3184-80
410	Tr 440 X 5	60	77	--	--	H-M 3088	MS 3092-88
	Tr 440 X 5	60	77	M 8	6,5	H-M 3088	MS 3092-88
	Tr 440 X 5	70	90	--	--	H-M 3188	MS 3192-88
	Tr 440 X 5	70	90	M 8	6,5	H-M 3188	MS 3192-88
430	Tr 460 X 5	60	77	--	--	H-M 3092	MS 3092-88
	Tr 460 X 5	60	77	M 8	6,5	H-M 3092	MS 3092-88
	Tr 460 X 5	75	95	--	--	H-M 3192	MS 3192-88
	Tr 460 X 5	75	95	M 8	6,5	H-M 3192	MS 3192-88
450	Tr 480 X 5	60	77	--	--	H-M 3096	MS 30/500-96
	Tr 480 X 5	60	77	M 8	6,5	H-M 3096	MS 30/500-96
	Tr 480 X 5	75	95	--	--	H-M 3196	MS 3196
	Tr 480 X 5	75	95	M 8	6,5	H-M 3196	MS 3196
470	Tr 500 X 5	68	85	--	--	H-M 30/500	MS 30/500-96
	Tr 500 X 5	68	85	M 8	6,5	H-M 30/500	MS 30/500-96
	Tr 500 X 5	80	100	--	--	H-M 31/500	MS 31/500

Spannhülsen
Adapter Sleeves



Ø Welle [mm]	Hauptabmessungen [mm]			Bezeichnung Spannhülse komplett	Gewicht [kg]
Shaft Ø [mm]	Boundary dimensions [mm]			Designation adapter sleeve, complete	Weight [kg]
d ₁	d	d ₂	L		m
470		630	356	OH31/500-H	145
500	530	630	265	H30/530	105
		630	265	OH30/530-H	105
530	560	650	282	H30/560	112
		650	282	OH30/560-H	112
560	600	700	289	H30/600	147
		700	289	OH30/600-H	147
600	630	730	301	H30/630	138
		730	301	OH30/630-H	138
630	670	780	324	H30/670	190
		780	324	OH30/670-H	190
670	710	830	342	H30/710	228
		830	342	OH30/710-H	228
710	750	870	356	H30/750	246
		870	356	OH30/750-H	246
750	800	920	366	H30/800	302
		920	366	OH30/800-H	302
800	850	980	380	H30/850	341
		980	380	OH30/850-H	341



Ø Welle [mm]	Gewinde	Abmessungen [mm]				zugehörige Nutmutter	zugehörige Mutternsicherung
Shaft Ø [mm]	Thread	Dimensions [mm]				Lock nut	Locking device
d ₁	G	L ₁	L ₂	G ₁	a		
470	Tr 500 X 5	80	100	M 8	6,5	H-M 31/500	MS 31/500
500	Tr 530 X 6	68	90	--	--	H-M 30/530	MS 30/600-530
	Tr 530 X 6	68	90	M 8	6	H-M 30/530	MS 30/600-530
530	Tr 560 X 6	75	97	--	--	H-M 30/560	MS 30/560
	Tr 560 X 6	75	97	M 8	6	H-M 30/560	MS 30/560
560	Tr 600 X 6	75	97	--	--	H-M 30/600	MS 30/600-530
	Tr 600 X 6	75	97	--	8	H-M 30/600	MS 30/600-530
600	Tr 630 X 6	75	97	--	--	H-M 30/630	MS 30/630
	Tr 630 X 6	75	97	M 8	6	H-M 30/630	MS 30/630
630	Tr 670 X 6	80	102	--	--	H-M 30/670	MS 30/670
	Tr 670 X 6	80	102	--	8	H-M 30/670	MS 30/670
670	Tr 710 X 7	90	112	--	--	H-M 30/710	MS 30/710
	Tr 710 X 7	90	112	--	8	H-M 30/710	MS 30/710
710	Tr 750 X 7	90	112	--	--	H-M 30/750	MS 30/800-750
	Tr 750 X 7	90	112	--	8	H-M 30/750	MS 30/800-750
750	Tr 840 X 7	90	112	--	--	H-M 30/800	MS 30/800-750
	Tr 800 X 7	90	112	--	10	H-M 30/800	MS 30/800-750
800	Tr 850 X 7	90	115	--	--	H-M 30/850	MS 30/900-850
	Tr 850 X 7	90	115	--	10	H-M 30/850	MS 30/900-850

Abziehhülsen

Normen, Hauptabmessungen

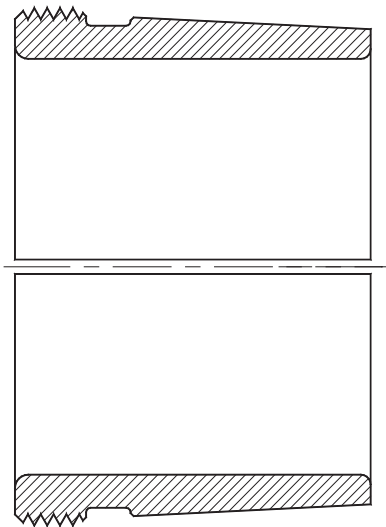
Abziehhülsen DIN 5416

Allgemeines

Abziehhülsen (siehe Abbildung unten) sind geschlitzte Stahlhülsen, die auf der einen Seite eine kegelige Mantelfläche aufweisen und am größeren Durchmesser ein Gewinde haben.

Der Kegel der Mantelfläche beträgt **1:12**, lediglich bei den Abziehhülsen der Reihe **AH 240** und **AH 241** beträgt der Kegel **1:30**.

NKE Abziehhülsen werden standardmäßig ohne Wellenmutter geliefert.



a

Withdrawal Sleeves

Standards, Boundary Dimensions

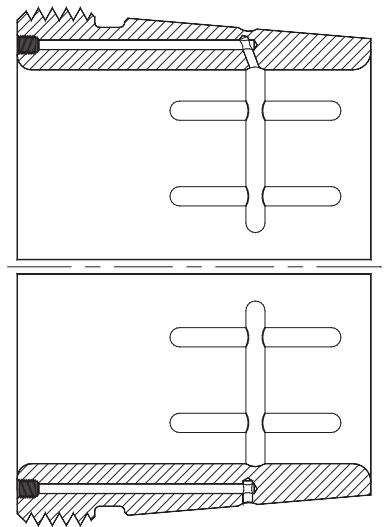
Withdrawal sleeves DIN 5416

General

Withdrawal sleeves (see sketch below) are slotted steel sleeves that have a tapered outer diameter on one side and a thread on the large diameter on the opposite side.

Standard withdrawal sleeves have tapered outers, taper **1:12** except for withdrawal sleeves of series **AH 240** and **AH 241** having tapers **1:30**.

NKE withdrawal sleeves are supplied without lock nut as standard.



b

NKE Abziehhülsen werden standardmäßig in zwei Grundausführungen gefertigt.

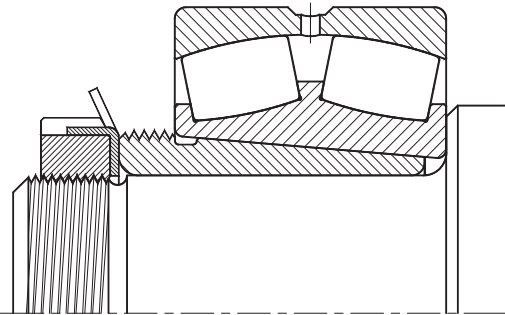
Neben der Standardausführung (Abb. **a**), stehen größere Abziehhülsen ab einem Bohrungsdurchmesser von etwa 200 mm auch mit den zur Anwendung des Druckölverfahrens erforderlichen Ölbohrungen und Ölverteilmuten zur Verfügung, siehe Abb. **b**.

NKE Abziehhülsen mit Ölbohrungen werden als **AOH** . . bezeichnet.

NKE withdrawal sleeves are produced in two different designs as standard.

Beside the standard design (see fig. **a**), larger withdrawal sleeves from bore diameter 200 mm onwards are also available with oil bores and oil distribution ducts as required for applying the oil injection method as shown in fig. **b**.

NKE withdrawal sleeves that are foreseen with facilities for an application of the oil injection method are designated "**AOH** . ."

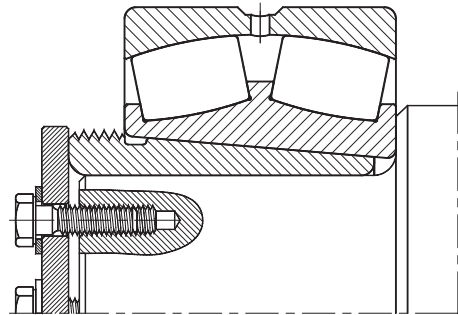


c

Bei einer Verwendung von Abziehhülsen muss der Lagerinnenring gegen eine geeignete Anlagefläche abgestützt werden, beispielsweise gegen einen Wellenbund, wie in Abb. **a** dargestellt ist.

Sollte aus Festigkeitsgründen am Wellenabsatz ein Radius erforderlich sein, der größer ist als die Kantenverrundung des Lagers, muss ein Abstandsring zwischen Wellenschulter und Lagerplanfläche eingebaut werden.

Die Abziehhülsen selbst müssen in jedem Fall gegen unbeabsichtigtes Lösen zusätzlich axial gesichert werden, beispielsweise durch Wellenmuttern (Abb. **c**) oder Haltescheiben (Abb. **d**).



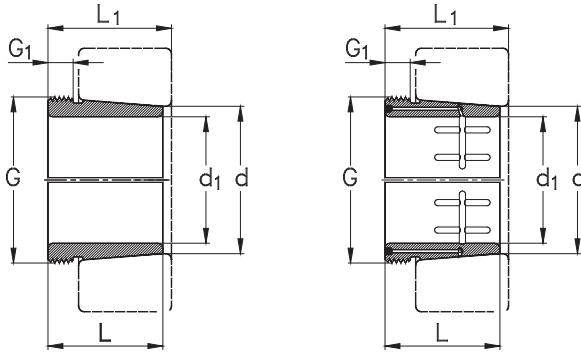
d

When withdrawal sleeves are used, the bearing inner ring must be supported by an effective surface contact, such as a shaft shoulder (see fig. **a**).

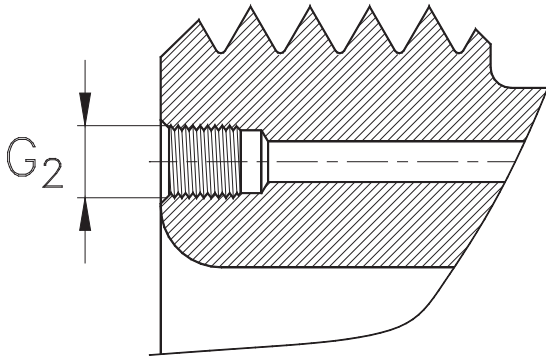
Where larger radii bearing journals and shaft shoulders are necessary for strength reasons, (e.g. where such radii become larger than the bearing fillet), suitable distance rings must be applied.

In each case the withdrawal sleeve must be secured against axial displacement loosening by means of lock nuts (see fig. **c**) or end plates (see fig. **d**).

Abziehhülsen
Withdrawal Sleeves

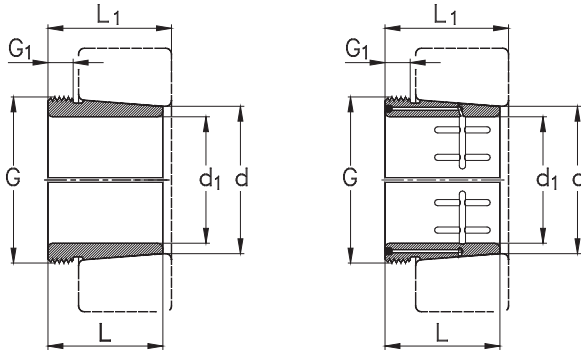


Ø Welle [mm] Shaft Ø [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]						Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
	d ₁	d	G	G ₁	G ₂	L			
35	40	M45X1,5	6	--	29	32	AH308	0,09	KM9
		M45X1,5	7	--	40	43	AH2308	0,13	KM9
40	45	M50X1,5	6	--	31	34	AH309	0,12	KM10
		M50X1,5	7	--	44	47	AH2309	0,16	KM10
45	50	M55X2	7	--	35	38	AHX310	0,13	KM11
		M55X2	9	--	50	53	AHX2310	0,19	KM11
50	55	M60X2	7	--	37	40	AHX311	0,16	KM12
		M60X2	10	--	54	57	AHX2311	0,26	KM12
55	60	M65X2	8	--	40	43	AHX312	0,19	KM13
		M65X2	11	--	58	61	AHX2312	0,3	KM13
60	65	M70X2	8	--	42	45	AH313-G	0,22	KM14
		M75X2	12	--	61	64	AH2313	0,39	KM15
65	70	M75X2	8	--	43	47	AH314-G	0,24	KM15
		M80X2	12	--	64	68	AHX2314	0,45	KM16
70	75	M80X2	8	--	45	49	AH315-G	0,29	KM16
		M85X2	12	--	68	72	AHX2315	0,53	KM17
75	80	M90X2	8	--	48	52	AH316	0,37	KM18
		M90X2	12	--	71	75	AHX2316	0,57	KM18
80	85	M9 X2	9	--	52	56	AHX317	0,43	KM19
		M95X2	13	--	74	78	AHX2317	0,65	KM19
85	90	M100X2	9	--	53	57	AHX318	0,46	KM20
		M100X2	10	--	63	67	AHX3218	0,57	KM20

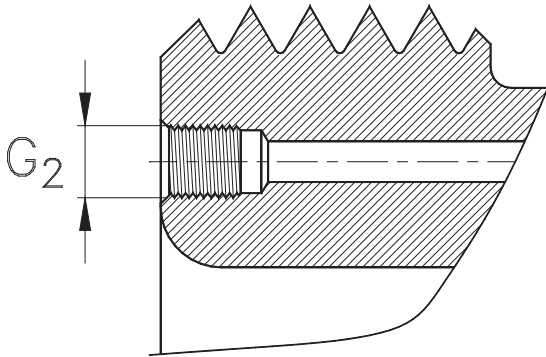


Ø Welle [mm] Shaft Ø [mm]		Hauptabmessungen [mm] Boundary dimensions [mm]					Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		M100X2	14	--	79	83	AHX2318	0,76	KM20
90	95	M105X2	10	--	57	61	AHX319	0,54	KM21
		M105X2	16	--	57	61	AHX2319	0,9	KM21
95	100	M110X2	10	--	59	63	AHX320	0,58	KM22
		M110X2	11	--	64	68	AHX3120	0,66	KM22
		M110X2	11	--	73	77	AHX3220	0,76	KM22
		M110X2	16	--	90	94	AHX2320	1	KM22
105	110	M120X2	11	--	68	72	AHX3122	0,76	KM24
		M125X2	11	--	82	86	AHX3222	1,05	KM25
		M125X2	16	--	98	102	AHX2322	1,35	KM25
		M115X2	13	--	82	91	AH24122	0,71	KM23
115	120	M130X2	13	--	60	64	AHX3024	0,73	KM26
		M130X2	12	--	75	79	AHX3124	0,94	KM26
		M135X2	13	--	90	94	AHX3224	1,3	KM27
		M135X2	17	--	105	109	AHX2324	1,65	KM27
		M125X2	13	--	73	82	AH24024	0,7	KM25
		M130X2	13	--	93	102	AH24124	1	KM26
125	130	M140X2	14	--	67	71	AHX3026	0,91	KM28
		M140X2	12	--	78	82	AHX3126	1,1	KM28
		M145X2	15	--	98	102	AHX3226	1,55	KM29
		M145X2	19	--	115	119	AHX2326	2	KM29
		M135X2	14	--	83	93	AH24026	0,88	KM27

Abziehhülsen
Withdrawal Sleeves

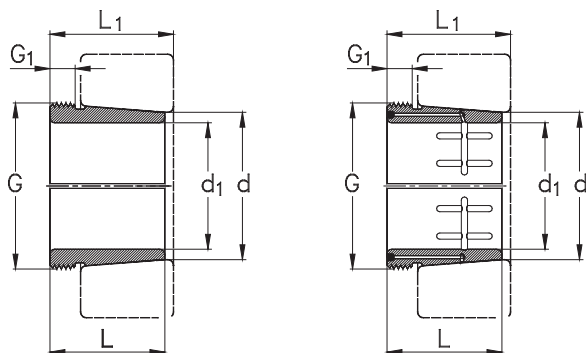


Ø Welle [mm] Shaft Ø [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]						Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		M140X2	14	--	94	104	AH24126	1,15	KM28
135	140	M150X2	14	--	68	73	AHX3028	1	KM30
		M150X2	14	--	83	88	AHX3128	1,3	KM30
		M155X3	15	--	104	109	AHX3228	1,85	KM31
		M155X3	20	--	125	130	AHX2328	2,35	KM31
		M145X2	14	--	83	93	AH24028	0,95	KM29
		M150X2	14	--	99	109	AH24128	1,3	KM30
145	150	M160X3	15	--	72	77	AHX3030	1,15	KM32
		M165X3	15	--	96	101	AHX3130	1,8	KM33
		M165X3	17	--	114	119	AHX3230	2,2	KM33
		M165X3	24	--	135	140	AHX2330	2,8	KM33
		M155X3	15	--	90	101	AH24030	1,05	KM31
		M160X3	15	--	115	126	AH24130	1,55	KM32
		M170X3	16	--	77	82	AH3032	2,05	KM34
150	160	M180X3	16	--	103	108	AH3132	3,2	KM36
		M180X3	20	--	124	130	AH3232	4	KM36
		M180X3	24	--	140	146	AH2332	4,65	KM36
		M170X3	15	--	95	106	AH24032	2,3	KM34
		M170X3	15	--	124	135	AH24132	3,05	KM34
160	170	M180X3	17	--	85	90	AH3034	2,4	KM36
		M190X3	16	--	104	109	AH3134	3,45	KM38
		M190X3	24	--	134	140	AH3234	4,8	KM38

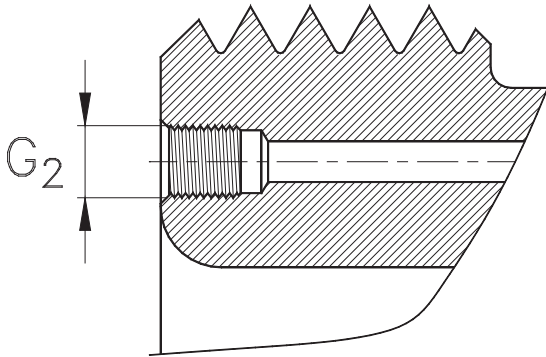


Ø Welle [mm] Shaft Ø [mm]		Hauptabmessungen [mm] Boundary dimensions [mm]					Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		M190X3	24	--	146	152	AH2334	5,25	KM38
		M180X3	16	--	106	117	AH24034	2,7	KM36
		M180X3	16	--	125	136	AH24134	3,25	KM36
170	180	M190X3	17	--	92	98	AH3036	2,8	KM38
		M200X3	17	--	105	110	AH2236	3,75	KM40
		M200X3	19	--	116	122	AH3136	4,25	KM40
		M200X3	24	--	140	146	AH3236	5,25	KM40
		M200X3	26	--	154	160	AH2336	6,05	KM40
		M190X3	16	--	116	127	AH24036	3,2	KM38
		M190X3	16	--	134	145	AH24136	3,75	KM38
180	190	Tr205X4	18	--	96	102	AH3038	3,4	HML 41-T
		Tr210X4	18	--	112	117	AH2238	4,25	HM 42-T
		Tr210X4	20	--	125	131	AH3138	4,9	HM42-T
		Tr210X4	25	--	145	152	AH3238	5,9	HM42-T
		Tr210X4	26	--	160	167	AH2338	6,7	HM42-T
		M200X3	18	--	118	131	AH24038	3,55	KM40
		M200X3	18	--	146	159	AH24138	4,45	KM40
190	200	Tr215X4	19	--	102	108	AH3040	3,85	HML 43-T
		Tr220X4	19	--	118	123	AH2240	4,7	HM44-T
		Tr220X4	21	--	134	140	AH3140	5,65	HM44-T
		Tr220X4	25	--	153	160	AH3240	6,6	HM44-T
		Tr220X4	30	--	170	177	AH2340	7,6	HM44-T

Abziehhülsen
Withdrawal Sleeves

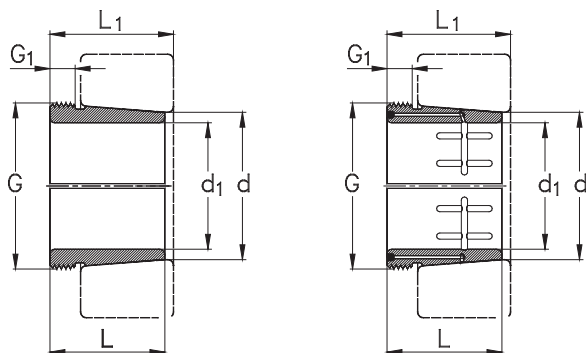


Ø Welle [mm] Shaft Ø [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]						Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		Tr210X4	18	--	127	140	AH24040	4	HM42-T
		Tr210X4	18	--	158	171	AH24140	5,05	HM42-T
200	220	Tr235X4	20	G 1/8	111	117	AOH3044	7,4	HML47-T
		Tr240X4	23	G 1/4	145	115	AOH3144	9,3	HM48-T
		Tr240X4	30	G 1/4	181	189	AOH2344	13,5	HM48-T
		Tr230X4	20	G 1/8	138	152	AOH24044	8,2	HM46-T
		Tr230X4	20	G 1/8	170	184	AOH24144	10	HM46-T
220	240	Tr260X4	21	G 1/4	116	123	AOH3048	7,95	HM3052
		Tr260X4	25	G 1/4	154	161	AOH3148	12	HM52-T
		Tr260X4	30	G 1/4	189	197	AOH2348	14	HM52-T
		Tr250X4	20	G 1/8	138	153	AOH24048	8,05	HM50-T
		Tr260X4	20	G 1/4	180	195	AOH24148	11,5	HM52-T
240	260	Tr280X4	23	G 1/4	128	135	AOH3052	9,6	HM3056
		Tr290X4	23	G 1/4	155	161	AOH2252	12,5	HM58-T
		Tr290X4	26	G 1/4	172	179	AOH3152	16	HM58-T
		Tr290X4	30	G 1/4	205	213	AOH2352	17,5	HM58-T
		Tr270X4	22	G 1/8	162	178	AOH24052	10,5	HM54-T
		Tr280X4	22	G 1/4	202	218	AOH24152	14	HM56-T
260	280	Tr300X4	24	G 1/4	131	139	AOH3056	11	HM3060
		Tr310X5	28	G 1/4	175	183	AOH3156	15,5	HM62-T
		Tr310X5	30	G 1/4	212	220	AOH2356	19,5	HM62-T
		Tr290X4	22	G 1/8	162	179	AOH24056	11,5	HM58-T

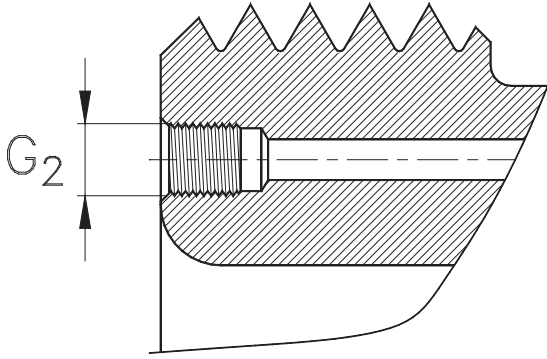


Ø Welle [mm] Shaft Ø [mm]		Hauptabmessungen [mm] Boundary dimensions [mm]					Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		Tr300X4	22	G 1/4	202	219	AOH24156	15	HM3160
280	300	Tr320X5	26	G 1/4	145	153	AOH3060	13	HM3064
		Tr330X5	30	G 1/4	192	200	AOH3160	19	HM66-T
		Tr330X5	34	G 1/4	228	236	AOH3260	23,5	HM66-T
		Tr310X5	24	G 1/8	184	202	AOH24060	14	HM62-T
		Tr320X5	24	G 1/4	224	242	AOH24160	18,5	HM3164
300	320	Tr345X5	27	G 1/4	149	157	AOH3064	14,5	HML69-T
		Tr350X5	31	G 1/4	209	217	AOH3164	22,5	HM70-T
		Tr350X5	36	G 1/4	246	254	AOH3264	27,5	HM70-T
		Tr330X5	24	G 1/8	184	202	AOH24064	15	HM66-T
		Tr340X5	24	G 1/4	242	260	AOH24164	20,5	HM3168
320	340	Tr365X5	28	G 1/4	162	171	AOH3068	17,5	HML73-T
		Tr370X5	33	G 1/4	225	234	AOH3168	26,5	HM74-T
		Tr370X5	38	G 1/4	264	273	AOH3268	32	HM74-T
		Tr360X5	26	G 1/4	206	225	AOH24068	18	HM3072
		Tr360X5	26	G 1/4	269	288	AOH24168	25,5	HM3172
340	360	Tr385X5	30	G 1/4	167	176	AOH3072	19	HML77-T
		Tr400X5	35	G 1/4	229	238	AOH3172	30	HM3180
		Tr400X5	40	G 1/4	274	283	AOH3272	33	HM3180
		Tr380X5	26	G 1/4	206	226	AOH24072	20	HM3076
		Tr380X5	26	G 1/4	269	289	AOH24172	26	HM3176
360	380	Tr410X5	31	G 1/4	170	180	AOH3076	23,5	HML82-T

Abziehhülsen
Withdrawal Sleeves



Ø Welle [mm] Shaft Ø [mm]	Hauptabmessungen [mm] Boundary dimensions [mm]						Bezeichnung Designation	Gewicht [kg] Weight [kg]	passende Nutmutter appropriate lock nut
d ₁	d	G	G ₁	G ₂	L	L ₁		m	
		Tr420X5	36	G 1/4	232	242	AOH3176	38	HM3184
		Tr420X5	42	G 1/4	284	294	AOH3276	45,5	HM3184
		Tr400X5	28	G 1/4	208	228	AOH24076	23,5	HM3080
		Tr400X5	28	G 1/4	271	291	AOH24176	31	HM3180
380	400	Tr430X5	33	G 1/4	183	193	AOH3080	27	HML86-T
		Tr440X5	38	G 1/4	240	250	AOH3180	39,5	HM3188
		Tr440X5	44	G 1/4	302	312	AOH3280	51,5	HM 3188
		Tr420X5	28	G 1/4	228	248	AOH24080	27	HM 3084
		Tr420X5	28	G 1/4	278	298	AOH24180	35	HM 3184
400	420	Tr450X5	34	G 1/4	186	196	AOH3084	29	HML 90 T
		Tr460X5	40	G 1/4	266	276	AOH3184	46	HM 3192
		Tr440X5	30	G 1/4	230	252	AOH24084	29	HM 3088
		Tr440X5	30	G 1/4	310	332	AOH24184	39	HM 3188
420	440	Tr460X5	30	G 1/4	242	264	AOH24088	32	HML 92 T
		Tr460X5	30	G 1/4	310	332	AOH24188	45,5	HM 3192
440	460	Tr480X5	32	G 1/4	332	355	AOH24192	50	HM 3196
460	480	Tr500X5	32	G 1/4	340	363	AOH24196	51,5	HM 31/500
480	500	Tr530X6	35	G 1/4	360	383	AOH241/500	57	HM 31/530
500	530	Tr550X6	35	G 1/4	370	394	AOH241/530	86	HM 110 T
530	560	Tr580X6	38	G 1/4	393	417	AOH241/560	97	HM 116 T
560	600	Tr630X6	38	G 1/4	413	439	AOH241/600	120	HM 126 T
600	630	Tr650X6	40	G 1/4	440	466	AOH241/630	130	HM 130 T



Nutmuttern

Normen, Hauptabmessungen

Nutmuttern	DIN 981
Sicherungsbleche, Sicherungsbügel	DIN 5406

Allgemeines

Nutmuttern dienen hauptsächlich zur Befestigung von Wälzlagern, aber auch anderer Maschinenteile wie Zahnrädern, Scheiben etc. Darüber hinaus werden Nutmuttern auch häufig beim Ein- oder Ausbau von Lagern, wie etwa zum Lösen von Abziehhülsen, verwendet.

Nutmuttern, die der Fixierung von Wälzlagern dienen, sind gegen unbeabsichtigtes Lösen mit Sicherungsblechen bzw. bei den größeren Muttern mit Sicherungsbügeln zu sichern.

Gewinde

NKE Nutmuttern bis einschließlich **Bohrungskennzahl 40** (Bohrungsdurchmesser 200 mm) werden standardmäßig mit **metrischen ISO-Gewinden**, gefertigt.

Größere Nutmuttern (ab Bohrungskennzahl 41) werden mit **metrischen ISO-Trapezgewinden** gefertigt.

Lock Nuts

Standards, Boundary Dimensions

Lock Nuts	DIN 981
Locking washer, Locking clips	DIN 5406

General

Lock nuts are primarily intended to secure the location of bearings but also they secure other machine parts (e.g. gears, sleeves, bushings etc).

Additionally lock nuts are also frequently used as a device to mount or dismount bearings (e.g. to remove bearings mounted on withdrawal sleeves).

For securing lock nuts that are being used to fix a bearing and to protect them from becoming loose lock washers or for larger nuts locking clips must be used.

Threads

NKE lock nuts up to a **bore reference number 40** (bore diameter 200 mm) are produced with **metric ISO-threads** as standard.

Larger lock nuts, (e.g. from a bore reference number 41 upwards), have **metric ISO- trapezoidal threads** as standard.

Ausführungen und Bezeichnungssystem der Standard-Nutmuttern

Die mit **metrischen ISO-Gewinden** versehenen Standard-Nutmuttern werden durch das Kurzzeichen **KM** bezeichnet.

Beispiel: **KM30**
Standard-Nutmutter,
mit metrischem ISO-Gewinde M 150x2.
Außendurchmesser 195 mm.

Neben diesen Standard-Nutmuttern gibt es auch eine als **KML** bezeichnete leichte Reihe, die bei ansonsten identischen Abmessungen einen gegenüber den normalen KM-Muttern verringerten Querschnitt aufweist.

Beispiel: **KML30**
Nutmutter, leichte Reihe,
mit metrischem ISO-Gewinde M 150x2.
Außendurchmesser 180 mm.

Die größeren, mit **metrischen ISO-Trapezgewinden** versehenen Nutmuttern werden mit **HM .. T** bezeichnet.

Beispiel: **HM52-T**
Standard-Nutmutter mit metrischem ISO-Trapezgewinde Tr 260x4.
Außendurchmesser 330 mm.

Auch bei den größeren Nutmuttern existiert eine leichte Reihe mit verringerter Querschnittshöhe:

Beispiel: **HML52-T**
Nutmutter, leichte Reihe, mit metrischem ISO-Trapezgewinde Tr 260x4.
Außendurchmesser 310 mm.

Design and Designation System of Standard Lock Nuts

The **standard lock nuts** with **metric ISO-threads** are identified by the symbol "**KM**".

Example: **KM30**
Standard lock nut,
with metric thread M 150x2.
Outer diameter 195 mm.

Additional to the standard nuts there also exists a narrow series of lock nuts, namely **KML**.

Lock nuts of the narrow series have reduced outer diameters, whilst all other dimensions remain as for the standard KM-lock nuts.

Example: **KML30**
Lock nut of narrow series,
with metric thread M 150x2.
Outer diameter 180 mm.

Larger lock nuts with **metric ISO-trapezoidal threads** are designated by the symbol **HM .. T**.

Example: **HM52-T**
Standard lock nut,
with metric trapezoidal thread Tr 260x4.
Outer diameter 330 mm.

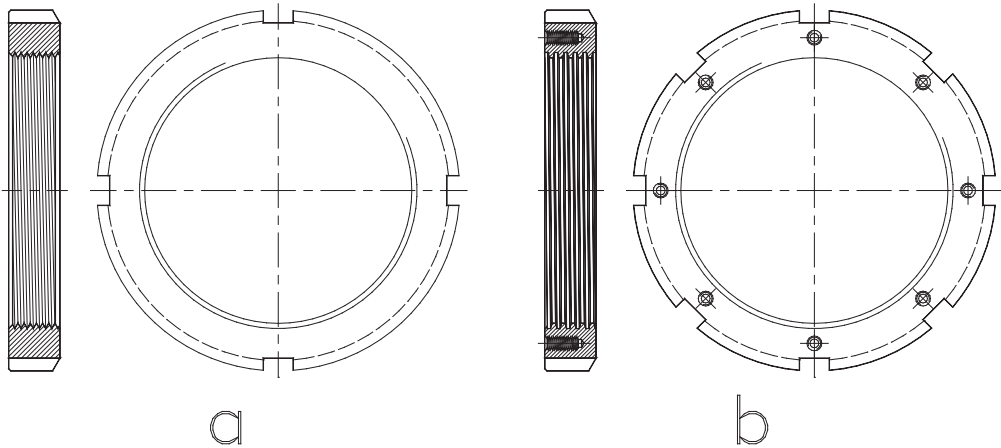
There is also a narrow series of larger lock nuts available with reduced sectional height:

Example: **HML52-T**
Lock nut of narrow series,
with metric trapezoidal thread Tr 260x4.
Outer diameter 310 mm.

Nutmuttern Lock Nuts

Je nach Größe haben Nutmuttern entweder vier (siehe Abb. a), oder acht (Abb. b) gleichmäßig über den Umfang verteilte Nuten.

Depending on their size, lock nuts have either four (see Fig. a) or, in case of larger lock nuts, eight (see Fig. b) slots equally spaced around their circumference.



Diese Nuten dienen zum einen zur besseren Handhabung bei Ein- und Ausbau, aber auch als Angriffsflächen zum Ansetzen des Montagewerkzeuges wie etwa Hakenschlüssel.

These slots provide better handling during mounting and dismounting, but their main function is the fixing point to apply the required mounting tools, e.g. hook spanners.

Auch die Laschen der Sicherungsbleche bzw. bei größeren Muttern die Sicherungsbügel greifen in diese Nuten ein.

These slots must also accommodate the lip of the locking washer or for larger nuts the locking clips.

Größere Nutmuttern haben darüber hinaus zu-sätzliche **Gewindebohrungen** an einer Planseite (Abb. b), die zur Aufnahme der Befestigungsschrauben der Sicherungsbügel dienen.

Larger lock nuts also have tapped holes in one face (Fig. b). Their function is too accomodate the screws engaged in securing the locking clips.

Weitere Mutterausführungen:

Neben den bereits erwähnten Ausführungen stehen Nutmuttern auch in einer Anzahl unterschiedlicher Varianten zur Verfügung:

Other Nut Designs:

Additional to the standard lock nut designs previously mentioned, nuts are available in several more variants, such as:

Weitere Muttern:

- Nutmuttern aus **rostfreiem Stahl**
- Nutmuttern mit **verzinkter** oder **phosphatierter** Oberfläche
- Nutmuttern mit **Linksgewinde**
- Nutmuttern mit **zölligem Gewinde**
- **KMT** und **KMTA**-Wellenmuttern
- **Hydraulikmuttern**

Wir informieren Sie auf Anfrage gerne näher.

Sicherungsbleche und Sicherungsbügel

Sicherungsbleche der Ausführung **MB** bzw. **MBL** (Abb. a) kommen bei den Nutmuttern der Reihen **KM** bzw. **KML** zum Einsatz.

Die größeren Muttern der Reihen **HM . . T** bzw. **HML . . T** werden mit **Sicherungsbügeln (MS)**, (siehe Abb. b) gesichert.

NKE Sicherungsbügel werden komplett mit Sechskantschraube und Federring geliefert.

Other nut variants:

- **Stainless steel** lock nuts
- Lock nuts with **zinc** or **phosphate coated surfaces**
- Lock nuts with **left hand threads**
- Lock nuts with **inch sized threads**
- **KMT** and **KMTA** type lock nuts
- **Hydraulic nuts**

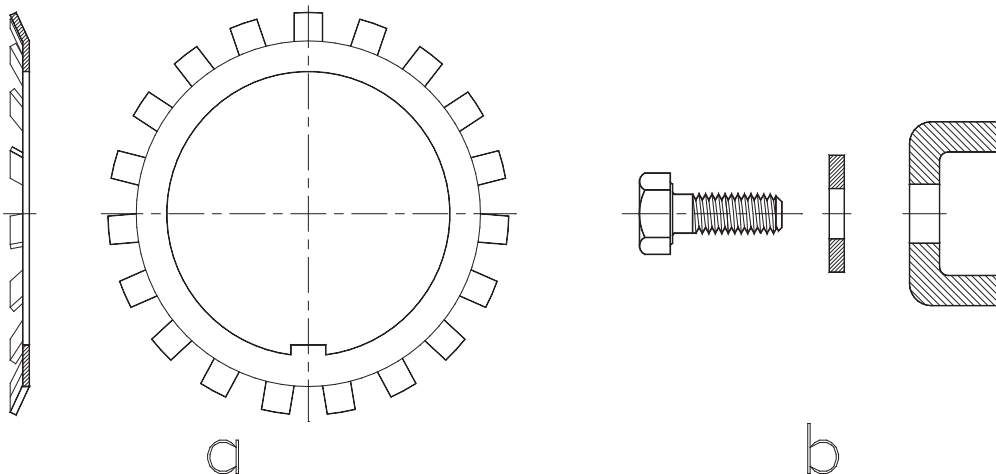
NKE will provide detailed information on request.

Locking Washers, Locking Clips

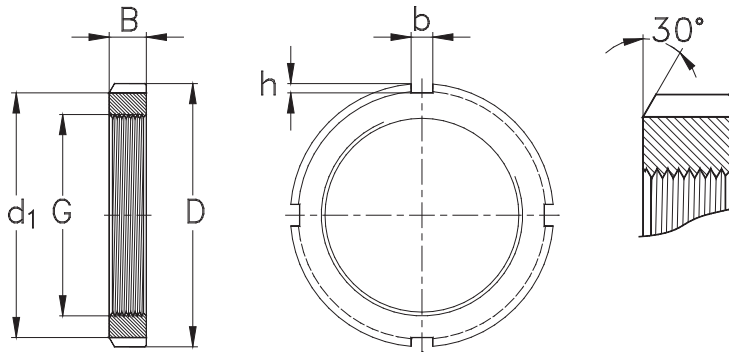
Locking washers of MB or MBL design (see Fig. a) are used with lock nuts for the series **KM** and **KML**, respectively.

Larger lock nuts of series **HM . . T** and **HML . . T** are secured against loosening by **applying locking clips (MS)**, (see Fig. b).

Locking clips are supplied complete with hexagonal head screw and a spring washer.



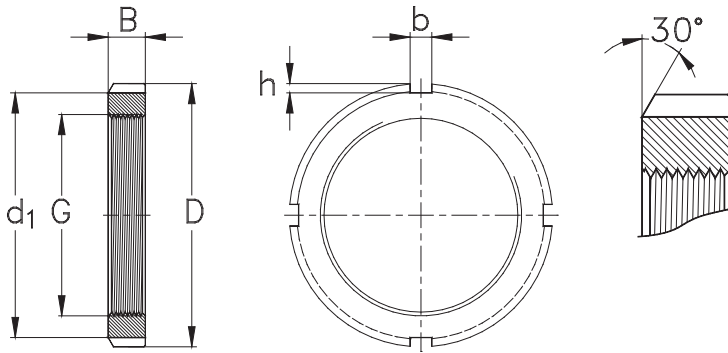
Nutmuttern
Lock Nuts



Gewinde	Hauptabmessungen [mm]					Bezeichnung	Gewicht [kg]	Sicherungsblech
Thread	Boundary dimensions [mm]					Designation	Weight [kg]	Locking washer
G	d ₁	D	B	b	h		m	
M10X0,75	13,5	18	4	3	2	KM0	0,006	MB0
M12X1	17	22	4	3	2	KM1	0,008	MB1
M15X1	21	25	5	4	2	KM2	0,012	MB2
M17X1	24	28	5	4	2	KM3	0,012	MB3
M20X1	26	32	6	4	2	KM4	0,02	MB4
M25X1,5	32	38	7	5	2	KM5	0,028	MB5
M30X1,5	38	45	7	5	2	KM6	0,038	MB6
M35X1,5	44	52	8	5	2	KM7	0,058	MB7
M40X1,5	50	58	9	6	2,5	KM8	0,078	MB8
M45X1,5	56	65	10	6	2,5	KM9	0,11	MB9
M50X1,5	61	70	11	6	2,5	KM10	0,14	MB10
M55X2	67	75	11	7	3	KM11	0,15	MB11
M60X2	73	80	11	7	3	KM12	0,16	MB12
M65X2	79	85	12	7	3	KM13	0,19	MB13
M70X2	85	92	12	8	3,5	KM14	0,22	MB14
M75X2	90	98	13	8	3,5	KM15	0,27	MB15
M80X2	95	105	15	8	3,5	KM16	0,36	MB16
M85X2	102	110	16	8	3,5	KM17	0,42	MB17
M90X2	108	120	16	10	4	KM18	0,51	MB18
M95X2	113	125	17	10	4	KM19	0,58	MB19
M100X2	120	130	18	10	4	KM20	0,68	MB20
M105X2	126	140	18	12	5	KM21	0,81	MB21

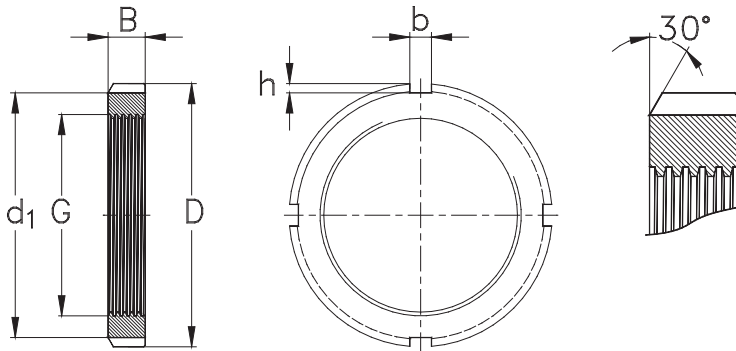
Gewinde		Hauptabmessungen [mm]				Bezeichnung	Gewicht [kg]	Sicherungsblech
Thread		Boundary dimensions [mm]				Designation	Weight [kg]	Locking washer
G	d ₁	D	B	b	h		m	
M110X2	133	145	19	12	5	KM22	0,89	MB22
M115X2	137	150	19	12	5	KM23	0,91	MB23
M120X2	135	145	20	12	5	KML24	0,69	MBL24
	138	155	20	12	5	KM24	0,98	MB24
M125X2	148	160	21	12	5	KM25	1,1	MB25
M130X2	145	155	21	12	5	KML26	0,84	MBL26
	149	165	21	12	5	KM26	1,2	MB26
M135X2	160	175	22	14	6	KM27	1,4	MB27
M140X2	155	165	22	12	5	KML28	0,92	MBL28
	160	180	22	14	6	KM28	1,4	MB28
M145X2	171	190	24	14	6	KM29	1,85	MB29
M150X2	170	180	24	14	5	KML30	1,3	MBL30
	171	195	24	14	6	KM30	1,85	MB30
M155X3	182	200	25	16	7	KM31	2,05	MB31
M160X3	180	190	25	14	5	KML32	1,4	MBL32
	182	210	25	16	7	KM32	2,25	MB32
M165X3	193	210	26	16	7	KM33	2,3	MB33
M170X3	190	200	26	16	5	KML34	1,6	MBL34
	193	220	26	16	7	KM34	2,55	MB34
M180X3	200	210	27	16	5	KML36	1,8	MBL36
	203	230	27	18	8	KM36	2,7	MB36
M190X3	210	220	28	16	5	KML38	1,9	MBL38

Nutmuttern
Lock Nuts



Gewinde	Hauptabmessungen [mm]					Bezeichnung	Gewicht [kg]	Sicherungsblech
Thread	Boundary dimensions [mm]					Designation	Weight [kg]	Locking washer
G	d₁	D	B	b	h		m	
	214	240	28	18	8	KM38	3	MB38
M200X3	222	240	29	18	8	KML40	2,6	MBL40
	226	250	29	18	8	KM40	3,3	MB40

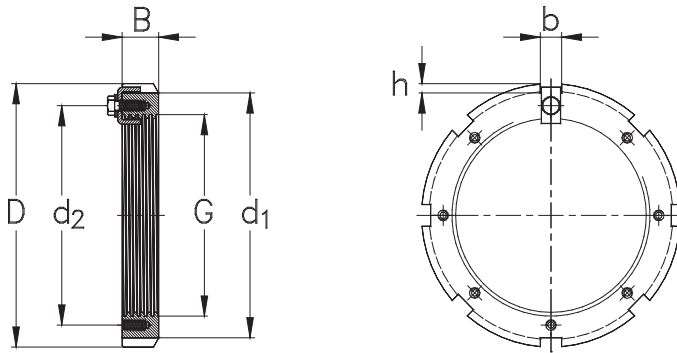
Nutmuttern
Lock Nuts



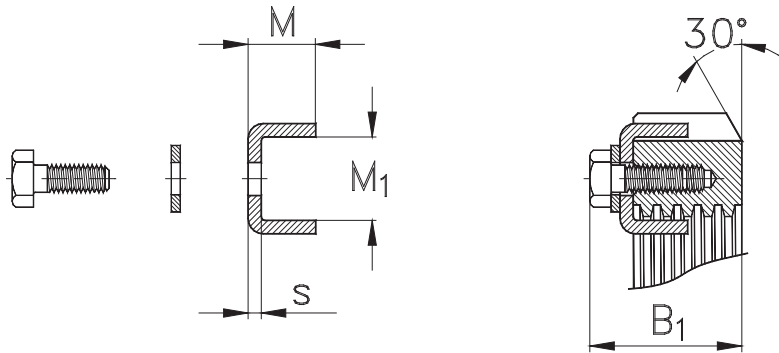
Gewinde		Hauptabmessungen [mm]				Bezeichnung	Gewicht [kg]	Sicherungsblech
Thread		Boundary dimensions [mm]				Designation	Weight [kg]	Locking washer
G	d ₁	D	B	b	h		m	
Tr205X4	232	250	30	18	8	HML41-T	3,2	--
Tr210X4	238	270	30	20	10	HM42-T	5,1	--
Tr215X4	242	260	30	20	9	HML43-T	3,3	--
Tr220X4	250	280	32	20	10	HM44-T	4,75	MB44
Tr230X4	260	290	34	20	10	HM46-T	5,45	--
Tr235X4	262	280	34	20	9	HML47-T	4,1	--
Tr240X4	270	300	34	20	10	HM48-T	5,6	MB48
Tr250X4	290	320	36	20	10	HM50-T	7,45	--
Tr260X4	290	310	34	20	10	HML52-T	5,8	--
	300	330	36	24	12	HM52-T	7,55	MB52
Tr270X4	310	340	38	24	12	HM54-T	8,3	--
Tr280X4	320	350	38	24	12	HM56-T	8,65	MB56
Tr290X4	330	370	40	24	12	HM58-T	10,5	--
Tr300X4	340	380	40	24	12	HM60-T	12	--
Tr310X5	350	390	42	24	12	HM62-T	13	--
Tr320X5	356	380	42	24	12	HML64-T	10,5	--
Tr330X5	380	420	52	28	15	HM66-T	20	--
Tr345X5	384	410	45	28	13	HML69-T	13	--
Tr350X5	410	450	55	28	15	HM70-T	25	--
Tr360X5	420	460	58	28	15	HM72-T	27,5	--
Tr365X5	404	430	48	28	13	HML73-T	14	--
Tr370X5	430	470	58	28	15	HM74-T	28	--

Gewinde		Hauptabmessungen [mm]				Bezeichnung	Gewicht [kg]	Sicherungsblech
Thread		Boundary dimensions [mm]				Designation	Weight [kg]	Locking washer
G	d ₁	D	B	b	h		m	
Tr385X5	422	450	48	28	14	HML77-T	15	--
Tr400X5	470	520	62	32	18	HM80-T	40	--
Tr410X5	452	480	52	32	14	HML82-T	19	--
Tr420X5	490	540	70	32	18	HM84-T	47	--
Tr430X5	472	500	52	32	14	HML86-T	20	--
Tr440X5	510	560	70	36	20	HM88-T	48,5	--
Tr450X5	490	520	60	32	15	HML90-T	24	--
Tr460X5	510	540	60	32	15	HML92-T	28	--
Tr480X5	530	560	60	36	15	HML96-T	29,5	--
Tr490X5	550	580	60	36	15	HML98-T	34	--
Tr500X5	550	580	68	36	15	HML100-T	35	--
Tr510X6	570	600	68	36	15	HML102-T	41	--
Tr520X6	570	600	68	36	15	HML104-T	37	--
Tr550X6	640	700	85	40	23	HM110-T	79,5	--
Tr580X6	670	730	85	45	25	HM116-T	83,5	--
Tr630X6	730	800	95	50	28	HM126-T	115	--
Tr650X6	750	820	100	50	28	HM130-T	124	--

Nutmuttern
Lock Nuts

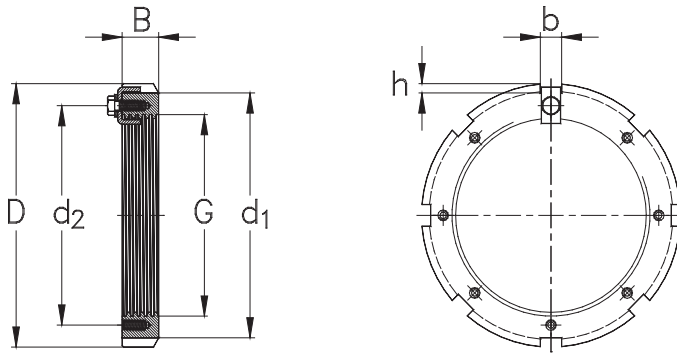


Gewinde	Hauptabmessungen [mm]						Bezeichnung	Gewicht [kg]
Thread	Boundary dimensions [mm]						Designation	Weight [kg]
G	d ₁	d ₂	D	B	b	h		m
Tr220X4	242	229	260	30	20	9	HM3044	2,75
Tr240X4	270	253	290	34	20	10	HM3048	4,5
Tr260X4	290	273	310	34	20	10	HM3052	4,8
Tr280X4	310	293	330	38	24	10	HM3056	5,75
Tr300X4	336	316	360	42	24	12	HM3060	8,35
	340	326	380	40	24	12	HM3160	11,5
Tr320X5	356	336	380	42	24	12	HM3064	9
	360	346	400	42	24	12	HM3164	13
Tr340X5	376	356	400	45	24	12	HM3068	11
	400	373	440	55	28	15	HM3168	24
Tr360X5	394	375	420	45	28	13	HM3072	11,5
	420	393	460	58	28	15	HM3172	26,5
Tr380X5	422	399	450	48	28	14	HM3076	15
	450	415	490	60	32	18	HM3176	32
Tr400X5	442	419	470	52	28	14	HM3080	17
	470	440	520	62	32	18	HM3180	38
Tr420X5	462	439	490	52	32	14	HM3084	18,5
	490	460	540	70	32	18	HM3184	45
Tr440X5	490	463	520	60	32	15	HM3088	26
	510	478	560	70	36	20	HM3188	46,5
Tr460X5	510	483	540	60	32	15	HM3092	27
	540	498	580	75	36	20	HM3192	50,5

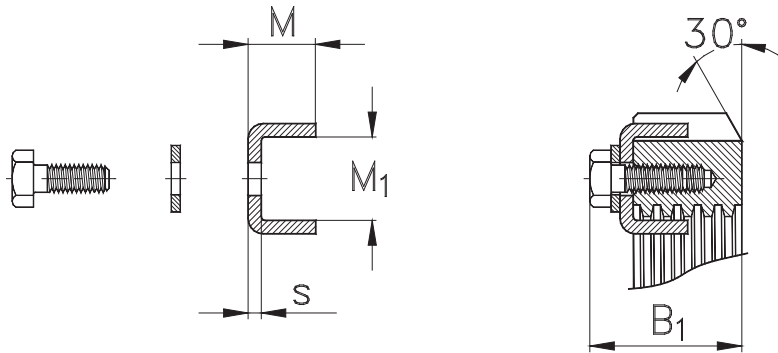


Sicherungsbügel	Abmessungen [mm]			Sechskantschraube	
<i>Locating clip</i>	<i>Dimensions [mm]</i>			<i>Hexagon-headed screw</i>	
	M	M ₁	s	B ₁	DIN 933
MS3044	12	13,5	4	41	M6x12
MS3052-48	12	17,5	4	46	M8X16
MS3052-48	12	17,5	4	46	M8X16
MS3056	12	17,5	4	50	M8X16
MS3060	12	20,5	4	54	M8X16
MS3160	12	30,5	4	53	M10X20
MS3068-64	15	21	5	55	M8X16
MS3164	15	31	5	56	M10X20
MS3068-64	15	21	5	58	M8X16
MS3271-68	15	38	5	72	M12X25
MS3072	15	20	5	58	M8X16
MS3172-68	15	38	5	75	M12X25
MS3080-76	15	24	5	62	M10X20
MS3176	15	40	5	77	M12X25
MS3080-76	15	24	5	66	M10X20
MS3184-80	15	45	5	82	M16X30
MS 3084	15	24	5	66	M10X20
MS 3184-80	15	45	5	90	M16X30
MS 3092-88	15	28	5	77	M12X25
MS 3192-88	15	43	5	90	M16X30
MS 3092-88	15	28	5	77	M12X25
MS 3192-88	15	43	5	95	M16X30

Nutmuttern
Lock Nuts

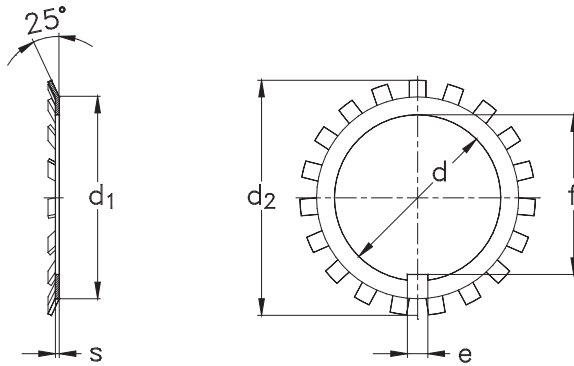


Gewinde	Hauptabmessungen [mm]						Bezeichnung	Gewicht [kg]
Thread	Boundary dimensions [mm]						Designation	Weight [kg]
G	d ₁	d ₂	D	B	b	h		m
Tr480X5	530	503	560	60	36	15	HM3096	28
	560	528	620	75	36	20	HM3196	62
Tr500X5	550	523	580	68	36	15	HM30/500	33,5
	580	540	630	80	40	23	HM31/500	63,5
Tr530X6	590	558	630	68	40	20	HM30/530	42,5
	610	575	670	80	40	23	HM31/530	71,5
Tr560X6	610	583	650	75	40	20	HM30/560	44,5
	650	608	710	85	45	25	HM31/560	86,5
Tr600X6	660	628	700	75	40	20	HM30/600	52,5
	690	648	750	85	45	25	HM31/600	91,5
Tr630X6	690	658	730	75	45	20	HM30/630	55
	730	685	800	95	50	28	HM31/630	125
Tr670X6	740	703	780	80	45	20	HM30/670	68,5
	775	730	850	106	50	28	HM31/670	155
Tr710X7	780	742	830	90	50	25	HM30/710	91,5
Tr750X7	820	782	870	90	55	25	HM30/750	94
Tr800X7	870	832	920	90	55	25	HM30/800	99,5
Tr850X7	925	887	980	90	60	25	HM30/900-850	115



Sicherungsbügel	Abmessungen [mm]			Sechskantschraube	
<i>Locating clip</i>	<i>Dimensions [mm]</i>			<i>Hexagon-headed screw</i>	
	M	M ₁	s	B ₁	DIN 933
MS 30/500-96	15	28	5	77	M12X25
MS 3196	15	53	5	95	M16X30
MS 30/500-96	15	28	5	85	M12X25
MS 31/500	15	45	5	100	M16X30
MS 30/600-530	21	34	7	90	M16X30
MS 31/530	21	51	7	105	M20X40
MS 30/560	21	29	7	97	M16X30
MS 31/600-560	21	54	7	110	M20X40
MS 30/600-530	21	34	7	97	M16X30
MS 31/600-560	21	54	7	110	M20X40
MS30/630	21	34	7	97	M16X30
MS31/630	21	61	7	120	M20X40
MS30/670	21	39	7	102	M16X30
MS31/670	21	66	7	131	M20X40
MS30/710	21	39	7	112	M16X30
MS30/800-750	21	39	7	112	M16X30
MS30/800-750	21	39	7	112	M16X30
MS30/900-850	21	44	7	115	M20X40

Sicherungsbleche
Locking Washers



Hauptabmessungen [mm] Boundary dimensions [mm]						Bezeichnung Designation	Gewicht [g] Weight [g]
d	d ₁	d ₂	s	e	f		m
10	13,5	21	1	3	8,5	MB0	1
12	17	25	1	3	10,5	MB1	2
15	21	28	1	4	13,5	MB2	3
17	24	32	1	4	15,5	MB3	3
20	26	36	1	4	18,5	MB4	4
25	32	42	1,25	5	23	MB5	6
30	38	49	1,25	5	27,5	MB6	8
35	44	57	1,25	6	32,5	MB7	11
40	50	62	1,25	6	37,5	MB8	13
45	56	69	1,25	6	42,5	MB9	15
50	61	74	1,25	6	47,5	MB10	16
55	67	81	1,5	8	52,5	MB11	22
60	73	86	1,5	8	57,5	MB12	24
65	79	92	1,5	8	62,5	MB13	30
70	85	98	1,5	8	66,5	MB14	32
75	90	104	1,5	8	71,5	MB15	35
80	95	112	1,75	10	76,5	MB16	46
85	102	119	1,75	10	81,5	MB17	53
90	108	126	1,75	10	86,5	MB18	61
95	113	133	1,75	10	91,5	MB19	66
100	120	142	1,75	12	96,5	MB20	77
105	126	145	1,75	12	100,5	MB21	83

Hauptabmessungen [mm] <i>Boundary dimensions [mm]</i>						Bezeichnung <i>Designation</i>	Gewicht [g] <i>Weight [g]</i>
d	d₁	d₂	s	e	f		m
110	133	154	1,75	12	105,5	MB22	91
115	137	159	2	12	110,5	MB23	107
120	138	164	2	14	115	MB24	108
125	148	170	2	14	120	MB25	115
130	149	175	2	14	125	MB26	115
135	160	185	2	14	130	MB27	140
140	160	192	2	16	135	MB28	135
145	172	202	2	16	140	MB29	165
150	171	205	2	16	145	MB30	180
155	182	212	2,5	16	147,5	MB31	200
160	182	217	2,5	18	154	MB32	215
165	193	222	2,5	18	157,5	MB33	240
170	193	232	2,5	18	164	MB34	240
180	203	242	2,5	20	174	MB36	260
190	214	252	2,5	20	184	MB38	260
200	226	262	2,5	20	194	MB40	280
220	250	292	3	24	213	MB44	350
240	270	312	3	24	233	MB48	450
260	300	342	3	28	253	MB52	650
280	320	362	3	28	273	MB56	1050

NKE Produkte in numerischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
112	Pendelkugellager mit verbreitertem Innenring	532
113	Pendelkugellager mit verbreitertem Innenring	532
12	Pendelkugellager mit zylindrischer Bohrung	508
12-K	Pendelkugellager mit kegeliger Bohrung	508
13	Pendelkugellager mit zylindrischer Bohrung	508
13-K	Pendelkugellager mit kegeliger Bohrung	508
160	Einreihige Rillenkugellager	386
22	Pendelkugellager	508
22-2RS	Abgedichtete Pendelkugellager mit zylindrischer Bohrung	508
22-K	Pendelkugellager mit kegeliger Bohrung	508
22-K-2RS	Abgedichtete Pendelkugellager mit kegeliger Bohrung	508
222	Pendelrollenlager mit zylindrischer Bohrung	718
222-K	Pendelrollenlager mit kegeliger Bohrung	718
223	Pendelrollenlager mit zylindrischer Bohrung	718
223-K	Pendelrollenlager mit kegeliger Bohrung	718
23	Pendelkugellager mit zylindrischer Bohrung	508
23-2RS	Abgedichtete Pendelkugellager mit zylindrischer Bohrung	508
23-K	Pendelkugellager mit kegeliger Bohrung	508
230	Pendelrollenlager mit zylindrischer Bohrung	718
230-K	Pendelrollenlager mit kegeliger Bohrung	718
231	Pendelrollenlager mit zylindrischer Bohrung	718
231-K	Pendelrollenlager mit kegeliger Bohrung	718
232	Pendelrollenlager mit zylindrischer Bohrung	718
232-K	Pendelrollenlager mit kegeliger Bohrung	718
239	Pendelrollenlager mit zylindrischer Bohrung	718
239-K	Pendelrollenlager mit kegeliger Bohrung	718
240	Pendelrollenlager mit zylindrischer Bohrung	718
240-K30	Pendelrollenlager mit kegeliger Bohrung	718
241	Pendelrollenlager mit zylindrischer Bohrung	718
241-K30	Pendelrollenlager mit kegeliger Bohrung	718
292	Axial-Pendelrollenlager	866
293	Axial-Pendelrollenlager	866
294	Axial-Pendelrollenlager	866
302	Einreihige metrische Kegelrollenlager	656
303	Einreihige metrische Kegelrollenlager	656

NKE Produkte in numerischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
3057-2RS	Laufrollen, zweireihig, mit zylindrischem Außenring und Dichtscheiben	882
3057-2Z	Laufrollen, zweireihig, mit zylindrischem Außenring und Deckscheiben	882
3058-2RS	Laufrollen, zweireihig, mit balligem Außenring und Dichtscheiben	882
3058-2Z	Laufrollen, zweireihig, mit balligem Außenring und Deckscheiben	882
3067-2RS	Laufrollen, zweireihig, mit zylindrischem Außenring und Dichtscheiben	882
3067-2Z	Laufrollen, zweireihig, mit zylindrischem Außenring und Deckscheiben	882
3068-2RS	Laufrollen, zweireihig, mit balligem Außenring und Dichtscheiben	882
3068-2Z	Laufrollen, zweireihig, mit balligem Außenring und Deckscheiben	882
313	Einreihige metrische Kegelrollenlager	656
313-DF	Einreihige metrische Kegelrollenlager, gepaart in X-Anordnung	692
32-B	Zweireihige Schrägkugellager	478
32-B-2RS	Zweireihige Schrägkugellager mit zwei Dichtscheiben	478
32-B-2Z	Zweireihige Schrägkugellager mit zwei Deckscheiben	478
320-X	Einreihige metrische Kegelrollenlager	656
322	Einreihige metrische Kegelrollenlager	656
322-DF	Einreihige metrische Kegelrollenlager, gepaart in X-Anordnung	692
323	Einreihige metrische Kegelrollenlager	656
33-B	Zweireihige Schrägkugellager	478
33-B-2RS	Zweireihige Schrägkugellager mit zwei Dichtscheiben	478
33-B-2Z	Zweireihige Schrägkugellager mit zwei Deckscheiben	478
330	Einreihige metrische Kegelrollenlager	656
331	Einreihige metrische Kegelrollenlager	656
332	Einreihige metrische Kegelrollenlager	656
511	Einseitig wirkende Axial-Rillenkugellager	808
512	Einseitig wirkende Axial-Rillenkugellager	808
513	Einseitig wirkende Axial-Rillenkugellager	808
514	Einseitig wirkende Axial-Rillenkugellager	808
522	Zweiseitig wirkende Axial-Rillenkugellager	820
523	Zweiseitig wirkende Axial-Rillenkugellager	820
524	Zweiseitig wirkende Axial-Rillenkugellager	820
532	Einseitig wirkende Axial-Rillenkugellager mit kugeliger Gehäusescheibe	826
533	Einseitig wirkende Axial-Rillenkugellager mit kugeliger Gehäusescheibe	826
534	Einseitig wirkende Axial-Rillenkugellager mit kugeliger Gehäusescheibe	826
542	Zweiseitig wirkende Axial-Rillenkugellager mit kugeligen Gehäusescheiben	834
543	Zweiseitig wirkende Axial-Rillenkugellager mit kugeligen Gehäusescheiben	834

NKE Produkte in numerischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
544	Zweiseitig wirkende Axial-Rillenkugellager mit kugeligen Gehäusescheiben	834
60	Einreihige Rillenkugellager	386
60-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
60-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
60-N	Einreihige Rillenkugellager mit Ringnut	422
60-NR	Einreihige Rillenkugellager mit Ringnut und Sprengring	422
60-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
60-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
607	Einreihige Rillenkugellager	386
607-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
607-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
607-RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
607-Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
608	Einreihige Rillenkugellager	386
608-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
608-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
608-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
608-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
609	Einreihige Rillenkugellager	386
609-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
609-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
609-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
609-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
618	Einreihige Rillenkugellager	386
618-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
618-2Z	Einreihige Rillenkugellager mit einer Dichtscheibe	386
618-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
618-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
618-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
619	Einreihige Rillenkugellager	386
619-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
619-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
62	Einreihige Rillenkugellager	386
62-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
62-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386

NKE Produkte in numerischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
62-2Z-NR	Einreihige Rillenkugellager mit zwei Deckscheiben, Ringnut und Sprengring	422
62-N	Einreihige Rillenkugellager mit Ringnut	422
62-NR	Einreihige Rillenkugellager mit Ringnut und Sprengring	422
62-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
62-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
62-Z-NR	Einreihige Rillenkugellager mit einer Deckscheibe, Ringnut und Sprengring	422
622-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
623-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
623-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
623-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
624	Einreihige Rillenkugellager	386
624-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
624-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
625	Einreihige Rillenkugellager	386
625-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
625-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
626	Einreihige Rillenkugellager	386
626-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
626-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
626-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
626-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
627	Einreihige Rillenkugellager	386
627-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
627-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
627-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
627-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
63	Einreihige Rillenkugellager	386
63-2RS	Einreihige Rillenkugellager mit zwei Dichtscheiben	386
63-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
63-2Z-NR	Einreihige Rillenkugellager mit zwei Deckscheiben, Ringnut und Sprengring	422
63-N	Einreihige Rillenkugellager mit Ringnut	422
63-NR	Einreihige Rillenkugellager mit Ringnut und Sprengring	422
63-RS	Einreihige Rillenkugellager mit einer Dichtscheibe	386
63-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
63-Z-NR	Einreihige Rillenkugellager mit einer Deckscheibe, Ringnut und Sprengring	422

NKE Produkte in numerischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
634	Einreihige Rillenkugellager	386
634-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
634-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
635	Einreihige Rillenkugellager	386
635-2Z	Einreihige Rillenkugellager mit zwei Deckscheiben	386
635-Z	Einreihige Rillenkugellager mit einer Deckscheibe	386
64	Einreihige Rillenkugellager	386
64-N	Einreihige Rillenkugellager mit Ringnut	422
64-NR	Einreihige Rillenkugellager mit Ringnut und Sprengring	422
70-C	Einreihige Schrägkugellager, Druckwinkel 15°	456
70-E	Einreihige Schrägkugellager, Druckwinkel 25°	456
719-C	Einreihige Schrägkugellager, Druckwinkel 15°	456
719-E	Einreihige Schrägkugellager, Druckwinkel 25°	456
72-BE	Einreihige Schrägkugellager, Druckwinkel 40°	456
72-BECB	Einreihige Schrägkugellager, Druckwinkel 40°, in Universalausführung	456
72-C	Einreihige Schrägkugellager, Druckwinkel 15°	456
72-E	Einreihige Schrägkugellager, Druckwinkel 25°	456
73-BE	Einreihige Schrägkugellager, Druckwinkel 40°	456
73-BECB	Einreihige Schrägkugellager, Druckwinkel 40°, in Universalausführung	456
811	Einseitig wirkende Axial-Zylinderrollenlager	850
812	Einseitig wirkende Axial-Zylinderrollenlager	850

NKE Produkte in alphabetischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
AH23	Abziehhülsen	990
AH240	Abziehhülsen	990
AH241	Abziehhülsen	990
AH3	Abziehhülsen	990
AH30	Abziehhülsen	990
AH31	Abziehhülsen	990
AH32	Abziehhülsen	990
AHX23	Abziehhülsen	990
AHX3	Abziehhülsen	990
AHX30	Abziehhülsen	990
AHX31	Abziehhülsen	990
AHX32	Abziehhülsen	990
AOH22	Abziehhülsen für Druckölmontage	990
AOH23	Abziehhülsen für Druckölmontage	990
AOH240	Abziehhülsen für Druckölmontage	990
AOH241	Abziehhülsen für Druckölmontage	990
AOH30	Abziehhülsen für Druckölmontage	990
AOH31	Abziehhülsen für Druckölmontage	990
AOH32	Abziehhülsen für Druckölmontage	990
ASE..	Gehäuse	916
AY..-NPPB	Gehäuselager	908
CJ	Gehäuse	928
CJTO	Gehäuse	928
CFT	Gehäuse	928
GAY..-NPPB	Gehäuselager	908
GE..-KRRB	Gehäuselager	908
GLCTE	Gehäuselagereinheit	928
GRAE..-NPPB	Gehäuselager	908
GS-811	Gehäusescheibe eines Axial-Zylinderrollenlagers	851
GS-812	Gehäusescheibe eines Axial-Zylinderrollenlagers	851
GYE..-NPPB	Gehäuselager	908
HJ10	Winkelringe für Zylinderrollenlager	551
HJ2	Winkelringe für Zylinderrollenlager	551
HJ2-E	Winkelringe für Zylinderrollenlager	551
HJ22	Winkelringe für Zylinderrollenlager	551

NKE Produkte in alphabetischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
HJ22-E	Winkelringe für Zylinderrollenlager	551
HJ23	Winkelringe für Zylinderrollenlager	551
HJ23-E	Winkelringe für Zylinderrollenlager	551
HJ3	Winkelringe für Zylinderrollenlager	551
HJ3-E	Winkelringe für Zylinderrollenlager	551
HJ4	Winkelringe für Zylinderrollenlager	551
HM-T	Wellenmuttern mit metrischem Trapezgewinde	992
HM30	Wellenmuttern mit metrischem Trapezgewinde	992
HM31	Wellenmuttern mit metrischem Trapezgewinde	992
HML-T	Wellenmuttern, leichte Reihe, mit metrischem Trapezgewinde	992
K811	Rollenkranz eines Axial-Zylinderrollenlagers	851
K812	Rollenkranz eines Axial-Zylinderrollenlagers	851
K-	Kegelrollenlager in Zollabmessungen	680
K-EE	Kegelrollenlager in Zollabmessungen	680
K-H	Kegelrollenlager in Zollabmessungen	680
K-HH	Kegelrollenlager in Zollabmessungen	680
K-HM	Kegelrollenlager in Zollabmessungen	680
K-L	Kegelrollenlager in Zollabmessungen	680
K-LL	Kegelrollenlager in Zollabmessungen	680
K-LM	Kegelrollenlager in Zollabmessungen	680
K-M	Kegelrollenlager in Zollabmessungen	680
KM	Wellenmuttern mit metrischem ISO - Gewinde	992
KML	Wellenmuttern, leichte Reihe, mit metrischem ISO - Gewinde	992
LCTE..	Gehäuse	928
MB	Sicherungsblech für Wellenmuttern	1014
ME..	Gehäuse	946
MEO..	Gehäuse	946
MSB	Gehäuse	962
MST	Gehäuse	962
N2-E	Einreihige Zylinderrollenlager	550
N3-E	Einreihige Zylinderrollenlager	550
NC18-V	Vollrollige Zylinderrollenlager, einreihig	608
NC29-V	Vollrollige Zylinderrollenlager, einreihig	608
NC30-V	Vollrollige Zylinderrollenlager, einreihig	608
NCF18-V	Vollrollige Zylinderrollenlager, einreihig	608

NKE Produkte in alphabetischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
NCF29-V	Vollrollige Zylinderrollenlager, einreihig	608
NCF30-V	Vollrollige Zylinderrollenlager, einreihig	608
NJ2	Einreihige Zylinderrollenlager	550
NJ2-E	Einreihige Zylinderrollenlager	550
NJ22-E	Einreihige Zylinderrollenlager	550
NJ23-E	Einreihige Zylinderrollenlager	550
NJ23-VH	Vollrollige Zylinderrollenlager, einreihig	608
NJ3-E	Einreihige Zylinderrollenlager	550
NJ4	Einreihige Zylinderrollenlager	550
NNC48-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNC49-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNCF48-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNCF49-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNCF50-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNCL48-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNCL49-V	Vollrollige Zylinderrollenlager, zweireihig	628
NNF50-2LS-V	Vollrollige Zylinderrollenlager, zweireihig ,abgedichtet	644
NU10	Einreihige Zylinderrollenlager	550
NU19	Einreihige Zylinderrollenlager	550
NU2-E	Einreihige Zylinderrollenlager	550
NU22	Einreihige Zylinderrollenlager	550
NU22-E	Einreihige Zylinderrollenlager	550
NU23	Einreihige Zylinderrollenlager	550
NU23-E	Einreihige Zylinderrollenlager	550
NU3	Einreihige Zylinderrollenlager	550
NU3-E	Einreihige Zylinderrollenlager	550
NU4	Einreihige Zylinderrollenlager	550
NUP2	Einreihige Zylinderrollenlager	550
NUP2-E	Einreihige Zylinderrollenlager	550
NUP22-E	Einreihige Zylinderrollenlager	550
NUP23-E	Einreihige Zylinderrollenlager	550
NUP3-E	Einreihige Zylinderrollenlager	550
NUP4	Einreihige Zylinderrollenlager	550
QJ2	Vierpunktlager	490
QJ3	Vierpunktlager	490

NKE Produkte in alphabetischer Reihung

Kurzzeichen	Produktbeschreibung	Seite
RAE...-NPPB	Gehäuselager	908
SHE..	Gehäuse	916
T2D	Einreihige metrische Kegelrollenlager	656
T2F	Einreihige metrische Kegelrollenlager	656
T2G	Einreihige metrische Kegelrollenlager	656
T3C	Einreihige metrische Kegelrollenlager	656
T3E	Einreihige metrische Kegelrollenlager	656
T3F	Einreihige metrische Kegelrollenlager	656
T4C	Einreihige metrische Kegelrollenlager	656
T4F	Einreihige metrische Kegelrollenlager	656
T4G	Einreihige metrische Kegelrollenlager	656
T5F	Einreihige metrische Kegelrollenlager	656
T7F	Einreihige metrische Kegelrollenlager	656
TN	Ungeteilte Stehlagergehäuse für Pendelkugellager mit breitem Innenring	532
TUE..	Gehäuse	952
U2	Unterlagscheiben für Axial-Rillenkugellager	826
U3	Unterlagscheiben für Axial-Rillenkugellager	826
U4	Unterlagscheiben für Axial-Rillenkugellager	826
WS811	Wellenscheibe eines Axial-Zylinderrollenlagers	851
WS812	Wellenscheibe eines Axial-Zylinderrollenlagers	851

NKE Products in Numerical Order

Symbol	Product Description	Page
112	Self aligning ball bearing with extended inner rings	532
113	Self aligning ball bearing with extended inner rings	532
12	Self aligning ball bearing with cylindrical bore	508
12 -K	Self aligning ball bearing with tapered bore	508
13	Self aligning ball bearing with cylindrical bore	508
13 -K	Self aligning ball bearing with tapered bore	508
160	Single row deep groove ball bearings	386
22	Spherical roller bearings with cylindrical bore	508
22 -2RS	Sealed self aligning ball bearing with cylindrical bore	508
22 -K	Self aligning ball bearing with tapered bore	508
22 K-2RS	Sealed self aligning ball bearing with tapered bore	508
222	Spherical roller bearings with cylindrical bore	718
222 -K	Spherical roller bearings with tapered bore	718
223	Spherical roller bearings with cylindrical bore	718
223 -K	Spherical roller bearings with tapered bore	718
23	Self aligning ball bearing with cylindrical bore	508
23 -2RS	Sealed self aligning ball bearing with cylindrical bore	508
23 -K	Self aligning ball bearing with tapered bore	508
230	Spherical roller bearings with cylindrical bore	718
230 -K	Spherical roller bearings with tapered bore	718
231	Spherical roller bearings with cylindrical bore	718
231 -K	Spherical roller bearings with tapered bore	718
232	Spherical roller bearings with cylindrical bore	718
232 -K	Spherical roller bearings with tapered bore	718
239	Spherical roller bearings with cylindrical bore	718
239 -K	Spherical roller bearings with tapered bore	718
240	Spherical roller bearings with cylindrical bore	718
240 -K30	Spherical roller bearings with tapered bore	718
241	Spherical roller bearings with cylindrical bore	718
241 -K30	Spherical roller bearings with tapered bore	718
292	Spherical roller thrust bearings	866
293	Spherical roller thrust bearings	866
294	Spherical roller thrust bearings	866
302	Single row tapered roller bearings, metric series	656
303	Single row tapered roller bearings, metric series	656

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Symbol	Product Description	Page
3057 -2RS	Cam rollers, double row, with cylindrical outer ring and seals	882
3057 -2Z	Cam rollers, double row, with cylindrical outer ring and shields	882
3058 -2RS	Cam rollers, double row, with sphered outer ring and seals	882
3058 -2Z	Cam rollers, double row, with sphered outer ring and shields	882
3067 -2RS	Cam rollers, double row, with cylindrical outer ring and seals	882
3067 -2Z	Cam rollers, double row, with cylindrical outer ring and shields	882
3068 -2RS	Cam rollers, double row, with sphered outer ring and seals	882
3068 -2Z	Cam rollers, double row, with sphered outer ring and shields	882
313	Single row tapered roller bearings, metric series	656
313 -DF	Single row tapered roller bearings, metric series, paired face-to-face	692
32 -B	Double row angular contact ball bearings	478
32 -B -2RS	Double row angular contact ball bearings with two seals	478
32 -B -2Z	Double row angular contact ball bearings with two shields	478
320 -X	Single row tapered roller bearings, metric series	650
322	Single row tapered roller bearings, metric series	650
322 -DF	Single row tapered roller bearings, metric series, paired face-to-face	692
323	Single row tapered roller bearings, metric series	650
33 -B	Double row angular contact ball bearings	478
33 -B -2RS	Double row angular contact ball bearings with two seals	478
33 -B -2Z	Double row angular contact ball bearings with two shields	478
330	Single row tapered roller bearings, metric series	656
331	Single row tapered roller bearings, metric series	656
332	Single row tapered roller bearings, metric series	656
511	Thrust ball bearings, single direction	808
512	Thrust ball bearings, single direction	808
513	Thrust ball bearings, single direction	808
514	Thrust ball bearings, single direction	808
522	Thrust ball bearings, double direction	820
523	Thrust ball bearings, double direction	820
524	Thrust ball bearings, double direction	820
532	Thrust ball bearings, single direction with sphered housing washer	826
533	Thrust ball bearings, single direction with sphered housing washer	826
534	Thrust ball bearings, single direction with sphered housing washer	826
542	Thrust ball bearings, double direction with sphered housing washers	834
543	Thrust ball bearings, double direction with sphered housing washers	834

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Symbol	Product Description	Page
544	Thrust ball bearings, double direction with sphered housing washers	834
60	Single row deep groove ball bearings	386
60 -2RS	Single row deep groove ball bearings with two seals	386
60 -ZZ	Single row deep groove ball bearings with two shields	386
60 -N	Single row deep groove ball bearings with groove	422
60 -NR	Single row deep groove ball bearings with groove and snap ring	422
60 -RS	Single row deep groove ball bearings with one seal	386
60 -Z	Single row deep groove ball bearings with one shield	386
607	Single row deep groove ball bearings	386
607 -2RS	Single row deep groove ball bearings with two seals	386
607 -ZZ	Single row deep groove ball bearings with two shields	386
607 -RS	Single row deep groove ball bearings with one seal	386
607 -Z	Single row deep groove ball bearings with one shield	386
608	Single row deep groove ball bearings	386
608 -2RS	Single row deep groove ball bearings with two seals	386
608 -ZZ	Single row deep groove ball bearings with two shields	386
608 -RS	Single row deep groove ball bearings with one seal	386
608 -Z	Single row deep groove ball bearings with one shield	386
609	Single row deep groove ball bearings	386
609 -2RS	Single row deep groove ball bearings with two seals	386
609 -ZZ	Single row deep groove ball bearings with two shields	386
609 -RS	Single row deep groove ball bearings with one seal	386
609 -Z	Single row deep groove ball bearings with one shield	386
618	Single row deep groove ball bearings	386
618 -2RS	Single row deep groove ball bearings with one seal	386
618 -ZZ	Single row deep groove ball bearings with two shields	386
618 -Z	Single row deep groove ball bearings with one shield	386
619	Single row deep groove ball bearings	386
619 -2RS	Single row deep groove ball bearings with two seals	386
619 -ZZ	Single row deep groove ball bearings with two shields	386
62	Single row deep groove ball bearings	386
62 -2RS	Single row deep groove ball bearings with two seals	386
62 -ZZ	Single row deep groove ball bearings with two shields	386
62 -ZZ-NR	Single row deep groove ball bearings with two shields, groove and snap ring	422
62 -N	Single row deep groove ball bearings with groove	422

NKE Products in Numerical Order

Symbol	Product Description	Page
62 -NR	Single row deep groove ball bearings with groove and snap ring	422
62 -RS	Single row deep groove ball bearings with one seal	422
62 -Z	Single row deep groove ball bearings with one shield	422
62 -Z-NR	Single row deep groove ball bearings with one shield, groove and snap ring	422
622 -2RS	Single row deep groove ball bearings with two seals	386
623 -ZZ	Single row deep groove ball bearings with two shields	386
623 -Z	Single row deep groove ball bearings with one shield	386
623 -2RS	Single row deep groove ball bearings with two seals	386
624	Single row deep groove ball bearings	386
624 -ZZ	Single row deep groove ball bearings with two shields	386
624 -Z	Single row deep groove ball bearings with one shield	386
625	Single row deep groove ball bearings	386
625 -ZZ	Single row deep groove ball bearings with two shields	386
625 -Z	Single row deep groove ball bearings with one shield	386
626	Single row deep groove ball bearings	386
626 -2RS	Single row deep groove ball bearings with two seals	386
626 -ZZ	Single row deep groove ball bearings with two shields	386
626 -RS	Single row deep groove ball bearings with one seal	386
626 -Z	Single row deep groove ball bearings with one shield	386
627	Single row deep groove ball bearings	386
627 -2RS	Single row deep groove ball bearings with two seals	386
627 -ZZ	Single row deep groove ball bearings with two shields	386
627 -RS	Single row deep groove ball bearings with one seal	386
627 -Z	Single row deep groove ball bearings with one shield	386
63	Single row deep groove ball bearings	386
63 -2RS	Single row deep groove ball bearings with two seals	386
63 -ZZ	Single row deep groove ball bearings with two shields	386
63 -ZZ-NR	Single row deep groove ball bearings with two shields, groove and snap ring	422
63 -N	Single row deep groove ball bearings with groove	422
63 -NR	Single row deep groove ball bearings with groove and snap ring	422
63 -RS	Single row deep groove ball bearings with one seal	386
63 -Z	Single row deep groove ball bearings with one shield	386
63 -Z-NR	Single row deep groove ball bearings with one shield, groove and snap ring	422

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Symbol	Product Description	Page
634	Single row deep groove ball bearings	386
634-2Z	Single row deep groove ball bearings with two shields	386
634 -Z	Single row deep groove ball bearings with one shield	386
635	Single row deep groove ball bearings	386
635 -2Z	Single row deep groove ball bearings with two shields	386
635 -Z	Single row deep groove ball bearings with one shield	386
64	Single row deep groove ball bearings	386
64 -N	Single row deep groove ball bearings with snap ring groove	422
64 -NR	Single row deep groove ball bearings with groove and snap ring	422
70 -C	Single row angular contact ball bearings, contact angle 15°	456
70 -E	Single row angular contact ball bearings, contact angle 25°	456
719 -C	Single row angular contact ball bearings, contact angle 15°	456
719 -E	Single row angular contact ball bearings, contact angle 25°	456
72 -BE	Single row angular contact ball bearings, contact angle 40°	456
72 -BECB	Single row angular contact ball bearings, contact angle 40°, for paired mounting (universal design)	462
72 -C	Single row angular contact ball bearings, contact angle 15°	456
72 -E	Single row angular contact ball bearings, contact angle 25°	456
73 -BE	Single row angular contact ball bearings, contact angle 40°	456
73 -BECB	Single row angular contact ball bearings, contact angle 40°, for paired mounting (universal design)	462
811	Cylindrical roller thrust bearings, single direction	850
812	Cylindrical roller thrust bearings, single direction	850

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Symbol	Product Description	Page
AH23	Withdrawal sleeves	990
AH240	Withdrawal sleeves	990
AH241	Withdrawal sleeves	990
AH3	Withdrawal sleeves	990
AH30	Withdrawal sleeves	990
AH31	Withdrawal sleeves	990
AH32	Withdrawal sleeves	990
AHX23	Withdrawal sleeves	990
AHX3	Withdrawal sleeves	990
AHX30	Withdrawal sleeves	990
AHX31	Withdrawal sleeves	990
AHX32	Withdrawal sleeves	990
AOH22	Withdrawal sleeves for oil injection method	990
AOH23	Withdrawal sleeves for oil injection method	990
AOH240	Withdrawal sleeves for oil injection method	990
AOH241	Withdrawal sleeves for oil injection method	990
AOH30	Withdrawal sleeves for oil injection method	990
AOH31	Withdrawal sleeves for oil injection method	990
AOH32	Withdrawal sleeves for oil injection method	990
ASE..	Housing	916
AY...-NPPB	Insert bearing	908
CJ	Housing	928
CJTO	Housing	928
CFT	Housing	928
GAY...-NPPB	Insert bearing	908
GE...-KRRB	Insert bearing	908
GLCTE..	Housing	928
GRAE...-NPPB	Insert bearing	908
GS-811	Housing washer	851
GS-812	Housing washer	851
GYE...-NPPB	Insert bearing	908
HJ10	Thrust collars for cylindrical roller bearings	551
HJ2	Thrust collars for cylindrical roller bearings	551
HJ2 -E	Thrust collars for cylindrical roller bearings	551
HJ22	Thrust collars for cylindrical roller bearings	551

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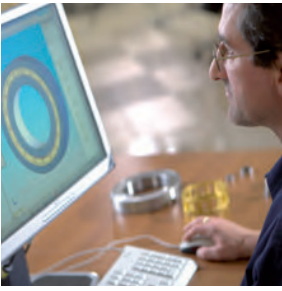
Symbol	Product Description	Page
HJ22 -E	Thrust collars for cylindrical roller bearings	551
HJ23	Thrust collars for cylindrical roller bearings	551
HJ23 -E	Thrust collars for cylindrical roller bearings	551
HJ3	Thrust collars for cylindrical roller bearings	551
HJ3 -E	Thrust collars for cylindrical roller bearings	551
HJ4	Thrust collars for cylindrical roller bearings	551
HM -T	Lock nuts with metric trapezoidal thread	992
HM30	Lock nuts with metric trapezoidal thread	992
HM31	Lock nuts with metric trapezoidal thread	992
HML -T	Lock nuts with metric trapezoidal thread	992
K-811	Cylindrical roller and cage thrust assembly	851
K-812	Cylindrical roller and cage thrust assembly	851
K-	Inch sized tapered roller bearing	680
K-EE	Inch sized tapered roller bearing	680
K-H	Inch sized tapered roller bearing	680
K-HH	Inch sized tapered roller bearing	680
K-HM	Inch sized tapered roller bearing	680
K-L	Inch sized tapered roller bearing	680
K-LL	Inch sized tapered roller bearing	680
K-LM	Inch sized tapered roller bearing	680
K-M	Inch sized tapered roller bearing	680
KM	Lock nuts with metric ISO-thread	992
KML	Lock nuts, narrow series, with metric ISO-thread	992
LCTE..	Housing	928
MB	Locking washer for lock nuts	1014
ME..	Housing	946
MEO..	Housing	946
MSB	Housing	962
MST	Housing	962
N2 -E	Single row cylindrical roller bearings	550
N3 -E	Single row cylindrical roller bearings	550
NC18 -V	Full complement type cylindrical roller bearings, single row	608
NC29 -V	Full complement type cylindrical roller bearings, single row	608
NC30 -V	Full complement type cylindrical roller bearings, single row	608
NCF18 -V	Full complement type cylindrical roller bearings, single row	608

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Symbol	Product Description	Page
NCF29 -V	Full complement type cylindrical roller bearings, single row	608
NCF30 -V	Full complement type cylindrical roller bearings, single row	608
NJ2	Single row cylindrical roller bearings	550
NJ2 -E	Single row cylindrical roller bearings	550
NJ22 -E	Single row cylindrical roller bearings	550
NJ23 -E	Single row cylindrical roller bearings	550
NJ23 -VH	Full complement type cylindrical roller bearings, single row	608
NJ3 -E	Single row cylindrical roller bearings	550
NJ4	Single row cylindrical roller bearings	550
NNC48 -V	Full complement type cylindrical roller bearings, double row	628
NNC49 -V	Full complement type cylindrical roller bearings, double row	628
NNCF48 -V	Full complement type cylindrical roller bearings, double row	628
NNCF49 -V	Full complement type cylindrical roller bearings, double row	628
NNCF50 -V	Full complement type cylindrical roller bearings, double row	628
NNCL48 -V	Full complement type cylindrical roller bearings, double row	628
NNCL49 -V	Full complement type cylindrical roller bearings, double row	628
NNF50 -2LS-V	Full complement type cylindrical roller bearings, double row	644
NU10	Single row cylindrical roller bearings	550
NU19	Single row cylindrical roller bearings	550
NU2 -E	Single row cylindrical roller bearings	550
NU22	Single row cylindrical roller bearings	550
NU22 -E	Single row cylindrical roller bearings	550
NU23	Single row cylindrical roller bearings	550
NU23 -E	Single row cylindrical roller bearings	550
NU3	Single row cylindrical roller bearings	550
NU3 -E	Single row cylindrical roller bearings	550
NU4	Single row cylindrical roller bearings	550
NUP2	Single row cylindrical roller bearings	550
NUP2 -E	Single row cylindrical roller bearings	550
NUP22 -E	Single row cylindrical roller bearings	550
NUP23 -E	Single row cylindrical roller bearings	550
NUP3 -E	Single row cylindrical roller bearings	550
NUP4	Single row cylindrical roller bearings	550
QJ2	Four point ball bearings	490
QJ3	Four point ball bearings	490

NKE Products in Alphabetical Order

Symbol	Product Description	Page
RAE..-NPPB	Insert bearing	908
SHE..	Housing	916
T2D	Single row tapered roller bearings, metric series	656
T2F	Single row tapered roller bearings, metric series	656
T2G	Single row tapered roller bearings, metric series	656
T3C	Single row tapered roller bearings, metric series	656
T3E	Single row tapered roller bearings, metric series	656
T3F	Single row tapered roller bearings, metric series	656
T4C	Single row tapered roller bearings, metric series	656
T4F	Single row tapered roller bearings, metric series	656
T4G	Single row tapered roller bearings, metric series	656
T5F	Single row tapered roller bearings, metric series	656
T7F	Single row tapered roller bearings, metric series	656
TUE..	Housing	952
U2	Seating washers for thrust ball bearings	826
U3	Seating washers for thrust ball bearings	826
U4	Seating washers for thrust ball bearings	851
WS811	Shaft washer of a cylindrical roller thrust bearing	550
WS812	Shaft washer of a cylindrical roller thrust bearing	550



NKE
BEARINGS

NKE AUSTRIA GmbH
Im Stadtgut C4,
A-4407 Steyr, Austria
Tel: +43 7252 86667
Fax: +43 7252 86667-59
office@nke.at
www.nke.at