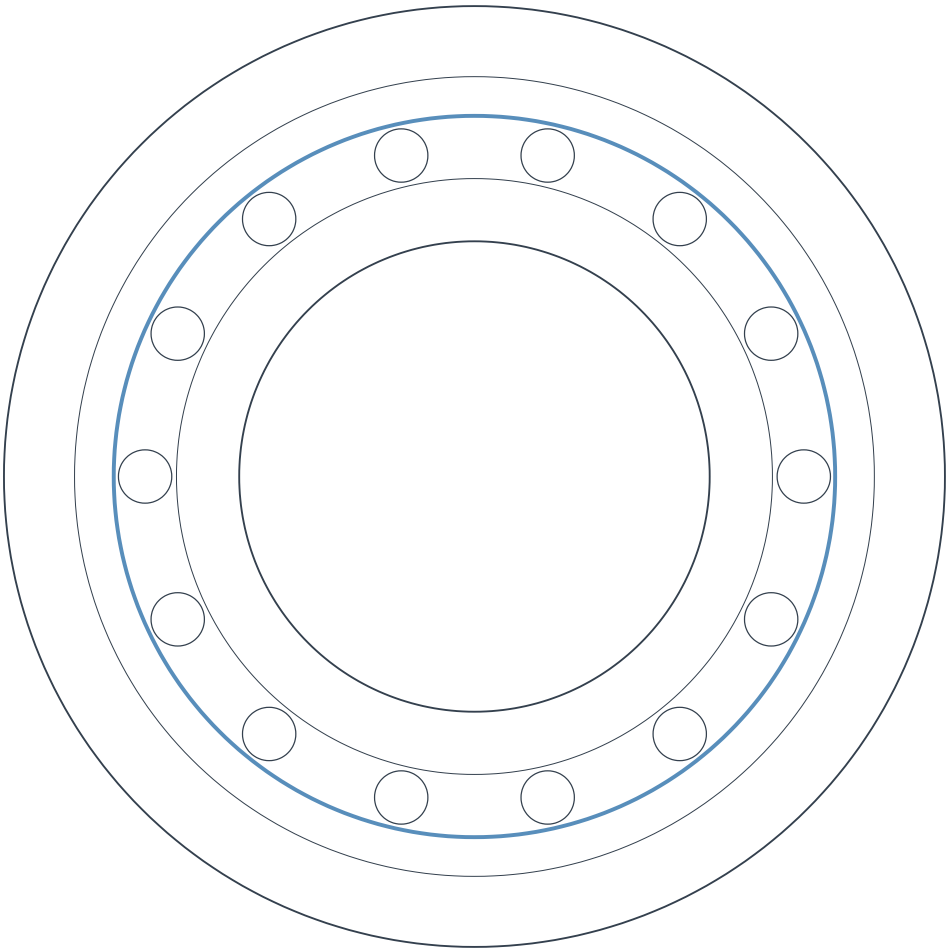


INA

Rolling Bearings

کاتالوگ جامع بلبرینگ و رولبرینگ INA

استعلام قیمت و خرید بلبرینگ INA ←

BRAND برند	ORIGIN کشور سازنده	PRODUCTS محصولات	PAGES تعداد صفحات	LANGUAGE زبان
INA	Germany	Rolling bearings & units	500	English

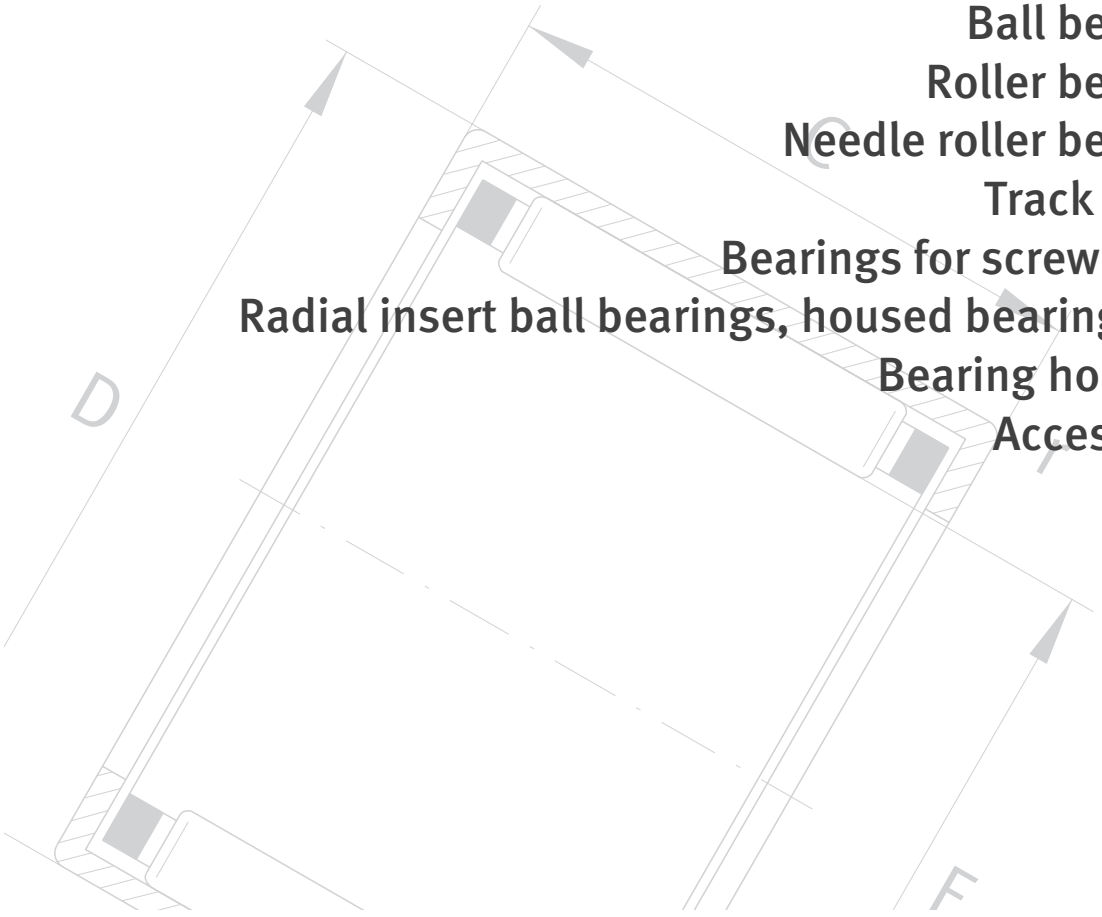
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021 3399 8121
021 3399 8100
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Rolling bearings

Ball bearings
Roller bearings
Needle roller bearings
Track rollers
Bearings for screw drives
Radial insert ball bearings, housed bearing units
Bearing housings
Accessories



Every care has been taken to ensure
the correctness of the information contained in
this publication but no liability can be assumed
for any incorrect or incomplete data. We reserve
the right to make modifications in the interests
of technical progress.

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Foreword

Schaeffler Group Industrial is a leading worldwide supplier of rolling bearings, spherical plain bearings, plain bearings, linear products, accessories specific to bearings and comprehensive maintenance products and services. It has approximately 40 000 catalogue products manufactured as standard, providing an extremely wide portfolio that gives secure coverage of applications from all 60 designated industrial market sectors.

The central factors responsible for this success are our outstanding strength in innovation, our global focus on local customer proximity, highly developed manufacturing methods, extremely high quality standards in all processes and our ability to transform specific customer requirements quickly and accurately into cost-effective solutions. Against this background of expertise, knowledge and experience together with our wide range of catalogue items, we see ourselves as a high performance, customer focussed partner in the development, manufacture and delivery of products.

Research and Development

As a company looking to the future, we are especially active in the field of research and development. The key areas in this respect include not only research into fundamental principles, materials technology, tribology and calculation but also extensive inspection and test methods as well as activities to optimise manufacturing technology. This is oriented towards ensuring the continuous development, improvement and application of our products in the long term.

We carry out research and development on a global basis. Our development centres are linked with each other worldwide and are thus in a position to exchange current information on a very short timescale as well as access and communicate the most recent data. This ensures that a uniform level of knowledge and information is available worldwide.

In addition to continued development of standard products, we work closely in research and development activities with our customers where specific customer solutions are required. They can thus benefit from the best product for their application, with the maximum possible performance capacity at a cost-effective price.

Manufacturing technologies, quality inspections, environmental protection

“Zero defects” is our quality objective. We have matched all our processes to this target. In addition, our many years of experience in forming of sheet metal and heavier section material, in vertical and horizontal forging, heat treatment, surface technologies, grinding, honing and assembly ensures that our products fulfil the required quality level.

Ongoing quality inspections are a defined component of the manufacturing process. These are integrated directly as a feedback function in the manufacturing process. This ensures that all products continuously fulfil the same high standard of quality.

We have a highly effective quality management system, and the quality of our products and processes is confirmed by certification; for example, all manufacturing facilities comply with DIN-EN ISO 9001:2000 and ISO/TS 16 949:2002.

With the validation and certification of our manufacturing sites, we are taking a pioneering role in environmental protection. All larger manufacturing sites are certified not only to ISO 14001, but are also validated in accordance with the more stringent EC ECO Management and Audit Scheme (EMAS).

Foreword

Worldwide presence

Through a closely knit network of development and manufacturing sites, sales companies and an international distribution structure, we are represented throughout the world. This global presence ensures effective linkage between the major markets in Europe, India, South East Asia/Pacific Region, East Asia, North and South America.

As a result, we have an on-site presence with service and technical advice in close proximity to the customer. We take orders from throughout the world and make deliveries worldwide too. Our distribution network generally has stock of the catalogue products relevant to the appropriate markets and company locations and can therefore make deliveries within a very short timescale.

Furthermore, we support our customers worldwide in resolving their bearing arrangement requirements, respond to technical queries and develop specific bearing arrangement solutions in local partnership with our customers.

The new rolling bearing catalogue – a technical compendium

As an interface between product, complex rolling bearing technology and our customers, we can offer not only personal consultations by our external sales and application engineering functions, but also our technical catalogues in electronic form and as paper copy.

Everything in one place

By combining numerous individual catalogues in one overall catalogue, we have now concentrated the majority of our rotary bearing range in a single printed volume. Even more strongly than before, this bundles together our technical knowledge and our advisory expertise, for your benefit. In one publication, you can now find the required INA and FAG products, both quickly and securely.

The catalogue describes the rolling bearings in accordance with DIN/ISO that are required for original equipment manufacture, distribution and the aftermarket, specific rolling bearing accessories and further rolling bearing types and design variants.
It is a completely new creation and is significantly different, in format as well, from all previous publications from Schaeffler Group Industrial.

Find it, select it, fit it

This catalogue constitutes a fundamental tool for information and advice that will assist you on all issues relating to rolling bearing technology. It will show you which products you may be able to use, what you need to consider when designing the bearing arrangement, which tolerances are suitable for the adjacent construction and how you can achieve the most effective sealing of your bearing arrangement. It will also tell you how to calculate the rating life of the bearings, what temperatures and loads can be supported, which lubricants are most suitable for the bearing arrangement and how you should carry out maintenance at the correct times. Of course it also describes the correct way to install the products.

Last but not least, this catalogue also promotes dialogue between you and us.

Valid for...

The catalogue supersedes the following publications:

- INA Catalogue 307,
  Needle Roller Bearings, Cylindrical Roller Bearings
- INA Catalogue 520,
  Radial Insert Ball Bearings, Housed Bearing Units
- INA Catalogue 901, High Precision Deep Groove Ball Bearings, Angular Contact Ball Bearings
- FAG Catalogue WL 41 520/3 E, Rolling Bearings
- INA publication LFR, Track Rollers
- INA publication GKL, Precision Bearings For Combined Loads
- INA publication ZAE, Bearings For Screw Drives.

The data in the catalogue represent the current level of knowledge as of January 2006. They reflect not only progress in recent years but also practical experience. Data in earlier catalogues and publications that do not correspond to the data in this catalogue are therefore invalid.

Significant innovations

In addition to the layout with its didactic structure and its user and application focus, there is also a range of technical innovations in the catalogue that are described below.

Technical principles

- Unified life calculation methods; notably calculation of minimum load and axial load capacity of FAG cylindrical roller bearings
- Unified calculation of fatigue limit load C_u
- Uniform life calculation for ball bearings in accordance with ISO
- Calculation of friction values for FAG bearings
- Standard for reference speed n_B from DIN 732 to ISO 15 312
- Formula symbols matched to relevant standards.

Lubrication

- Detailed operating temperature data for greases
- New overview of greases in use
- New method for calculating the grease operating life/ relubrication interval
- New diagram for estimating the required oil quantities
- New diagram relating to the oil change interval
- Arcanol rolling bearing greases.

Products

- New prefixes, designations and suffixes for all products, with harmonisation of the brands; see New product designations
- Needle roller bearings, cylindrical roller bearings, single row angular contact ball bearings and spherical roller bearings in X-life quality; see X-life
- Spindle bearings: standard bearings with ceramic balls (HCB)
- High precision cylindrical roller bearings:
  expanded data on shaft and housing tolerances
- Spherical roller bearings:
  design E1 in place of E and axial load carrying capacity
- Housings:
  new seals DHV and TCV, additional inch sizes in series SNV
- Expanded range of housing series S30 and SD31.

Foreword

New product designations

In this catalogue, the designation system of the two brands has been harmonised. With this adaptation, we have also created a single, common standard for our customers.

The designations are now simpler and the codes are thus more transparent. For example, in some designs the seals for track rollers have been matched to those for our ball bearings and the P type seals have been replaced by radially preloaded seals. The suffix has therefore changed from PP to 2RSR and describes the radial preload of the contact seals on both sides.

The new prefixes, designations and suffixes are published for the first time in this catalogue. Orders submitted using the old system will of course continue to be processed very rapidly and to your full satisfaction.

X-life – maximum customer benefit through excellent product quality

X-life is the premium brand of Schaeffler Group Industrial. It brings together the strengths of the two brands and opens up completely new design opportunities for design engineers. X-life is an all-encompassing concept: advice, product development, service and sales are fully integrated with each other in all phases of the product cycle. As a service surround system, it includes a comprehensive lubrication concept. X-life stands for continuous quality improvement and local customer focus applied worldwide.

Advantages of the X-life grade

The use of state of the art manufacturing technologies has resulted in a better, more uniform surface over the whole contact face between the rolling elements and raceway. As a result, under identical load there is a significant reduction in the stress conditions present on the rolling elements and raceway. The improved surface quality gives reduced friction and lower bearing temperatures, running resistance is lower and less strain is placed on the lubricant.

Thanks to such improvements, the basic dynamic load ratings are significantly higher than those of the previous design. As a result, the basic rating life is higher; i.e. the operating life of the bearings is considerably longer under the same operating conditions. Alternatively, higher loads can be applied while maintaining the same life values.

With their optimised characteristics, X-life bearings open up completely new application prospects, such as downsizing of the bearing arrangement. Furthermore, the improved price/performance ratio ultimately increases the overall cost-effectiveness of the bearing arrangement.

X-life bearings are described in the sections on product features and are indicated in the dimension tables by the symbol XL.

Product ranges for specific market sectors

Special product ranges are available for specific market sectors. In addition to standard products, these include a large number of special solutions. The range extends from simple, application-specific bearings via complete, ready-to-fit systems to special solutions that can be used to fulfil the most complex bearing technology requirements with high functional security and cost-effectiveness.

Contact our External Sales at the earliest possible stage and benefit from the broad knowledge and considerable experience of these specialists for your project.

medias® *professional* – the electronic information system

medias® *professional*, the proven selection and information system, contains the INA/FAG catalogue products in electronic format. As with the printed catalogue, this gives our customers product information on both brands in a single data source. This saves time and gives easier handling.

medias® is available online and on CD in several languages, is easy to navigate and is particular clear thank to the use of numerous pictures, diagrams and models. There are also highly representative application examples, classified by market sector.

Datasheets on the bearing series can be generated as PDF files. It includes a lubricant database and also the web2CAD link for direct download and inclusion of 3D models.

medias® focusses on the individual bearing. The complete shaft can be simulated and any influences arising from its deformation on the bearings can be determined using the calculation program BEARINX®. This program can also be made available to direct customers as BEARINX®-Online via the Internet (for conditions, see the INA/FAG homepage).

In conclusion, ***medias***® *professional* is a comprehensive, reliable system to help you help yourself answer many questions on rolling bearing technology by electronic means, quickly and at any location.

Other technical publications

This main catalogue HR1 has approximately 1 500 pages and contains a large proportion of the core rotary range of the brands INA and FAG. Nevertheless, we develop and manufacture many other products and systems of interest in terms of technical progress and cost-effectiveness for rotary and linear bearing arrangements as well as for the automotive sector. These are covered in separate, product-specific technical publications that can be obtained upon request.

INA and FAG – the brands for you when it comes to motion and advice

The new catalogue stands for pioneering bearing technology, application-focussed advice, the highest product and performance density and continuous development.

The benefits to you:

- Selection of products from a vast product range
- Maximum benefit, since the most suitable product is used in the right place
- Worldwide product availability
- Short delivery times
- Long term supply capability
- Security of planning for the long view
- Simplified stockholding
- Market-competitive prices
- Global service
- Comprehensive, application-focussed advice.

Together we move the world

For us, technical progress means never standing still. In partnership with you, we are continually working on new solutions so that your vision and our technical ideas can continue to become a reality, to your benefit. With our products and our knowledge, we can together continue to fulfil the challenges of your market in relation to rolling bearing arrangements. To this end, this catalogue is an important instrument.

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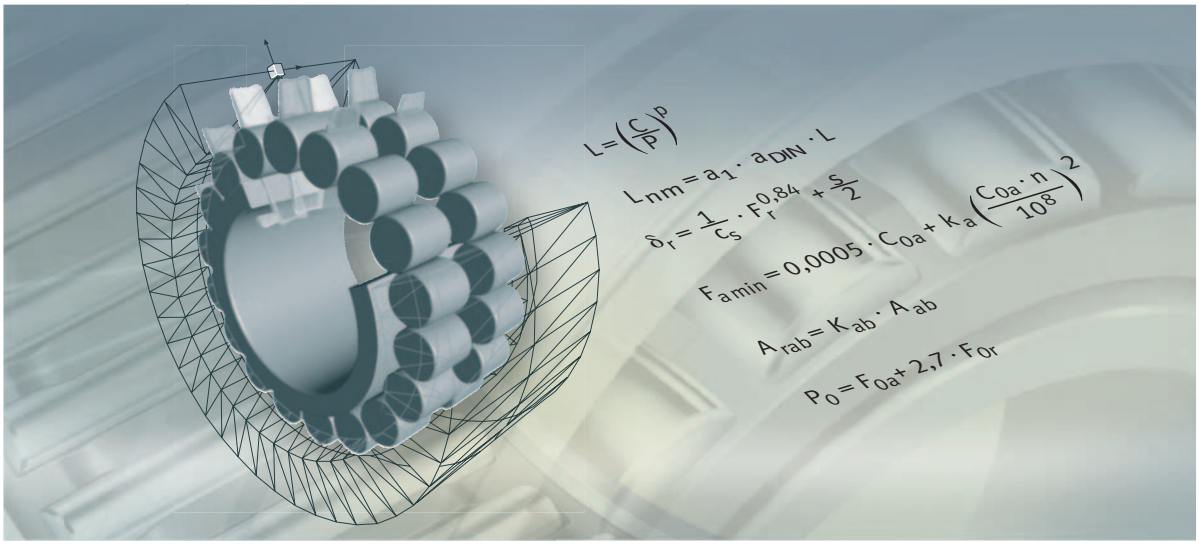
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Load carrying capacity and life

Schaeffler KG introduced the “Expanded calculation of the adjusted rating life” in 1997. This method is standardised in accordance with DIN ISO 281, Appendix 1. The method will be incorporated in the next version of the international standard ISO 281.

Fatigue theory as a principle

The basis of the rating life calculation in accordance with ISO 281 is Lundberg and Palmgren’s fatigue theory which always gives a final rating life.

However, modern, high quality bearings can exceed by a considerable margin the values calculated in accordance with ISO 281 under favourable operating conditions. Ioannides and Harris have developed a further model of fatigue in rolling contact that expands on the Lundberg/Palmgren theory and gives a better description of the performance capability of modern bearings.

The method “Expanded calculation of the adjusted rating life” takes account of the following influences:

- the bearing load
- the fatigue limit of the material
- the extent to which the surfaces are separated by the lubricant
- the cleanliness in the lubrication gap
- additives in the lubricant
- the internal load distribution and frictional conditions in the bearing.

Caution! The influencing factors, especially those relating to contamination, are extremely complex. A great deal of experience is essential for an accurate assessment. For further advice, we recommend that you consult the engineering service of Schaeffler Group Industrial.

The tables and diagrams can give only guide values.

Dynamic load carrying capacity and life

The required size of a rolling bearing is dependent on the demands made on its:

- load carrying capacity
- rating life
- operational reliability.

The dynamic load carrying capacity is described in terms of the basic dynamic load ratings. The basic dynamic load ratings are based on DIN ISO 281.

The basic dynamic load ratings for rolling bearings are matched to contemporary performance standards and those published in previous FAG and INA catalogues.

The fatigue behaviour of the material determines the dynamic load carrying capacity of the rolling bearing.

The dynamic load carrying capacity is described in terms of the basic dynamic load rating and the basic rating life.

The rating life as a fatigue period depends on:

- the load
- the operating speed
- the statistical probability of the first appearance of failure.

The basic dynamic load rating C applies to rotating rolling bearings. It is:

- a constant radial load C_r for radial bearings
- a constant, concentrically acting axial load C_a for axial bearings.

The basic dynamic load rating C is that load of constant magnitude and direction which a sufficiently large number of apparently identical bearings can endure for a basic rating life of one million revolutions.

Load carrying capacity and life

Calculation of the rating life

The methods for calculating the rating life are:

- the basic rating life to DIN ISO 281, page 34
- the adjusted rating life to DIN ISO 281, page 35
- the expanded adjusted rating life to DIN ISO 281, Appendix 1, page 38.

Basic rating life

The basic rating life L and L_h is determined using the following formulae:

$$L = \left(\frac{C}{P}\right)^p$$

$$L_h = \frac{16666}{n} \cdot \left(\frac{C}{P}\right)^p$$

L — 10^6 revolutions
The basic rating life in millions of revolutions is the life reached or exceeded by 90% of a sufficiently large group of apparently identical bearings before the first evidence of material fatigue develops

L_h — h
The basic rating life as defined for L but expressed in operating hours

C — N
Basic dynamic load rating

P — N
Equivalent dynamic bearing load for radial and axial bearings
(see also Equivalent operating values, page 42 and page 43)

p — –
Life exponent;
for roller bearings: p = 10/3
for ball bearings: p =3

n — min^{-1}
Operating speed
(see also Equivalent operating values, page 42 and page 43).

Equivalent dynamic load

The equivalent dynamic load P is a calculated value. This value is constant in size and direction; it is a radial load for radial bearings and an axial load for axial bearings.

P gives the same rating life as the combined load occurring in practice.

$$P = X \cdot F_r + Y \cdot F_a$$

P — N
Equivalent dynamic bearing load

F_r — N
radial dynamic bearing load

F_a — N
axial dynamic bearing load

X — –
Radial factor given in the dimension tables or product description

Y — –
Axial factor given in the dimension tables or product description.

Caution! This calculation cannot be applied to radial needle roller bearings, axial needle roller bearings and axial cylindrical roller bearings. Combined loads are not permissible with these bearings.

Equivalent values for non-constant loads or speeds:
see Equivalent operating values, page 42 and page 43.

Adjusted rating life

The adjusted rating life can be calculated if, in addition to the load and speed, other influences are known such as:

- special material characteristics
- lubrication

or

- if a requisite reliability other than 90% is specified.

$$L_{na} = a_1 \cdot a_2 \cdot a_3 \cdot L$$

L_{na} 10^6 revolutions
Adjusted rating life for special material characteristics and operating conditions with a requisite reliability of (100 – n) %

L 10^6 revolutions
Basic rating life

a_1 –
Life adjustment factor for a requisite reliability other than 90%, table Life adjustment factor a_1

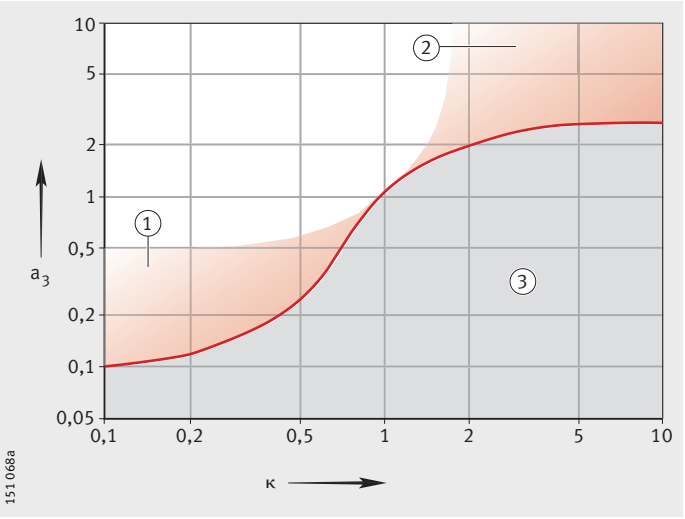
a_2 –
Life adjustment factor for special material characteristics – for standard rolling bearing steels: $a_2 = 1$

a_3 –
Life adjustment factor for special operating conditions – in particular lubrication, *Figure 1*.

The viscosity ratio κ is determined according to the formula on page 36.

Life adjustment factor a_1

Requisite reliability	90%	95%	96%	97%	98%	99%
Life adjustment factor a_1	1	0,62	0,53	0,44	0,33	0,21



a_3 = life adjustment factor
κ = viscosity ratio
① Good cleanliness and suitable additives
② Very high cleanliness and low load
③ Contamination in the lubricant

Figure 1
Life adjustment factor a_3

Load carrying capacity and life

Viscosity ratio

The viscosity ratio κ is an indication of the quality of lubricant film formation:

$$\kappa = \frac{\nu}{\nu_1}$$

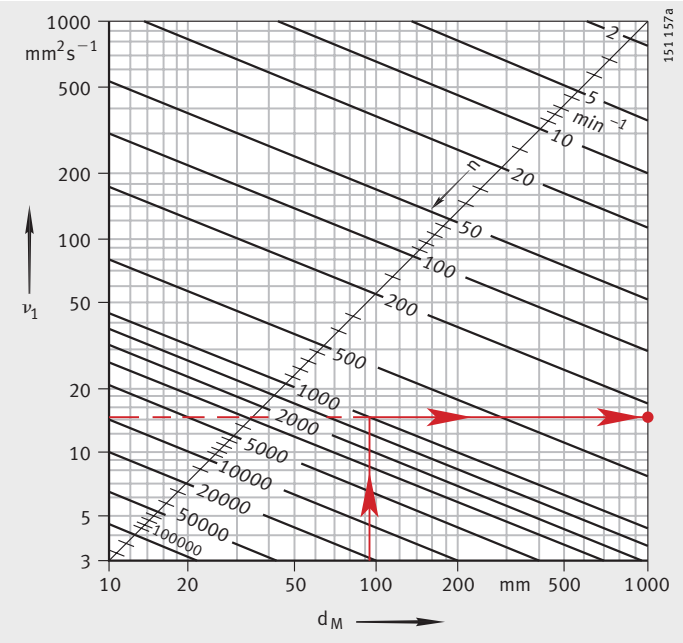
ν mm^2s^{-1}
Kinematic viscosity of the lubricant at operating temperature
ν_1 mm^2s^{-1}
Reference viscosity of the lubricant at operating temperature.

The reference viscosity ν_1 is determined from the mean bearing diameter $d_M = (D + d)/2$ and the operating speed n, *Figure 2*, Reference viscosity ν_1, page 37.

The nominal vicosity of the oil at +40 °C is determined from the required operating viscosity ν and the operating temperature ϑ, *Figure 3*, V/T diagram for mineral oils, page 37. In the case of greases, ν is the operating viscosity of the base oil.

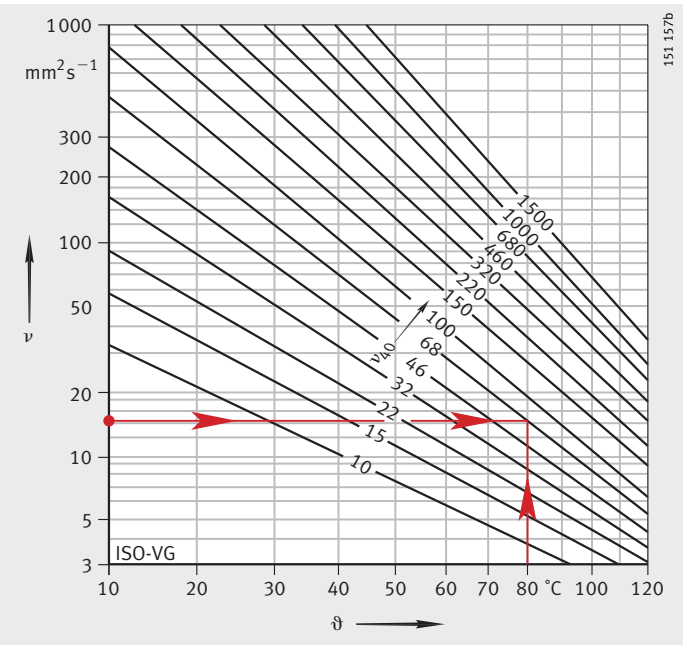
In the case of heavily loaded bearings with a high proportion of sliding contact, the temperature in the contact area of the rolling elements may be up to 20 K higher than the temperature measured on the stationary ring (without the influence of any external heat).

Caution! Taking account of EP additives in calculation of the expanded adjusted rating life L_{nm}: see page 38.



ν_1 = reference viscosity
d_M = mean bearing diameter
n = speed

Figure 2
Reference viscosity ν_1



ν = operating viscosity
ϑ = operating temperature
ν_{40} = viscosity at +40 °C

Figure 3
V/T diagram for mineral oils

Load carrying capacity and life

Expanded adjusted rating life

The expanded adjusted rating life is calculated according to the following formula:

$$L_{nm} = a_1 \cdot a_{DIN} \cdot L$$

L_{nm} 10^6 revolutions
Expanded adjusted rating life to DIN ISO 281, Appendix 1.
This appendix defines manual calculation at the catalogue level; computer-aided calculation is standardised in DIN ISO 281, Appendix 4

a_1 –
Life adjustment factor for a requisite reliability other than 90%, table Life adjustment factor a_1, page 35

a_{DIN} –
Life adjustment factor for operating conditions, see formula below

L 10^6 revolutions
Basic rating life, page 34.

Life adjustment factor a_{DIN}

The standardised method for calculating the life adjustment factor a_{DIN} essentially takes account of the following influences:

- the load on the bearing
- the lubrication conditions – viscosity and type of lubricant, speed, bearing size, additives
- the fatigue limit of the material
- the type of bearing
- the residual stress in the material
- the environmental conditions
- contamination in the lubricant.

$$a_{DIN} = f\left[\frac{e_C \cdot C_u}{P}, \kappa\right]$$

a_{DIN} –
Life adjustment factor for operating conditions, see *Figure 4* to *Figure 7*

e_C –
Life adjustment factor for contamination, see table, page 41

C_u N
Fatigue limit load, according to dimension tables

P N
Equivalent dynamic bearing load

κ –
Viscosity ratio, see page 36
For $\kappa > 4$ calculation should be carried out using $\kappa = 4$.
This calculation method cannot be used for $\kappa < 0{,}1$.

Taking account of EP additives

DIN ISO 281, Appendix 1, describes how EP additives are taken into consideration. For a viscosity ratio $\kappa < 1$ and a contamination factor $e_C \geqq 0{,}2$, calculation can be carried out using the value $\kappa = 1$ for lubricants with EP additives that have been proven effective. With severe contamination (contamination factor $e_C < 0{,}2$), the effectiveness of the additives under these contamination conditions must be proven. The effectiveness of the EP additives can be demonstrated in the actual application or on a rolling bearing test rig FE 8 to DIN 51819-1.

If the EP additives are proven effective and calculation is carried out using the value $\kappa = 1$, the life adjustment factor must be restricted to $a_{DIN} \leqq 3$. If the calculated value a_{DIN} for the actual κ is greater than 3, this value can be used in calculation.

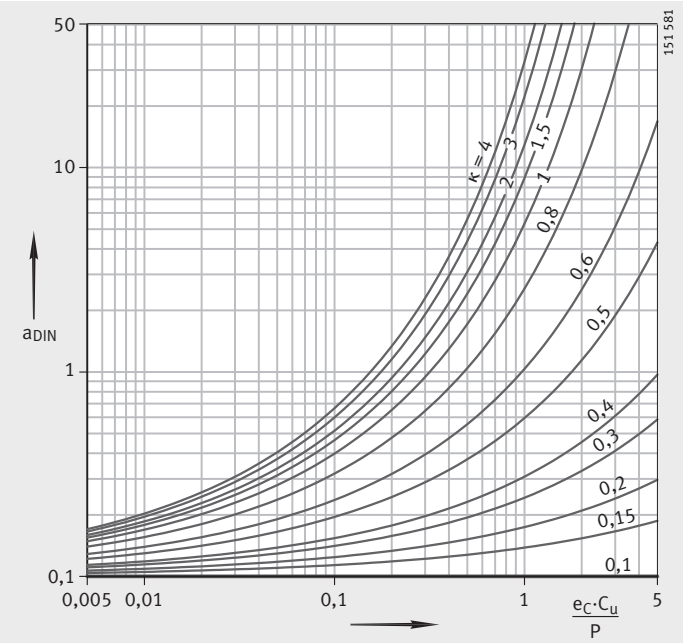


Figure 4
Life adjustment factor a_{DIN} for radial roller bearings

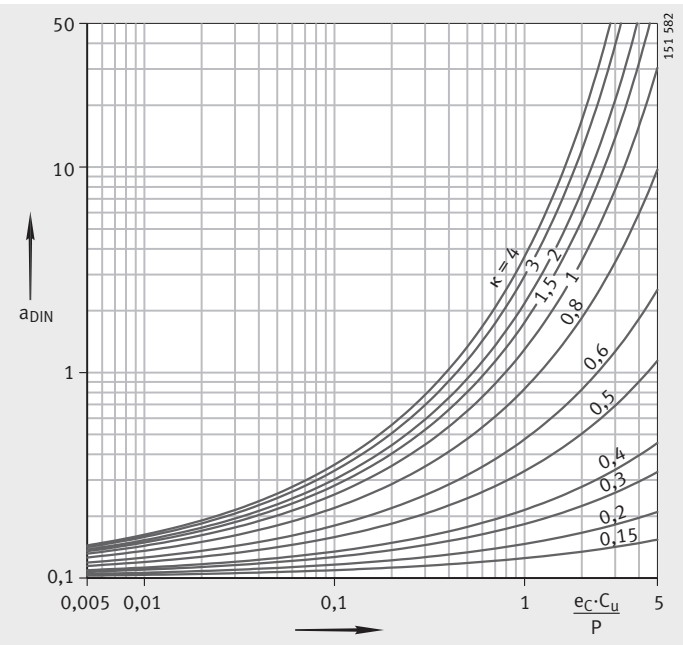


Figure 5
Life adjustment factor a_{DIN} for axial roller bearings

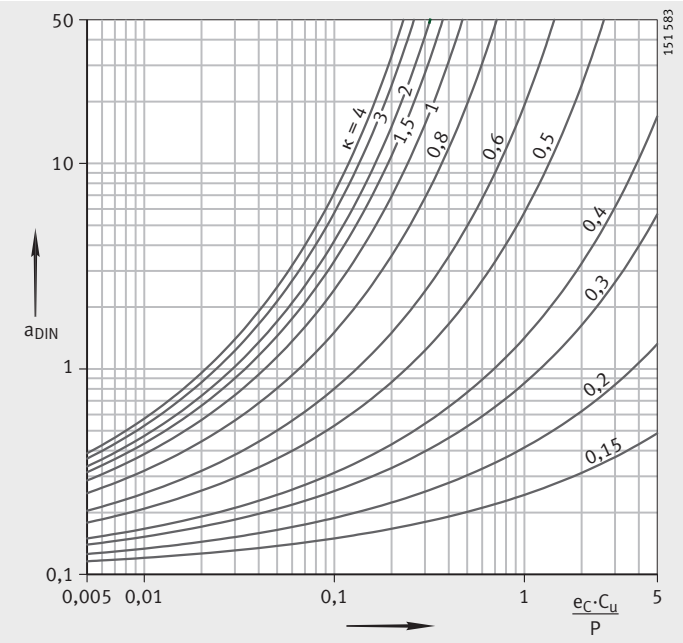


Figure 6
Life adjustment factor a_{DIN} for radial ball bearings

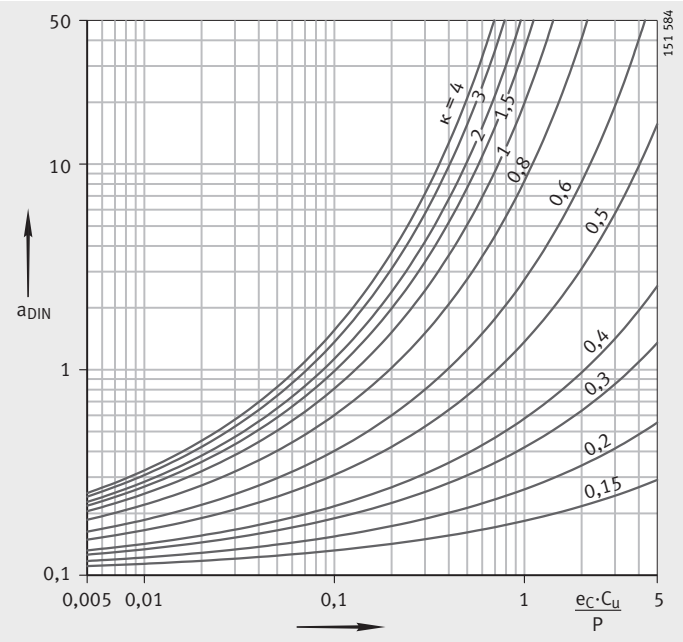


Figure 7
Life adjustment factor a_{DIN} for axial ball bearings

Fatigue limit load

The fatigue limit load C_u is defined as the load below which – under laboratory conditions – no fatigue occurs in the material.

Life adjustment factor for contamination

The life adjustment factor for contamination e_C takes into consideration the influence of contamination in the lubrication gap on the rating life, table Factor e_C.

The rating life is reduced by solid particles in the lubrication gap and is dependent on:

- the type, size, hardness and number of particles
- the relative lubrication film thickness
- the bearing size.

Due to the complex nature of the interaction between these influencing factors, only an approximate guide value can be attained. The values in the tables are valid for contamination by solid particles, table Factor e_C. They do not take account of other contamination such as that caused by water or other fluids.

Caution!

Under severe contamination – $e_C \rightarrow 0$ – the bearings may fail due to wear.

In this case, the operating life is substantially less than the calculated life.

Factor e_C

Contamination	Factor e_C	
	$d_M < 100$ mm[1]	$d_M \geqq 100$ mm[1]
Extreme cleanliness - Particle size within lubricant film thickness - Laboratory conditions	1	1
High cleanliness - Oil filtered through extremely fine filter - Sealed, greased bearings	0,8 to 0,6	0,9 to 0,8
Standard cleanliness - Oil filtered through fine filter	0,6 to 0,5	0,8 to 0,6
Slight contamination - Slight contamination of oil	0,5 to 0,3	0,6 to 0,4
Typical contamination - Bearing contaminated with abraded material from other machine elements	0,3 to 0,1	0,4 to 0,2
Heavy contamination - Bearing environment is heavily contaminated - Bearing arrangement is insufficiently sealed	0,1 to 0	0,1 to 0
Very heavy contamination	0	0

[1] d_M = mean bearing diameter $(d + D)/2$.

Load carrying capacity and life

Equivalent operating values

The rating life formulae are based on the assumption that the bearing load P and bearing speed n are constant.

If the load and speed are not constant, equivalent operating values can be determined that induce the same fatigue as the actual conditions.

Caution! The equivalent operating values calculated here already take account of the life adjustment factors a_3 or a_{DIN}. They must not be applied again when calculating the adjusted rating life.

Variable load and speed

If the load and speed vary over a time period T, the speed n and equivalent bearing load P are calculated as follows:

$$n = \frac{1}{T}\int_0^T n(t)\cdot dt$$

$$P = \sqrt[p]{\frac{\int_0^T \frac{1}{a(t)}\cdot n(t)\cdot F^p(t)\cdot dt}{\int_0^T n(t)\cdot dt}}$$

Variation in steps

If the load and speed vary in steps over a time period T, the speed n and equivalent bearing load P are calculated as follows:

$$n = \frac{q_1\cdot n_1 + q_2\cdot n_2 + \ldots + q_z\cdot n_z}{100}$$

$$P = \sqrt[p]{\frac{\frac{1}{a_i}\cdot q_i\cdot n_i\cdot F_i^p + \ldots + \frac{1}{a_z}\cdot q_z\cdot n_z\cdot F_z^p}{q_i\cdot n_i + \ldots + q_z\cdot n_z}}$$

Variable load at constant speed

If the function F describes the variation in the load over the time period T and the speed is constant, the equivalent bearing load P is calculated as follows:

$$P = \sqrt[p]{\frac{1}{T}\int_0^T \frac{1}{a(t)}\cdot F^p(t)\cdot dt}$$

Load varying in steps and constant speed

If the load varies in steps over a time period T and the speed is constant, the equivalent bearing load P is calculated as follows:

$$P = \sqrt[p]{\frac{\frac{1}{a_i}\cdot q_i\cdot F_i^p + \ldots + \frac{1}{a_z}\cdot q_z\cdot F_z^p}{100}}$$

Constant load at variable speed

If the speed varies but the load remains constant, the following applies:

$$n = \frac{1}{T}\int_0^T \frac{1}{a(t)}\cdot n(t)\cdot dt$$

Constant load with speed varying in steps

If the speed varies in steps but the load remains constant, the following applies:

$$n = \frac{\frac{1}{a_i} \cdot q_i \cdot n_i + \ldots + \frac{1}{a_z} \cdot q_z \cdot n_z}{100}$$

Oscillating bearing motion

The equivalent speed under oscillating bearing motion is calculated as follows:

$$n = n_{osc} \cdot \frac{\varphi}{180°}$$

Caution!

The formula is valid only if the angle of oscillation is greater than twice the angular pitch of the rolling elements.
If the angle of oscillation is smaller, there is a risk of false brinelling.

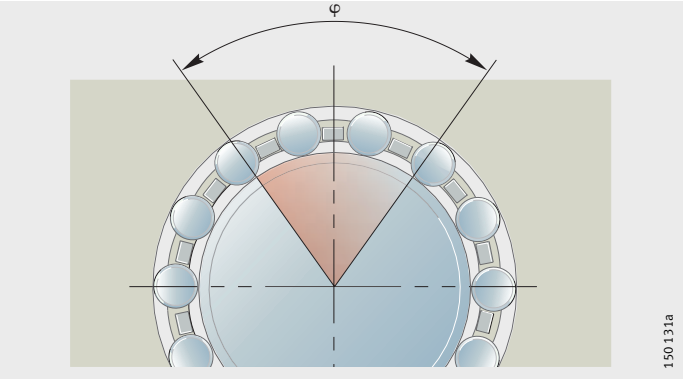


Figure 8
Angle of oscillation φ

Symbols, units and definitions

n	min^{-1}
Mean speed	
T	min
Time period under consideration	
P	N
Equivalent bearing load	
p	–
Life exponent: for roller bearings: p = 10/3 for ball bearings: p = 3	
a_i, a(t)	–
Life adjustment factor a_{DIN} for current operating condition, see Life adjustment factor a_{DIN}, page 38	
n_i, n(t)	min^{-1}
Bearing speed for current operating condition	
q_i	%
Duration of operating condition as a proportion of the total operating period; $q_i = (\Delta t_i/T) \cdot 100$	
F_i, F(t)	N
Bearing load during the current operating condition	
n_{osc}	min^{-1}
Frequency of oscillating motion	
φ	°
Angle of oscillation, *Figure 8*.	

Load carrying capacity and life

Required rating life

If no information is available on the required rating life, the guide values from the following tables may be used.

Caution!

Do not overspecify the bearing. If the calculated life is greater than 60 000 h, this normally means that the bearing arrangement is overspecified.

Pay attention to the minimum load for the bearings; see the design and safety guidelines in the product sections.

Motor vehicles

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Motorcycles	400	2 000	400	2 400
Passenger car powertrains	500	1 100	500	1 200
Passenger car bearings protected against contamination (gearbox)	200	500	200	500
Passenger car wheel bearings	1 400	5 300	1 500	7 000
Light commercial vehicles	2 000	4 000	2 400	5 000
Medium commercial vehicles	2 900	5 300	3 600	7 000
Heavy commercial vehicles	4 000	8 800	5 000	12 000
Buses	2 900	11 000	3 600	16 000
Internal combustion engines	900	4 000	900	5 000

Rail vehicles

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Wheelset bearings for freight wagons	7 800	21 000	–	–
Tram carriages	–	–	35 000	50 000
Passenger carriages	–	–	20 000	35 000
Goods wagons	–	–	20 000	35 000
Tipper wagons	–	–	20 000	35 000
Powered units	–	–	35 000	50 000
Locomotives/external bearings	–	–	35 000	50 000
Locomotives/internal bearings	–	–	75 000	110 000
Gearboxes for rail vehicles	14 000	46 000	20 000	75 000

Shipbuilding

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Marine thrust blocks	–	–	20 000	50 000
Marine shaft bearings	–	–	50 000	200 000
Large marine gearboxes	14 000	46 000	20 000	75 000
Small marine gearboxes	4 000	14 000	5 000	20 000
Boat propulsion systems	1 700	7 800	2 000	10 000

Agricultural machinery

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Tractors	1 700	4 000	2 000	5 000
Self-propelled machinery	1 700	4 000	2 000	5 000
Seasonal machinery	500	1 700	500	2 000

Construction machinery

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Dozers, loaders	4 000	7 800	5 000	10 000
Excavators/travelling gear	500	1 700	500	2 000
Excavators/slewing gear	1 700	4 000	2 000	5 000
Vibratory road rollers, imbalance generators	1 700	4 000	2 000	5 000
Vibrator bodies	500	1 700	500	2 000

Electric motors

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Electric motors for household appliances	1 700	4 000	–	–
Series motors	21 000	32 000	35 000	50 000
Large motors	32 000	63 000	50 000	110 000
Electric traction motors	14 000	21 000	20 000	35 000

Rolling mills, steelworks equipment

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Rolling mill frames	500	14 000	500	20 000
Rolling mill gearboxes	14 000	32 000	20 000	50 000
Roller tables	7 800	21 000	10 000	35 000
Centrifugal casting machines	21 000	46 000	35 000	75 000

Machine tools

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Headstock spindles, milling spindles	14 000	46 000	20 000	75 000
Drilling spindles	14 000	32 000	20 000	50 000
Grinding spindles	7 800	21 000	10 000	35 000
Workpiece spindles in grinding machines	21 000	63 000	35 000	110 000
Machine tool gearboxes	14 000	32 000	20 000	50 000
Presses/flywheels	21 000	32 000	35 000	50 000
Presses/eccentric shafts	14 000	21 000	20 000	35 000
Electric tools and compressed air tools	4 000	14 000	5 000	20 000

Woodworking machinery

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Milling spindles and cutter blocks	14 000	32 000	20 000	50 000
Saw frames/main bearings	–	–	35 000	50 000
Saw frames/ connecting rod bearings	–	–	10 000	20 000
Circular saws	4 000	14 000	5 000	20 000

Load carrying capacity and life

Gearboxes in general machine building

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Universal gearboxes	4 000	14 000	5 000	20 000
Geared motors	4 000	14 000	5 000	20 000
Large gearboxes, stationary	14 000	46 000	20 000	75 000

Conveying equipment

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Belt drives/mining	–	–	75 000	150 000
Conveyor belt rollers/mining	46 000	63 000	75 000	110 000
Conveyor belt rollers/general	7 800	21 000	10 000	35 000
Belt drums	–	–	50 000	75 000
Bucket wheel excavators/trav. dr.	7 800	21 000	10 000	35 000
Bucket wheel excavators/buck. wh.	–	–	75 000	200 000
Bucket wheel excavators/ bucket wheel drive	46 000	83 000	75 000	150 000
Winding cable sheaves	32 000	46 000	50 000	75 000
Sheaves	7 800	21 000	10 000	35 000

Pumps, fans, compressors

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Ventilators, fans	21 000	46 000	35 000	75 000
Large fans	32 000	63 000	50 000	110 000
Piston pumps	21 000	46 000	35 000	75 000
Centrifugal pumps	14 000	46 000	20 000	75 000
Hydraulic axial and radial piston engines	500	7 800	500	10 000
Gear pumps	500	7 800	500	10 000
Compressors	4 000	21 000	5 000	35 000

Centrifuges, stirrers

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Centrifuges	7 800	14 000	10 000	20 000
Large stirrers	21 000	32 000	35 000	50 000

Textile machinery

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Spinning machines/spindles	21 000	46 000	35 000	75 000
Weaving and knitting machines	14 000	32 000	20 000	50 000

Plastics processing

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Plastics worm extruders	14 000	21 000	20 000	35 000
Rubber and plastics calenders	21 000	46 000	35 000	75 000

Crushers, mills, screens

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Jaw crushers	–	–	20 000	35 000
Gyratory crushers, roll crushers	–	–	20 000	35 000
Rigid hammer mills, hammer mills, impact crushers	–	–	50 000	110 000
Tube mills	–	–	50 000	100 000
Vibration grinding mills	–	–	5 000	20 000
Grinding track mills	–	–	50 000	110 000
Vibrating screens	–	–	10 000	20 000
Briquette presses	–	–	35 000	50 000
Rotary furnace track rollers	–	–	50 000	110 000

Paper and printing machinery

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Paper machinery/wet section	–	–	110 000	150 000
Paper machinery/dry section	–	–	150 000	250 000
Paper machinery/refiners	–	–	110 000	150 000
Paper machinery/calenders	–	–	75 000	110 000
Printing machinery	32 000	46 000	50 000	75 000

Operating life

The operating life is the life actually achieved by a rolling bearing. It may differ significantly from the calculated life.

This may be due to wear or fatigue as a result of:

- deviating operating conditions
- misalignment between the shaft and housing
- insufficient or excessive operating clearance
- contamination
- insufficient lubrication
- excessive operating temperature
- oscillating bearing motion with very small angles of oscillation – false brinelling
- high vibration and false brinelling
- very high shock loads – leading to static overloading
- prior damage during installation.

Due to the wide variety of possible installation and operating conditions, it is not possible to precisely predetermine the operating life. The most reliable way of arriving at a close estimate is by comparison with similar applications.

Axial load carrying capacity of cylindrical roller bearings

Radial cylindrical roller bearings used as semi-locating and locating bearings can support axial forces in one or both directions in addition to radial forces.

The axial load carrying capacity is dependent on:

- the size of the sliding surfaces between the ribs and the end faces of the rolling elements
- the sliding velocity at the ribs
- the lubrication on the contact surfaces.

Caution!

Ribs subjected to load must be supported across their entire height, *Figure 9*.

If severe shaft flexing is present, reversed bending loads may occur as a result of this support at the rib. Special analysis is required in this case.

The limiting load $F_{a\ max}$ must not be exceeded, in order to avoid unacceptable pressure at the contact surfaces. Calculation of axial load: see page 49.

The ratio F_a/F_r must not exceed a value of 0,4.

Continuous axial loading without simultaneous radial loading is not permissible.

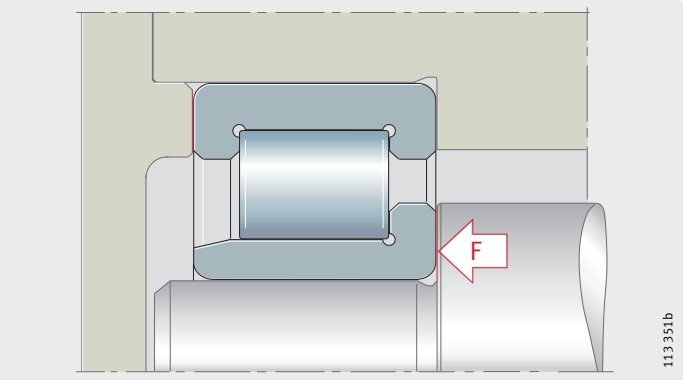


Figure 9
Support of ribs under axial load

Calculation of axial load

The permissible axial load $F_{a\,per}$ and the axial limiting load $F_{a\,max}$ are calculated according to the following formulae:

$$F_{a\,per} = k_S \cdot k_B \cdot {d_M}^{1,5} \cdot n^{-0,6} \leqq F_{a\,max}$$

$$F_{a\,max} = 0,075 \cdot k_B \cdot {d_M}^{2,1}$$

$F_{a\,per}$ N
Permissible axial load

$F_{a\,max}$ N
Axial limiting load

k_S –
Factor dependent on the lubrication method, see table Factor k_S for the lubrication method

k_B –
Factor dependent on the bearing series, see table Bearing factor k_B

d_M mm
Mean bearing diameter (d + D)/2

n min^{-1}
Operating speed.

Factor k_S for the lubrication method

Lubrication methods[1]	k_S
Minimal heat dissipation, drip feed oil lubrication, oil mist lubrication, low operating viscosity ($\nu < 0,5 \cdot \nu_1$)	7,5 to 10
Little heat dissipation, oil sump lubrication, oil spray lubrication, low oil flow	10 to 15
Good heat dissipation, recirculating oil lubrication (pressure oil lubrication)	12 to 18
Very good heat dissipation, recirculating oil lubrication with oil cooling, high operating viscosity ($\nu > 2 \cdot \nu_1$)	16 to 24

1) The precondition for these k_S values is the reference viscosity ν_1 according to the section Oil lubrication. Doped lubricating oils should be used, for example CLP (DIN 51 517) and HLP (DIN 51 524) of ISO VG classes 32 to 460 and ATF oils (DIN 51 502) and gearbox oils (DIN 51 512) of SAE viscosity classes 75 W to 140 W.

Bearing factor k_B

Series	k_B
SL1818, SL0148	4,5
SL1829, SL0149	11
SL1830, SL1850	17
SL1822	20
LSL1923, ZSL1923	28
SL1923	30
NJ2..-E, NJ22..-E, NUP2..-E, NUP22..-E	18
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	23

Load carrying capacity and life

Static load carrying capacity

Very high static loads or shock loads can cause plastic deformation on the raceways and rolling elements. This deformation limits the static load carrying capacity of the rolling bearing with respect to the permissible noise level during running.

If a rolling bearing operates without rotary motion or with only infrequent rotary motion, its size is determined in accordance with the basic static load rating C_0.

According to DIN ISO 76, this is:

- a constant radial load C_{0r} for radial bearings
- a constant, concentrically acting axial load C_{0a} for axial bearings.

The basic static load rating C_0 is that load under which the Hertzian pressure at the most heavily loaded point between the rolling elements and raceways reaches the following values:

- for roller bearings, 4 000 N/mm^2
- for ball bearings, 4 200 N/mm^2
- for self-aligning ball bearings, 4 600 N/mm^2.

Under normal contact conditions, this load causes a permanent deformation at the contact points of approx. 1/10 000 of the rolling element diameter.

Static load safety factor

The static load safety factor S_0 is the ratio between the basic static load rating C_0 and the equivalent static load P_0:

$$S_0 = \frac{C_0}{P_0}$$

S_0 –
Static load safety factor
C_0 (C_{or}, C_{oa}) N
Basic static load rating according to dimension tables
P_0 (P_{or}, P_{oa}) N
Equivalent static load on the radial or axial bearing.

Caution! Guide values and shock loads occurring during operation according to table Guide values for static load safety factor must be taken into consideration.

Guide values for axial spherical roller bearings and high precision bearings: see corresponding product description.

For drawn cup needle roller bearings, $S_0 \geqq 3$ is necessary.

Guide values for static load safety factor

Operating conditions	S_0	
	Roller bearings	Ball bearings
Smooth, low-vibration, normal operation with minimal demands for smooth running; bearings with slight rotary motion	≧ 1	≧ 0,5
Normal operation with greater demands for smooth running	≧ 2	≧ 1
Operation with pronounced shock loads	≧ 3	≧ 2
Bearing arrangement with high requirements for running accuracy and smooth running	≧ 4	≧ 3

Equivalent static load

The equivalent static load P_0 is a calculated value.
It corresponds to a radial load in radial bearings and a concentric axial load in axial bearings.

P_0 induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined load occurring in practice.

$$P_0 = X_0 \cdot F_{0r} + Y_0 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load
F_{0r} N
Radial static bearing load
F_{0a} N
Axial static bearing load
X_0 –
Radial factor given in the dimension tables or product description
Y_0 –
Axial factor given in the dimension tables or product description.

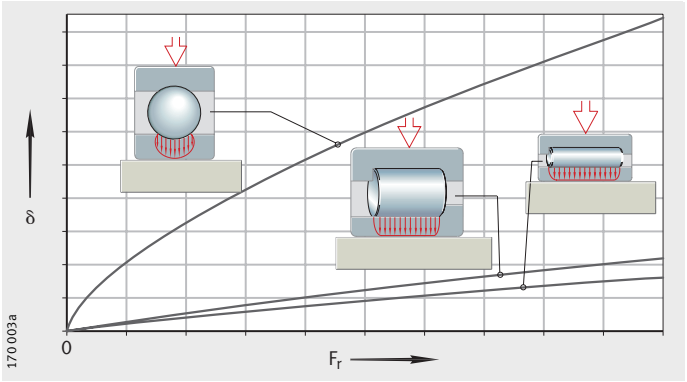
Caution! This calculation cannot be applied to radial needle roller bearings, axial needle roller bearings and axial cylindrical roller bearings. Combined loads are not permissible with these bearings.

Rigidity

The rigidity of a rolling bearing is dependent on the bearing type, size and operating clearance.

The rigidity increases with the number of rolling elements supporting the load.

Rolling bearings with line contact have a higher rigidity than rolling bearings with point contact, *Figure 1*.



δ = displacement
F_r = radial bearing load

Figure 1
Rigidity,
dependent on the bearing type

Deflection

Rolling bearings have a progressive deflection rate.
The displacement values can be determined using approximation formulae.

Caution! The formulae are valid for bearings without misalignment and with a rigid surrounding structure.

In axial bearings, a concentrically acting load is assumed.

$$\delta_r = \frac{1}{c_s} \cdot F_r^{0,84} + \frac{s}{2}$$

$$\delta_a = \frac{1}{c_s} \cdot \left[\left(F_{av} + F_a \right)^{0,84} - F_{av}^{\ 0,84} \right]$$

$$c_s = K_c \cdot d^{0,65}$$

c_S — $N^{0,84}/\mu m$
Rigidity parameter

d — mm
Bearing bore diameter

δ_r — µm
Radial displacement between shaft axis and centre of bore, *Figure 2*

δ_a — µm
Axial displacement between shaft locating washer and housing locating washer, *Figure 3*

S — µm
Radial operating clearance of fitted, unloaded bearing

F_r — N
Radial bearing load

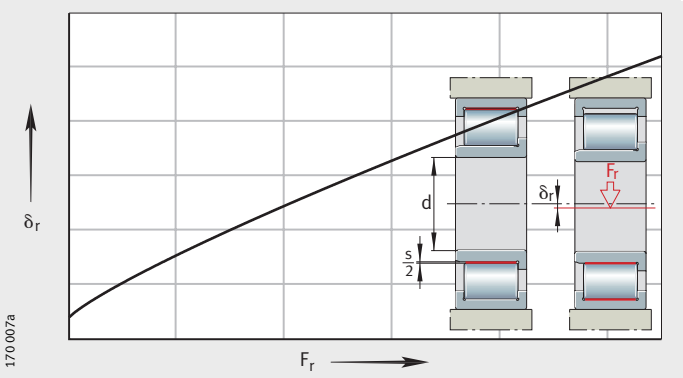
F_a — N
Axial bearing load

F_{av} — N
Axial preload force

K_c — –
Factor for determining the rigidity parameter, table Factor K_c, page 53.

Factor K_c

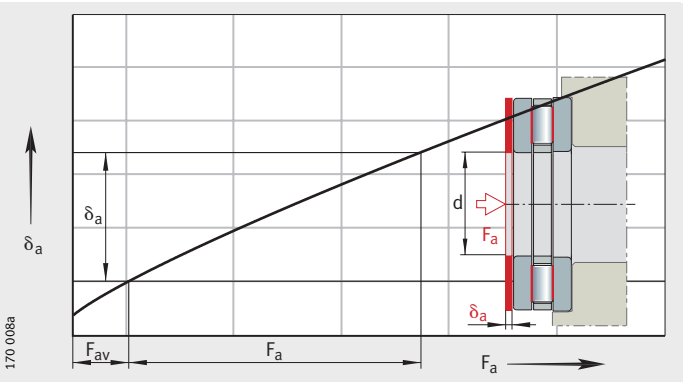
Series	K_c	Series	K_c
SL1818	12,8	NJ2..-E	11,1
SL1829, SL1830, SL1923	16	NJ3..-E	11,3
SL1850, SL0148, SL0248, SL0249	29,2	NJ22..-E	15,4
NA48	24,9	NJ23..-E	16,9
NA49	23,5	NU10	9,5
NA69	37,3	NU19	11,3
NKIS	21,3	NN30..-AS-K	18,6
NKI	$4{,}4 \cdot B^{0,8}/d^{0,2}$	ZNR31-22	21,1
HK, BK	$4{,}2 \cdot C^{0,8}/d^{0,2}$	ZNR31-23	23,2
K811, 811, K812, 812	36,7	ZNR31-30	30
K893, 893, K894, 894	59,7	ZNR31-31	29,3
		ZNR31-32	28,9



δ_r = radial displacement
F_r = radial bearing load

Figure 2

Radial displacement δ_r
Example:
radial cylindrical roller bearing



δ_a = axial displacement
F_a = axial bearing load

Figure 3

Axial displacement δ_a
Example:
axial cylindrical roller bearing

Friction and increases in temperature

Friction

The friction in a rolling bearing is made up of several components, see table Frictional component and influencing factor. Due to the large number of influencing factors, the frictional torque and thus the frictional energy can only be calculated in approximate terms and on the precondition of constant operating conditions.

Frictional component and influencing factor

Frictional component	Influencing factor
Rolling friction	Magnitude of load
Sliding friction of rolling elements Sliding friction of cage	Magnitude and direction of load Speed and lubrication conditions, running-in condition
Fluid friction – flow resistance	Type and speed Type, quantity and operating viscosity of lubricant
Seal friction	Type and preload of seal

The idling friction is dependent on:

- the quantity of lubricant
- the speed
- the operating viscosity of the lubricant
- the seals
- the running-in condition of the bearing.

Heat dissipation

Friction is converted into heat; this heat is dissipated from the bearing. The equilibrium between the frictional energy and heat dissipation allows calculation of the thermally permissible speed n_{per}, see Speeds, page 62.

Heat dissipation by the lubricant

If oil lubrication is used, a portion of the heat is dissipated by the oil: recirculating oil lubrication with additional cooling is particularly effective.

Caution! Grease does not give dissipation of heat.

Heat dissipation via the shaft and housing

Heat dissipation via the shaft and housing is dependent on the temperature difference between the bearing and the surrounding structure, *Figure 1*.

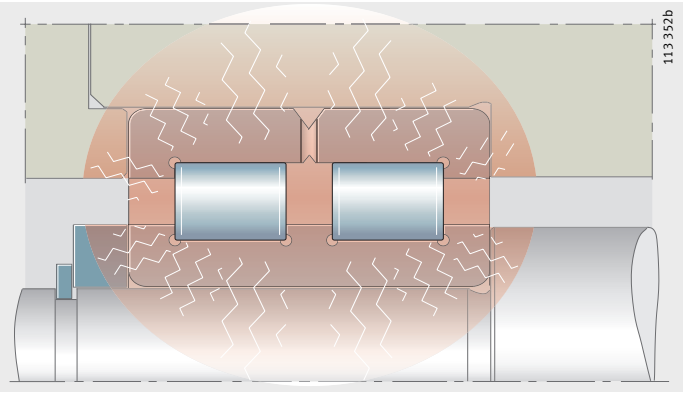


Figure 1
Temperature distribution between bearing, shaft and housing

Caution! Any additional adjacent sources of heat or thermal radiation must be taken into consideration.

Calculation of friction values

In order to determine the friction values, the speed and load must be known. The type of lubrication, lubrication method and viscosity of lubricant at operating temperature are further important factors in calculation.

Total frictional torque M_R
(calculation of axially loaded cylindrical roller bearings, see page 60):

$$M_R = M_0 + M_1$$

Frictional energy N_R:

$$N_R = M_R \cdot \frac{n}{9550}$$

Frictional torque as a function of speed for $\nu \cdot n \geqq 2\,000$:

$$M_0 = f_0 \cdot (\nu \cdot n)^{\frac{2}{3}} \cdot {d_M}^3 \cdot 10^{-7}$$

Frictional torque as a function of speed for $\nu \cdot n < 2\,000$:

$$M_0 = f_0 \cdot 160 \cdot {d_M}^3 \cdot 10^{-7}$$

Frictional torque as a function of load for needle roller and cylindrical roller bearings:

$$M_1 = f_1 \cdot F \cdot d_M$$

Frictional torque as a function of load for ball bearings, tapered roller bearings and spherical roller bearings:

$$M_1 = f_1 \cdot P_1 \cdot d_M$$

M_R Nmm
Total frictional torque

M_0 Nmm
Frictional torque as a function of speed

M_1 Nmm
Frictional torque as a function of load

N_R W
Frictional energy

n min^{-1}
Operating speed

f_0 –
Bearing factor for frictional energy as a function of speed, see *Figure 2* and tables from page 57 to page 59

f_1 –
Bearing factor for frictional torque as a function of load, tables from page 57 to page 59

ν mm^2s^{-1}
Kinematic viscosity of lubricant at operating temperature. In the case of grease, the decisive factor is the viscosity of the base oil at operating temperature

F (F_r, F_a) N
Radial load for radial bearings, axial load for axial bearings

P_1 N
Decisive load for frictional torque, table Ball bearings, tapered roller bearings and spherical roller bearings, page 60

d_M mm
Mean bearing diameter.

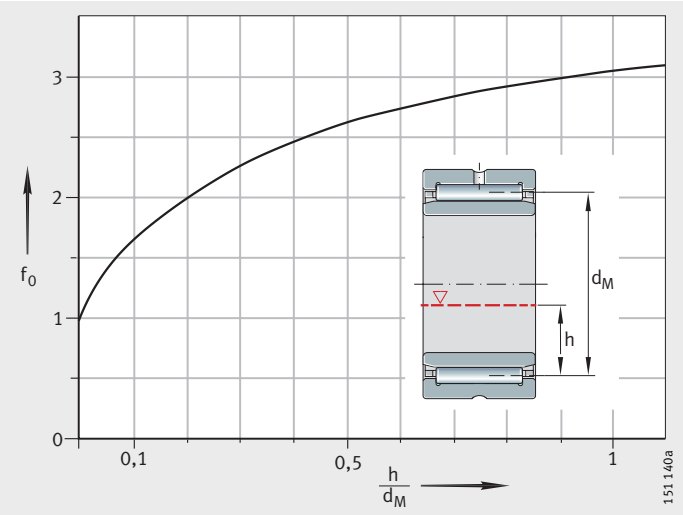
Bearing factors

The bearing factors f_0 and f_1 are mean values determined from series of tests and corresponding data according to ISO 15 312.

They are valid for grease lubrication applied to fitted bearings. In the freshly greased state, the bearing factor f_0 may be higher by a factor of between two and five.

If oil mist lubrication is used, a marginal lubricant supply is assumed.

If oil bath lubrication is used, the oil level must reach the centre of the lowest rolling element. If the oil level is higher, f_0 may be up to 3 times the value given in the table, *Figure 2*.



f_0 = bearing factor
h = oil level
d_M = mean bearing diameter

Figure 2

Increase in the bearing factor f_0, as a function of the oil level h

Bearing factors for needle roller bearings, drawn cup needle roller bearings, needle roller and cage assemblies

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
NA48	3	5	0,0005
NA49	4	5,5	
RNA48	3	5	
RNA49	4	5,5	
NA69	7	10	
RNA69			
NKI, NK, NKIS, NKS, NAO, RNO, K	(12 · B)/(33 + d)	(18 · B)/(33 + d)	
HK, BK	(24 · B)/(33 + d)	(36 · B)/(33 + d)	
HN	(30 · B)/(33 + d)	(45 · B)/(33 + d)	

Bearing factors for cylindrical roller bearings, full complement

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
SL1818	3	5	0,00055
SL1829	4	6	
SL1830	5	7	
SL1822	5	8	
SL0148, SL0248	6	9	
SL0149, SL0249	7	11	
SL1923	8	12	
SL1850	9	13	

Bearing factors for cylindrical roller bearings with cage

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
LSL1923	1	3,7	0,00020
ZSL1923	1	3,8	0,00025
2..-E	1,3	2	0,00030
3..-E			0,00035
4			0,00040
10, 19			0,00020
22..-E	2	3	0,00040
23..-E	2,7	4	0,00040
30	1,7	2,5	0,00040

Bearing factors for axial roller bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
AXK, AXW	3	4	0,0015
811, K811	2	3	
812, K812			
893, K893			
894, K894			

Bearing factors for combined bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
ZARN, ZARF	3	4	0,0015
NKXR	2	3	
NX, NKX	2	3	$0{,}001 \cdot (F_a/C_0)^{0,33}$
ZKLN, ZKLF	4	6	
NKIA, NKIB	3	5	0,0005

Bearing factors for tapered roller bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
302, 303, 313	2	3	0,0004
329, 320, 322, 323	3	4,5	
330, 331, 332	4	6	

Bearing factors for axial and radial spherical roller bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
213	2,3	3,5	$0{,}0005 \cdot (P_0/C_0)^{0,33}$
222	2,7	4	
223	3	4,5	$0{,}0008 \cdot (P_0/C_0)^{0,33}$
230, 239			$0{,}00075 \cdot (P_0/C_0)^{0,5}$
231	3,7	5,5	$0{,}0012 \cdot (P_0/C_0)^{0,5}$
232	4	6	$0{,}0016 \cdot (P_0/C_0)^{0,5}$
240	4,3	6,5	$0{,}0012 \cdot (P_0/C_0)^{0,5}$
241	4,7	7	$0{,}0022 \cdot (P_0/C_0)^{0,5}$
292..-E	1,7	2,5	0,00023
293..-E	2	3	0,00030
294..-E	2,2	3,3	0,00033

Bearing factors for deep groove ball bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
618, 618..-2Z, (2RSR)	1,1	1,7	$0{,}0005 \cdot (P_0/C_0)^{0,5}$
160	1,1	1,7	$0{,}0007 \cdot (P_0/C_0)^{0,5}$
60, 60..-2RSR, 60..-2Z, 619, 619..-2Z, (2RSR)	1,1	1,7	
622..-2RSR	1,1	–	$0{,}0009 \cdot (P_0/C_0)^{0,5}$
623..-2RSR	1,1	–	
62, 62..-2RSR, 62..-2Z	1,3	2	
63, 63..-2RSR, 63..-2Z	1,5	2,3	
64	1,5	2,3	
42..-B	2,3	3,5	$0{,}0010 \cdot (P_0/C_0)^{0,5}$
43..-B	4	6	

Bearing factors for angular contact ball bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
70..-B, 70..-B-2RS	1,3	2	$0{,}001 \cdot (P_0/C_0)^{0,33}$
718..-B, 72..-B, 72..-B-2RS			
73..-B, 73..-B-2RS	2	3	
30..-B, 30..-B-2RSR, 30..-B-2Z	2,3	3,5	
32..-B, 32..-B-2RSR, 32..-B-2Z, 32			
38..-B, 38..-B-2RSR, 38..-B-2Z			
33..-B, 33..-B-2RSR, 33, 33..-DA	4	6	

Bearing factors for self-aligning ball bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
12	1	1,5	$0{,}0003 \cdot (P_0/C_0)^{0,4}$
13	1,3	2	
22	1,7	2,5	
23	2	3	

Bearing factors for four point contact bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
QJ2, QJ3	2,7	4	$0{,}001 \cdot (P_0/C_0)^{0,33}$

Bearing factors for axial deep groove ball bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
511, 512, 513, 514, 532, 533	1	1,5	$0{,}0012 \cdot (F_a/C_0)^{0,33}$
522, 523, 524, 542, 543	1,3	2	

Symbols, units and definitions

B mm
Bearing width

C_0 (C_{0r}, C_{0a}) N
Basic static load rating according to dimension tables

d mm
Shaft diameter

P_0 N
Equivalent static bearing load

F_a N
Axial dynamic bearing load

F_r N
Radial dynamic bearing load.

Decisive load for ball bearings, tapered roller bearings and spherical roller bearings

Bearing type	Single bearing P_1	Bearing pair P_1
Deep groove ball bearings	$3,3 \cdot F_a - 0,1 \cdot F_r$	–
Angular contact ball bearings, single row	$F_a - 0,1 \cdot F_r$	$1,4 \cdot F_a - 0,1 \cdot F_r$
Angular contact ball bearings, double row	$1,4 \cdot F_a - 0,1 \cdot F_r$	–
Four point contact bearings	$1,5 \cdot F_a + 3,6 \cdot F_r$	–
Tapered roller bearings	$2 \cdot Y \cdot F_a$ or F_r Use the larger value	$1,21 \cdot Y \cdot F_a$ or F_r Use the larger value
Spherical roller bearings	$1,6 \cdot F_a/e$ if $F_a/F_r > e$ $F_r \{1 + 0,6 \cdot [F_a/(e \cdot F_r)]^3\}$ if $F_a/F_r \leqq e$. In cylindrical roller bearings with additional axial load, M_2 must be added to the frictional torque M_1: $M = M_0 + M_1 + M_2$	

Caution! If $P_1 \leqq F_r$, then $P_1 = F_r$.

Cylindrical roller bearings under axial load

In cylindrical roller bearings under axial load, sliding friction between the end faces of the rolling elements and the ribs on the rings leads to an additional frictional torque M_2.

The total frictional torque is therefore:

$$M_R = M_0 + M_1 + M_2$$

$$M_2 = f_2 \cdot F_a \cdot d_M$$

$$A = k_B \cdot 10^{-3} \cdot d_M^{2,1}$$

M_R Nmm
Total frictional torque

M_0 Nmm
Frictional torque as a function of speed

M_1 Nmm
Frictional torque as a function of radial load

M_2 Nmm
Frictional torque as a function of axial load

f_2 –
Factor as a function of the bearing series, *Figure 3*, page 61

A –
Bearing parameter according to above formula

F_a N
Axial dynamic bearing load

k_B –
Factor as a function of the bearing series, table Bearing factor k_B, page 61

d_M mm
Mean bearing diameter (d + D)/2.

f_2 = bearing factor
F_a = axial dynamic bearing load
A = bearing parameter
ν = operating viscosity
n = operating speed
d_M = mean bearing diameter

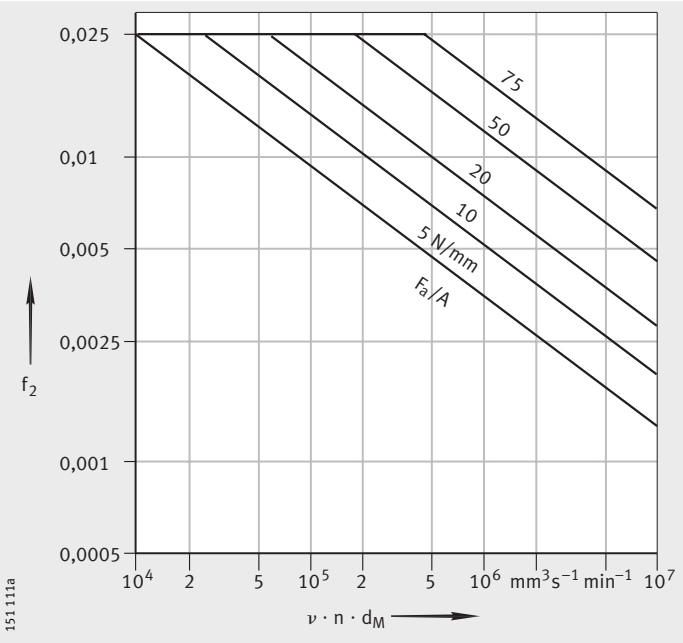


Figure 3
Bearing factor f_2 as a function of operating parameter $\nu \cdot n \cdot d_M$

Caution!

The bearing factors f_2 are subject to wide scatter. The values shown are valid for recirculating oil lubrication with an adequate oil quantity, *Figure 3*.

The curves must not be extrapolated, *Figure 3*.

Bearing factor k_B

Series	k_B
SL1818, SL0148	4,5
SL1829, SL0149	11
SL1830, SL1850	17
SL1822	20
LSL1923, ZSL1923	28
SL1923	30
NJ2..-E, NJ22..-E, NUP2..-E, NUP22..-E	18
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	23

Speeds

On the basis of DIN 732-1, calculation of the thermal reference speed n_B has been standardised in ISO 15312. The calculation of reference speeds was matched to this standard, giving modified values compared to the previous catalogue data.

The symbols used in the formulae have been matched to the international standard.

Thermal reference speed

The thermal reference speed n_B is used as an auxiliary quantity for calculating the thermally safe operating speed n_{per}. This is the speed at which, under defined reference conditions, a bearing operating temperature of +70 °C is achieved.

Reference conditions

The reference conditions are based on the usual operating conditions of the most significant bearing types and sizes.

They are defined as follows in ISO 15 312:

- mean ambient temperature ϑ_{Ar} = +20 °C
- mean bearing temperature at the outer ring ϑ_r = +70 °C
- load on radial bearings: $P_{1r} = 0{,}05 \cdot C_{0r}$
- load on axial bearings: $P_{1a} = 0{,}02 \cdot C_{0a}$
- operating viscosities:
  These are selected for radial bearings such that similar reference speeds are achieved for both oil and grease lubrication
  - radial bearings: 12 mm^2s^{-1} (ISO VG 32)
  - axial bearings: 24 mm^2s^{-1} (ISO VG 68)
- heat dissipation through the bearing seating surfaces in accordance with the following formulae:

for radial bearings, bearing seat $A_r \leqq 50\,000$ mm^2

$$q_r = 0{,}016\ W/mm^2$$

for radial bearings, bearing seat $A_r > 50\,000$ mm^2

$$q_r = 0{,}016 \cdot \left(\frac{A_r}{50000}\right)^{-0{,}34}\ W/mm^2$$

for axial bearings, bearing seat $A_r \leqq 50\,000$ mm^2

$$q_r = 0{,}020\ W/mm^2$$

for axial bearings, bearing seat $A_r > 50\,000$ mm^2

$$q_r = 0{,}020 \cdot \left(\frac{A_r}{50000}\right)^{-0{,}16}\ W/mm^2$$

Limiting speed

The limiting speed n_G is based on practical experience. It takes account of additional criteria such as smooth running, sealing function and centrifugal forces.

Caution! The limiting speed must not be exceeded even under favourable operating and cooling conditions.

Thermally safe operating speed

The thermally safe operating speed n_{per} is calculated according to DIN 732-2 (draft). Calculation is based on the heat balance in the bearing, the equilibrium between frictional energy as a function of speed and heat dissipation as a function of temperature. When equilibrium is present, the bearing temperature is constant.

The permissible operating temperature determines the thermally safe operating speed n_{per} of the bearing. The preconditions for calculation are correct fitting, normal operating clearance and constant operating conditions.

The calculation method is not valid for:

- sealed bearings with contact seals, since the maximum speed is restricted by the permissible sliding speed at the seal lip
- yoke and stud type track rollers
- aligning needle roller bearings
- axial deep groove and axial angular contact ball bearings.

Calculation of the thermally safe operating speed

The thermally safe operating speed n_{per} is the product of the reference speed n_B and the speed ratio f_n:

$$n_{per} = n_B \cdot f_n$$

Caution! The limiting speed must be observed.

The speed ratio is derived from *Figure 1*, page 64:

$$k_L \cdot {f_n}^{5/3} + k_P \cdot f_n = 1$$

In the normal range $0{,}01 < k_L < 10$ and $0{,}01 < k_P < 10$, f_n can be calculated using an approximation formula:

$$f_n = \frac{490{,}77}{1 + 498{,}78 \cdot {k_L}^{0{,}599} + 852{,}88 \cdot {k_P}^{0{,}963} - 504{,}5 \cdot {k_L}^{0{,}055} \cdot {k_P}^{0{,}832}}$$

Heat dissipation via the bearing seating surfaces $\dot{Q}_S$, *Figure 2*, page 64:

$$\dot{Q}_S = k_q \cdot A_r \cdot \Delta\vartheta_A$$

Heat dissipation by the lubricant $\dot{Q}_L$:

$$\dot{Q}_L = 0{,}0286 \frac{kW}{l/min \cdot K} \cdot \dot{V}_L \cdot \Delta\vartheta_L$$

Total dissipated heat flow $\dot{Q}$:

$$\dot{Q} = \dot{Q}_S + \dot{Q}_L + \dot{Q}_E$$

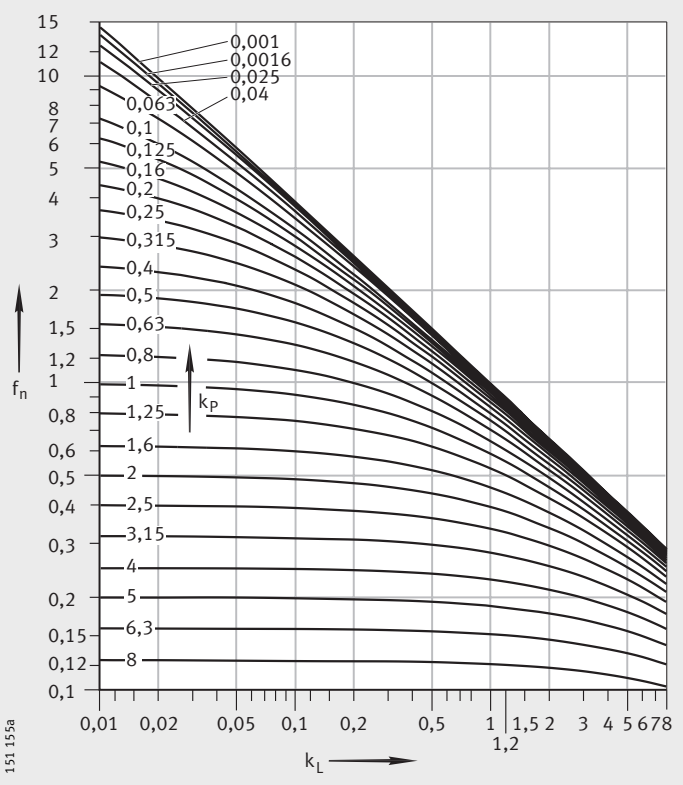
Lubricant film parameter k_L:

$$k_L = 10^{-6} \cdot \frac{\pi}{30} \cdot n_B \cdot \frac{10^{-7} \cdot f_0 \cdot (\nu \cdot n_B)^{\frac{2}{3}} \cdot {d_M}^3}{\dot{Q}}$$

Load parameter k_P:

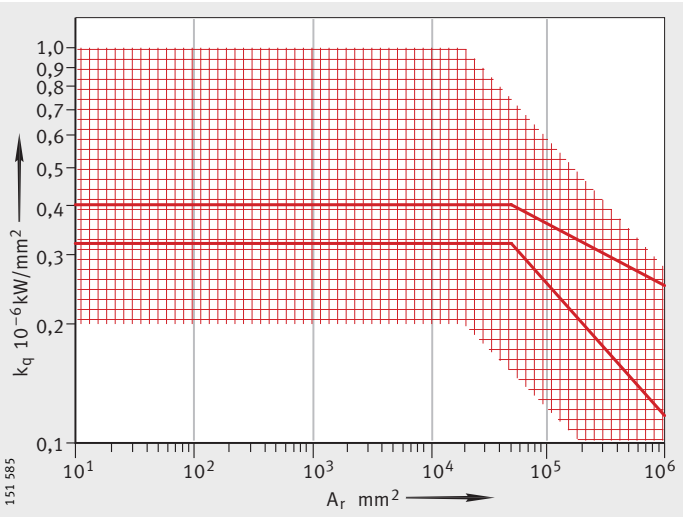
$$k_P = 10^{-6} \cdot \frac{\pi}{30} \cdot n_B \cdot \frac{f_1 \cdot P_1 \cdot d_M}{\dot{Q}}$$

Speeds



f_n = speed ratio
k_L = lubricant film parameter
k_p = load parameter

Figure 1
Speed ratio f_n



k_q = heat transfer coefficient
A_r = bearing seating surface

Figure 2
Heat transfer coefficient k_q as a function of the bearing seating surface A_r

Symbols, units and definitions

A_r	mm^2	
Bearing seating surface for		
radial bearings:		$A_r = \pi \times B \times (D + d)$
axial bearings:		$A_r = \pi/2 \times (D^2 - d^2)$
tapered roller bearings:		$A_r = \pi \times T \times (D + d)$
axial spherical roller bearings:		$A_r = \pi/4 \times (D^2 + {d_1}^2 - {D_1}^2 - d^2)$

Symbols, units and definitions continued

B mm
Bearing width

d mm
Bearing bore

D mm
Bearing outside diameter

d_1 mm
Outside diameter of shaft locating washer

D_1 mm
Inside diameter of housing locating washer

d_M mm
Mean bearing diameter (D + d)/2

f_0 –
Bearing factor for frictional torque as a function of speed
(see section Friction and increases in temperature)

f_1 –
Bearing factor for frictional torque as a function of load
(see section Friction and increases in temperature)

f_n –
Speed ratio, *Figure 1*, page 64

k_L –
Lubricant film parameter

k_P –
Load parameter

k_q 10^{-6} kW/mm^2
Heat transfer coefficient of bearing seating surface, *Figure 2*, page 64.
This is dependent on the housing design, size and material and installation position. Under normal conditions, the heat transfer coefficient for bearing seating surfaces up to 25 000 mm^2 is between 0,2 and 1,0 · 10^{-6} kW/mm^2

P_1 N
Radial load for radial bearings, axial load for axial bearings

n_{per} min^{-1}
Thermally safe operating speed

n_B min^{-1}
Reference speed according to dimension tables

q_r W/mm^2
Heat flow density

$\dot{Q}$ kW
Total dissipated heat flow

$\dot{Q}_E$ kW
Heat flow due to heating by external source

$\dot{Q}_L$ kW
Heat flow dissipated by the lubricant

$\dot{Q}_S$ kW
Heat flow dissipated via the bearing seating surfaces

T mm
Total width of tapered roller bearing

$\dot{V}_L$ l/min
Oil flow

$\Delta\vartheta_A$ K
Difference between mean bearing temperature and ambient temperature

$\Delta\vartheta_L$ K
Difference between oil output temperature and oil input temperature

ν mm^{2}s^{-1}
Kinematic viscosity of lubricant at operating temperature.

Lubrication

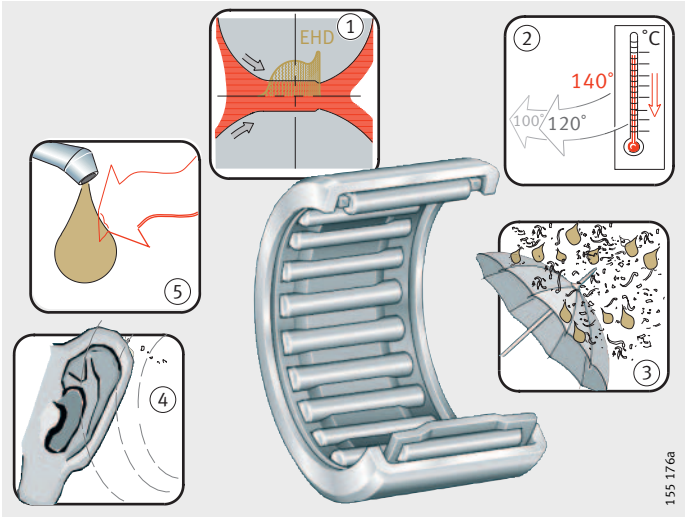
Principles

Lubrication and maintenance are important for the reliable operation and long operating life of rolling bearings.

Functions of the lubricant

The lubricant should, *Figure 1*:

- form a lubricant film on the contact surfaces that is sufficiently capable of supporting loads and thus preventing wear and premature fatigue ①
- dissipate heat in the case of oil lubrication ②
- give additional sealing of the bearing, in the case of grease lubrication, against the entry of both solid and fluid contaminants ③
- reduce the running noise ④
- protect the bearing against corrosion ⑤.



① Formation of a lubricant film capable of supporting loads
② Heat dissipation in the case of oil lubrication
③ Sealing of the bearing against external contaminants in the case of grease lubrication
④ Damping of running noise
⑤ Protection against corrosion

Figure 1
Functions of the lubricant

Selection of the type of lubrication

It should be determined as early as possible in the design process whether bearings should be lubricated using grease or oil.

The following factors are decisive in determining the type of lubrication and quantity of lubricant:

- the operating conditions
- the type and size of the bearing
- the adjacent construction
- the lubricant feed.

Criteria for grease lubrication

In the case of grease lubrication, the following criteria must be considered:

- very little design work required
- sealing action
- reservoir effect
- long operating life with little maintenance work (“for life” lubrication possible in certain circumstances)
- if relubrication is required, it may be necessary to provide collection areas for old grease and feed ducts
- no heat dissipation by the lubricant
- no rinsing out of wear debris and other particles.

Criteria for oil lubrication

In the case of oil lubrication, the following criteria must be considered:

- good lubricant distribution and supply to contact areas
- dissipation of heat possible from the bearing (significant principally at high speeds and/or loads)
- rinsing out of wear debris
- very low friction losses with minimal quantity lubrication
- more work required on feed and sealing.

Under extreme operating conditions (such as very high temperatures, vacuum, aggressive media), it may be possible to use special lubrication methods such as solid lubricants in consultation with the engineering service.

Design of lubricant feed

When designing feed lines and lubrication holes in the housings and shafts, *Figure 2* and *Figure 3*:

- these should lead directly to the lubrication hole in the rolling bearing
- they should be as short as possible
- an individual feed should be provided for each bearing.

Caution!

Ensure that the feeds are filled, *Figure 2*; the feed line should be bled if necessary.

Follow the instructions provided by the lubrication device manufacturer.

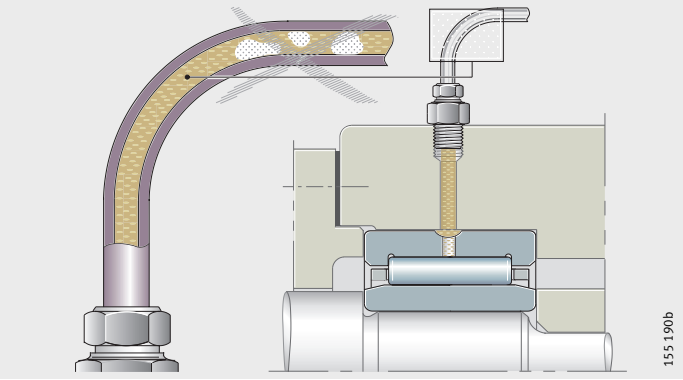


Figure 2
Lubricant feed

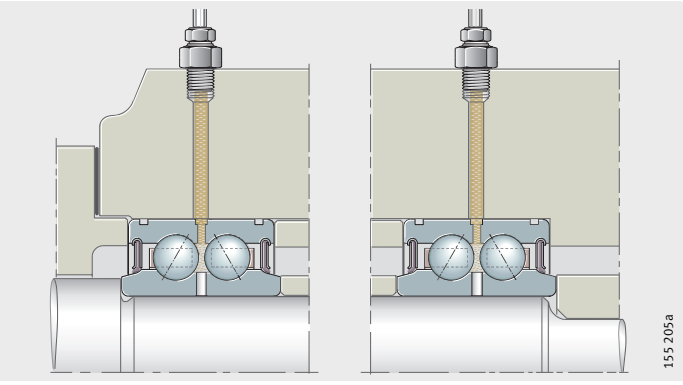


Figure 3
Arrangement of feed to more than one bearing on a shaft

Lubrication

Grease lubrication

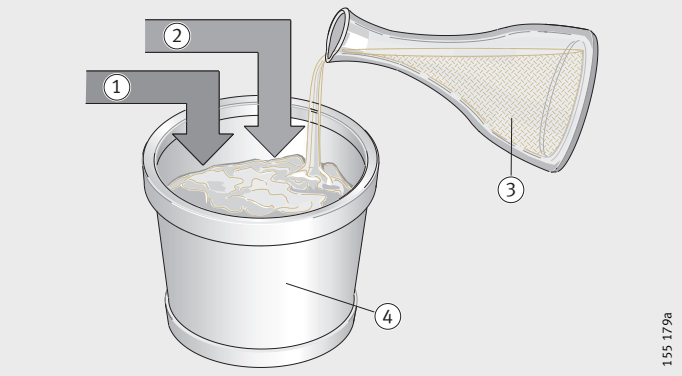
Greases can be differentiated in terms of their thickeners and base oils. The base oils of greases are covered by the information in the section “Oil lubrication”, page 83.

Composition of a grease

Conventional greases have metal soaps as thickeners and a mineral base oil.

They also contain additives. These have a specific influence on, for example, the characteristics in relation to wear prevention, corrosion prevention or resistance to ageing. These combinations of additives are not, however, fully effective across every temperature and load range.

Greases exhibit widely varying behaviour in response to environmental influences such as temperature and moisture.



① Thickener
② Additives
③ Base oil
④ Grease

Figure 4
Type of grease

Caution! Lubricants should be checked for their compatibility with:

- other lubricants
- anti-corrosion agents
- thermoplastics, thermosets and elastomers
- light and non-ferrous metals
- coatings
- colouring agents and paints
- the environment.
  When considering compatibility with the environment, attention must be paid to toxicity, biodegradability and water pollution class.

Type of grease

The characteristics of a grease are dependent on:

- the base oil
- the viscosity of the base oil
  (this is important for the speed range)
- the thickener
  (the shear strength is significant for the speed range)
- the additives.

Consistency of greases

Greases are subdivided into consistency classes – NLGI classes– (DIN 51 818). For rolling bearings, classes 1, 2 or 3 should be used in preference, *Figure 5*.

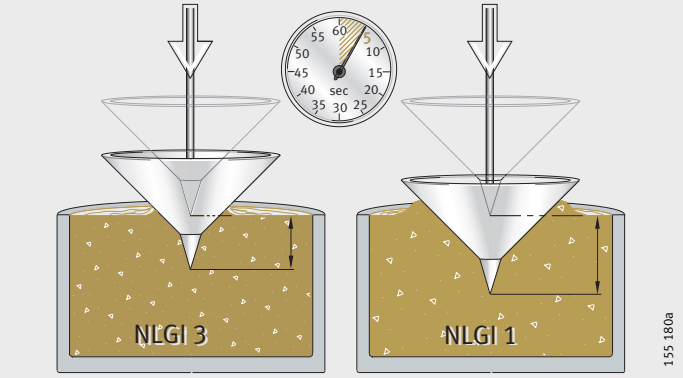


Figure 5
Consistency of greases

Selection of suitable grease

Rolling bearing greases K to DIN 51 825 are suitable.

Suitable greases should be selected in accordance with the operating conditions of the bearing:

- temperature
- compressive load
- speed
- the presence of water/moisture.

Operating temperature range

The operating temperature range of the grease must correspond to the range of possible operating temperatures in the rolling bearing.

Grease manufacturers indicate an operating temperature range for their rolling bearing greases K in accordance with DIN 51 825.

The upper value is determined in accordance with DIN 51 821 by means of testing using the FAG rolling bearing grease test rig FE 9. At the upper operating temperature, a 50% failure probability (F_{50}) of at least 100 hours must be achieved in this test.

The lower value is defined in accordance with DIN 51 825 by means of flow pressure. The flow pressure of a grease is the pressure required to press a stream of grease through a defined nozzle.

For greases of type K, the flow pressure at the lower operating temperature must be less than 1 400 mbar.

The use of flow pressure in determining the lower operating temperature only indicates, however, whether the grease can be moved at this temperature. This cannot be used to give an indication of its suitability for use in rolling bearings at low temperatures.

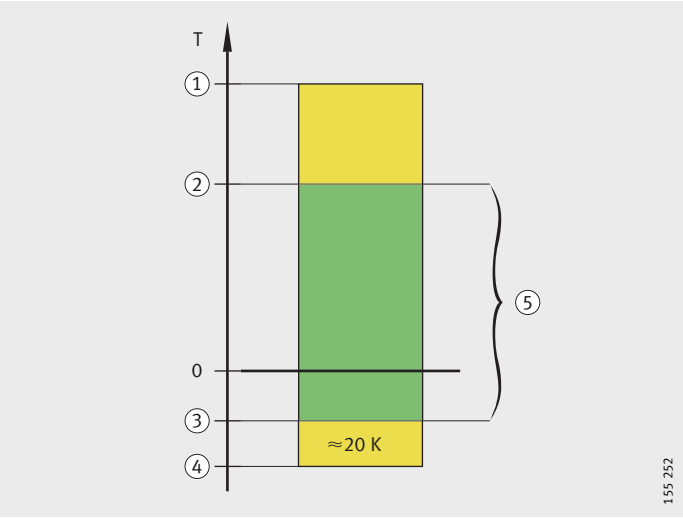
In addition to the lower operating temperature of a grease, therefore, the low temperature frictional torque is also determined in accordance with ASTM D 1478 or IP 186/93. At the lower operating temperature, the starting torque must not exceed 1000 Nmm and the running torque must not exceed 100 Nmm.

Schaeffler Group Industrial recommends that greases should be used in accordance with the bearing temperature normally occurring in the standard operating range in order to achieve a reliable lubricating action and an acceptable grease operating life, *Figure 6*.

At low temperatures, greases release very little base oil. This can result in lubricant starvation. Schaeffler Group Industrial therefore recommends that greases are not used below the lower continuous limit temperature $T_{lowerlimit}$, *Figure 6*. This is approx. 20 K above the lower operating temperature of the grease as indicated by the grease manufacturer.

The upper continuous limit temperature $T_{upperlimit}$ must not be exceeded if a reduction in the grease operating life due to temperature is to be avoided. See the section Grease operating life, page 74.

Caution! At consistently low temperatures (for example in cold store applications), it must be ensured that the grease releases sufficient oil in relation to the bearing type.



① Upper operating temperature according to grease manufacturer
② $T_{upperlimit}$
③ $T_{lowerlimit}$
④ Lower operating temperature according to grease manufacturer
⑤ Standard operating range

Figure 6
Operating temperature range

Pressure properties

The viscosity at operating temperature must be sufficiently high for the formation of a lubricant film capable of supporting loads.

At high loads, greases with EP characteristics – “extreme pressure” – and high base oil viscosity should be used (KP grease to DIN 51 825). Such greases should also be used for bearings with substantial sliding or line contact.

Silicone greases should only be used at low loads (P ≦ 3% C).

Caution! Greases with solid lubricants should preferably be used for applications with mixed or boundary friction conditions.

The solid lubricant particle size must not exceed 5 µm.

Speed

Grease should be selected in accordance with the speed parameter $n \cdot d_M$ for grease (see table, page 72 and page 73):

- For rolling bearings running at high speeds or with a low starting torque, greases with a high speed parameter should be used.
- For bearings running at low speeds, greases with a low speed parameter should be used.

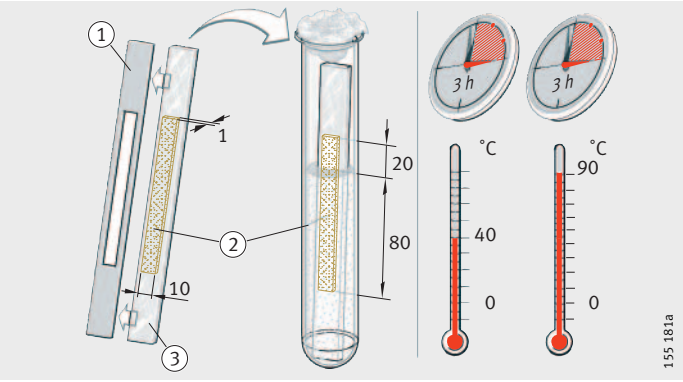
Under centrifugal acceleration greater than 500 g, separation (of the thickener and base oil) may occur. In this case, please consult the lubricant manufacturer.

Caution! The consistency of polycarbamide greases can be altered by shear stresses to a greater extent than that of metal soap greases.

Water/moisture

Water in the grease has a highly detrimental effect on the operating life of the bearing:

- the static behaviour of greases in the presence of water is assessed in accordance with DIN 51 807, see *Figure 7*
- the anti-corrosion characteristics can be tested according to DIN 51 802 (Emcor test) – information is given in the grease manufacturer’s data sheets.



① Blank
② Grease specimen
③ Glass slide

Figure 7
Behaviour in the presence of water in accordance with DIN 51 807

Lubrication

Greases with special suitability

Schaeffler Group Industrial uses greases in accordance with the table Greases. These have proved particularly suitable for the applications in mechanical-dynamic tests.

Greases

Desig-nation	Classification	Type of grease
GA01	Ball bearing grease for T < +180 °C	Polycarbamide Ester oil
GA02	Ball bearing grease for T < +160 °C	Polycarbamide SHC
GA13	Standard ball bearing/ insert bearing grease for D > 62 mm	Lithium soap Mineral oil
GA14	Low-noise ball bearing grease for D ≦62 mm	Lithium soap Mineral oil
GA15	Low-noise ball bearing grease for high speeds	Lithium soap Ester oil
GA22	Free-running grease with low frictional torque	Lithium soap Ester oil
L014	Initial greasing for insert bearings for low temperatures	Gel Ester oil
L086	Initial greasing for insert bearings for wide temperature range and low loads	Sodium complex soap Silicone oil
GA08	Grease for line contact	Lithium complex soap Mineral oil
GA26	Standard grease for drawn cup roller clutches	Calcium/ lithium soap Mineral oil
GA28	Screw drive bearing grease	Lithium soap Ester oil
GA11	Rolling bearing grease resistant to media for temperatures up to +250 °C	PTFE Alkoxyfluoroether
GA47	Rolling bearing grease resistant to media for temperatures up to +140 °C	Barium complex soap Mineral oil

1) The upper continuous limit temperature $T_{upperlimit}$ must not be exceeded if a reduction in the grease operating life due to temperature is to be avoided.

2) Dependent on bearing type.

3) Operating temperature range determined not according to DIN 51 825 but to MIL specification.

Operating temperature range °C	Upper continuous limit temperature $T_{upperlimit}$ [1] °C	NLGI class	Speed parameter $n \cdot d_M$ $min^{-1} \cdot mm$	ISO VG class (base oil) [2]	Designation
−40 to +180	+115	2 to 3	600 000	68 to 220	**GA01**
−40 to +160	+85	2 to 3	500 000	68 to 220	**GA02**
−30 to +140	+75	3	500 000	68 to 150	**GA13**
−30 to +140	+75	2	500 000	68 to 150	**GA14**
−50 to +150	+70	2 to 3	1 000 000	22 to 32	**GA15**
−50 to +120	+70	2	1 000 000	10 to 22	**GA22**
−54 to +204 [3]	+80	1 to 2	900 000	22 to 46	**L014**
−40 to +180	+115	3	150 000	68 to 150	**L086**
−30 to +140	+95	2 to 3	500 000	150 to 320	**GA08**
−20 to +80	+60	2	500 000	10 to 22	**GA26**
−30 to +160	+110	2	600 000	15 to 100	**GA28**
−40 to +250	+180	2	300 000	460 to 680	**GA11**
−20 to +140	+70	1 to 2	350 000	150 to 320	**GA47**

Lubrication

Grease operating life

The grease operating life t_{fG} is the decisive value if it is less than the calculated bearing life. It applies if rolling bearings cannot be relubricated.

A guide value for the grease operating life t_{fG} can be determined in approximate terms.

$$t_{fG} = t_f \cdot K_T \cdot K_P \cdot K_R \cdot K_U \cdot K_S$$

t_{fG} h
Guide value for grease operating life

t_f h
Basic grease operating life

K_T, K_P, K_R, K_U, K_S –
Correction factors for temperature, load, oscillation, environment, vertical shaft, page 77 to page 80.

Caution! If a grease operating life > 3 years is required, this should be discussed with the lubricant manufacturer.

Basic grease operating life

The basic grease operating life t_f is valid under the following preconditions, see table:

Preconditions for basic grease operating life t_f

	Precondition
Bearing temperature	< Upper continuous limit temperature $T_{upperlimit}$
Load ratio	$C_0/P = 20$
Speed and load	Constant
Load in main direction	Radial bearings – radial, axial bearings – axial
Axis of rotation	Horizontal for radial bearings
Inner ring	Rotating
Environmental influences	No disruptive influences

Bearing-specific speed parameter $k_f \cdot n \cdot d_M$

The basic grease operating life t_f is dependent on the bearing-specific speed parameter $k_f \cdot n \cdot d_M$.

k_f –
Factor for bearing type, table Factor k_f, page 75

n min^{-1}
Operating speed or equivalent speed

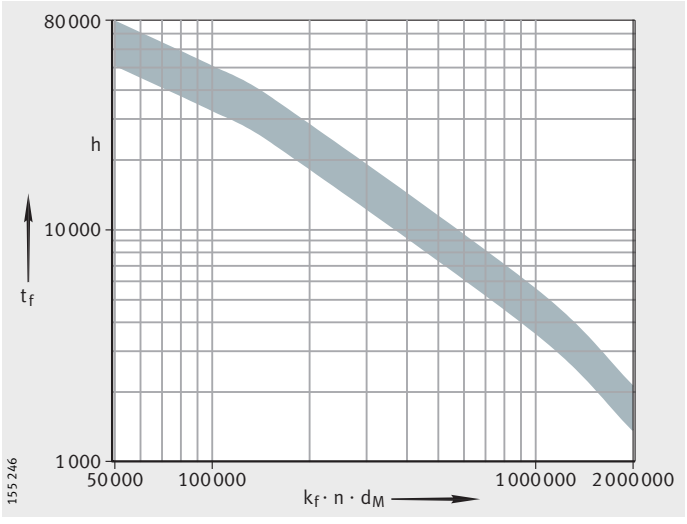
d_M mm
Mean bearing diameter (d + D)/2.

Factor k_f – as a function of bearing type

Bearing type	Factor k_f
Deep groove ball bearings, single row	1
Deep groove ball bearings, double row	1,5
Angular contact ball bearings, single row	1,6
Angular contact ball bearings, double row	2
Four point contact bearings	1,6
Self-aligning ball bearings	1,45
Axial deep groove ball bearings	5,5
Axial angular contact ball bearings, double row	1,4
Cylindrical roller bearings, single row, with constant axial load	3,25
Cylindrical roller bearings, single row, with alternating axial load	2
Cylindrical roller bearings, double row	3,5
Cylindrical roller bearings, full complement	5,3
Tapered roller bearings	4
Barrel roller bearings	10
Spherical roller bearings without central rib	8
Spherical roller bearings with central rib	10,5
Needle roller and cage assemblies, needle roller bearings	3,6
Drawn cup needle roller bearings	4,2
Yoke and stud type track rollers, with cage or full complement cylindrical roller set	15,5
Yoke and stud type track rollers with full complement needle roller set	30
Yoke type track rollers, single row	1
Yoke type track rollers, double row	2
Yoke type track rollers PWTR, stud type track rollers PWKR	3,2
Cylindrical roller bearings LSL, ZSL	3,1
Crossed roller bearings	4,4
Axial needle roller bearings, axial cylindrical roller bearings	58
Radial insert ball bearings, housed bearing units	1

Calculation of basic grease operating life t_f

Calculation of the bearing-specific speed parameter $k_f \cdot n \cdot d_M$ and basic grease operating life t_f from *Figure 8*.



t_f = basic grease operating life
$k_f \cdot n \cdot d_M$ = speed parameter

Figure 8
Calculation of basic grease operating life t_f

Lubrication

Guidelines on calculating the grease operating life

Combined rolling bearings

Caution! The radial and axial bearing components must be calculated separately – the decisive value is the shorter grease operating life.

Rotating outer ring

If the outer ring rotates, there may be a reduction in the grease operating life.

In the case of yoke and stud type track rollers:

- angular misalignment must be zero
- the effect of the rotating outer ring on the grease operating life is taken into consideration in the bearing type factor k_f.

Restrictions

Caution! The grease operating life cannot be determined using the above method:

- if the grease can flow out of the rolling bearing
  - there is excessive evaporation of the base oil
  - in bearings without seals
  - in axial bearings with a horizontal axis of rotation
- if air is sucked into the rolling bearing during operation
  - this can cause the grease to oxidise
- in combined rotary and linear motion
  - the grease is distributed over the whole stroke length
- if contamination, water or other fluids enter the bearings
- for spindle bearings
- for drawn cup roller clutches
- for screw drive bearings
- for high precision bearings for combined loads.

The additional guidelines on lubrication in the product sections must be observed.

Correction factors for determining the grease operating life

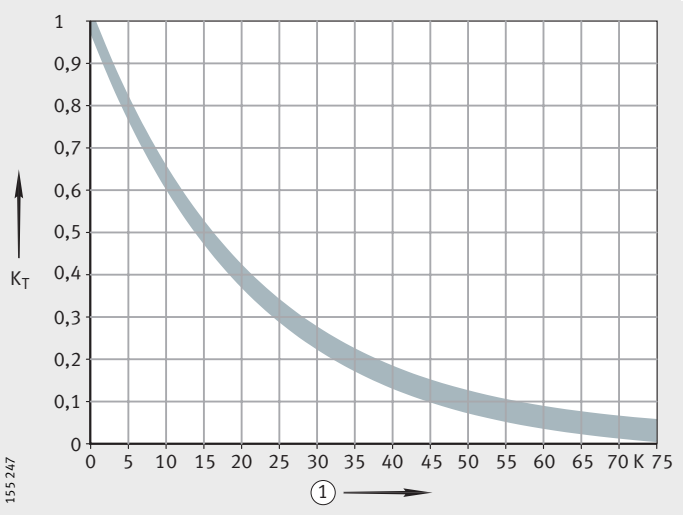
Temperature factor K_T

If the bearing temperature is higher than the continuous limit temperature $T_{upperlimit}$, K_T must be calculated from the diagram, *Figure 9*.

Caution!

The diagram should not be used if the bearing temperature is higher than the upper operating temperature of the grease used, see table Greases, page 72.

If necessary, select a different grease and/or consult the engineering service.



K_T = temperature factor
① K above $T_{upperlimit}$

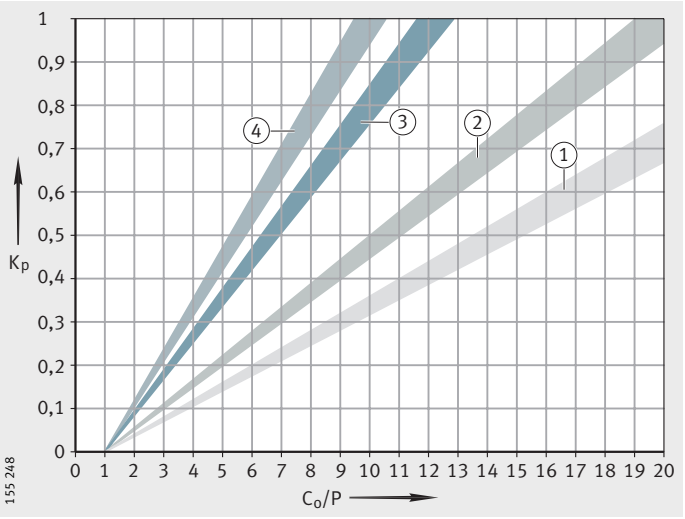
Figure 9
Temperature factor K_T

Lubrication

Load factor K_P

The load factor reflects the reduction due to higher load, as a function of the bearing type. This places greater strain on the grease, *Figure 10*.

This is based on high-quality lithium soap greases.



①, ②, ③, ④ See table K_P factor
C_0/P = ratio between basic static load rating and equivalent dynamic bearing load

Figure 10
K_P factor for bearings

K_P factor

Curve[1)]	Application
①	Axial angular contact ball bearings, double row
	Axial deep groove ball bearings
	Axial needle roller bearings, axial cylindrical roller bearings
	Crossed roller bearings
②	Spherical roller bearings with central rib
	Needle roller and cage assemblies, needle roller bearings
	Drawn cup needle roller bearings
	Cylindrical roller bearings, double row
③	Yoke type track rollers PWTR, stud type track rollers PWKR
	Cylindrical roller bearings LSL, ZSL
	Yoke and stud type track rollers, with cage or full complement cylindrical roller set
	Yoke and stud type track rollers with full complement needle roller set
	Tapered roller bearings
	Spherical roller bearings without central rib (E1)
	Barrel roller bearings
	Cylindrical roller bearings, full complement
	Cylindrical roller bearings, single row (constant/alternating load)
	Four point contact bearings
④	Deep groove ball bearings (single/double row)
	Angular contact ball bearings (single/double row)
	Self-aligning ball bearings
	Yoke type track rollers (single/double row)
	Radial insert ball bearings, housed bearing units

1) Curves: see *Figure 10*.

Oscillation factor K_R

Oscillating motion places a greater strain on the grease than does rotating motion.

Caution!

In order to reduce fretting corrosion, the lubrication interval should be reduced.

If the rolling elements do not undergo a complete revolution, please consult the engineering service.

The factor K_R applies for an angle of oscillation φ of $< 180°$, *Figure 11* and *Figure 12*.

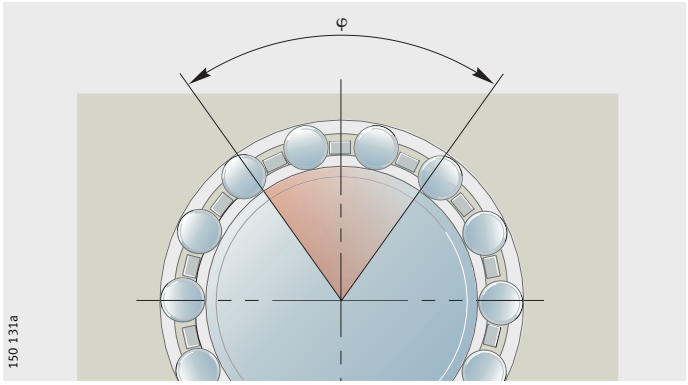
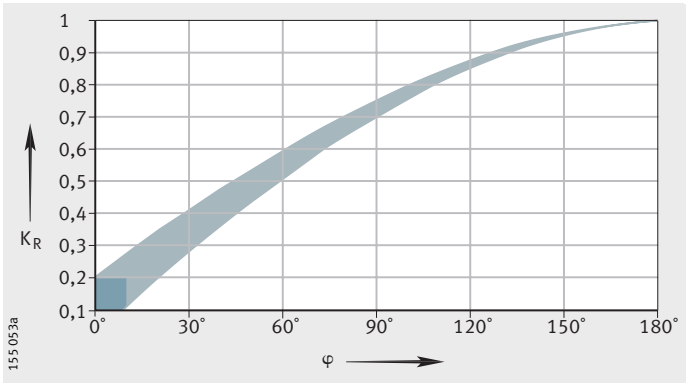


Figure 11
Angle of oscillation φ



K_R = oscillation factor
φ = angle of oscillation

Figure 12
Oscillation factor K_R

Environmental factor K_U

The environmental factor K_U takes account of the influences of moisture, shaking forces, slight vibration (leading to fretting corrosion) and shocks, see table Environmental factor K_U.

Caution!

The environmental factor K_U does not take account of extreme environmental influences such as water, aggressive media, contamination, radiation and extreme vibrations such as those occurring in vibratory machines.

In relation to contamination, attention should also be paid to the section Influence of contamination on life calculation.

Environmental factor K_U

Environmental influence	Environmental factor K_U
Slight	1
Moderate	0,8
Severe	0,5

Factor K_S for vertical shafts

If increased escape of grease is expected, for example in radial bearings with a vertical axis of rotation, the factor according to the table Factor K_S for vertical shafts must be applied.

Factor K_S for vertical shafts

Vertical shaft	Factor K_S
Vertical shaft (depending on sealing)	0,5 to 0,7
Otherwise	1

Relubrication intervals

For rolling bearings that are relubricated, attention must be paid to the lubrication interval in order to ensure reliable function of the bearings.

Caution!

The precise lubrication interval should be determined by tests conducted under application conditions:

- sufficiently long observation periods must be used
- the condition of the grease must be checked at regular intervals.

In most applications, experience has shown that the guide value is:

$$t_{fR} = 0{,}5 \cdot t_{fG}$$

t_{fR} h
Guide value for relubrication interval

t_{fG} h
Guide value for grease operating life.

Conditions

The grease should be the same as that used for initial greasing.

If different greases are used, their miscibility and compatibility should be checked.

Relubrication should be carried out:

- with the bearing still warm from operation and rotating if safe to do so
- before the bearing comes to rest if safe to do so
- before extended breaks in operation.

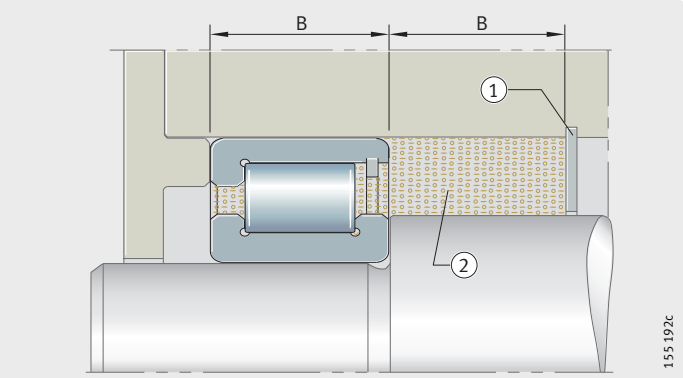
Relubrication quantity

Due to the compact construction of INA/FAG bearings, we recommend that relubrication should be carried out using 50% to 80% of the initial greasing quantity.

If feed lines filled with air are present, the filling volume of the feed lines should be included in calculation of the relubrication quantity.

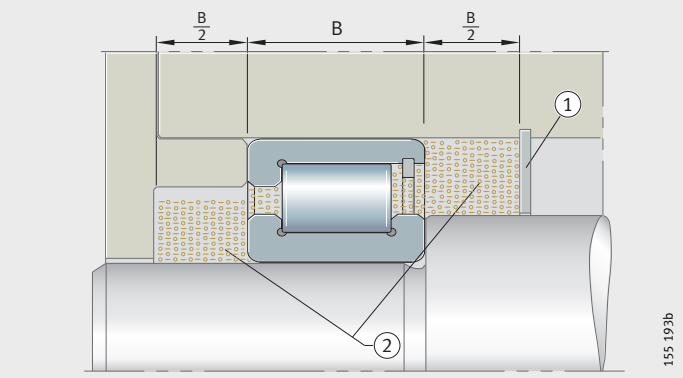
Relubrication

Regreasing should continue until a fresh collar of grease appears at the seal gaps. Old grease must be able to leave the bearing unhindered.



① Sealing shield
② Grease reservoir

Figure 13
Grease reservoir on one side



① Sealing shield
② Grease reservoir

Figure 14
Grease reservoir on both sides

The initial greasing quantity is between 30% and 100% of the available volume in the bearing, dependent on the bearing type and operating conditions.

A grease reservoir can extend the grease operating life. The grease in the reservoir must be in constant contact with the grease on the raceway. The grease operating life does not increase proportionally with the size of the grease reservoir.

The volume of the grease reservoir should correspond to the area in the bearing between the inner and outer ring (not taking account of the cage and rolling elements), *Figure 13* and *Figure 14*.

Evaporation of the base oil should be prevented by design measures, for example by sealing shields, *Figure 13* and *Figure 14*.

Lubrication

Miscibility

Mixing of greases should be avoided if at all possible.

If mixing of greases is unavoidable, the following preconditions must be fulfilled:

- same base oil
- compatible thickener types
- similar base oil viscosities – differing by no more than one ISO VG class
- same consistency – NLGI class.

Caution! Consult the grease manufacturer.

Even if these preconditions are fulfilled, impairment of the performance capability of the mixed grease cannot be ruled out.

If a conscious decision is taken to change to a different grease grade, the grease should be rinsed out if this is permitted by the design of the mounting location. Further relubrication should be carried out after a shortened period.

Caution! If incompatible greases are mixed this may lead to substantial structural changes and even to a substantial softening of the mixed grease.

Definite statements on miscibility can only be obtained by means of suitable tests.

Storage

Experience shows that the greases used can be stored for up to 3 years.

The preconditions are:

- a closed room or store
- temperatures between 0 °C and + 40 °C
- relative humidity no more than 65%
- no influence of chemical agents – vapours, gases, fluids
- the bearings are sealed.

Caution! Lubricants age due to environmental influences. The information provided by the lubricant manufacturer should be adhered to.

After long periods of storage, the start-up frictional torque of greased bearings can be temporarily higher than normal. The lubricity of the grease may also have deteriorated.

Since the lubrication characteristics of greases vary and different raw materials may be used for greases of the same name as a result of globalisation, we cannot offer any guarantees either for the lubricants used by customers for relubrication or for their characteristics in operation.

Oil lubrication

For the lubrication of rolling bearings, mineral oils and synthetic oils are essentially suitable. Oils with a mineral oil base are used most frequently. They must fulfil at least the requirements according to DIN 51 517 or DIN 51 524.
Special oils, often synthetic oils, are used under extreme operating conditions or where there are special requirements relating to oil resistance.

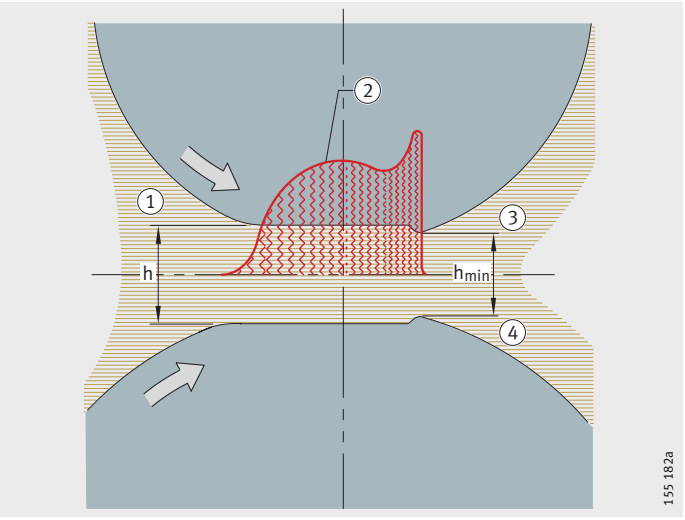
Caution! In thes cases, please consult the lubricant manufacturer or our engineering service.

Operating temperatures

Caution! The information provided by the lubricant manufacturer should be taken as authoritative.

Selection of suitable oil

The achievable life and security against wear are higher with better separation of the contact surfaces by a lubricant film, *Figure 15* and section Load carrying capacity and life.



① Entry zone
② Pressure curve according to EHD theory
③ Exit zone
④ Lubricant

Figure 15
Lubricant film in the contact zones – schematic

Lubrication

Reference viscosity for mineral oils

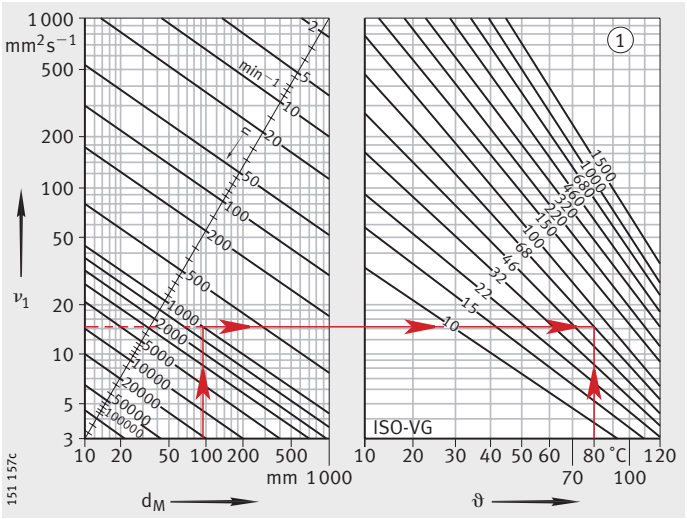
The guide value for ν_1 is dependent on:

- the mean bearing diameter d_M and the speed n.

The guide value ν_1 takes account of:

- the EHD theory on the formation of a lubricant film
- practical experience.

Depending on the operating speed, the oil at operating temperature must have at least the reference viscosity ν_1, *Figure 16*.



n = operating speed
ν_1 = reference viscosity
d_M = mean bearing diameter (d + D)/2
ϑ = operating temperature
① Viscosity mm^2s^{-1} at +40 °C

Figure 16
Reference viscosity and V/T diagram for mineral oils

Calculation of reference viscosity

Calculate the reference viscosity ν_1 in accordance with the example, *Figure 16*:

- Assign ν_1 to a nominal viscosity with ISO VG between 10 and 1 500
  - centre point viscosity to DIN 51 519
- Round intermediate values should be rounded to the nearest ISO VG
  - due to the steps between the groups.

Caution! This method cannot be used for synthetic oils, since these have different viscosity/pressure and viscosity/temperature characteristics.

Please consult our engineering service.

Influence of temperature on viscosity

As the temperature increases, the viscosity of the oil decreases. This temperature-dependent change in the viscosity is described using the viscosity index VI. For mineral oils, this VI should be at least 95.

Caution! When selecting the viscosity, the lower operating temperature must be taken into consideration:

- increasing viscosity restricts the flow behaviour of the lubricant and leads to increased power losses.

Very long life can be achieved with a viscosity ratio $\kappa = \nu/\nu_1 = 3$ to 4 (ν = operating viscosity). Highly viscous oils do not, however, bring only advantages. In addition to the aforementioned power losses due to lubrication friction, there may be problems with the feed and removal of oil at low or even at normal temperatures.

The oil must therefore be selected to be sufficiently viscous that the longest possible fatigue life is achieved while ensuring satisfactory supply of oil to the bearings at all times.

Pressure properties of oil

If the bearings are subjected to high loads or the operating viscosity ν is less than the reference viscosity ν_1, oils with anti-wear additives (type P to DIN 51 502) should be used.

Such oils are also necessary for types of rolling bearings with a substantial proportion of sliding contact (for example bearings with line contact).

These additives form boundary layers to reduce the harmful effects of metallic contact occurring at various areas (wear).

The suitability of these additives varies and is normally heavily dependent on temperature. Their effectiveness can only be assessed by means of testing in the rolling bearing (for example on our test rig FE8 in accordance with DIN 51 819).

Caution! Silicone oils should only be used for low loads (P ≦ 3% C).

Compatibility

Caution! Before oils are used, their behaviour must be checked in relation to plastics, seal materials (elastomers) and light and non-ferrous metals.

This must be checked under dynamic conditions and at operating temperature.

Synthetic oils must always be checked for their compatibility and the lubricant manufacturer must be consulted.

Miscibility

Mixing of different oils should be avoided wherever possible. In particular, the presence of different additive packages may lead to undesirable interactions.

In general, oils with a mineral oil base and the same classification are miscible, for example two oils both of type HLP can be mixed.

The viscosities should vary by no more than one ISO VG class.

Caution! Synthetic oils must always be checked for their compatibility and the lubricant manufacturer must be consulted.

Miscibility must be checked in advance for each individual case.

Lubrication

Cleanliness

The cleanliness of the oil influences the rating life of bearings, see section Expanded adjusted rating life.

Recommendation:

- An oil filter should be provided and attention should be paid to the filtration rate (recommended filter mesh $< 25\ \mu m$).

Lubrication methods

A distinction can essentially be drawn between the following methods:

- drip feed oil lubrication
- pneumatic oil lubrication
  - in order to protect the environment, this should be used as a substitute for oil mist lubrication
- oil bath lubrication
  - splash or sump lubrication
- recirculating oil lubrication.

Drip feed oil lubrication

This method is suitable for bearings running at high speeds, *Figure 17*.

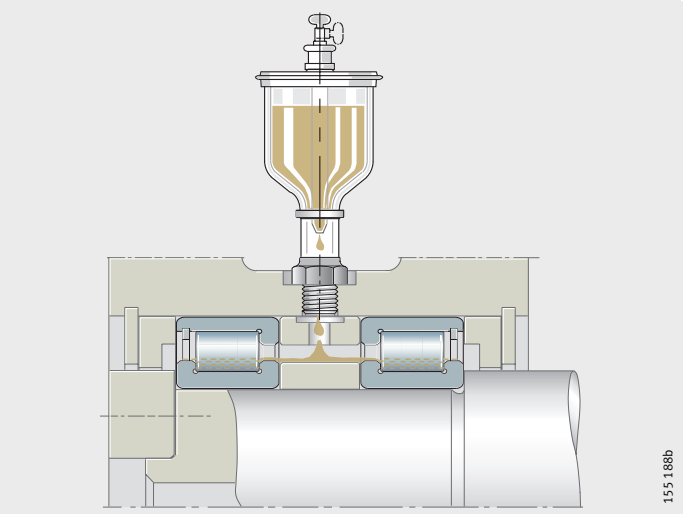


Figure 17
Drip feed lubrication – schematic

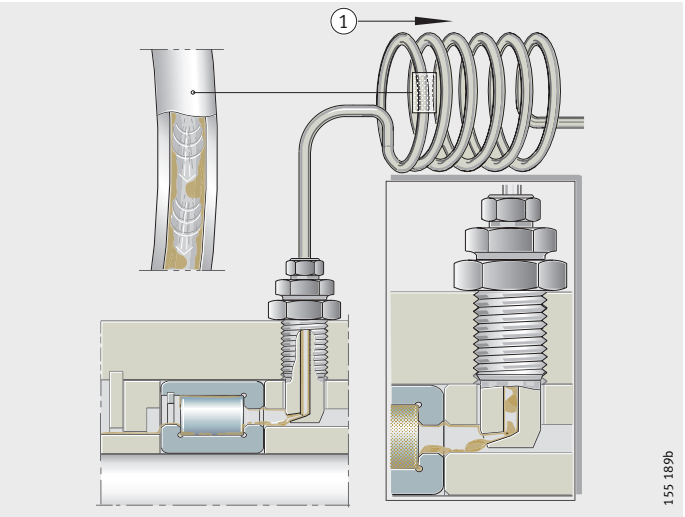
The oil quantity required is dependent on the type and size of bearing, the operating speed and the load.

The guide value is between 3 drops/min and 50 drops/min for each rolling element raceway (one drop weighs approx. 0,025 g).

Caution! Excess oil must be allowed to flow out of the bearing arrangement.

Pneumatic oil lubrication

This method is particularly suitable for radial bearings running at high speeds and under low loads ($n \cdot d_M = 800\,000$ to $3\,000\,000\ min^{-1} \cdot mm$). Parameters for designing the equipment should be requested from the lubrication device manufacturer, *Figure 18*.



① To the pneumatic oil unit

Figure 18
Pneumatic oil lubrication – schematic

With a pneumatic oil lubrication system designed for minimal quantity lubrication, low frictional torque and a low operating temperature can be achieved.

Clean compressed air free from moisture feeds oil to the bearing. This generates an excess pressure. This prevents contaminants from entering the bearing.

Pneumatic oil lubrication has little cooling effect.

Caution! Pneumatic oil lubrication of axial bearings should be avoided if possible.

The oil quantity required for adequate supply is dependent on the bearing type.

Follow the instructions provided by the lubrication device manufacturer.

Lubrication

Oil bath lubrication

The oil level should reach the centre line of the lowest rolling element, *Figure 19*. If the oil level is higher than this, the bearing temperature may increase at high circumferential speeds and losses due to splashing may occur. Furthermore, foaming of the oil may occur.

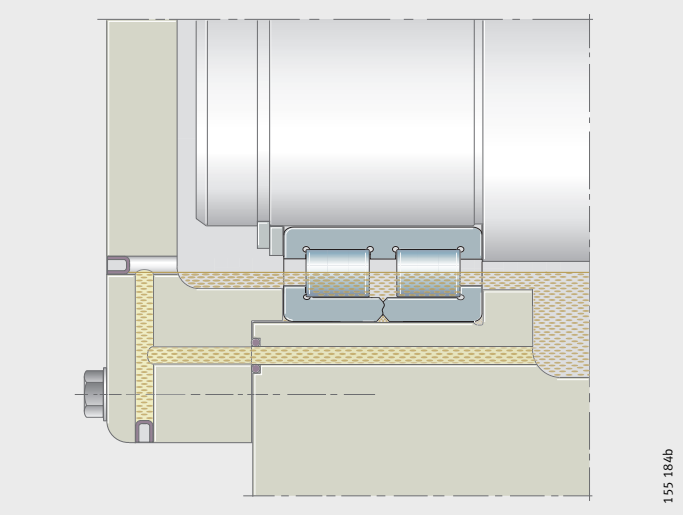


Figure 19
Oil bath lubrication – schematic

In general, the method is suitable up to $n \cdot d_M = 300\,000\ min^{-1} \cdot mm$.

At $n \cdot d_M < 150\,000\ min^{-1} \cdot mm$, the bearing may be fully immersed.

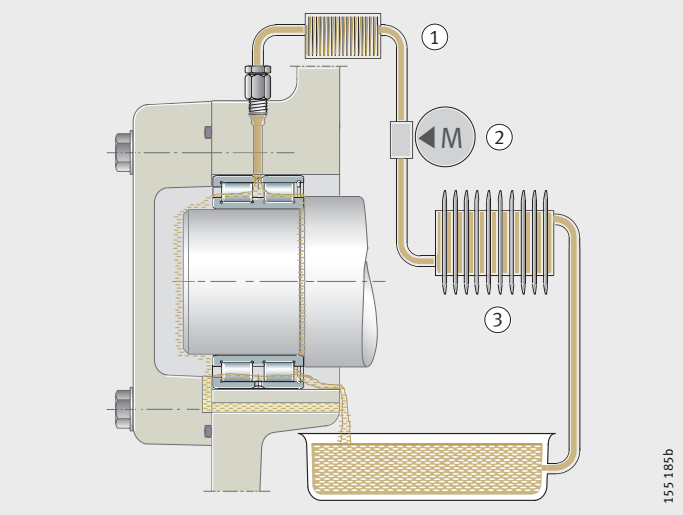
In bearings with an asymmetrical cross-section, oil return ducts must be provided due to the pumping effect so that recirculation can be achieved.

In axial bearings, the oil level must cover the inside diameter of the axial cage.

The oil quantity in the housing must be adequately proportioned, otherwise very short oil change intervals will be necessary.

Recirculating oil lubrication

In recirculating oil lubrication, the oil is subjected to additional cooling, *Figure 20*. The oil can therefore dissipate heat from the bearing. The quantity of oil required for heat dissipation is dependent on the cooling conditions, see section Speeds.

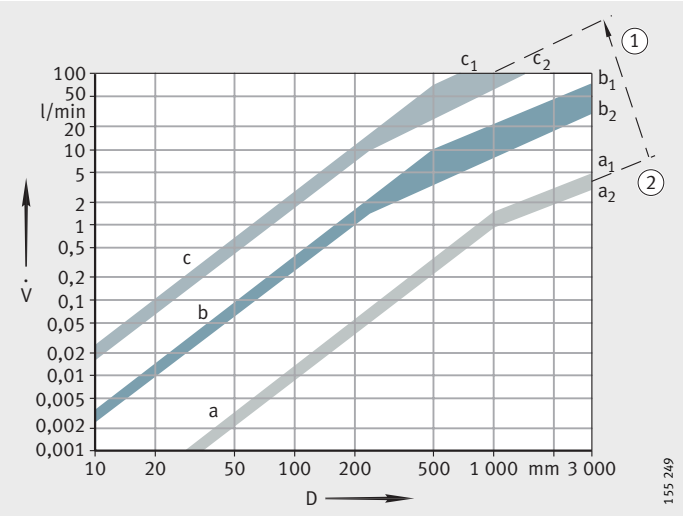


① Filter
② Pump
③ Cooling system

Figure 20
Recirculating oil lubrication – schematic

The oil quantities $\dot{V}$ are matched to the operating conditions, *Figure 21*. The diagram indicates oil quantities that can be fed through the bearing without pressure with a side feed arrangement and banking up to the lower edge of the shaft.

For bearings with an asymmetrical cross-section (such as angular contact ball bearings, tapered roller bearings, axial spherical roller bearings), larger throughput quantities are permissible due to the pumping effect than for bearings with a symmetrical cross-section. Large quantities can be used to dissipate wear debris or heat.



D = outside bearing diameter
$\dot{V}$ = oil quantity
① Increasing oil quantity required for heat dissipation
② No heat dissipation necessary
a = oil quantity sufficient for lubrication
b = upper limit for bearings of symmetrical design
c = upper limit for bearings of asymmetrical design
a_1; b_1; c_1: $D/d > 1,5$
a_2; b_2; c_2: $D/d \leqq 1,5$

Figure 21
Oil quantities

Lubrication

Design of adjacent construction for oil lubrication

The lubrication holes in the housing and shaft must align with those in the rolling bearings.

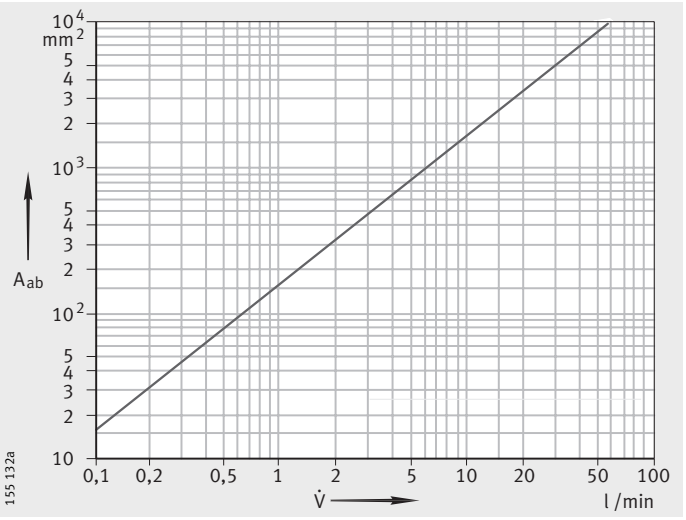
Adequate cross-sections must be provided for annular slots, pockets, etc.

The oil must be able to flow out without pressure (this prevents oil build-up and additional heating of the oil).

In axial bearings, the oil must always be fed from the inside to the outside.

Outlet cross-section – guide values for oil lubrication

The cross-section of the oil outlet hole should be significantly larger than that of the inlet, *Figure 22*.



A_{ab} = cross-section for pressure-free oil runout
$\dot{V}$ = oil quantity

Figure 22
Outlet cross-sections – guide values

The cross-section A_{rab} is dependent on the oil quantity and the viscosity.

$$A_{rab} = K_{ab} \cdot A_{ab}$$

A_{rab} mm^2
Outlet cross-section taking account of viscosity
K_{ab} –
Correction factor for viscosity, see table Correction factor K_{ab}
A_{ab} mm^2
Outlet cross-section, *Figure 22*.

Correction factor K_{ab}

Viscosity $mm^2 \cdot s^{-1}$	Correction factor K_{ab}
up to 30	1
30 to 60	1,2 to 1,6
60 to 90	1,8 to 2,2
90 to 120	2,4 to 2,8
120 to 150	3 to 3,4

Oil injection lubrication

In bearings running at high speeds, the oil is injected into the gap between the cage and bearing ring. Injection lubrication using large recirculation quantities is associated with high power loss, *Figure 23*.

Heating of the bearings can only be held within limits with a considerable amount of effort. The appropriate upper limit for the speed parameter $n \cdot d_M = 1\,000\,000\ min^{-1} \cdot mm$ for recirculating lubrication with suitable bearings (for example spindle bearings) can be exceeded to a considerable degree when using injection lubrication.

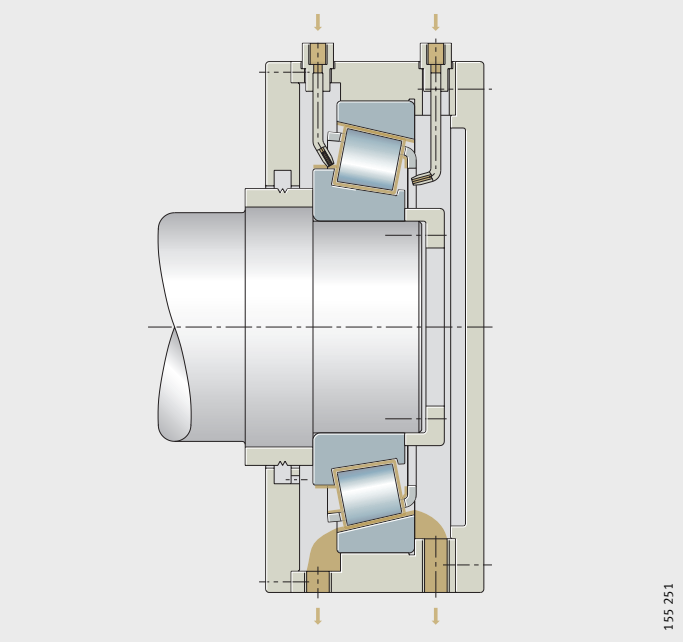


Figure 23

Oil injection lubrication – oil feed from both sides for tapered roller bearing running at high speeds

Lubrication

Heat dissipation by the lubricant

Oil can dissipate frictional heat from the bearing.
The following can be calculated:

- the heat flow $\dot{Q}_L$ dissipated by the lubricant, see section Speeds
- the required lubricant volume flow $\dot{V}_L$.

Heat flow

$$\dot{Q} = 10^{-6} \cdot \frac{\pi}{30} \cdot n \cdot (M_0 + M_1) + \dot{Q}_E$$

$$\dot{Q}_L = \dot{Q} - \dot{Q}_S$$

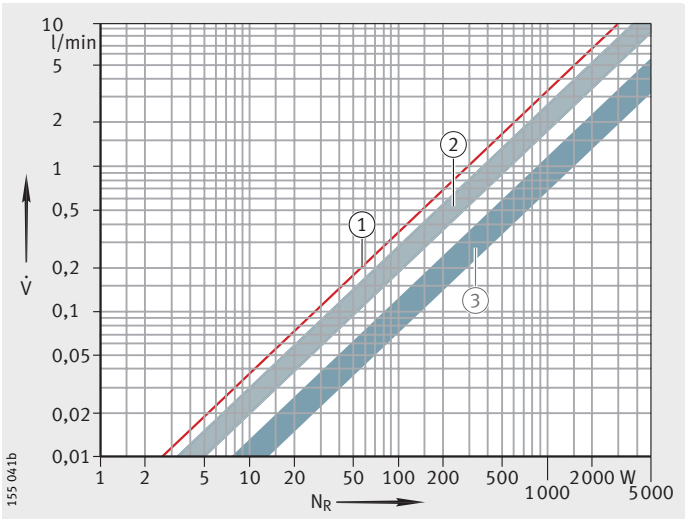
Approximate calculation

$$\dot{V}_L = \frac{\dot{Q}_L}{0{,}0286 \cdot \Delta\vartheta_L}$$

$\dot{Q}_L$ kW
Heat flow dissipated by the lubricant
$\dot{Q}$ kW
Total dissipated heat flow
$\dot{Q}_S$ kW
Heat flow dissipated via the bearing seating surfaces
$\dot{Q}_E$ kW
Heat flow due to heating by external source
n min^{-1}
Operating speed or equivalent speed
M_0 Nmm
Frictional torque as a function of speed
M_1 Nmm
Frictional torque as a function of load
$\dot{V}_L$ l/min
Lubricant volume flow
$\Delta\vartheta_L$ K
Difference between oil outlet and oil inlet temperature.

Guide values for the oil quantity in cooling and lubrication

If these values cannot be calculated, the guide values in accordance with *Figure 24* are valid for a temperature difference of $\Delta\vartheta_L$ = 10 K.



$\dot{V}$ = oil quantity
N_R = frictional energy
① No account is taken of thermal conduction, radiation or convection
② Empirical values for normal cooling conditions
③ Empirical values for very good cooling conditions

Figure 24
Guide values for the oil quantity in lubrication/cooling

Oil changes

In general, an annual oil change is sufficient for temperatures in the bearing of less than +50 °C and low levels of contamination.

Severe operating conditions

Under severe conditions, the oil should be changed more frequently.

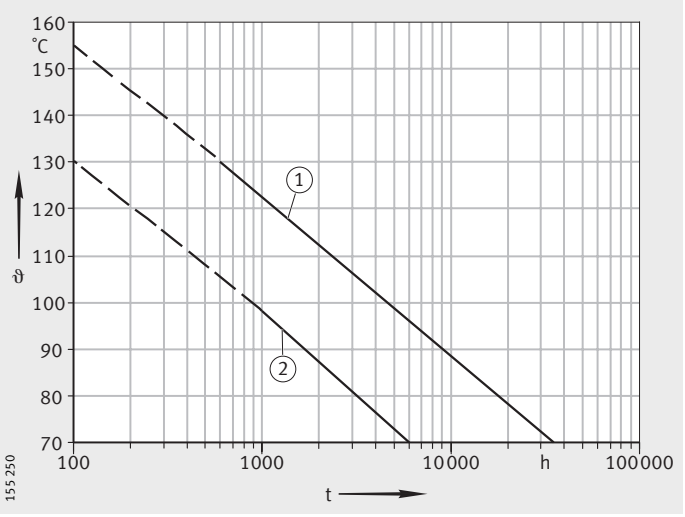
This applies, for example, in the case of higher temperatures and low oil quantities with high recirculation frequencies.

The recirculation frequency indicates how often the entire oil volume available is recirculated and pumped per hour:

$$\text{Circulation index} = \frac{\text{Pump displacement}\left[\text{m}^3/\text{h}\right]}{\text{Container volume}\left[\text{m}^3\right]}$$

Caution! The precise oil change intervals should be determined with the assistance of the oil manufacturer.

Guide values for oil change intervals are given in *Figure 25*.



t = oil change interval
ϑ = oil sump temperature
① Synthetic gearbox oils
② Mineral gearbox oils
Source: FVA Project No. 171

Figure 25
Oil change intervals

Lubrication

Arcanol – rolling bearing greases

In co-operation with renowned lubricant manufacturers, Schaeffler Group Industrial has developed lubricating greases that are particularly suitable for rolling bearings. The greases in the Arcanol range are tested on the lubricant test rigs FE8 (DIN 51 819) and FE9 (DIN 51 821) in rolling bearings in relation to life, friction, wear and temperature suitability.

Every grease batch in the Arcanol range is subjected to goods inward inspection in order to ensure consistent quality.

The greases in the range are arranged in grades in terms of their performance capability such that almost all areas of application are covered, see table Arcanol rolling bearing greases.

Arcanol rolling bearing greases

Arcanol grease	Designation to DIN 51 825	Classification	Type of grease
MULTI2	K2N–30	Low-noise ball bearing grease for D ≦ 62 mm	Lithium soap Mineral oil
MULTI3	K3N–30	Standard ball bearing/insert bearing grease for D > 62 mm	Lithium soap Mineral oil
SPEED2,6	KE3K–50	Spindle bearing grease Standard	Polycarbamide PAO + ester oil
MULTITOP	KP2N–40	Universal high performance grease	Lithium soap Mineral oil + ester oil[1)]
TEMP90	KP2P–40	Low-noise rolling bearing grease, up to +160 °C	Calcium soap + polycarbamide, PAO[1)]
TEMP110	KE2P–40	Universal grease for higher temperatures	Lithium complex soap, ester oil
TEMP120	KPHC2R–30	Grease for high temperatures and high loads	Polycarbamide PAO + ester oil[1)]
TEMP200	KFK2U–40	Rolling bearing grease for T >+150 °C to +250 °C	PTFE Alkoxyfluoroether
LOAD220	KP2N–20	Heavy duty grease, wide speed range	Lithium-calcium soap[1)] Mineral oil
LOAD400	KP2N–20	Grease for high loads, shocks	Lithium-calcium soap[1)] Mineral oil
LOAD1000	KP2N–20	Grease for high loads, shocks, large bearings	Lithium-calcium soap[1)] Mineral oil
FOOD2	KPF2K–30	Grease with foodstuffs approval	Aluminium complex soap White oil
VIB3	KP3N–30	Grease for oscillating motion	Lithium complex soap Mineral oil
BIO2	KPE2K–30	Grease with rapid biodegradability	Lithium-calcium soap[1)] Ester oil

[1)] With EP additives.

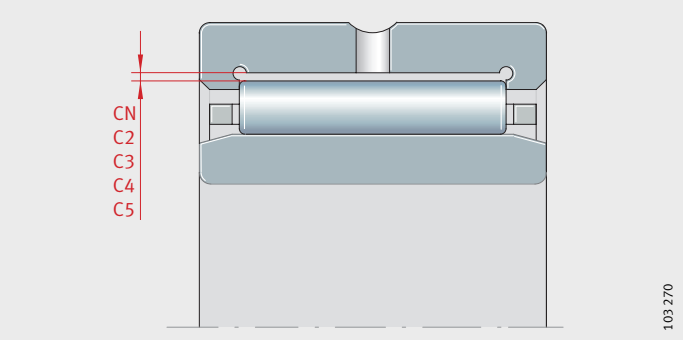
Operating temperature range °C	Upper continuous limit temperature $T_{upperlimit}$ °C	NLGI class	Speed parameter $n \cdot d_M$ $min^{-1} \cdot mm$	Kinematic viscosity	
				at +40 °C mm^2/s	at +100 °C
−30 to +140	+75	2	500 000	100	10
−30 to +140	+75	3	500 000	80	8
−50 to +120	+80	2/3	2 000 000	22	5
−40 to +150	+80	2	800 000	85	12,5
−40 to +160	+90	2	500 000	130	15,5
−40 to +160	+110	2	600 000	150	19,8
−35 to +180	+120	2	300 000	460	40
−40 to +260	+200	2	300 000	400	35
−20 to +140	+80	2	500 000	220	16
−25 to +140	+80	2	400 000	400	28
−20 to +140	+80	2	300 000	1 000	42
−30 to +120	+70	2	500 000	192	17,5
−30 to +150	+90	3	350 000	170	13,5
−30 to +120	+80	2	300 000	58	10

Bearing data

Radial internal clearance

The radial internal clearance applies to bearings with an inner ring before the bearing is fitted. It is defined as the amount by which the inner ring can be moved in a radial direction from one extreme position to the other in relation to the outer ring, *Figure 1*.

The radial internal clearance is subdivided into groups according to DIN 620 and ISO 5 753, see table Radial internal clearance groups. The values for the radial internal clearance are given in DIN 620-4, ISO 5 753 and in the Features section of the product description.



CN, C2, C3, C4, C5
Internal clearance groups

Figure 1
Radial internal clearance

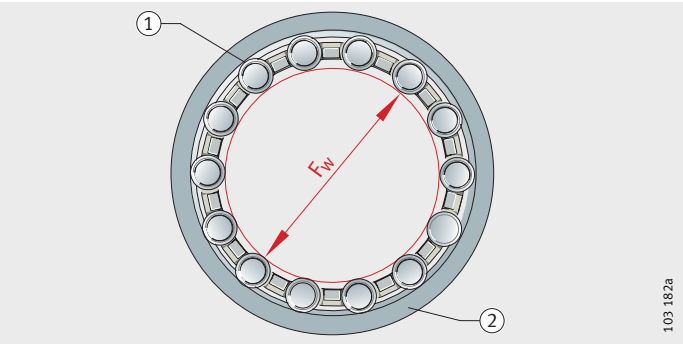
Radial internal clearance groups

Internal clearance group[1)]	Description	Standard	Application
CN	Normal CN is not included in bearing designations	DIN 620-4 ISO 5 753	Normal operating conditions, shaft and housing tolerances as shown in Operating clearance and Design of bearing arrangements
C2	Smaller than CN		High alternating loads combined with oscillating motion
C3	Larger than CN		Bearing rings with press fits and large temperature differential between inner and outer ring
C4	Larger than C3		
C5	Larger than C4	ISO 5 753	

1) Internal clearance group values: see also product sections.

Enveloping circle

In bearings without inner ring, the enveloping circle value F_w is used. This is the inner inscribed circle of the needle rollers in clearance-free contact with the outer raceway, *Figure 2*. For unfitted bearings, it is in tolerance zone F6 (except for drawn cup needle roller bearings).



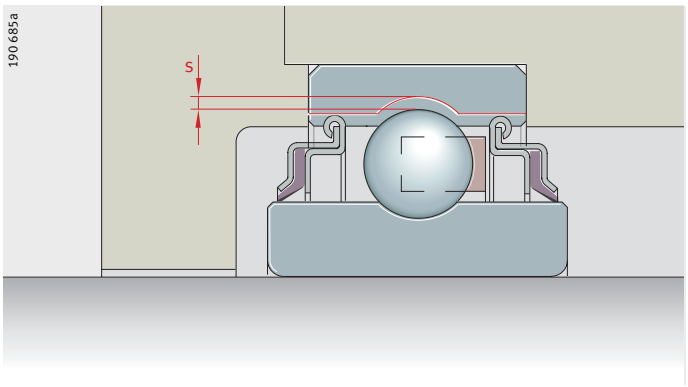
① Needle roller
② Outer raceway

Figure 2
Enveloping circle F_w

Operating clearance

The operating clearance is determined on a fitted bearing still warm from operation. It is defined as the amount by which the shaft can be moved in a radial direction from one extreme position to the other, *Figure 3*.

The operating clearance is derived from the radial internal clearance and the change in the radial internal clearance as a result of interference fit and thermal influences in the fitted condition.



s = operating clearance

Figure 3
Operating clearance

Operating clearance value

The operating clearance value is dependent on the operating and installation conditions of the bearing.

A larger operating clearance is necessary, for example, if heat is transferred via the shaft, the shaft undergoes deflection or if misalignment occurs.

An operating clearance smaller than CN should only be used in special cases, for example in high precision bearing arrangements.

The normal operating clearance is achieved with internal clearance CN or, in larger bearings, predominantly with C3 if the recommended shaft and housing tolerances are fulfilled, see section Design of bearing arrangements, page 125.

Caution! Please observe the design guidelines in the section Design of bearing arrangements.

Calculation of operating clearance

The operating clearance is derived from:

$$s = s_r - \Delta s_P - \Delta s_T$$

s µm
Radial operating clearance of fitted bearing warm from operation

s_r µm
Radial internal clearance

Δs_P µm
Reduction in radial internal clearance due to fit

Δs_T µm
Reduction in radial internal clearance due to temperature.

Bearing data

Reduction in radial internal clearance due to fit

The radial internal clearance is reduced due to the fit as a result of expansion of the inner ring and contraction of the outer ring:

$$\Delta s_P = \Delta d + \Delta D$$

Δd μm
Expansion of the inner ring
ΔD μm
Contraction of the outer ring.

Expansion of the inner ring

The expansion of the inner ring is calculated as follows:

$$\Delta d \approx 0{,}9 \cdot U \cdot d/F \approx 0{,}8 \cdot U$$

d mm
Bore diameter of the inner ring
U μm
Theoretical interference of the fitted parts with firm seating
The theoretical interference is determined from:
the mean deviations and the upper and lower deviations of the tolerance zones of the fitted parts reduced by $^1/_3$ of their acceptable value. This must be reduced by the amount by which parts are smoothed during fitting
F mm
Raceway diameter of the inner ring.

Caution! For very thin-walled housings and light metal housings, the reduction in the radial internal clearance must be determined by mounting trials.

Contraction of the outer ring

The expansion of the inner ring is calculated as follows:

$$\Delta D \approx 0{,}8 \cdot U \cdot E/D \approx 0{,}7 \cdot U$$

E mm
Raceway diameter of the outer ring
D mm
Outside diameter of the outer ring.

Reduction in the radial internal clearance due to temperature

The radial internal clearance can alter considerably if there is a substantial temperature differential between the inner and outer ring.

$$\Delta s_T = \alpha \cdot d_M \cdot 1000 \cdot (\vartheta_{IR} - \vartheta_{AR})$$

Δs_T μm
Reduction in the radial internal clearance due to temperature
α K^{-1}
Coefficient of thermal expansion of steel: $\alpha = 0{,}000011\ K^{-1}$
d_M mm
Mean bearing diameter (d + D)/2
ϑ_{IR} °C, K
Temperature of the inner ring
ϑ_{AR} °C, K
Temperature of the outer ring.

Caution! A larger radial internal clearance should be used for shafts running at high speeds, since adequate thermal compensation between the bearing, shaft and housing does not occur in this situation.

Δs_T can, in this case, be significantly higher in this case than for continuous operation.

Bearing materials

INA and FAG rolling bearings fulfil the requirements for fatigue strength, wear resistance, hardness, toughness and structural stability.

The material used for the rings and rolling elements is generally a low alloy, through hardening chromium steel of high purity. For bearings subjected to considerable shock loads and reversed bending stresses, case hardening steel is also used (supplied by agreement).

In recent years, the improved quality of rolling bearing steels has been the principal factor in achieving considerable increases in basic load ratings.

The results of research as well as practical experience confirm that bearings made from the steel currently used as standard can achieve their endurance limit if loads are not excessively high and the lubrication and cleanliness conditions are favourable.

High Nitrogen Steel

Through the use of special bearings made from HNS (High Nitrogen Steel, supplied by agreement), it is possible to achieve adequate service life even under the most challenging conditions (high temperatures, moisture, contamination).

Ceramic materials

Ceramic hybrid spindle bearings contain balls made from silicon nitride. These ceramic balls are substantially lighter than steel balls. The centrifugal forces and friction are significantly lower.

Hybrid bearings allow very high speeds – even with grease lubrication – as well as long operating life and low operating temperatures.

Materials and bearing components

Material	Bearing component – example
Through hardening chromium steel – rolling bearing steel to ISO 683-17	Outer and inner ring, axial washer
HNS – High Nitrogen Steel	Outer and inner ring
Corrosion-resistant steel – rolling bearing steel to ISO 683-17	Outer and inner ring
Case hardening steel	e.g. outer ring of yoke type track rollers
Flame or induction hardening steel	Stud of stud type track rollers
Steel strip to EN 10139, SAE J403	Outer ring of drawn cup needle roller bearings
Silicon nitride	Ceramic balls
Brass alloy	Cage
Aluminium alloy	Cage
Polyamide – thermoplastic	Cage
NBR, FPM, PUR	Sealing ring

Bearing data

Cages

The most important functions of the cage are:

- to separate the rolling elements from each other in order to minimise friction and heat generation
- to maintain the rolling elements at the same distance from each other in order to ensure uniform load distribution
- to prevent the rolling elements from falling out in bearings that can be dismantled or swivelled out
- to guide the rolling elements in the load zone of the bearing.

Rolling bearing cages are subdivided into sheet metal and solid section cages.

Sheet metal cages

These cages are predominantly made from steel and for some bearings from brass, *Figure 4*. In comparison with solid section cages made from metal, they are of lower mass.

Since a sheet metal cage only fills a small proportion of the gap between the inner and outer ring, lubricant can easily reach the interior of the bearing and is held on the cage.

In general, a sheet steel cage is only included in the bearing designation if it is not defined as a standard version of the bearing.

Solid section cages

These cages are made from metal, laminated fabric or plastic, *Figure 5*. They can be identified from the bearing designation.

Solid section cages made from metal or laminated fabric

Solid section cages made from metal are used where there are requirements for high cage strength and at high temperatures.

Solid section cages are also used if the cage must be guided on ribs. Rib-guided cages for bearings running at high speeds are made in many cases from light materials such as light metal or laminated fabric in order to achieve low inertia forces.

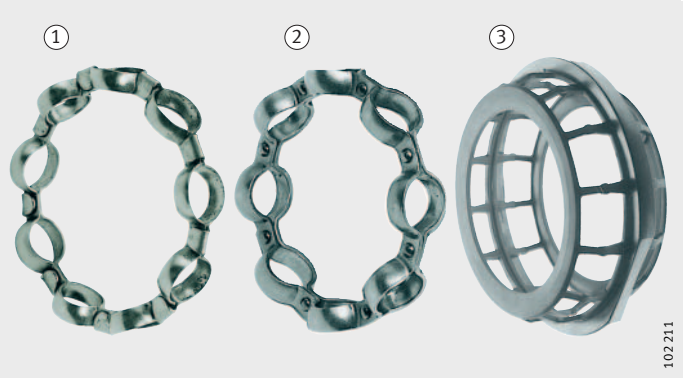
Solid section cages made from polyamide PA66

Solid section cages made from polyamide 66 are produced using injection moulding, *Figure 6*. Cage types can thus generally be realised that allow designs with particularly high load carrying capacity. The elasticity and low mass of polyamide are favourable under shock type bearing loads, high accelerations and decelerations und tilting of the bearing rings in relation to each other. Polyamide cages have very good sliding and emergency running characteristics.

Cages made from glass fibre reinforced polyamide 66 are suitable for long term temperatures up to +120 °C.

Caution! When using oil lubrication, additives in the oil can impair the cage operating life. The interrelationship between the cage operating life, the long term temperature of the stationary bearing ring and the lubricant is shown in *Figure 7*, page 102. Aged oil can also impair the cage operating life at high temperatures, so attention must be paid to compliance with the oil change intervals.

Cage designs – examples



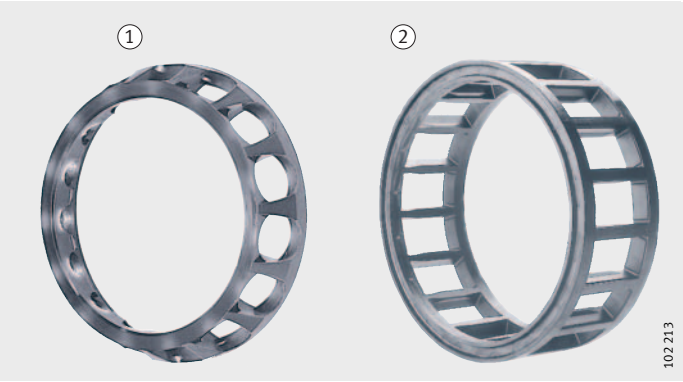
① Lug cage and
② Riveted cage for deep groove ball bearings
③ Window cage for spherical roller bearings

Figure 4
Sheet steel cages



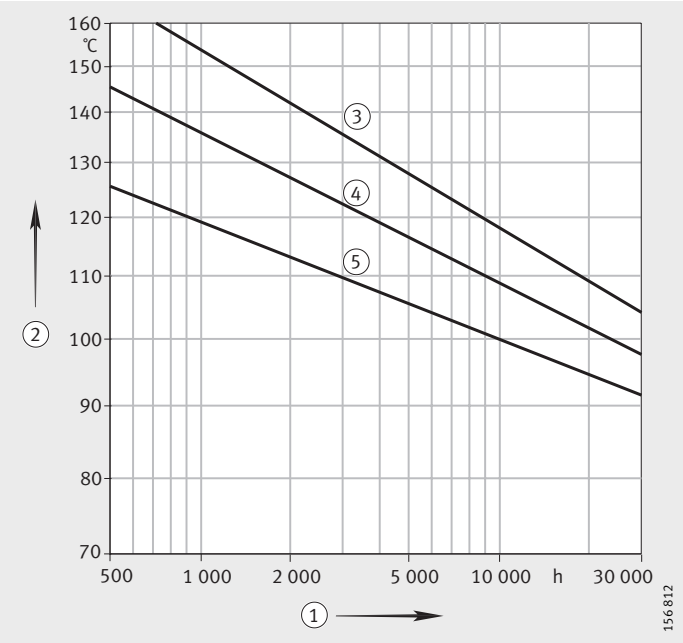
① Riveted solid section cage for deep groove ball bearings
② Window cage for angular contact ball bearings
③ Riveted cage with crosspiece rivets for cylindrical roller bearings

Figure 5
Solid section brass cages



① Window cage for single row angular contact ball bearings
② Window cage for cylindrical roller bearings

Figure 6
Solid section cages made from glass fibre reinforced polyamide



① Operating life of window cages
② The curves are valid for the long term temperature of the stationary bearing ring
If the high temperature does not act continuously, the cage operating life is longer.
③ Rolling bearing grease K to DIN 51 825, engine oil or machine oil
④ Gearbox oil
⑤ Hypoid oil

Figure 7
Operating life of window cages made from polyamide PA66-GF25

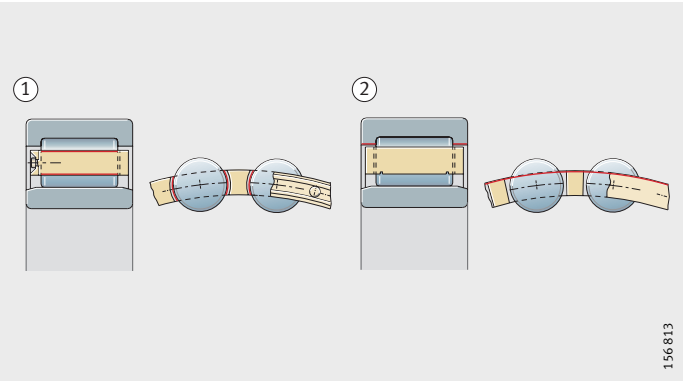
Guidance method

A further means of distinguishing between cages is their guidance method, *Figure 8*. Most cages are guided by the rolling elements and do not have a suffix for the guidance method.

If guidance is by the bearing outer ring, the suffix A is used. Cages that are guided on the inner ring have the suffix B.

Under normal operating conditions, the cage design defined as the standard cage is generally suitable. Standard cages that may differ within a bearing series according to the bearing size are described in the product sections.

Under special operating conditions, a cage that is suitable for the specific conditions must be selected.



Rolling bearing cages
① Guided by rolling elements
② Guided by ribs

Figure 8
Guidance of cages

Operating temperature

Rolling bearings are thermally stabilised such that, depending on the bearing type, they are generally dimensionally stable up to +120 °C or +150 °C.

Operating temperatures above +150 °C require special heat treatment. Bearings treated in this way are available by agreement and are identified by the suffix S1 ... S4 (DIN 623-1).

Temperature range and corresponding suffixes:
see table Bearings for high temperatures.

Caution! The temperature data in the product sections must be observed.

Bearings for high temperatures – suffixes

Suffix	S1	S2	S3	S4
Max. operating temperature	+200 °C	+250 °C	+300 °C	+350 °C

Track rollers

An operating temperature of +70 °C is regarded as a normal operating temperature. Further temperature data in the product descriptions must be observed.

Sealed bearings

The permissible temperature for sealed bearings is dependent on the requirements for the operating life of the grease filling and on the action of the contact seals.

Sealed bearings are greased with specially tested, high performance, high quality greases. These greases can withstand +120 °C for short periods. At long term temperatures of +70 °C and above, a reduction in the operating life of standard greases with a lithium soap base must be expected.

In many cases, adequate operating life values are only achieved at high temperatures through the use of special greases. In these cases, it must also be checked whether seals made from especially heat-resistant materials must be used. The operating limit of normal contact seals is +100 °C.

Caution! If high temperature synthetic materials are used for seals and greases, it must be noted that the particularly high performance materials containing fluoride may give off harmful gases and vapours when heated to approx. +300 °C and above. This may occur, for example, if a welding torch is used in the dismantling of a bearing.

High temperatures are critical especially in the case of seals made from fluoroelastomer (FKM, FPM, e.g. Viton) or greases containing fluoride such as the rolling bearing grease Arcanol TEMP200 and greases to GA11.

If high temperatures are unavoidable, attention must be paid to the valid safety data sheet for the specific fluoride-containing material, which can be obtained upon request.

Bearing data

Anti-corrosion protection

Bearings are not resistant to corrosion by water or agents containing alkalis or acids but are often exposed to these corrosion-inducing agents. In these applications, anti-corrosion protection is therefore a decisive factor in achieving a long operating life of the bearings.

In principle, corrosion-resistant steels to ISO 693-17 can be used for components at risk of corrosion. These bearings have the prefix S; for deep groove ball bearings with anti-corrosion protection, see page 186. In many applications, however, the INA special plating Corrotect® is more cost-effective.

Corrotect® plating

Corrotect® is an extremely thin, electroplated surface coating – coating thickness 0,5 µm to 3 µm.

The coating is effective against moisture, contaminated water, salt spray and weakly alkaline and weakly acidic cleaning agents.



Figure 9
Bearing rings after the salt spray test.
Left: a part with Corrotect® plating;
Right: an unplated bearing ring

Advantages of the plating

The advantages of the INA special plating Corrotect® are all-round rust protection, including the turned surfaces of chamfers and radii, *Figure 9*. It also gives long term prevention of rust penetration beneath seals and smaller bright spots are protected against rust by the cathodic protection effect. In comparison with unplated parts, operating life is significantly increased by the anti-corrosion protection. Unplated bearings can be easily replaced by plated bearings of the same dimensions; there is no decrease in load carrying capacity, in contrast to corrosion-resistant steels. During storage, there is no need to use organic-based preservatives.

Fitting of plated bearings

Caution!

Before bearings plated with Corrotect® are fitted, compatibility with the media should always be checked.

In order to reduce the press-in force required, the surface of the parts should be lightly greased – the tolerances are increased by the thickness of the plating.

Dimensional and geometrical tolerances

Unless stated otherwise, the tolerances for radial rolling bearings correspond to DIN 620-2 and ISO 492; the tolerances for axial rolling bearings correspond to DIN 620-3 and ISO 199, *Figure 10*.

The accuracy corresponds to tolerance class PN. For bearings with increased accuracy, the tolerances are restricted to values in the classes P6, P5, P4 and P2. Tolerance tables for the individual tolerance classes: see page 107 to page 120.

The standardised tolerance classes are not applied to high precision bearings, which are produced to the tolerance classes P4S, SP and UP. These tolerances are listed in the product descriptions for the high precision bearings.

Measurement methods according to DIN 620-1 and ISO 1132-2 are valid for the acceptance inspection of rolling bearings.

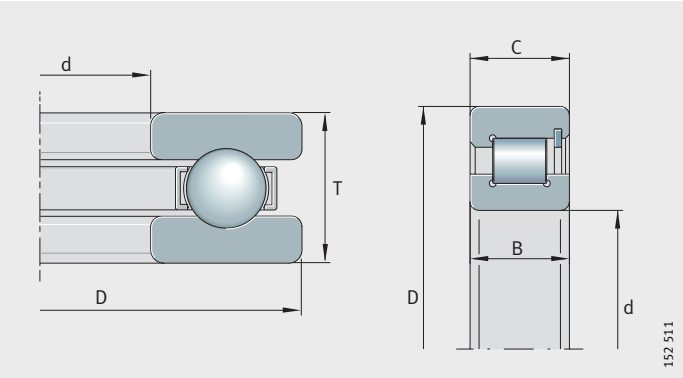


Figure 10
Main dimensions to DIN 620

Bearing data

Tolerance symbols and definitions

Tolerance symbol	Toleranced characteristic to DIN 1 132 and DIN 620
d	Nominal bore diameter
Δ_{dmp}	Deviation of mean bore diameter in a single plane
Δ_{d1mp}	Deviation of mean large end diameter in tapered bores
V_{dsp}	Variation of single bore diameter in a single plane
V_{dmp}	Variation of mean bore diameter
D	Nominal outside diameter
Δ_{Dmp}	Deviation of mean outside diameter in a single plane
V_{Dsp}	Variation of single outside diameter in a single plane
V_{Dmp}	Variation of mean outside diameter
B	Nominal inner ring width
Δ_{Bs}	Deviation of a single inner ring width
V_{Bs}	Variation of inner ring width
C	Nominal outer ring width
Δ_{Cs}	Deviation of a single outer ring width
V_{Cs}	Variation of outer ring width
K_{ia}	Radial runout of inner ring of assembled bearing
K_{ea}	Radial runout of outer ring of assembled bearing
S_d	Runout of inner ring face to the bore
S_D	Runout of outer ring outside surface generatrix to the face
S_{ia}	Axial runout of inner ring of assembled bearing
S_{ea}	Axial runout of outer ring of assembled bearing
S_i	Variation of washer thickness of shaft locating washer
S_e	Variation of washer thickness of housing locating washer
T	Nominal bearing height of a single direction axial bearing

Radial bearings, excluding tapered roller bearings

Tolerance class PN
Inner ring
Tolerances in μm

d		Δ_{dmp}		V_{dsp} Diameter series			V_{dmp}	K_{ia}
mm		Deviation		9	0, 1	2, 3, 4		
over	incl.	upper	lower	max.	max.	max.	max.	max.
0,6[1]	2,5	0	−8	10	8	6	6	10
2,5	10	0	−8	10	8	6	6	10
10	18	0	−8	10	8	6	6	10
18	30	0	−10	13	10	8	8	13
30	50	0	−12	15	12	9	9	15
50	80	0	−15	19	19	11	11	20
80	120	0	−20	25	25	15	15	25
120	180	0	−25	31	31	19	19	30
180	250	0	−30	38	38	23	23	40
250	315	0	−35	44	44	26	26	50
315	400	0	−40	50	50	30	30	60
400	500	0	−45	56	56	34	34	65
500	630	0	−50	63	63	38	38	70
630	800	0	−75	–	–	–	–	80
800	1 000	0	−100	–	–	–	–	90
1 000	1 250	0	−125	–	–	–	–	100
1 250	1 600	0	−160	–	–	–	–	120
1 600	2 000	0	−200	–	–	–	–	140

Tolerance class PN
Inner ring – continued
Tolerances in μm

d		Δ_{Bs}				V_{Bs}
mm		Normal deviation		Modified deviation[2]		
over	incl.	upper	lower	upper	lower	max.
0,6[1]	2,5	0	−40	0	–	12
2,5	10	0	−120	0	−250	15
10	18	0	−120	0	−250	20
18	30	0	−120	0	−250	20
30	50	0	−120	0	−250	20
50	80	0	−150	0	−380	25
80	120	0	−200	0	−380	25
120	180	0	−250	0	−500	30
180	250	0	−300	0	−500	30
250	315	0	−350	0	−500	35
315	400	0	−400	0	−630	40
400	500	0	−450	0	–	50
500	630	0	−500	0	–	60
630	800	0	−750	0	–	70
800	1 000	0	−1 000	0	–	80
1 000	1 250	0	−1 250	0	–	100
1 250	1 600	0	−1 600	0	–	120
1 600	2 000	0	−2 000	0	–	140

[1] This diameter is included in the group.

[2] Only for bearings manufactured specifically for use as matched pairs.

Tolerance class PN
Outer ring [1]
Tolerances in μm

D mm		Δ_{Dmp} Deviation		V_{Dsp} Open bearings Diameter series			Bearings with sealing shields or sealing washers	V_{Dmp} [3]	K_{ea}
				9	0, 1	2, 3, 4			
over	incl.	up-per	lower	max.	max.	max.	max.	max.	max.
2,5[2]	6	0	−8	10	8	6	10	6	15
6	18	0	−8	10	8	6	10	6	15
18	30	0	−9	12	9	7	12	7	15
30	50	0	−11	14	11	8	16	8	20
50	80	0	−13	16	13	10	20	10	25
80	120	0	−15	19	19	11	26	11	35
120	150	0	−18	23	23	14	30	14	40
150	180	0	−25	31	31	19	38	19	45
180	250	0	−30	38	38	23	–	23	50
250	315	0	−35	44	44	26	–	26	60
315	400	0	−40	50	50	30	–	30	70
400	500	0	−45	56	56	34	–	34	80
500	630	0	−50	63	63	38	–	38	100
630	800	0	−75	94	94	55	–	55	120
800	1 000	0	−100	125	125	75	–	75	140
1 000	1 250	0	−125	–	–	–	–	–	160
1 250	1 600	0	−160	–	–	–	–	–	190
1 600	2 000	0	−200	–	–	–	–	–	220
2 000	2 500	0	−250	–	–	–	–	–	250

[1] $\overline{\Delta_{Cs}}$, Δ_{C1s}, V_{Cs} and V_{C2s} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (see table Tolerance class PN, Inner ring, Tolerances in μm, page 107).

[2] This diameter is included in the group.

[3] Applies before assembly of the bearing and after removal of internal and/or external snap rings.

Radial bearings, excluding tapered roller bearings

Tolerance class P6
Inner ring
Tolerances in μm

d		Δ_{dmp}		V_{dsp} Diameter series			V_{dmp}	K_{ia}
mm		Deviation		9	0, 1	2, 3, 4		
over	incl.	upper	lower	max.	max.	max.	max.	max.
0,6[1]	2,5	0	−7	9	7	5	5	5
2,5	10	0	−7	9	7	5	5	6
10	18	0	−7	9	7	5	5	7
18	30	0	−8	10	8	6	6	8
30	50	0	−10	13	10	8	8	10
50	80	0	−12	15	15	9	9	10
80	120	0	−15	19	19	11	11	13
120	180	0	−18	23	23	14	14	18
180	250	0	−22	28	28	17	17	20
250	315	0	−25	31	31	19	19	25
315	400	0	−30	38	38	23	23	30
400	500	0	−35	44	44	26	26	35
500	630	0	−40	50	50	30	30	40

Tolerance class P6
Inner ring – continued
Tolerances in μm

d		Δ_{Bs}				V_{Bs}
mm		Normal deviation		Modified deviation[2]		
over	incl.	upper	lower	upper	lower	max.
0,6[1]	2,5	0	−40	–	–	12
2,5	10	0	−120	0	−250	15
10	18	0	−120	0	−250	20
18	30	0	−120	0	−250	20
30	50	0	−120	0	−250	20
50	80	0	−150	0	−380	25
80	120	0	−200	0	−380	25
120	180	0	−250	0	−550	30
180	250	0	−300	0	−500	30
250	315	0	−350	0	−500	35
315	400	0	−400	0	−630	40
400	500	0	−450	–	–	45
500	630	0	−500	–	–	50

[1] This diameter is included in the group.

[2] Only for bearings manufactured specifically for use as matched pairs.

Tolerance class P6
Outer ring [1]
Tolerances in μm

D mm		Δ_{Dmp} Deviation		V_{Dsp} Open bearings Diameter series			Bearings with sealing shields or sealing washers	V_{Dmp} [3]	K_{ea}
				9	0, 1	2, 3, 4			
over	incl.	upper	lower	max.	max.	max.	max.	max.	max.
2,5[2]	6	0	−7	9	7	5	9	5	8
6	18	0	−7	9	7	5	9	5	8
18	30	0	−8	10	8	6	10	6	9
30	50	0	−9	11	9	7	13	7	10
50	80	0	−11	14	11	8	16	8	13
80	120	0	−13	16	16	10	20	10	18
120	150	0	−15	19	19	11	25	11	20
150	180	0	−18	23	23	14	30	14	23
180	250	0	−20	25	25	15	–	15	25
250	315	0	−25	31	31	19	–	19	30
315	400	0	−28	35	35	21	–	21	35
400	500	0	−33	41	41	25	–	25	40
500	630	0	−38	48	48	29	–	29	50
630	800	0	−45	56	56	34	–	34	60
800	1 000	0	−60	75	75	45	–	45	75

[1] $\overline{\Delta_{Cs}}$, $\overline{\Delta_{C1s}}$, V_{Cs} and V_{C2s} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (see table Tolerance class P6, Inner ring, Tolerances in μm, page 109).

[2] This diameter is included in the group.

[3] Applies before assembly of the bearing and after removal of internal and/or external snap rings.

Radial bearings, excluding tapered roller bearings

Tolerance class P5
Inner ring
Tolerances in μm

d		Δ_{dmp}		V_{dsp} Diameter series		V_{dmp}	K_{ia}	S_d
mm		Deviation		9	0, 1, 2, 3, 4			
over	incl.	upper	lower	max.	max.	max.	max.	max.
0,6[1]	2,5	0	−5	5	4	3	4	7
2,5	10	0	−5	5	4	3	4	7
10	18	0	−5	5	4	3	4	7
18	30	0	−6	6	5	3	4	8
30	50	0	−8	8	6	4	5	8
50	80	0	−9	9	7	5	5	8
80	120	0	−10	10	8	5	6	9
120	180	0	−13	13	10	7	8	10
180	250	0	−15	15	12	8	10	11
250	315	0	−18	18	14	9	13	13
315	400	0	−23	23	18	12	15	15

Tolerance class P5
Inner ring – continued
Tolerances in μm

d		S_{ia}[2]	Δ_{Bs}				V_{Bs}
mm			Normal deviation		Modified deviation[3]		
over	incl.	max.	upper	lower	upper	lower	max.
0,6[1]	2,5	7	0	−40	0	−250	5
2,5	10	7	0	−40	0	−250	5
10	18	7	0	−80	0	−250	5
18	30	8	0	−120	0	−250	5
30	50	8	0	−120	0	−250	5
50	80	8	0	−150	0	−250	6
80	120	9	0	−200	0	−380	7
120	180	10	0	−250	0	−380	8
180	250	13	0	−300	0	−500	10
250	315	15	0	−350	0	−500	13
315	400	20	0	−400	0	−630	15

1) This diameter is included in the group.

2) Only for deep groove and angular contact ball bearings.

3) Only for bearings manufactured specifically for use as matched pairs.

Bearing data

Tolerance class P5
Outer ring [1]
Tolerances in μm

D mm		Δ_{Dmp} Deviation		V_{Dsp} [3] Diameter series		V_{Dmp} [4]	K_{ea}	S_D	S_{ea} [5]	V_{Cs}
				9	0, 1, 2, 3, 4					
over	incl.	upper	lower	max.	max.	max.	max.	max.	max.	max.
2,5[2]	6	0	−5	5	4	3	5	8	8	5
6	18	0	−5	5	4	3	5	8	8	5
18	30	0	−6	6	5	3	6	8	8	5
30	50	0	−7	7	5	4	7	8	8	5
50	80	0	−9	9	7	5	8	8	10	6
80	120	0	−10	10	8	5	10	9	11	8
120	150	0	−11	11	8	6	11	10	13	8
150	180	0	−13	13	10	7	13	10	14	8
180	250	0	−15	15	11	8	15	11	15	10
250	315	0	−18	18	14	9	18	13	18	11
315	400	0	−20	20	15	10	20	13	–	13
400	500	0	−23	23	17	12	23	15	–	15
500	630	0	−28	28	21	14	25	18	–	18
630	800	0	−35	35	26	18	30	20	–	20

1) Δ_{Cs} is identical to Δ_{Bs} for the inner ring of the corresponding bearing (see table Tolerance class P5, Inner ring – continued, Tolerances in μm, page 111).

2) This diameter is included in the group.

3) No values are given for radial ball bearings with sealing shields or sealing washers.

4) Applies before assembly of the bearing and after removal of internal and/or external snap rings.

5) Only for deep groove and angular contact ball bearings.

Radial bearings, excluding tapered roller bearings

Tolerance class P4
Inner ring
Tolerances in μm

d		Δ_{dmp}		Δ_{ds}		V_{dsp}		V_{dmp}	K_{ia}
				Diameter series					
mm		Deviation		0, 1, 2, 3, 4 Deviation		9	0, 1, 2, 3, 4		
over	incl.	upper	lower	upper	lower	max.	max.	max.	max.
0,6[1]	2,5	0	−4	0	−4	4	3	2	2,5
2,5	10	0	−4	0	−4	4	3	2	2,5
10	18	0	−4	0	−4	4	3	2	2,5
18	30	0	−5	0	−5	5	4	2,5	3
30	50	0	−6	0	−6	6	5	3	4
50	80	0	−7	0	−7	7	5	3,5	4
80	120	0	−8	0	−8	8	6	4	5
120	180	0	−10	0	−10	10	8	5	6
180	250	0	−12	0	−12	12	9	6	8

Tolerance class P4
Inner ring – continued
Tolerances in μm

d		S_d	S_{ia}[2]	Δ_{Bs}				V_{Bs}
				Normal deviation		Modified deviation[3]		
mm								
over	incl.	max.	max.	upper	lower	upper	lower	max.
0,6[1]	2,5	3	3	0	−40	0	−250	2,5
2,5	10	3	3	0	−40	0	−250	2,5
10	18	3	3	0	−80	0	−250	2,5
18	30	4	4	0	−120	0	−250	2,5
30	50	4	4	0	−120	0	−250	3
50	80	5	5	0	−150	0	−250	4
80	120	5	5	0	−200	0	−380	4
120	180	6	6	0	−250	0	−380	5
180	250	7	7	0	−300	0	−500	6

1) This diameter is included in the group.

2) Only for deep groove and angular contact ball bearings.

3) Only for bearings manufactured specifically for use as matched pairs.

Tolerance class P4
Outer ring
Tolerances in μm

D mm		Δ_{Dmp} Deviation		Δ_{Ds} Diameter series 0, 1, 2, 3, 4 Deviation		V_{Dsp} [2] Diameter series 9	V_{Dsp} [2] Diameter series 0, 1, 2, 3, 4	V_{Dmp}	K_{ea}
over	incl.	upper	lower	upper	lower	max.	max.	max.	max.
2,5[1]	6	0	–4	0	–4	4	3	2	3
6	18	0	–4	0	–4	4	3	2	3
18	30	0	–5	0	–5	5	4	2,5	4
30	50	0	–6	0	–6	6	5	3	5
50	80	0	–7	0	–7	7	5	3,5	5
80	120	0	–8	0	–8	8	6	4	6
120	150	0	–9	0	–9	9	7	5	7
150	180	0	–10	0	–10	10	8	5	8
180	250	0	–11	0	–11	11	8	6	10
250	315	0	–13	0	–13	13	10	7	11
315	400	0	–15	0	–15	15	11	8	13

Tolerance class P4
Outer ring – continued
Tolerances in μm

D mm		S_D S_{D1}	S_{ea} [3]	Δ_{Cs}	V_{Cs}
over	incl.	max.	max.		max.
2,5[1]	6	4	5	Δ_{Cs} and V_{Cs} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (see table Tolerance class P4, Inner ring – continued, Tolerances in μm, page 113)	2,5
6	18	4	5		2,5
18	30	4	5		2,5
30	50	4	5		2,5
50	80	4	5		3
80	120	5	6		4
120	150	5	7		5
150	180	5	8		5
180	250	7	10		7
250	315	8	10		7
315	400	10	13		8

1) This diameter is included in the group.

2) No values are given for bearings with sealing shields or sealing washers.

3) Only for deep groove and angular contact ball bearings.

Radial bearings, excluding tapered roller bearings

Tolerance class P2
Inner ring
Tolerances in μm

d mm		Δ_{dmp} Deviation		Δ_{ds} Deviation		V_{dsp}	V_{dmp}	K_{ia}
over	incl.	upper	lower	upper	lower	max.	max.	max.
0,6[1]	2,5	0	−2,5	0	−2,5	2,5	1,5	1,5
2,5	10	0	−2,5	0	−2,5	2,5	1,5	1,5
10	18	0	−2,5	0	−2,5	2,5	1,5	1,5
18	30	0	−2,5	0	−2,5	2,5	1,5	2,5
30	50	0	−2,5	0	−2,5	2,5	1,5	2,5
50	80	0	−4	0	−4	4	2	2,5
80	120	0	−5	0	−5	5	2,5	2,5
120	150	0	−7	0	−7	7	3,5	2,5
150	180	0	−7	0	−7	7	3,5	5
180	250	0	−8	0	−8	8	4	5

Tolerance class P2
Inner ring – continued
Tolerances in μm

d mm		S_d	S_{ia}[2]	Δ_{Bs} Normal deviation		V_{Bs}
over	incl.	max.	max.	upper	lower	max.
0,6[1]	2,5	1,5	1,5	0	−40	1,5
2,5	10	1,5	1,5	0	−40	1,5
10	18	1,5	1,5	0	−80	1,5
18	30	1,5	2,5	0	−120	1,5
30	50	1,5	2,5	0	−120	1,5
50	80	1,5	2,5	0	−150	1,5
80	120	2,5	2,5	0	−200	2,5
120	150	2,5	2,5	0	−250	2,5
150	180	4	5	0	−300	4
180	250	5	5	0	−350	5

[1] This diameter is included in the group.

[2] Only for deep groove and angular contact ball bearings.

Bearing data

Tolerance class P2
Outer ring
Tolerances in μm

D mm		Δ_{Dmp} Deviation		Δ_{Ds} Deviation		V_{Dsp} [2]	V_{Dmp}	K_{ea}
over	incl.	upper	lower	upper	lower	max.	max.	max.
2,5 [1]	6	0	−2,5	0	−2,5	2,5	1,5	1,5
6	18	0	−2,5	0	−2,5	2,5	1,5	1,5
18	30	0	−4	0	−4	4	2	2,5
30	50	0	−4	0	−4	4	2	2,5
50	80	0	−4	0	−4	4	2	4
80	120	0	−5	0	−5	5	2,5	5
120	150	0	−5	0	−5	5	2,5	5
150	180	0	−7	0	−7	7	2,5	5
180	250	0	−8	0	−8	8	4	7
250	315	0	−8	0	−8	8	4	7
315	400	0	−10	0	−10	10	5	8

Tolerance class P2
Outer ring – continued
Tolerances in μm

D mm		S_D S_{D1}	S_{ea} [3]	Δ_{Cs}	V_{Cs}
over	incl.	max.	max.		max.
2,5 [1]	6	1,5	1,5	Δ_{Cs} and V_{Cs} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (see table Tolerance class P2, Inner ring – continued, Tolerances in μm, page 115)	1,5
6	18	1,5	1,5		1,5
18	30	1,5	2,5		1,5
30	50	1,5	2,5		1,5
50	80	1,5	4		1,5
80	120	2,5	5		2,5
120	150	2,5	5		2,5
150	180	2,5	5		2,5
180	250	4	7		4
250	315	5	7		5
315	400	7	8		7

1) This diameter is included in the group.

2) No values are given for bearings with sealing shields or sealing washers.

3) Only for deep groove and angular contact ball bearings.

Tolerances for tapered bores – taper 1:12
Tolerances in μm

Bore diameter d mm		Tolerance class PN				
		Δ_{dmp} Deviation μm		V_{dp} [1]	$\Delta_{d1\,mp} - \Delta_{dmp}$ Deviation μm	
over	incl.	upper	lower	max.	upper	lower
18	30	+21	0	13	+21	0
30	50	+25	0	15	+25	0
50	80	+30	0	19	+30	0
80	120	+35	0	25	+35	0
120	180	+40	0	31	+40	0
180	250	+46	0	38	+46	0
250	315	+52	0	44	+52	0
315	400	+57	0	50	+57	0
400	500	+63	0	56	+63	0
500	630	+70	0	–	+70	0
630	800	+80	0	–	+80	0
800	1 000	+90	0	–	+90	0

[1] Valid in any radial cross-section of the bore.

Tolerances for tapered bores – taper 1:30
Tolerances in μm

Bore diameter d mm		Tolerance class PN				
		Δ_{dmp} Deviation μm		V_{dp} [1]	$\Delta_{d1\,mp} - \Delta_{dmp}$ Deviation μm	
over	incl.	upper	lower	max.	upper	lower
–	80	+15	0	19	+35	0
80	120	+20	0	25	+40	0
120	180	+25	0	31	+50	0
180	250	+30	0	38	+55	0
250	315	+35	0	44	+60	0
315	400	+40	0	50	+65	0
400	500	+45	0	56	+75	0
500	630	+50	0	63	+85	0
630	800	+75	0	–	+100	0
800	1 000	+100	0	–	+100	0

[1] Valid in any radial cross-section of the bore.

Taper 1:12
Half of taper angle $\alpha = 2° 23' 9{,}4''$
Theoretical large end diameter

$$d_1 = d + \frac{1}{12} \times B$$

Taper 1:30
Half of taper angle $\alpha = 0° 57' 17{,}4''$
Theoretical large end diameter

$$d_1 = d + \frac{1}{30} \times B$$

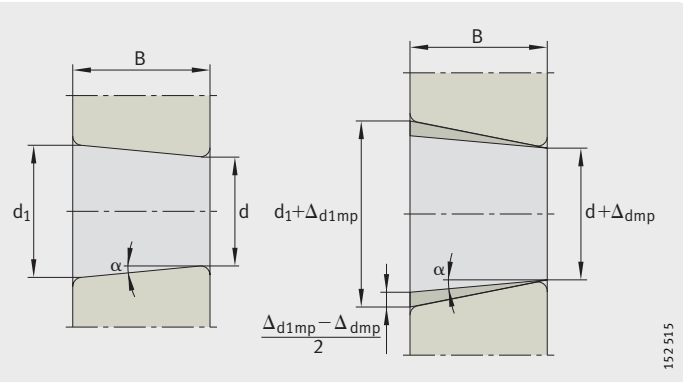


Figure 11
Tolerances for tapered bores

Axial bearings

Bore diameter tolerances for shaft locating washers to ISO 199 and DIN 620-3 Tolerances in μm

d		PN (normal tolerance), P6 and P5			P4		
mm		Δ_{dmp} Deviation		V_{dp}	Δ_{dmp} Deviation		V_{dp}
over	incl.	upper	lower	max.	upper	lower	max.
–	18	0	−8	6	0	−7	5
18	30	0	−10	8	0	−8	6
30	50	0	−12	9	0	−10	8
50	80	0	−15	11	0	−12	9
80	120	0	−20	15	0	−15	11
120	180	0	−25	19	0	−18	14
180	250	0	−30	23	0	−22	17
250	315	0	−35	26	0	−25	19
315	400	0	−40	30	0	−30	23
400	500	0	−45	34	0	−35	26
500	630	0	−50	38	0	−40	30
630	800	0	−75	56	0	−50	–
800	1 000	0	−100	75	0	–	–
1 000	1 250	0	−125	95	0	–	–

Outside diameter tolerances for housing locating washers to ISO 199 and DIN 620-3 Tolerances in μm

D		PN (normal tolerance), P6 and P5			P4		
mm		Δ_{Dmp} Deviation		V_{Dp}	Δ_{Dmp} Deviation		V_{Dp}
over	incl.	upper	lower	max.	upper	lower	max.
10	18	0	−11	8	0	−7	5
18	30	0	−13	10	0	−8	6
30	50	0	−16	12	0	−9	7
50	80	0	−19	14	0	−11	8
80	120	0	−22	17	0	−13	10
120	180	0	−25	19	0	−15	11
180	250	0	−30	23	0	−20	15
250	315	0	−35	26	0	−25	19
315	400	0	−40	30	0	−28	21
400	500	0	−45	34	0	−33	25
500	630	0	−50	38	0	−38	29
630	800	0	−75	55	0	−45	34
800	1 000	0	−100	75	–	–	–
1 000	1 250	0	−125	75	–	–	–
1 250	1 600	0	−160	120	–	–	–

Variation of washer thickness for shaft and housing locating washers Tolerances in μm

d mm		S_i				S_e
		PN (normal tolerance)	P6	P5	P4	PN (normal tolerance), P6, P5, P4
over	incl.	max.	max.	max.	max.	
–	18	10	5	3	2	Identical to S_i for the shaft locating washer of the corresponding bearing
18	30	10	5	3	2	
30	50	10	6	3	2	
50	80	10	7	4	3	
80	120	15	8	4	3	
120	180	15	9	5	4	
180	250	20	10	5	4	
250	315	25	13	7	5	
315	400	30	15	7	5	
400	500	30	18	9	6	
500	630	35	21	11	7	
630	800	40	25	13	8	
800	1 000	45	30	15	8	
1 000	1 250	50	35	18	9	

Tolerances for nominal bearing height

These tolerances are given in the table on page 120.
The corresponding dimensional symbols are shown in *Figure 12*.

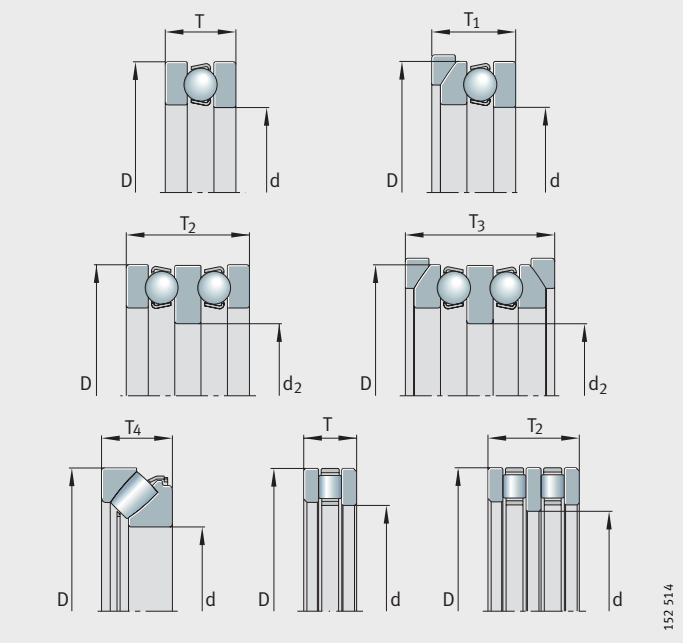


Figure 12
Tolerances
for nominal bearing height

Tolerances for nominal bearing height
Tolerances in μm

d mm		T Deviation		T_1 Deviation		T_2 Deviation	
over	incl.	upper	lower	upper	lower	upper	lower
–	30	20	–250	100	–250	150	–400
30	50	20	–250	100	–250	150	–400
50	80	20	–300	100	–300	150	–500
80	120	25	–300	150	–300	200	–500
120	180	25	–400	150	–400	200	–600
180	250	30	–400	150	–400	250	–600
250	315	40	–400	200	–400	350	–700
315	400	40	–500	200	–500	350	–700
400	500	50	–500	300	–500	400	–900
500	630	60	–600	350	–600	500	–1 100
630	800	70	–750	400	–750	600	–1 300
800	1 000	80	–1 000	450	–1 000	700	–1 500
1 000	1 250	100	–1 400	500	–1 400	900	–1 800

Tolerances for nominal bearing height – continued
Tolerances in μm

d mm		T_3 Deviation		T_4 Deviation	
over	incl.	upper	lower	upper	lower
–	30	300	–400	20	–300
30	50	300	–400	20	–300
50	80	300	–500	20	–400
80	120	400	–500	25	–400
120	180	400	–600	25	–500
180	250	500	–600	30	–500
250	315	600	–700	40	–700
315	400	600	–700	40	–700
400	500	750	–900	50	–900
500	630	900	–1 100	60	–1 200
630	800	1 100	–1 300	70	–1 400
800	1 000	1 300	–1 500	80	–1 800
1 000	1 250	1 600	–1 800	100	–2 400

Chamfer dimensions

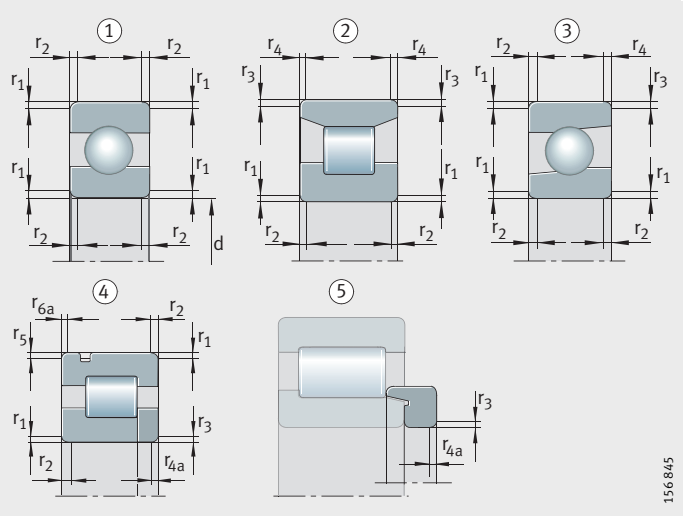
The chamfer dimensions correspond to DIN 620-6.

Radial bearings, excluding tapered roller bearings

The minimum and maximum values for the bearings are given in the table Limit values for chamfer dimensions to DIN 620-6, page 122.

For drawn cup needle roller bearings with open ends HK, drawn cup needle roller bearings with closed end BK and aligning needle roller bearings PNA and RPNA, the chamfer dimensions deviate from DIN 620-6. The lower limit values for r are given in the dimension tables.

Chamfer dimensions for tapered roller bearings: see page 123; for axial bearings, see page 124.



① Symmetrical ring cross-section with identical chamfers on both rings
② Symmetrical ring cross-section with different chamfers on both rings
③ Asymmetrical ring cross-section
④ Annular slot on outer ring, bearing with rib washer
⑤ L-section ring

Figure 13
Chamfer dimensions for radial bearings excluding tapered roller bearings

Limit values for chamfer dimensions to DIN 620-6

$r^{1)}$	d		r_1 to r_{6a}	r_1, r_3, r_5	r_2, r_4, r_6 [2)]	r_{4a}, r_{6a}
	over	incl.	min.	max.	max.	max.
mm	mm	mm	mm	mm	mm	mm
0,05	–	–	0,05	0,1	0,1	0,1
0,08	–	–	0,08	0,16	0,16	0,16
0,1	–	–	0,1	0,2	0,2	0,2
0,15	–	–	0,15	0,3	0,6	0,3
0,2	–	–	0,2	0,5	0,8	0,5
0,3	–	40	0,3	0,6	1	0,8
	40	–	0,3	0,8	1	0,8
0,5	–	40	0,5	1	2	1,5
	40	–	0,5	1,3	2	1,5
0,6	–	40	0,6	1	2	1,5
	40	–	0,6	1,3	2	1,5
1	–	50	1	1,5	3	2,2
	50	–	1	1,9	3	2,2
1,1	–	120	1,1	2	3,5	2,7
	120	–	1,1	2,5	4	2,7
1,5	–	120	1,5	2,3	4	3,5
	120	–	1,5	3	5	3,5
2	–	80	2	3	4,5	4
	80	220	2	3,5	5	4
	220	–	2	3,8	6	4
2,1	–	280	2,1	4	6,5	4,5
	280	–	2,1	4,5	7	4,5
2,5	–	100	2,5	3,8	6	5
	100	280	2,5	4,5	6	5
	280	–	2,5	5	7	5
3	–	280	3	5	8	5,5
	280	–	3	5,5	8	5,5
4	–	–	4	6,5	9	6,5
5	–	–	5	8	10	8
6	–	–	6	10	13	10
7,5	–	–	7,5	12,5	17	12,5
9,5	–	–	9,5	15	19	15
12	–	–	12	18	24	18
15	–	–	15	21	30	21
19	–	–	19	25	38	25

1) The nominal chamfer dimension r is identical to the smallest permissible chamfer dimension r_{min}.

2) For bearings with a width of 2 mm or less, the values for r_1 apply.

Tapered roller bearings

The minimum and maximum values for metric tapered roller bearings are given in the table Limit values for chamfer dimensions.

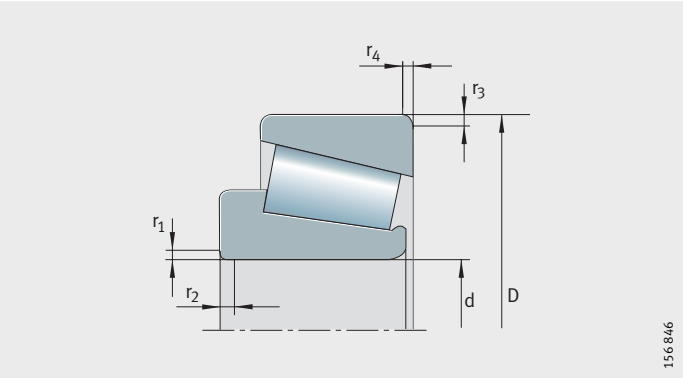


Figure 14
Chamfer dimensions
for metric tapered roller bearings

Limit values for chamfer dimensions

r[1)]	d		r_1 to r_4	r_1, r_3	r_2, r_4
	over	incl.	min.	max.	max.
mm	mm	mm	mm	mm	mm
0,3	–	40	0,3	0,7	1,4
	40	–	0,3	0,9	1,6
0,6	–	40	0,6	1,1	1,7
	40	–	0,6	1,3	2
1	–	50	1	1,6	2,5
	50	–	1	1,9	3
1,5	–	120	1,5	2,3	3
	120	250	1,5	2,8	3,5
	250	–	1,5	3,5	4
2	–	120	2	2,8	4
	120	250	2	3,5	4,5
	250	–	2	4	5
2,5	–	120	2,5	3,5	5
	120	250	2,5	4	5,5
	250	–	2,5	4,5	6
3	–	120	3	4	5,5
	120	250	3	4,5	6,5
	250	400	3	5	7
	400	–	3	5,5	7,5
4	–	120	4	5	7
	120	250	4	5,5	7,5
	250	400	4	6	8
	400	–	4	6,5	8,5
5	–	180	5	6,5	8
	180	–	5	7,5	9
6	–	180	6	7,5	10
	180	–	6	9	11

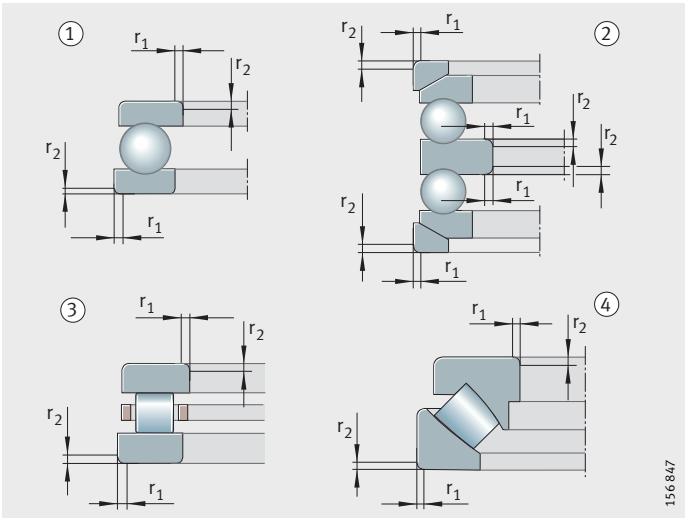
1) The nominal chamfer dimension r is identical to the smallest permissible chamfer dimension r_{min}.

Bearing data

Axial bearings

The minimum and maximum values for the bearings are given in the table Limit values for chamfer dimensions.
The table corresponds to DIN 620-6.

For axial deep groove ball bearings, the tolerances for the chamfer dimensions are identical in both axial and radial directions.



① Single direction axial deep groove ball bearing with flat housing locating washer
② Double direction axial deep groove ball bearing with spherical housing locating washers and seating washers
③ Single direction axial cylindrical roller bearing
④ Single direction axial spherical roller bearing

Figure 15
Chamfer dimensions for axial bearings

Limit values for chamfer dimensions

$r^{1)}$	r_1, r_2	
	min.	max.
mm	mm	mm
0,05	0,05	0,1
0,08	0,08	0,16
0,1	0,1	0,2
0,15	0,15	0,3
0,2	0,2	0,5
0,3	0,3	0,8
0,6	0,6	1,5
1	1	2,2
1,1	1,1	2,7
1,5	1,5	3,5
2	2	4
2,1	2,1	4,5
3	3	5,5
4	4	6,5
5	5	8
6	6	10
7,5	7,5	12,5
9,5	9,5	15
12	12	18
15	15	21
19	19	25

1) The nominal chamfer dimension r is identical to the smallest permissible chamfer dimension r_{min}.

Design of bearing arrangements

Selection of bearing arrangement

The guidance and support of a rotating shaft requires at least two bearings arranged at a certain distance from each other. Depending on the application, a decision is made between a locating/non-locating bearing arrangement, an adjusted bearing arrangement and a floating bearing arrangement.

Locating/non-locating bearing arrangement

On a shaft supported by two radial bearings, the distances between the bearing seats on the shaft and in the housing frequently do not coincide as a result of manufacturing tolerances. The distances may also change as a result of temperature increases during operation. These differences in distance are compensated in the non-locating bearing. Examples of locating/non-locating bearing arrangements: see *Figure 1* to *Figure 4*.

Non-locating bearings

Ideal non-locating bearings are cylindrical roller bearings with cage of series N and NU or needle roller bearings, *Figure 1* ②, ④. In these bearings, the roller and cage assembly can be displaced on the raceway of the bearing ring without ribs.

All other bearing types, for example deep groove ball bearings and spherical roller bearings, can only act as non-locating bearings if one bearing ring has a fit that allows displacement, *Figure 2*. The bearing ring subjected to point load therefore has a loose fit; this is normally the outer ring, see Conditions of rotation, page 132.

Locating bearings

The locating bearing guides the shaft in an axial direction and supports external axial forces. In order to prevent axial preload, shafts with more than two bearings have only one locating bearing.

The type of bearing selected as a locating bearing depends on the magnitude of the axial forces and the accuracy with which the shafts must be axially guided.

A double row angular contact ball bearing, *Figure 3* ①, for example, will give closer axial guidance than a deep groove ball bearing or a spherical roller bearing. A pair of symmetrically arranged angular contact ball bearings or tapered roller bearings *Figure 4*, used as locating bearings will provide extremely close axial guidance.

Angular contact ball bearings of the universal design, *Figure 5*, give particular advantages. The bearings can be fitted in pairs in any O or X arrangement without shims. Angular contact ball bearings of the universal design are matched so that, in an X or O arrangement, they have a low axial internal clearance (design UA), zero clearance (UO) or slight preload (UL).

Spindle bearings of the universal design UL, *Figure 6*, have slight preload when fitted in an X or O arrangement (designs with higher preload are available by agreement).

In gearboxes, a four point contact bearing is sometimes fitted directly adjacent to a cylindrical roller bearing to give a locating bearing arrangement, *Figure 3* ③. The four point contact bearing, without radial support of the outer ring, can only support axial forces. The radial force is supported by the cylindrical roller bearing.

If a lower axial force is present, a cylindrical roller bearing with cage of series NUP can also be used as a locating bearing, *Figure 4* ③.

No adjustment or setting work with matched pairs of tapered roller bearings

Fitting is also made easier with a matched pair of tapered roller bearings as a locating bearing (313..-N11CA), *Figure 7* ②. They are matched with appropriate axial internal clearance so that no adjustment or setting work is required.

Examples of locating/non-locating bearing arrangements

Deep groove ball bearing
① Locating bearing
Cylindrical roller bearing NU
② Non-locating bearing
Axial angular contact ball bearing ZKLN
③ Locating bearing
Needle roller bearing NKIS
④ Non-locating bearing

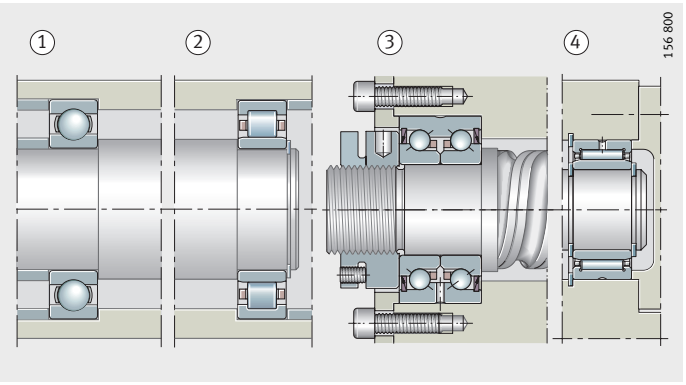


Figure 1
Deep groove, axial angular contact ball bearing as locating bearing Cylindrical, needle roller bearing as non-locating bearing

Deep groove ball bearing
① Locating bearing
② Non-locating bearing
Spherical roller bearing
③ Locating bearing
④ Non-locating bearing

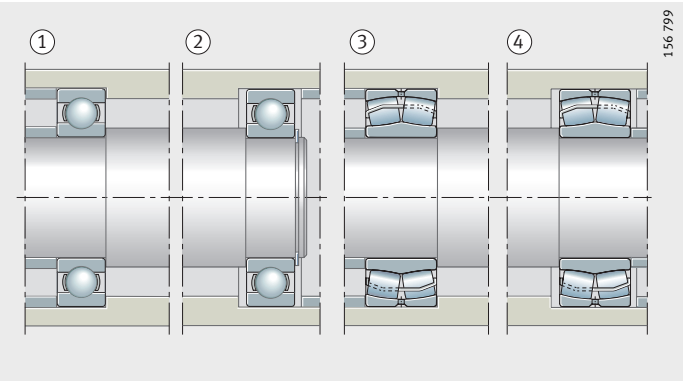


Figure 2
Deep groove ball and spherical roller bearing as locating and non-locating bearing

Double row angular contact ball bearing
① Locating bearing
Cylindrical roller bearing NU
② Non-locating bearing
Four point contact, cylindrical roller bearing
③ Locating bearing
Cylindrical roller bearing NU
④ Non-locating bearing

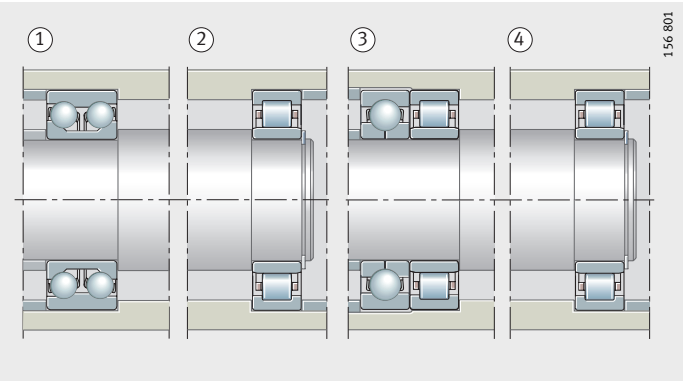


Figure 3
Double row angular contact ball and four point contact bearing as locating bearing, cylindrical roller bearing as non-locating bearing

Two tapered roller bearings
① Locating bearing
Cylindrical roller bearing NU
② Non-locating bearing
Cylindrical roller bearing NUP
③ Locating bearing
Cylindrical roller bearing NU
④ Non-locating bearing

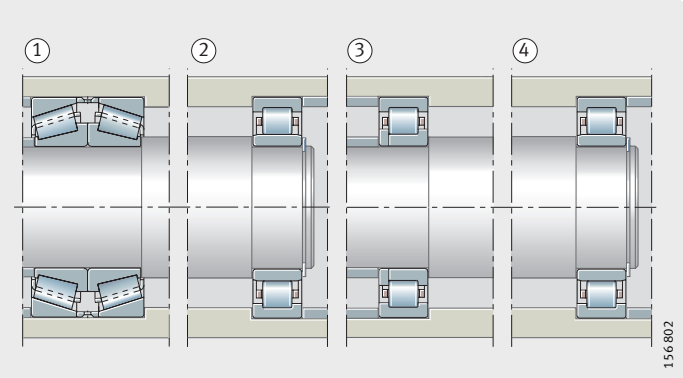


Figure 4
Tapered, cylindrical roller bearing as locating bearing, cylindrical roller bearing as non-locating bearing

① O arrangement
② X arrangement

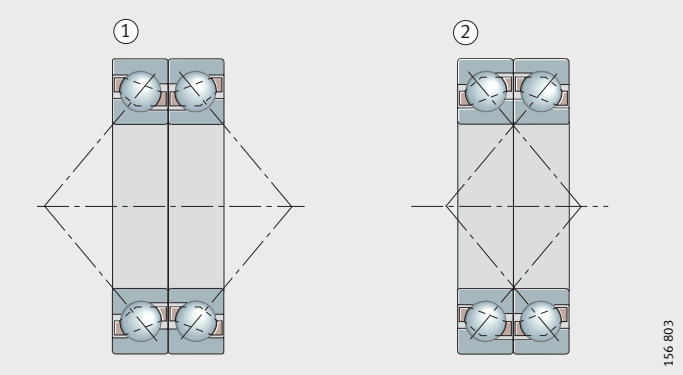


Figure 5
Pair of angular contact ball bearings of universal design as locating bearing

① O arrangement
② X arrangement
③ Tandem O arrangement

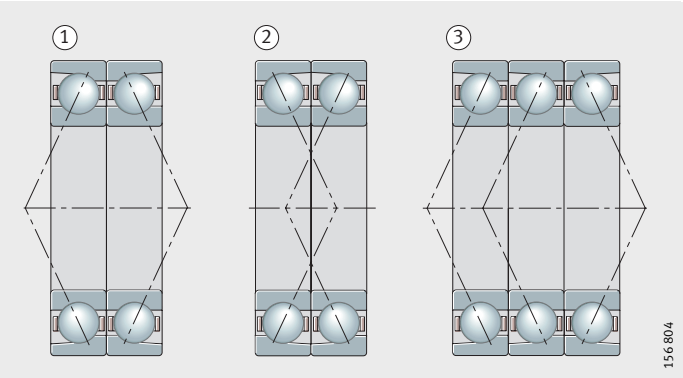


Figure 6
Pair of spindle bearings of universal design as locating bearing

① O arrangement
② X arrangement

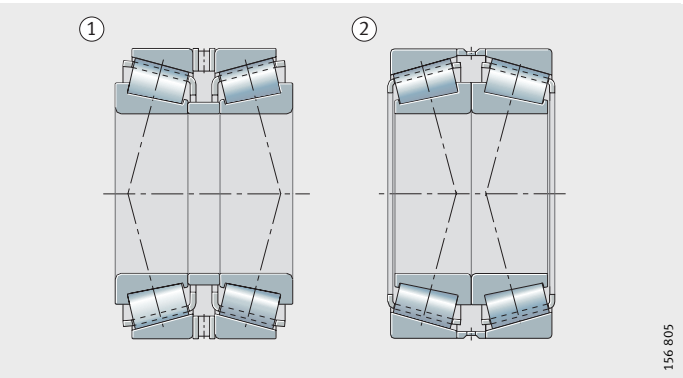


Figure 7
Pair of tapered roller bearings as locating bearing

Design of bearing arrangements

Adjusted bearing arrangement

An adjusted bearing arrangement generally consists of two symmetrically arranged angular contact ball bearings or tapered roller bearings, *Figure 8*.

During fitting, one bearing ring is displaced on its seat until the bearing arrangement achieves the required clearance or the necessary preload.

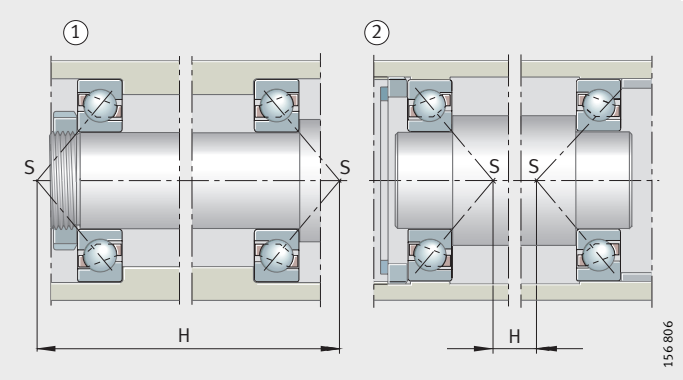
Application

Due to this adjustment facility, the adjusted bearing arrangement is particularly suitable where close guidance is required, for example in pinion bearing arrangements with spiral toothed bevel gears and spindle bearing arrangements in machine tools.

X and O arrangements

A fundamental distinction is drawn between the O arrangement, *Figure 8* ①, and the X arrangement, *Figure 8* ②, of the bearings. In the O arrangement, the cones and their apexes S formed by the pressure lines point outwards; in the X arrangement, the cones point inwards.

The support base H, in other words the distance between the apexes of the pressure cones, is larger in the O arrangement than in the X arrangement. The O arrangement therefore gives the lower tilting clearance.



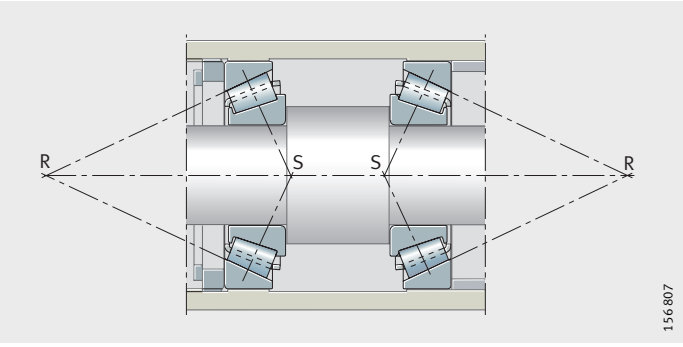
① O arrangement
② X arrangement
S = apexes of the pressure cones
H = support distance

Figure 8

Adjusted bearing arrangement with angular contact ball bearings in O arrangement and X arrangement

Influence of thermal expansion in X and O arrangements

When setting the axial internal clearance, thermal expansion must be taken into consideration. In the X arrangement, *Figure 9*, a temperature differential between the shaft and housing always leads to a reduction in the internal clearance (assuming the following preconditions: shaft and housing of identical material, inner ring and complete shaft at identical temperature, outer ring and complete housing at identical temperature).



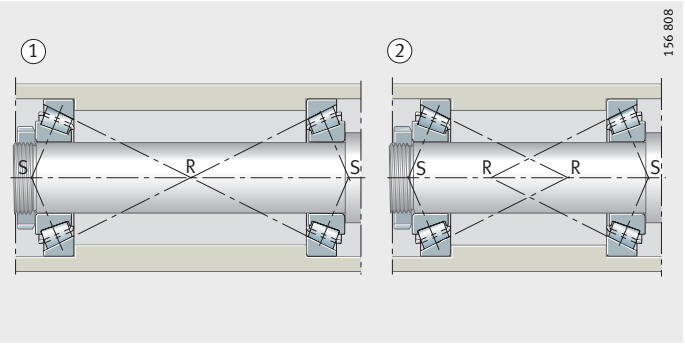
S = apexes of the pressure cones
R = roller cone apexes

Figure 9

Adjusted bearing arrangement with tapered roller bearings in X arrangement and apexes of the roller cones

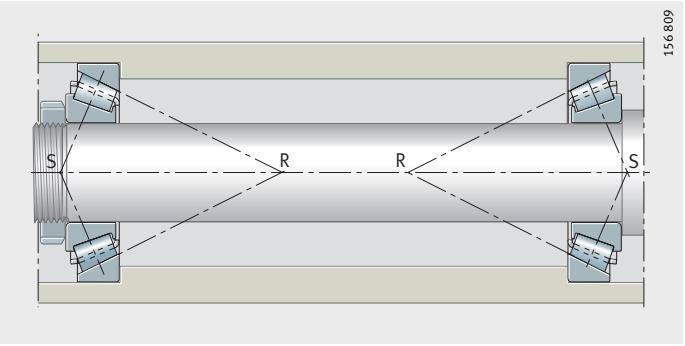
In the O arrangement, a distinction is drawn between three cases:

- The apexes R of the roller cones, i. e. the intersection points of the extended outer ring raceway with the bearing axis, coincide: the required internal clearance is achieved, *Figure 10* ①.
- The roller cones overlap if there is a short distance between the bearings: the axial internal clearance is reduced, *Figure 10* ②.
- The roller cones do not meet if there is a large distance between the bearings: the axial internal clearance is increased, *Figure 11*.



① Intersection points coincide
② Intersection points overlap
S = apexes of the pressure cones
R = roller cone apexes

Figure 10
Adjusted bearing arrangement with tapered roller bearings in O arrangement

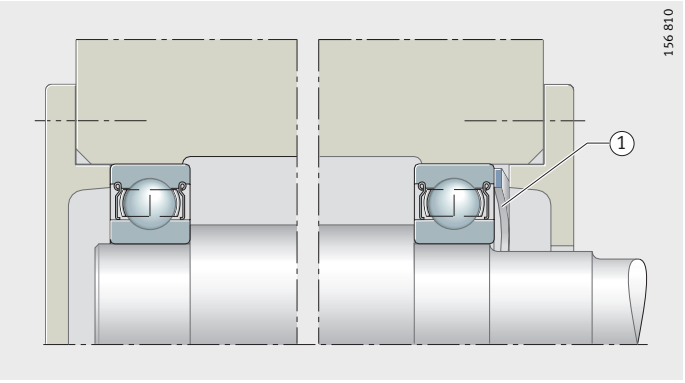


S = apexes of the pressure cones
R = roller cone apexes

Figure 11
Adjusted bearing arrangement with tapered roller bearings in O arrangement, no overlap of roller cone apexes

Elastic adjustment

Adjusted bearing arrangements can also be achieved by preloading using springs, *Figure 12* ①. The elastic adjustment method compensates for thermal expansion. It can also be used where bearing arrangements are at risk of vibration while stationary.



① Curved spring washer

Figure 12
Adjusted deep groove ball bearings preloaded by curved spring washer

Design of bearing arrangements

Floating bearing arrangement

The floating bearing arrangement is an economical solution where close axial guidance of the shaft is not required, *Figure 13*. The construction is similar to that of the adjusted bearing arrangement.

In the floating bearing arrangement, however, the shaft can be displaced in relation to the housing to the extent of the axial clearance s. The value s is defined as a function of the required guidance accuracy such that the bearings are not axially preloaded even under unfavourable thermal conditions.

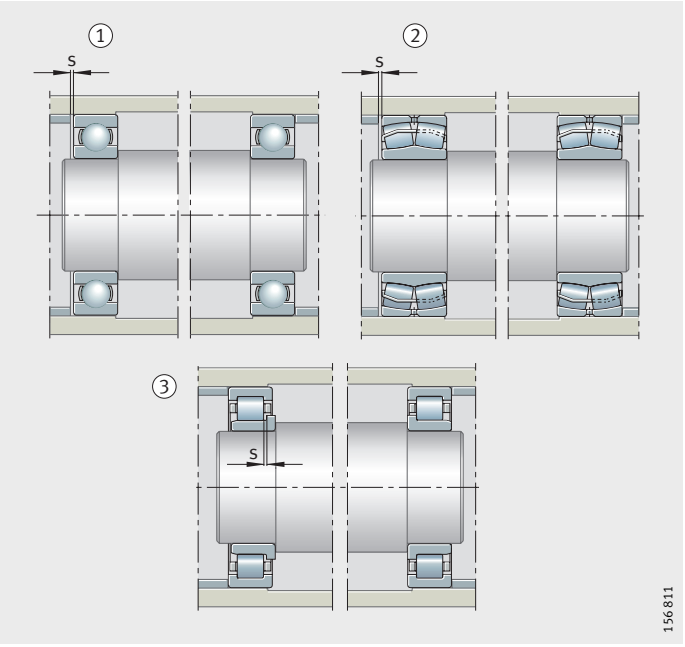
Suitable bearings

Suitable bearing types for the floating bearing arrangement include deep groove ball bearings, self-aligning ball bearings and spherical roller bearings.

In both bearings, one ring – usually an outer ring – has a fit that allows displacement.

In floating bearing arrangements comprising cylindrical roller bearings with cage of series NJ, the length compensation takes place within the bearings. The inner and outer rings can have tight fits, *Figure 13* ③.

Tapered roller bearings and angular contact ball bearings are not suitable for a floating bearing arrangement, since they must be adjusted in order to run correctly.



① Two deep groove ball bearings
② Two spherical roller bearings
③ Two cylindrical roller bearings NJ
s = axial clearance

Figure 13
Examples of floating bearing arrangements

Fits

Rolling bearings are located on the shaft and in the housing in a radial, axial and tangential direction according to their function.

Radial and tangential location is normally achieved by force locking, i.e. tight fits on the bearing rings. Axial location is normally achieved by geometrical locking, see Axial location of bearings, page 156.

Criteria for selection of fits

The following must be observed when selecting fits:

- The bearing rings must be well supported on their circumference in order to allow full utilisation of the load carrying capacity.
- The bearings must not creep on their mating parts, otherwise the seats will be damaged.
- One ring of the non-locating bearing must adapt to changes in shaft and housing length and must therefore be capable of axial displacement; it is only in cylindrical roller bearings N and NU that displacement occurs within the bearing.
- The bearings must be easy to fit and dismantle.

Good support of the bearing rings on their circumference requires rigid seating, i.e. a tight fit. The requirement that bearings must not creep on their mating parts also requires rigid seating.

If non-separable bearings must be fitted and dismantled, a tight fit cannot be achieved, at least for one ring.

In cylindrical roller bearings N and NU and needle roller bearings, both rings can have tight fits, since the length compensation takes place within the bearing and since the rings can be fitted separately.

With tight fits and a temperature differential between the inner and outer ring, the radial internal clearance of the bearing is reduced. This must be taken into consideration when selecting the internal clearance, Operating clearance, page 97.

Caution!

If materials other than cast iron or steel are used for the adjacent construction, the following must also be taken into consideration to achieve rigid seating: the modulus of elasticity and the differing coefficients of thermal expansion of the materials.

For aluminium housings, thin-walled housings and hollow shafts, a closer fit should be selected if necessary in order to achieve the same force locking as with cast iron, steel or solid shafts.

Higher loads, especially shocks, require a fit with larger interference and adherence to narrow geometrical tolerances.

Seats for axial bearings

Axial bearings, which can support axial loads only, must not be guided radially (with the exception of: axial cylindrical roller bearings, in which the degree of freedom in the radial direction is present due to the flat raceways).

In axial bearings with groove-shaped raceways, such as axial deep groove ball bearings, this is not present and must be achieved by a loose seat for the stationary washer. A rigid seat is normally selected for the rotating washer.

Where axial bearings support radial forces in addition to axial forces, such as in axial spherical roller bearings, fits should be selected in the same way as for radial bearings.

The contact surfaces of the mating parts must be perpendicular to the axis of rotation (runout tolerance to IT5 or better), in order to ensure uniform load distribution over all the rolling elements.

Design of bearing arrangements

Conditions of rotation

The conditions of rotation indicate the motion of one bearing ring with respect to the load direction and are expressed as either circumferential load or point load, see table Conditions of rotation.

Point load

If the ring remains stationary relative to the load direction, there are no forces that displace the ring relative to its seating surface. This type of load is described as point load.

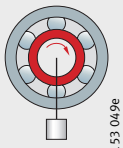
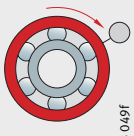
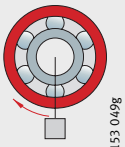
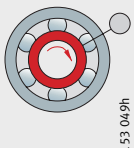
There is no risk that the seating surface will be damaged and a loose fit is possible.

Circumferential load

If forces are present that displace the ring relative to its seating surface, every point on the raceway is subjected to load over the course of one revolution of the bearing. A load with this characteristic is described as a circumferential load.

Caution! There is a risk that the seating surface will be damaged and a tight fit should be used.

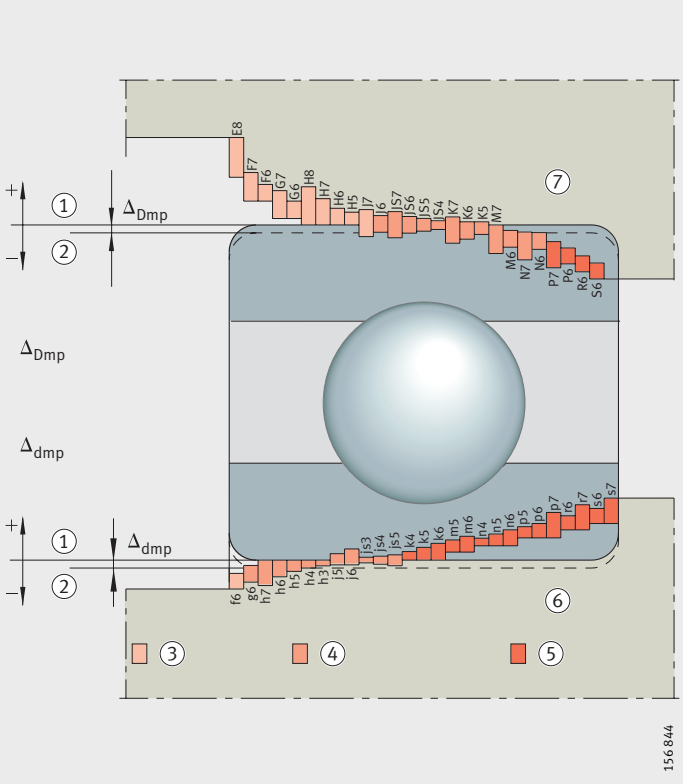
Conditions of rotation

Conditions of motion	Example	Schematic	Load case	Fit
Rotating inner ring Stationary outer ring Constant load direction	Shaft with weight load	 153 049e	Circumferential load on inner ring	Inner ring: tight fit necessary Outer ring: loose fit permissible
Stationary inner ring Rotating outer ring Load direction rotates with outer ring	Hub bearing arrangement with significant imbalance	 153 049f	and Point load on outer ring	
Stationary inner ring Rotating outer ring Constant load direction	Passenger car front wheel bearing (hub bearing arrangement)	 153 049g	Point load on inner ring	Inner ring: loose fit permissible Outer ring: tight fit necessary
Rotating inner ring Stationary outer ring Load direction rotates with inner ring	Centrifuge, vibrating screen	 153 049h	and Circumferential load on outer ring	

Shaft and housing tolerances

The fit is determined by the ISO tolerances for shafts and housings (ISO 286), in conjunction with the tolerances Δ_{dmp} for the bore and Δ_{Dmp} for the outside diameter of the bearings (DIN 620). The ISO tolerances are defined in the form of tolerance zones. They are determined by their position relative to the zero line (= tolerance position) and their size (= tolerance grade, see ISO 286). The tolerance position is indicated by letters (upper case for housings, lower case for shafts). A schematic illustration of the most common rolling bearing fits is shown in *Figure 14*.

The tables on pages 134 to 136 contain recommendations for the selection of shaft and housing tolerances.



① Zero line
② Nominal diameter
③ Loose fit
④ Transition fit
⑤ Tight fit
⑥ Shaft diameter
⑦ Housing bore
Δ_{Dmp} = tolerances for bearing outside diameter
Δ_{dmp} = tolerances for bearing bore

Figure 14
Fits for rolling bearings

Shaft tolerances – radial bearings with cylindrical bore

Condition of rotation	Bearing type	Shaft diameter mm	Displacement facility Load	Tolerance
Point load on inner ring	Ball bearings, roller bearings	all sizes	Inner ring easily displaced	g6 (g5)
			Inner ring not easily displaced. Angular contact ball bearings and tapered roller bearings with adjusted inner ring	h6 (j6)
	Needle roller bearings	all sizes	Non-locating bearings	h6 (g6)[1]
Circumferential load on inner ring or indeterminate load direction	Ball bearings	up to 50	Normal loads[2]	j6 (j5)
		50 to 100	Low loads[3]	j6 (j5)
			Normal and high loads[4]	k6 (k5)
		100 to 200	Low loads[2]	k6 (m6)
			Normal and high loads[5]	m6 (m5)
		over 200	Low loads	m6 (m5)
			Normal and high loads	n6 (n5)
	Roller bearings	up to 60	Low loads	j6 (j5)
			Normal and high loads	k6 (k5)
		60 to 200	Low loads	k6 (k5)
			Normal loads	m6 (m5)
			High loads	n6 (n5)
		200 to 500	Normal loads	m6 (n6)
			High loads, shocks	p6
		over 500	Normal loads	n6 (p6)
			High loads	p6
	Needle roller bearings	up to 50	Low loads	k6
			Normal and high loads	m6
		50 to 120	Low loads	m6
			Normal and high loads	n6
		120 to 250	Low loads	n6
			Normal and high loads	p6
		250 to 400	Low loads	p6
			Normal and high loads	r6
		400 to 500	Low loads	r6
			Normal and high loads	s6
		over 500	Low loads	r6
			Normal and high loads	s6

1) For easier fitting.
2) $C/P > 10$
3) $C/P > 12$
4) $C/P < 12$
5) $C/P < 10$

Shaft tolerances – axial bearings

Load	Bearing type	Shaft diameter	Operating conditions	Toler-ance
Axial load	Axial deep groove ball bearings	all sizes	–	j6
	Axial deep groove ball bearings, double direction		–	k6
	Axial cylindrical roller bearings with shaft locating washer		–	h6 (j6)
	Axial cylindrical roller and cage assemblies		–	h8
Combined load	Axial spherical roller bearings	all sizes	Point load on shaft locating washer	j6
		up to 200 mm	Circumferential load on shaft locating washer	j6 (k6)
		over 200 mm		k6 (m6)

Housing tolerances – radial bearings

Condition of rotation	Displacement facility Load	Operating conditions	Tolerance
Point load on outer ring	Outer ring easily displaced Housing unsplit	The tolerance grade is determined by the running accuracy required	H7 (H6)[1]
	Outer ring easily displaced Housing split		H8 (H7)
	Outer ring not easily displaced Housing unsplit	High running accuracy required	H6 (J6)
	Outer ring not easily displaced Angular contact ball bearings and tapered roller bearings with adjusted outer ring	Normal running accuracy	H7 (J7)
	Outer ring easily displaced	Heat input via shaft	G7[2]
Circumferential load on outer ring or indeterminate load direction	Low loads Outer ring cannot be displaced	High running accuracy requirements K6, M6, N6 and P6	K7 (K6)
	Normal loads, shocks Outer ring cannot be displaced		M7 (M6)
	High loads, shocks ($C/P < 6$) Outer ring cannot be displaced		N7 (N6)
	High loads, severe shocks Thin-walled housing, outer ring cannot be displaced		P7 (P6)

1) G7 for flake graphite cast iron housings if bearing outside diameter $D > 250$ mm and temperature differential between outer ring and housing > 10 K.

2) F7 for flake graphite cast iron housings if bearing outside diameter $D > 250$ mm and temperature differential between outer ring and housing > 10 K.

Housing tolerances – axial bearings

Load	Bearing type	Operating conditions	Tolerance
Axial load	Axial deep groove ball bearings	Normal running accuracy High running accuracy	E8 H6
	Axial cyl. roller bearings with housing locating washer	–	H7 (K7)
	Axial cyl. roller and cage assemblies	–	H10
	Axial spherical roller bearings	Normal loads High loads	E8 G7
Combined loads Point load on housing locating washer	Axial spherical roller bearings	–	H7
Combined loads Circumferential load on housing locating washer	Axial spherical roller bearings	–	K7

Tables for shaft and housing fits

The numerical values for the fits (page 138 to page 151) are valid for solid steel shafts and cast iron housings. In the table header, below the nominal diameters, are the normal tolerances for the bore or outside diameters of radial bearings (excluding tapered roller bearings). Below these are the deviations for the most important tolerance zones for fitting of rolling bearings.

Shaft fits

In each cell are five numbers in accordance with the following scheme, for example for shaft ∅40 j5:

Example: table entry for shaft fit

Shaft deviation in µm		Fit interference or fit clearance in µm	
Maximum material value	+6	**18**[2)]	Interference or fit clearance if the maximum material values are combined
		10[1)2)]	Probable interference or fit clearance
Minimum material value	−5	5[3)]	Interference or fit clearance if the minimum material values are combined

1) The probable interference of fit clearance is the value obtained if the actual dimensions are one third away from the maximum material values.

2) Values printed in bold type indicate fit interference.

3) Values printed in regular type indicate fit clearance.

Shaft fits: see tables from page 138.

Housing fits

In each cell are five numbers in accordance with the following scheme, for example for housing ∅100 K6:

Example: table entry for housing fit

Housing deviation in µm		Fit interference or fit clearance in µm	
Minimum material value	+4	**18**[2)]	Interference or fit clearance if the maximum material values are combined
		6[1)2)]	Probable interference or fit clearance
Maximum material value	−18	19[3)]	Interference or fit clearance if the minimum material values are combined

1) The probable interference or fit clearance is the value obtained if the actual dimensions are one third away from the maximum material values.

2) Values printed in bold type indicate fit interference.

3) Values printed in regular type indicate fit clearance.

Housing fits: see tables from page 147.

Shaft fits

Nominal shaft diameter in mm										
over	**3**		**6**		**10**		**18**		**30**	
incl.	**6**		**10**		**18**		**30**		**50**	
Deviation of bearing bore diameter in μm (normal tolerance)										
Δ_{dmp}	0		0		0		0		0	
	−8		−8		−8		−10		−12	
Shaft deviation, fit interference or fit clearance in μm										
g5	−4	**4**	−5	**3**	−6	**2**	−7	**3**	−9	**3**
	−9	**0**	−11	2	−14	3	−16	3	−20	5
		9		11		14		16		20
g6	−4	**4**	−5	**3**	−6	**2**	−7	**3**	−9	**3**
	−12	1	−14	3	−17	4	−20	5	−25	6
		12		14		17		20		25
h5	0	**8**	0	**8**	0	**8**	0	**10**	0	**12**
	−5	**4**	−6	**3**	−8	**3**	−9	**4**	−11	**4**
		5		6		8		9		11
h6	0	**8**	0	**8**	0	**8**	0	**10**	0	**12**
	−8	**3**	−9	**2**	−11	**2**	−13	**2**	−16	**3**
		8		9		11		13		16
j5	+3	**11**	+4	**12**	+5	**13**	+5	**15**	+6	**18**
	−2	**7**	−2	**7**	−3	**8**	−4	**9**	−5	**10**
		2		2		3		4		5
j6	+6	**14**	+7	**15**	+8	**16**	+9	**19**	+11	**23**
	−2	**8**	−2	**9**	−3	**10**	−4	**11**	−5	**14**
		2		2		3		4		5
js5	+2,5	**11**	+3	**11**	+4	**12**	+4,5	**15**	+5,5	**18**
	−2,5	**6**	−3	**6**	−4	**6**	−4,5	**9**	−5,5	**10**
		3		3		4		5		6
js6	+4	**12**	+4,5	**13**	+5,5	**14**	+6,5	**17**	+8	**20**
	−4	**7**	−4,5	**7**	−5,5	**8**	−6,5	**9**	−8	**11**
		4		5		6		7		8
k5	+6	**14**	+7	**15**	+9	**17**	+11	**21**	+13	**25**
	+1	**9**	+1	**10**	+1	**12**	+2	**15**	+2	**17**
		1		**1**		**1**		**2**		**2**
k6	+9	**17**	+10	**18**	+12	**20**	+15	**25**	+18	**30**
	+1	**11**	+1	**12**	+1	**14**	+2	**17**	+2	**21**
		1		**1**		**1**		**2**		**2**
m5	+9	**17**	+12	**20**	+15	**23**	+17	**27**	+20	**32**
	+4	**13**	+6	**15**	+7	**18**	+8	**21**	+9	**24**
		4		**6**		**7**		**8**		**9**
m6	+12	**20**	+15	**23**	+18	**26**	+21	**31**	+25	**37**
	+4	**15**	+6	**17**	+7	**20**	+8	**23**	+9	**27**
		4		**6**		**7**		**8**		**9**

50 **65**	**65** **80**	**80** **100**	**100** **120**	**120** **140**	**140** **160**	**160** **180**	**180** **200**	**200** **225**	**225** **250**
0 −15	0 −15	0 −20	0 −20	0 −25	0 −25	0 −25	0 −30	0 −30	0 −30
−10 −23 **5** 4 23	−10 −23 **5** 4 23	−12 −27 **8** 4 27	−12 −27 **8** 4 27	−14 −32 **11** 3 32	−14 −32 **11** 3 32	−14 −32 **11** 3 32	−15 −35 **15** 2 35	−15 −35 **15** 2 35	−15 −35 **15** 2 35
−10 −29 **5** 6 29	−10 −29 **5** 6 29	−12 −34 **8** 6 34	−12 −34 **8** 6 34	−14 −39 **11** 6 39	−14 −39 **11** 6 39	−14 −39 **11** 6 39	−15 −44 **15** 5 44	−15 −44 **15** 5 44	−15 −44 **15** 5 44
0 −13 **15** **6** 13	0 −13 **15** **6** 13	0 −15 **20** **8** 15	0 −15 **20** **8** 15	0 −18 **25** **11** 18	0 −18 **25** **11** 18	0 −18 **25** **11** 18	0 −20 **30** **13** 20	0 −20 **30** **13** 20	0 −20 **30** **13** 20
0 −19 **15** **4** 19	0 −19 **15** **4** 19	0 −22 **20** **6** 22	0 −22 **20** **6** 22	0 −25 **25** **8** 25	0 −25 **25** **8** 25	0 −25 **25** **8** 25	0 −29 **30** **10** 29	0 −29 **30** **10** 29	0 −29 **30** **10** 29
+6 −7 **21** **12** 7	+6 −7 **21** **12** 7	+6 −9 **26** **14** 9	+6 −9 **26** **14** 9	+7 −11 **32** **18** 11	+7 −11 **32** **18** 11	+7 −11 **32** **18** 11	+7 −13 **37** **20** 13	+7 −13 **37** **20** 13	+7 −13 **37** **20** 13
+12 −7 **27** **16** 7	+12 −7 **27** **16** 7	+13 −9 **33** **19** 9	+13 −9 **33** **19** 9	+14 −11 **39** **22** 11	+14 −11 **39** **22** 11	+14 −11 **39** **22** 11	+16 −13 **46** **26** 13	+16 −13 **46** **26** 13	+16 −13 **46** **26** 13
+6,5 −6,5 **22** **13** 7	+6,5 −6,5 **22** **13** 7	+7,5 −7,5 **28** **16** 8	+7,5 −7,5 **28** **16** 8	+9 −9 **34** **20** 9	+9 −9 **34** **20** 9	+9 −9 **34** **20** 9	+10 −10 **40** **23** 10	+10 −10 **40** **23** 10	+10 −10 **40** **23** 10
+9,5 −9,5 **25** **13** 10	+9,5 −9,5 **25** **13** 10	+11 −11 **31** **17** 11	+11 −11 **31** **17** 11	+12,5 −12,5 **38** **21** 13	+12,5 −12,5 **38** **21** 13	+12,5 −12,5 **38** **21** 13	+14,5 −14,5 **45** **25** 15	+14,5 −14,5 **45** **25** 15	+14,5 −14,5 **45** **25** 15
+15 +2 **30** **21** **2**	+15 +2 **30** **21** **2**	+18 +3 **38** **26** **3**	+18 +3 **38** **26** **3**	+21 +3 **46** **32** **3**	+21 +3 **46** **32** **3**	+21 +3 **46** **32** **3**	+24 +4 **54** **37** **4**	+24 +4 **54** **37** **4**	+24 +4 **54** **37** **4**
+21 +2 **36** **25** **2**	+21 +2 **36** **25** **2**	+25 +3 **45** **31** **3**	+25 +3 **45** **31** **3**	+28 +3 **53** **36** **3**	+28 +3 **53** **36** **3**	+28 +3 **53** **36** **3**	+33 +4 **63** **43** **4**	+33 +4 **63** **43** **4**	+33 +4 **63** **43** **4**
+24 +11 **39** **30** **11**	+24 +11 **39** **30** **11**	+28 +13 **48** **36** **13**	+28 +13 **48** **36** **13**	+33 +15 **58** **44** **15**	+33 +15 **58** **44** **15**	+33 +15 **58** **44** **15**	+37 +17 **67** **50** **17**	+37 +17 **67** **50** **17**	+37 +17 **67** **50** **17**
+30 +11 **45** **34** **11**	+30 +11 **45** **34** **11**	+35 +13 **55** **42** **13**	+35 +13 **55** **42** **13**	+40 +15 **65** **48** **15**	+40 +15 **65** **48** **15**	+40 +15 **65** **48** **15**	+46 +17 **76** **56** **17**	+46 +17 **76** **56** **17**	+46 +17 **76** **56** **17**

Shaft fits

Nominal shaft diameter in mm								
over incl.	**250** **280**		**280** **315**		**315** **355**		**355** **400**	
Deviation of bearing bore diameter in μm (normal tolerance)								
Δ_{dmp}	0 −35		0 −35		0 −40		0 −40	
Shaft deviation, fit interference or fit clearance in μm								
g5	−17 −40	**18** 1 40	−17 −40	**18** 1 40	−18 −43	**22** **0** 43	−18 −43	**22** **0** 43
g6	−17 −49	**18** 4 49	−17 −49	**18** 4 49	−18 −54	**22** 3 54	−18 −54	**22** 3 54
h5	0 −23	**35** **16** 23	0 −23	**35** **16** 23	0 −25	**40** **18** 25	0 −25	**40** **18** 25
h6	0 −32	**35** **13** 32	0 −32	**35** **13** 32	0 −36	**40** **15** 36	0 −36	**40** **15** 36
j5	+7 −16	**42** **23** 16	+7 −16	**42** **23** 16	+7 −18	**47** **25** 18	+7 −18	**47** **25** 18
j6	+16 −16	**51** **29** 16	+16 −16	**51** **29** 16	+18 −18	**58** **33** 18	+18 −18	**58** **33** 18
js5	+11,5 −11,5	**47** **27** 12	+11,5 −11,5	**47** **27** 12	+12,5 −12,5	**53** **32** 13	+12,5 −12,5	**53** **32** 13
js6	+16 −16	**51** **29** 16	+16 −16	**51** **29** 16	+18 −18	**58** **33** 18	+18 −18	**58** **33** 18
k5	+27 +4	**62** **43** **4**	+27 +4	**62** **43** **4**	+29 +4	**69** **47** **4**	+29 +4	**69** **47** **4**
k6	+36 +4	**71** **49** **4**	+36 +4	**71** **49** **4**	+40 +4	**80** **55** **4**	+40 +4	**80** **55** **4**
m5	+43 +20	**78** **59** **20**	+43 +20	**78** **59** **20**	+46 +21	**86** **64** **21**	+46 +21	**86** **64** **21**
m6	+52 +20	**87** **65** **20**	+52 +20	**87** **65** **20**	+57 +21	**97** **72** **21**	+57 +21	**97** **72** **21**

400 450	450 500	500 560	560 630	630 710	710 800	800 900
0 −45	0 −45	0 −50	0 −50	0 −75	0 −75	0 −100
−20 −47 **25** **1** 47	−20 −47 **25** **1** 47	−22 −51 **28** **1** 51	−22 −51 **28** **1** 51	−24 −56 **51** **15** 56	−24 −56 **51** **15** 56	−26 −62 **74** **29** 62
−20 −60 **25** 3 60	−20 −60 **25** 3 60	−22 −66 **28** 4 66	−22 −66 **28** 4 66	−24 −74 **51** **9** 74	−24 −74 **51** **9** 74	−26 −82 **74** **24** 82
0 −27 **45** **21** 27	0 −27 **45** **21** 27	0 −29 **50** **23** 29	0 −29 **50** **23** 29	0 −32 **75** **39** 32	0 −32 **75** **39** 32	0 −36 **100** **55** 36
0 −40 **45** **17** 40	0 −40 **45** **17** 40	0 −44 **50** **18** 44	0 −44 **50** **18** 44	0 −50 **75** **33** 50	0 −50 **75** **33** 50	0 −56 **100** **48** 56
+7 −20 **52** **28** 20	+7 −20 **52** **28** 20	– –	– –	– –	– –	– –
+20 −20 **65** **37** 20	+20 −20 **65** **37** 20	+22 −22 **72** **40** 22	+22 −22 **72** **40** 22	+25 −25 **100** **58** 25	+25 −25 **100** **58** 25	+28 −28 **128** **76** 28
+13,5 −13,5 **59** **35** 14	+13,5 −13,5 **59** **35** 14	+14,5 −14,5 **65** **38** 15	+14,5 −14,5 **65** **38** 15	+16 −16 **91** **55** 16	+16 −16 **91** **55** 16	+18 −18 **118** **73** 18
+20 −20 **65** **37** 20	+20 −20 **65** **37** 20	+22 −22 **72** **40** 22	+22 −22 **72** **40** 22	+25 −25 **100** **58** 25	+25 −25 **100** **58** 25	+28 −28 **128** **76** 28
+32 +5 **77** **53** **5**	+32 +5 **77** **53** **5**	+29 0 **79** **53** **0**	+29 0 **79** **53** **0**	+32 0 **107** **71** **0**	+32 0 **107** **71** **0**	+36 0 **136** **91** **0**
+45 +5 **90** **62** **5**	+45 +5 **90** **62** **5**	+44 0 **94** **62** **0**	+44 0 **94** **62** **0**	+50 0 **125** **83** **0**	+50 0 **125** **83** **0**	+56 0 **156** **104** **0**
+50 +23 **95** **71** **23**	+50 +23 **95** **71** **23**	+55 +26 **105** **78** **26**	+55 +26 **105** **78** **26**	+62 +30 **137** **101** **30**	+62 +30 **137** **101** **30**	+70 +34 **170** **125** **34**
+63 +23 **108** **80** **23**	+63 +23 **108** **80** **23**	+70 +26 **120** **88** **26**	+70 +26 **120** **88** **26**	+80 +30 **155** **113** **30**	+80 +30 **155** **113** **30**	+90 +34 **190** **138** **34**

Shaft fits

Nominal shaft diameter in mm												
over	**3**		**6**		**10**		**18**		**30**		**50**	
incl.	**6**		**10**		**18**		**30**		**50**		**65**	
Deviation of bearing bore diameter in µm (normal tolerance)												
Δ_{dmp}	0		0		0		0		0		0	
	−8		−8		−8		−10		−12		−15	
Shaft deviation, fit interference or fit clearance in µm												
n5	+13	**21**	+16	**24**	+20	**28**	+24	**34**	+28	**40**	+33	**48**
	+8	**17**	+10	**19**	+12	**23**	+15	**28**	+17	**32**	+20	**39**
		8		**10**		**12**		**15**		**17**		**20**
n6	+16	**24**	+19	**27**	+23	**31**	+28	**38**	+33	**45**	+39	**54**
	+8	**19**	+10	**21**	+12	**25**	+15	**30**	+17	**36**	+20	**43**
		8		**10**		**12**		**15**		**17**		**20**
p6	+20	**28**	+24	**32**	+29	**37**	+35	**45**	+42	**54**	+51	**66**
	+12	**23**	+15	**26**	+18	**31**	+22	**37**	+26	**45**	+32	**55**
		12		**15**		**18**		**22**		**26**		**32**
p7	+24	**32**	+30	**38**	+36	**44**	+43	**53**	+51	**63**	+62	**77**
	+12	**25**	+15	**30**	+18	**35**	+22	**43**	+26	**51**	+32	**62**
		12		**15**		**18**		**22**		**26**		**32**
r6	+23	**31**	+28	**36**	+34	**42**	+41	**51**	+50	**62**	+60	**75**
	+15	**25**	+19	**30**	+23	**35**	+28	**44**	+34	**53**	+41	**64**
		15		**19**		**23**		**28**		**34**		**41**
r7	+27	**35**	+34	**42**	+41	**49**	+49	**59**	+59	**71**	+71	**86**
	+15	**28**	+19	**34**	+23	**40**	+28	**49**	+34	**59**	+41	**71**
		15		**19**		**23**		**28**		**34**		**41**
Shaft tolerances for adapter sleeves and extraction sleeves												
h7/ $\frac{IT5}{2}$	0	*2,5*	0	*3*	0	*4*	0	*4,5*	0	*5,5*	0	*6,5*
	−12		−15		−18		−21		−25		−30	
h8/ $\frac{IT5}{2}$	0	*2,5*	0	*3*	0	*4*	0	*4,5*	0	*5,5*	0	*6,5*
	−18		−22		−27		−33		−39		−46	
h9/ $\frac{IT6}{2}$	0	*4*	0	*4,5*	0	*5,5*	0	*6,5*	0	*8*	0	*9,5*
	−30		−36		−43		−52		−62		−74	

The values printed in *italic* type indicate guide values for the cylindricity tolerance t_1 (ISO 1101).

65 **80**	**80** **100**	**100** **120**	**120** **140**	**140** **160**	**160** **180**	**180** **200**	**200** **225**	**225** **250**
0 −15	0 −20	0 −20	0 −25	0 −25	0 −25	0 −30	0 −30	0 −30
+33 | **48** +20 | **39** **20**	+38 | **58** +23 | **46** **23**	+38 | **58** +23 | **46** **23**	+45 | **70** +27 | **56** **27**	+45 | **70** +27 | **56** **27**	+45 | **70** +27 | **56** **27**	+51 | **81** +31 | **64** **31**	+51 | **81** +31 | **64** **31**	+51 | **81** +31 | **64** **31**
+39 | **54** +20 | **43** **20**	+45 | **65** +23 | **51** **23**	+45 | **65** +23 | **51** **23**	+52 | **77** +27 | **60** **27**	+52 | **77** +27 | **60** **27**	+52 | **77** +27 | **60** **27**	+60 | **90** +31 | **70** **31**	+60 | **90** +31 | **70** **31**	+60 | **90** +31 | **70** **31**
+51 | **66** +32 | **55** **32**	+59 | **79** +37 | **65** **37**	+59 | **79** +37 | **65** **37**	+68 | **93** +43 | **76** **43**	+68 | **93** +43 | **76** **43**	+68 | **93** +43 | **76** **43**	+79 | **109** +50 | **89** **50**	+79 | **109** +50 | **89** **50**	+79 | **109** +50 | **89** **50**
+62 | **77** +32 | **62** **32**	+72 | **92** +37 | **73** **37**	+72 | **92** +37 | **73** **37**	+83 | **108** +43 | **87** **43**	+83 | **108** +43 | **87** **43**	+83 | **108** +43 | **87** **43**	+96 | **126** +50 | **101** **50**	+96 | **126** +50 | **101** **50**	+96 | **126** +50 | **101** **50**
+62 | **77** +43 | **66** **43**	+73 | **93** +51 | **79** **51**	+76 | **96** +54 | **82** **54**	+88 | **113** +63 | **97** **63**	+90 | **115** +65 | **99** **65**	+93 | **118** +68 | **102** **68**	+106 | **136** +77 | **116** **77**	+109 | **139** +80 | **119** **80**	+113 | **143** +84 | **123** **84**
+73 | **88** +43 | **73** **43**	+86 | **106** +51 | **87** **51**	+89 | **109** +54 | **90** **54**	+103 | **128** +63 | **107** **63**	+105 | **130** +65 | **109** **65**	+108 | **133** +68 | **112** **68**	+123 | **153** +77 | **128** **77**	+126 | **156** +80 | **131** **80**	+130 | **160** +84 | **135** **84**
0 −30 | *6,5*	0 −35 | *7,5*	0 −35 | *7,5*	0 −40 | *9*	0 −40 | *9*	0 −40 | *9*	0 −46 | *10*	0 −46 | *10*	0 −46 | *10*
0 −46 | *6,5*	0 −54 | *7,5*	0 −54 | *7,5*	0 −63 | *9*	0 −63 | *9*	0 −63 | *9*	0 −72 | *10*	0 −72 | *10*	0 −72 | *10*
0 −74 | *9,5*	0 −87 | *11*	0 −87 | *11*	0 −100 | *12,5*	0 −100 | *12,5*	0 −100 | *12,5*	0 −115 | *14,5*	0 −115 | *14,5*	0 −115 | *14,5*

Shaft fits

Nominal shaft diameter in mm										
over incl.	**250** **280**		**280** **315**		**315** **355**		**355** **400**		**400** **450**	
Deviation of bearing bore diameter in μm (normal tolerance)										
Δ_{dmp}	0 −35		0 −35		0 −40		0 −40		0 −45	
Shaft deviation, fit interference or fit clearance in μm										
n5	+57 +34	**92** **73** **34**	+57 +34	**92** **73** **34**	+62 +37	**102** **80** **37**	+62 +37	**102** **80** **37**	+67 +40	**112** **88** **40**
n6	+66 +34	**101** **79** **34**	+66 +34	**101** **79** **34**	+73 +37	**113** **88** **37**	+73 +37	**113** **88** **37**	+80 +40	**125** **97** **40**
p6	+88 +56	**123** **101** **56**	+88 +56	**123** **101** **56**	+98 +62	**138** **113** **62**	+98 +62	**138** **113** **62**	+108 +68	**153** **125** **68**
p7	+108 +56	**143** **114** **56**	+108 +56	**143** **114** **56**	+119 +62	**159** **127** **62**	+119 +62	**159** **127** **62**	+131 +68	**176** **139** **68**
r6	+126 +94	**161** **138** **94**	+130 +98	**165** **142** **98**	+144 +108	**184** **159** **108**	+150 +114	**190** **165** **114**	+166 +126	**211** **183** **126**
r7	+146 +94	**181** **152** **94**	+150 +98	**185** **156** **98**	+165 +108	**205** **173** **108**	+171 +114	**211** **179** **114**	+189 +126	**234** **198** **126**
Shaft tolerances for adapter sleeves and extraction sleeves										
h7/ $\frac{IT5}{2}$	0 −52	*11,5*	0 −52	*11,5*	0 −57	*12,5*	0 −57	*12,5*	0 −63	*13,5*
h8/ $\frac{IT5}{2}$	0 −81	*11,5*	0 −81	*11,5*	0 −89	*12,5*	0 −89	*12,5*	0 −97	*13,5*
h9/ $\frac{IT6}{2}$	0 −130	*16*	0 −130	*16*	0 −140	*18*	0 −140	*18*	0 −155	*20*

The values printed in *italic* type indicate guide values for the cylindricity tolerance t_1 (ISO 1101).

450 **500**		**500** **560**		**560** **630**		**630** **710**		**710** **800**		**800** **900**	
0 −45		0 −50		0 −50		0 −75		0 −75		0 −100	
+67 +40	**112** **88** **40**	+73 +44	**123** **96** **44**	+73 +44	**123** **96** **44**	+82 +50	**157** **121** **50**	+82 +50	**157** **121** **50**	+92 +56	**192** **147** **56**
+80 +40	**125** **97** **40**	+88 +44	**138** **106** **44**	+88 +44	**138** **106** **44**	+100 +50	**175** **133** **50**	+100 +50	**175** **133** **50**	+112 +56	**212** **160** **56**
+108 +68	**153** **125** **68**	+122 +78	**172** **140** **78**	+122 +78	**172** **140** **78**	+138 +88	**213** **171** **88**	+138 +88	**213** **171** **88**	+156 +100	**256** **204** **100**
+131 +68	**176** **139** **68**	+148 +78	**198** **158** **78**	+148 +78	**198** **158** **78**	+168 +88	**243** **199** **88**	+168 +88	**243** **199** **88**	+190 +100	**290** **227** **100**
+172 +132	**217** **189** **132**	+194 +150	**244** **212** **150**	+199 +155	**249** **217** **155**	+225 +175	**300** **258** **175**	+235 +185	**310** **268** **185**	+266 +210	**366** **314** **210**
+195 +132	**240** **204** **132**	+220 +150	**270** **230** **150**	+225 +155	**275** **235** **155**	+255 +175	**330** **278** **175**	+265 +185	**340** **288** **185**	+300 +210	**400** **337** **210**
0 −63	*13,5*	0 −70	*14,5*	0 −70	*14,5*	0 −80	*16*	0 −80	*16*	0 −90	*18*
0 −97	*13,5*	0 −110	*14,5*	0 −110	*14,5*	0 −125	*16*	0 −125	*16*	0 −140	*18*
0 −155	*20*	0 −175	*22*	0 −175	*22*	0 −200	*25*	0 −200	*25*	0 −230	*28*

Design of bearing arrangements

Housing fits

Nominal housing bore diameter in mm										
over incl.	**6** **10**		**10** **18**		**18** **30**		**30** **50**		**50** **80**	
Deviation of bearing outside diameter in μm (normal tolerance)										
Δ_{Dmp}	0 −8		0 −8		0 −9		0 −11		0 −13	
Housing deviation, fit interference or fit clearance in μm										
E8	+47 +25	25 35 55	+59 +32	32 44 67	+73 +40	40 54 82	+89 +50	50 67 100	+106 +60	60 79 119
F7	+28 +13	13 21 36	+34 +16	16 25 42	+41 +20	20 30 50	+50 +25	25 37 61	+60 +30	30 44 73
G6	+14 +5	5 11 22	+17 +6	6 12 25	+20 +7	7 14 29	+25 +9	9 18 36	+29 +10	10 21 42
G7	+20 +5	5 13 28	+24 +6	6 15 32	+28 +7	7 17 37	+34 +9	9 21 45	+40 +10	10 24 53
H6	+9 0	**0** 6 17	+11 0	**0** 6 19	+13 0	**0** 7 22	+16 0	**0** 9 27	+19 0	**0** 11 32
H7	+15 0	**0** 8 23	+18 0	**0** 9 26	+21 0	**0** 10 30	+25 0	**0** 12 36	+30 0	**0** 14 43
H8	+22 0	**0** 10 30	+27 0	**0** 12 35	+33 0	**0** 14 42	+39 0	**0** 17 50	+46 0	**0** 20 59
J6	+5 −4	**4** 2 13	+6 −5	**5** 1 14	+8 −5	**5** 2 17	+10 −6	**6** 3 21	+13 −6	**6** 5 26
J7	+8 −7	**7** 1 16	+10 −8	**8** 1 18	+12 −9	**9** 1 21	+14 −11	**11** 1 25	+18 −12	**12** 2 31
JS6	+4,5 −4,5	**4,5** 2 12,5	+5,5 −5,5	**5,5** 1 13,5	+6,5 −6,5	**6,5** **0** 15,5	+8 −8	**8** 1 19	+9,5 −9,5	**9,5** **0** 22,5
JS7	−7,5 −7,5	**7,5** 1 15,5	+9 −9	**9** **0** 17	+10,5 −10,5	**10,5** **1** 19,5	+12,5 −12,5	**12,5** **1** 23,5	+15 −15	**15** **1** 28
K6	+2 −7	**7** **1** 10	+2 −9	**9** **3** 10	+2 −11	**11** **4** 11	+3 −13	**13** **4** 14	+4 −15	**15** **4** 17
K7	+5 −10	**10** **2** 13	+6 −12	**12** **3** 14	+6 −15	**15** **5** 15	+7 −18	**18** **6** 18	+9 −21	**21** **7** 22

Housing fits

Nominal housing bore diameter in mm								
over incl.	**80** **120**		**120** **150**		**150** **180**		**180** **250**	
Deviation of bearing outside diameter in μm (normal tolerance)								
Δ_{Dmp}	0 −15		0 −18		0 −25		0 −30	
Housing deviation, fit interference or fit clearance in μm								
E8	+126 +72	72 85 141	+148 +85	85 112 166	+148 +85	85 114 173	+172 +100	100 134 202
F7	+71 +36	36 53 86	+83 +43	43 62 101	+83 +43	43 64 108	+96 +50	50 75 126
G6	+34 +12	12 24 49	+39 +14	14 28 57	+39 +14	14 31 64	+44 +15	15 35 74
G7	+47 +12	12 29 62	+54 +14	14 33 72	+54 +14	14 36 79	+61 +15	15 40 91
H6	+22 0	**0** 12 37	+25 0	**0** 14 43	+25 0	**0** 17 50	+29 0	**0** 20 59
H7	+35 0	**0** 17 50	+40 0	**0** 19 58	+40 0	**0** 22 65	+46 0	**0** 25 76
H8	+54 0	**0** 23 69	+63 0	**0** 27 81	+63 0	**0** 29 88	+72 0	**0** 34 102
J6	+16 −6	**6** 6 31	+18 −7	**7** 7 36	+18 −7	**7** 10 43	+22 −7	**7** 13 52
J7	+22 −13	**13** 4 37	+26 −14	**14** 5 44	+26 −14	**14** 8 51	+30 −16	**16** 9 60
JS6	+11 −11	**11** 1 26	+12,5 −12,5	**12,5** 1 30,5	+12,5 −12,5	**12,5** 3 37,5	+14,5 −14,5	**14,5** 5 44,5
JS7	+17,5 −17,5	**17,5** **1** 32,5	+20 −20	**20** 1 38	+20 −20	**20** 1 45	+23 −23	**23** 2 53
K6	+4 −18	**18** **6** 19	+4 −21	**21** **7** 22	+4 −21	**21** **4** 29	+5 −24	**24** **4** 35
K7	+10 −25	**25** **8** 25	+12 −28	**28** **9** 30	+12 −28	**28** **6** 37	+13 −33	**33** **8** 43

250 **315**		**315** **400**		**400** **500**		**500** **630**		**630** **800**		**800** **1000**		**1000** **1250**	
0 −35		0 −40		0 −45		0 −50		0 −75		0 −100		0 −125	
+191 +110	110 149 226	+214 +125	125 168 254	+232 +135	135 182 277	+255 +145	145 199 305	+285 +160	160 227 360	+310 +170	170 250 410	+360 +195	195 292 485
+108 +56	56 85 143	+119 +62	62 94 159	+131 +68	68 104 176	+146 +76	76 116 196	+160 +80	80 132 235	+176 +86	86 149 276	+203 +98	98 175 328
+49 +17	17 39 84	+54 +18	18 43 94	+60 +20	20 48 105	+66 +22	22 54 116	+74 +24	24 66 149	+82 +26	26 78 182	+94 +28	28 93 219
+69 +17	17 46 104	+75 +18	18 50 115	+83 +20	20 56 128	+92 +22	22 62 142	+104 +24	24 76 179	+116 +26	26 89 216	+133 +28	28 105 258
+32 0	**0** 22 67	+36 0	**0** 25 76	+40 0	**0** 28 85	+44 0	**0** 32 94	+50 0	**0** 42 125	+56 0	**0** 52 156	+66 0	**0** 64 191
+52 0	**0** 29 87	+57 0	**0** 32 97	+63 0	**0** 36 108	+70 0	**0** 40 120	+80 0	**0** 52 155	+90 0	**0** 63 190	+105 0	**0** 77 230
+81 0	**0** 39 116	+89 0	**0** 43 129	+97 0	**0** 47 142	+110 0	**0** 54 160	+125 0	**0** 67 200	+140 0	**0** 80 240	+165 0	**0** 97 290
+25 −7	**7** 15 60	+29 −7	**7** 18 69	+33 −7	**7** 21 78	–	–	–	–	–	–	–	–
+36 −16	**16** 13 71	+39 −18	**18** 14 79	+43 −20	**20** 16 88	–	–	–	–	–	–	–	–
+16 −16	**16** 7 51	+18 −18	**18** 6 58	+20 −20	**20** 8 65	+22 −22	**22** 10 72	+25 −25	**25** 17 100	+28 −28	**28** 24 128	+33 −33	**33** 31 158
+26 −26	**26** 3 61	+28,5 −28,5	**28,5** 3 68,5	+31,5 −31,5	**31,5** 4 76,5	+35 −35	**35** 5 85	+40 −40	**40** 12 115	+45 −45	**45** 18 145	+52 −52	**52** 24 177
+5 −27	**27** **5** 40	+7 −29	**29** **4** 47	+8 −32	**32** **4** 53	0 −44	**44** **12** 50	0 −50	**50** **8** 75	0 −56	**56** **4** 100	0 −66	**66** **2** 125
+16 −36	**36** **7** 51	+17 −40	**40** **8** 57	+18 −45	**45** **9** 63	0 −70	**70** **30** 50	0 −80	**80** **28** 75	0 −90	**90** **27** 100	0 −105	**105** **28** 125

Housing fits

	Nominal housing bore diameter in mm											
	over	**6**		**10**		**18**		**30**		**50**		**80**
	incl.	**10**		**18**		**30**		**50**		**80**		**120**
	Deviation of bearing outside diameter in μm (normal tolerance)											
	Δ_{Dmp}	0		0		0		0		0		0
		−8		−8		−9		−11		−13		−15
	Housing deviation, fit interference or fit clearance in μm											
M6	−3	**12**		−4	**15**	−4	**17**	−4	**20**	−5	**24**	−6	**28**
	−12	**6**		−15	**9**	−17	**10**	−20	**11**	−24	**13**	−28	**16**
		5			4		5		7		8		9
M7	0	**15**		0	**18**	0	**21**	0	**25**	0	**30**	0	**35**
	−15	**7**		−18	**9**	−21	**11**	−25	**13**	−30	**16**	−35	**18**
		8			8		9		11		13		15
N6	−7	**16**		−9	**20**	−11	**24**	−12	**28**	−14	**33**	−16	**38**
	−16	**10**		−20	**14**	−24	**17**	−28	**19**	−33	**22**	−38	**26**
		1			**1**		**2**		**1**		**1**		**1**
N7	−4	**19**		−5	**23**	−7	**28**	−8	**33**	−9	**39**	−10	**45**
	−19	**11**		−23	**14**	−28	**18**	−33	**21**	−39	**25**	−45	**28**
		4			3		2		3		4		5
P6	−12	**21**		−15	**26**	−18	**31**	−21	**37**	−26	**45**	−30	**52**
	−21	**15**		−26	**20**	−31	**24**	−37	**28**	−45	**34**	−52	**40**
		4			**7**		**9**		**10**		**13**		**15**
P7	−9	**24**		−11	**29**	−14	**35**	−17	**42**	−21	**51**	−24	**59**
	−24	**16**		−29	**20**	−35	**25**	−42	**30**	−51	**37**	−59	**42**
		1			**3**		**5**		**6**		**8**		**9**

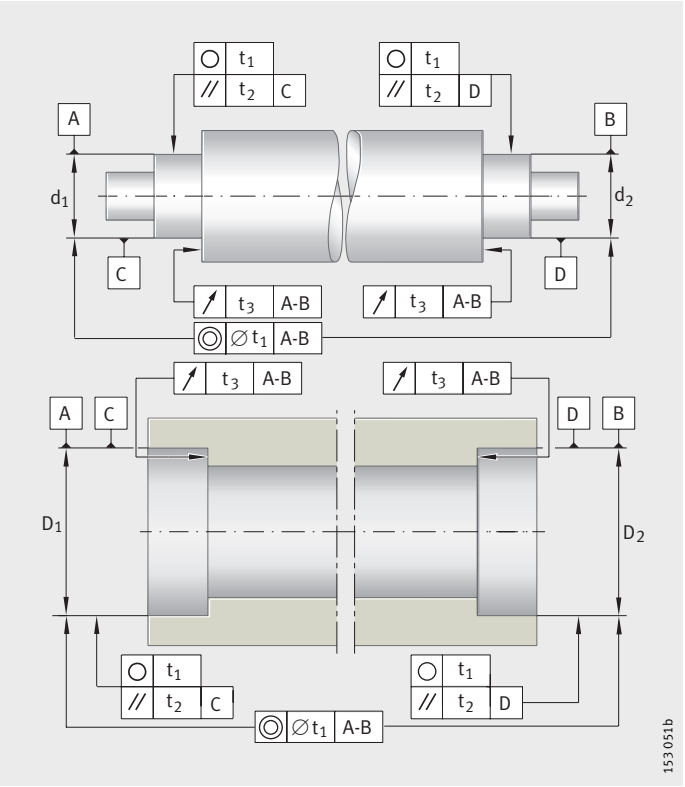
120 **150**		**150** **180**		**180** **250**		**250** **315**		**315** **400**		**400** **500**		**500** **630**		**630** **800**		**800** **1000**	
0 −18		0 −25		0 −30		0 −35		0 −40		0 −45		0 −50		0 −75		0 −100	
−8 −33	**33** **19** 10	−8 −33	**33** **16** 17	−8 −37	**37** **17** 22	−9 −41	**41** **19** 26	−10 −46	**46** **21** 30	−10 −50	**50** **22** 35	−26 −70	**70** **38** 24	−30 −80	**80** **38** 45	−34 −90	**90** **38** 66
0 −40	**40** **21** 18	0 −40	**40** **18** 25	0 −46	**46** **21** 30	0 −52	**52** **23** 35	0 −57	**57** **25** 40	0 −63	**63** **27** 45	−26 −96	**96** **56** 24	−30 −110	**110** **58** 45	−34 −124	**124** **61** 66
−20 −45	**45** **31** **2**	−20 −45	**45** **28** 5	−22 −51	**51** **31** 8	−25 −57	**57** **35** 10	−26 −62	**62** **37** 14	−27 −67	**67** **39** 18	−44 −88	**88** **56** 6	−50 −100	**100** **58** 25	−56 −112	**112** **60** 44
−12 −52	**52** **33** 6	−12 −52	**52** **30** 13	−14 −60	**60** **35** 16	−14 −66	**66** **37** 21	−16 −73	**73** **41** 24	−17 −80	**80** **44** 28	−44 −114	**114** **74** 6	−50 −130	**130** **78** 25	−56 −146	**146** **83** 44
−36 −61	**61** **47** **18**	−36 −61	**61** **44** **11**	−41 −70	**70** **50** **11**	−47 −79	**79** **57** **12**	−51 −87	**87** **62** **11**	−55 −95	**95** **67** **10**	−78 −122	**122** **90** **28**	−88 −138	**138** **96** **13**	−100 −156	**156** **104** **0**
−28 −68	**68** **49** **10**	−28 −68	**68** **46** **3**	−33 −79	**79** **54** **3**	−36 −88	**88** **59** **1**	−41 −98	**98** **66** **1**	−45 −108	**108** **72** **0**	−78 −148	**148** **108** **28**	−88 −168	**168** **126** **13**	−100 −190	**190** **127** **0**

Housing fits

Nominal housing bore diameter in mm		
over incl.	**1000** **1250**	
Deviation of bearing outside diameter in µm (normal tolerance)		
Δ_{Dmp}	0 −125	
Housing deviation, fit interference or fit clearance in µm		
M6	−40 −106	**106** **45** 85
M7	−40 −145	**145** **68** 85
N6	−66 −132	**132** **67** 59
N7	−66 −171	**171** **94** 59
P6	−120 −186	**186** **121** 5
P7	−120 −225	**225** **148** 5

Geometrical tolerances of bearing seating surfaces

In order to achieve the required fit, the bearing seats/fit surfaces of the shaft and housing must conform to certain tolerances matched to the bearings, *Figure 15* and table Geometrical tolerances of bearing seating surfaces, page 153.



t_1 = roundness
t_2 = parallelism
t_3 = runout of abutment shoulders

Figure 15
Geometrical tolerances

Accuracy of bearing seating surfaces

The degree of accuracy for the bearing seat tolerances on the shaft and in the housing is given in the tables Geometrical tolerances of bearing seating surfaces, page 153, and the ISO fundamental tolerances (ISO 286).

Second bearing seat

The tolerances for a second bearing seat on the shaft (d_2) or in the housing (D_2) – expressed in terms of coaxiality to DIN ISO 1101 – must be based on the angular adjustment facility of the specific bearing. Misalignments due to elastic deformation of the shaft and housing must be taken into consideration.

Housings

In split housings, the joints must be free from burrs.

The accuracy of the bearing seats is determined as a function of the accuracy of the bearing selected.

Geometrical tolerances of bearing seating surfaces

Bearing tolerance class	Bearing seating surface	Diameter tolerance	Roundness tolerance t_1	Parallelism tolerance t_2	Abutment shoulder runout tolerance t_3
PN P6X	Shaft	IT6 (IT5)	Circumferential load IT4/2	IT4	IT4
			Point load IT5/2	IT5	
	Housing	IT7 (IT6)	Circumferential load IT5/2	IT5	IT5
			Point load IT6/2	IT6	
P5	Shaft	IT5	Circumferential load IT2/2	IT2	IT2
			Point load IT3/2	IT3	
	Housing	IT6	Circumferential load IT3/2	IT3	IT3
			Point load IT4/2	IT4	
P4 P4S SP	Shaft	IT4	Circumferential load IT1/2	IT1	IT1
			Point load IT2/2	IT2	
	Housing	IT5	Circumferential load IT2/2	IT2	IT2
			Point load IT3/2	IT3	
UP	Shaft	IT3	Circumferential load IT0/2	IT0	IT0
			Point load IT1/2	IT1	
	Housing	IT4	Circumferential load IT1/2	IT1	IT1
			Point load IT2/2	IT2	

Roughness of bearing seats

The roughness of the bearing seats must be matched to the tolerance class of the bearings. The mean roughness value R_a must not be too high, in order to maintain the interference loss within limits. Shafts should be ground and bores should be precision turned.

The bore and shaft tolerances and permissible roughness values are also given in the design and safety guidelines in the product sections. The guide values for roughness correspond to DIN 5 425-1.

Raceways for bearings without inner and/or outer ring

In rolling bearings without an inner and/or outer ring as a raceway, the rolling elements run directly on the shaft or in the housing bore.

Caution!

The shaft and housing bore must be suitable for use as rolling bearing raceways.

A precision ground raceway surface without undulations is essential. The raceways must always be precision machined (grinding and honing). At a mean roughness $R_a > 0{,}2$ µm, it is not possible to utilise the full load carrying capacity of the bearings.

The additional guidelines on shaft design in the product sections must be observed.

The diameter tolerances of the shaft and housing determine the internal clearance.

Materials for raceways

Through hardening steels

Through hardening steels to ISO 683-17 (e.g. 100Cr6) are suitable as materials for rolling bearing raceways in direct bearing arrangements. These steels can also be surface layer hardened.

Case hardening steels

Case hardening steels must conform to ISO 683-17 (e.g. 17MnCr5, 16CrNiMo6) or EN 10 084 (e.g. 16MnCr5).

Flame or induction hardening

For flame and induction hardening, the steels used must conform to ISO 683-17 (e.g. Cf54, 43CrMo4) or to DIN 17 212 (e.g. Cf53).

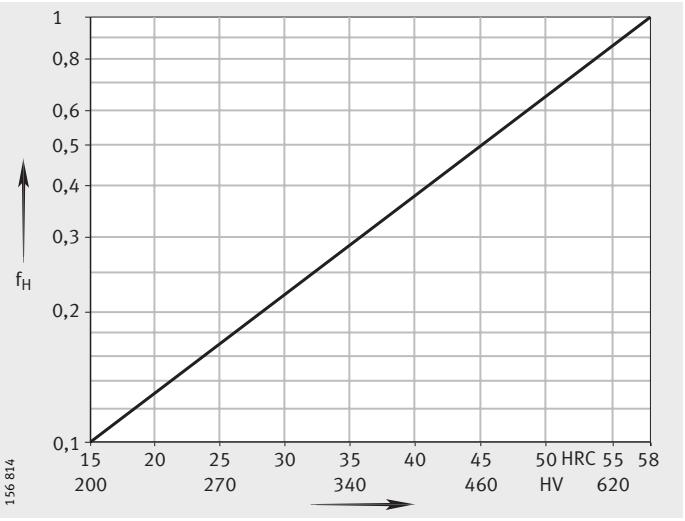
Surface hardness and hardening depth

Case, flame or induction hardened steels must have a surface hardness of 670 HV + 170 HV and an adequate hardening depth CHD or Rht.

The hardening depth is, according to DIN 50 190, the depth of the hardened surface zone at which there is still a hardness of 550 HV. It is measured on the finish ground shaft and must correspond to the stated values, but must in any case be ≧ 0,3 mm.

Caution!

If the raceways are softer than 650 HV (58 HRC), the bearing arrangement will not achieve the full load carrying capacity. The basic dynamic load rating C_r and the basic static load rating C_{0r} must then be reduced by the factor f_H, *Figure 16*.



f_H = factor to take account of raceway hardness
HRC, HV = surface hardness

Figure 16
Factor f_H to take account of raceway surface hardness

Hardness curves

The hardness curves are shown schematically, see *Figure 17* and *Figure 18*. The required hardness curve is derived from the strain on the material.

The formulae are based on the hardness curves normally achieved with professional heat treatment.

Case hardening:

$$CHD \geqq 0{,}078 \cdot D_w$$

Flame or induction hardening:

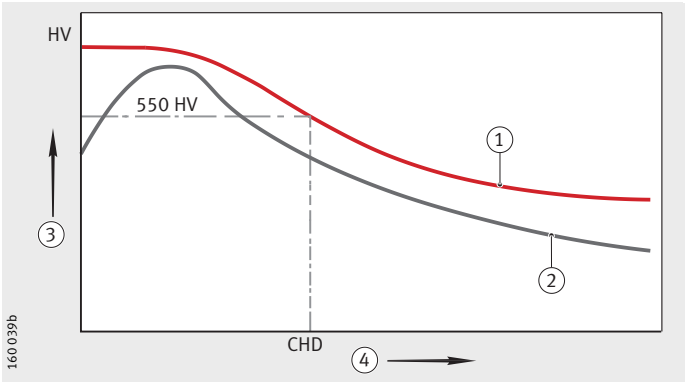
$$Rht \geqq 140 \cdot D_w / R_{p0,2}$$

CHD mm
Case hardening depth

Rht mm
Effective hardening depth

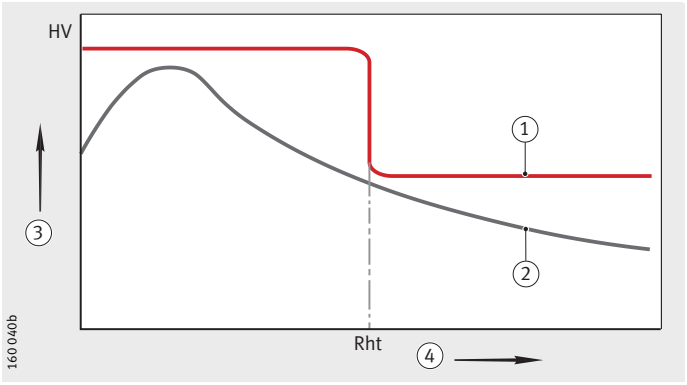
D_w mm
Rolling element diameter

$R_{p\,0,2}$ N/mm^2
Proof stress.



① Case hardening
② Required hardness
③ Hardness
④ Distance from surface
CHD = case hardening depth with hardness 550 HV

Figure 17
Case hardening depth CHD – hardness curve



① Flame or induction hardening
② Required hardness
③ Hardness
④ Distance from surface
Rht = effective hardening depth

Figure 18
Effective hardening depth Rht

Design of bearing arrangements

Axial location of bearings

Axial location of the bearing rings is matched to the specific bearing arrangement (locating bearing, non-locating bearing, adjusted and floating arrangements of bearings).

Examples: see *Figure 19*, page 157 to *Figure 29*, page 160.

Design guidelines

Bearing rings must be located by force or geometrical locking in order to prevent lateral movement.

The bearing rings must only be in contact with the shaft or housing shoulder, but not with the fillet.

Every radius of the mating part must be smaller than the smallest chamfer dimension r or r_1 of the bearing.

The radius should have rounding to DIN 5 418 or an undercut to DIN 509.

The shoulders on the mating parts must be large enough to provide a sufficiently wide contact surface even with the largest chamfer dimension of the bearing (DIN 5 418).

The bearing tables give the maximum values for the radius r_a and r_{a1} and the diameter of the abutment shoulders (D_a and d_a).

Any special characteristics of the individual bearing types, e.g. for needle roller bearings, cylindrical roller bearings, tapered roller bearings and axial bearings are indicated in the product sections.

Locating bearings

Locating bearings can support axial forces. The retaining element must be matched to these axial forces. The following are suitable: shoulders on shaft and housing, snap rings, housing cover, shaft covers, nuts, spacer rings etc.

Non-locating bearings

Non-locating bearings only need to support slight axial forces occurring in thermal expansion. The means of axial location only needs to prevent creep of the rings. A tight fit is often sufficient.

Self-retaining bearings

In non-separable bearings, only one bearing ring requires a tight fit; the other ring is retained by the rolling elements.

Deep groove ball bearings, double row angular contact ball bearings

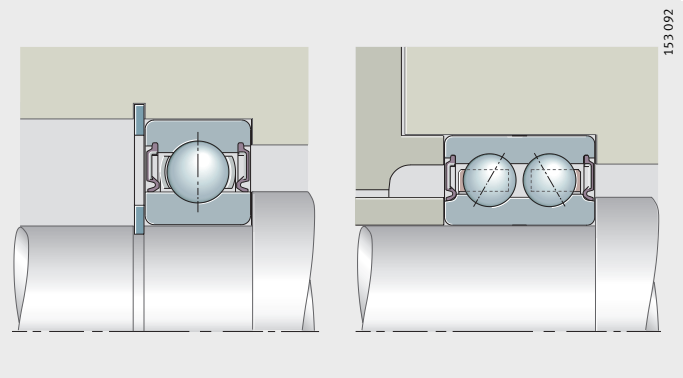


Figure 19
Locating bearing
Supported on both sides on inner and outer rings

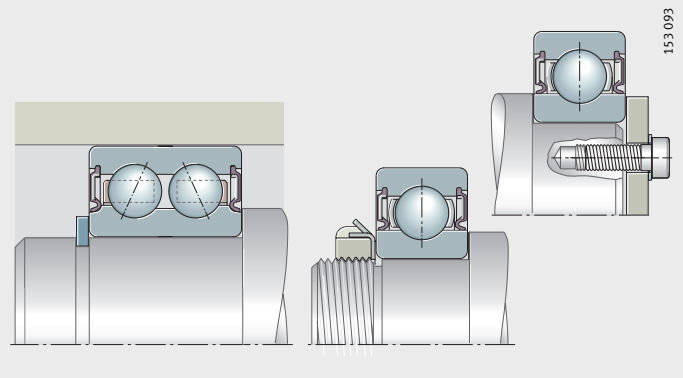


Figure 20
Non-locating bearing
Supported on both sides on inner ring
Ribs of axially loaded bearing to be supported up to shoulder diameter

Cylindrical roller bearings

The bearings must be supported on both sides on the inner and outer rings, *Figure 21* to *Figure 23*.

The ribs of axially loaded cylindrical roller bearings must be supported up to dimension d_1 and D_1.
Dimensions d_1, D_1: see dimension tables.

For semi-locating bearings, support of the bearing rings is required on only one side, i. e. the side with the rib supporting the axial load.

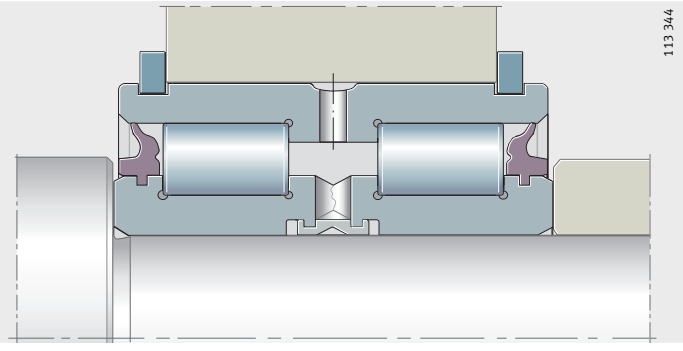
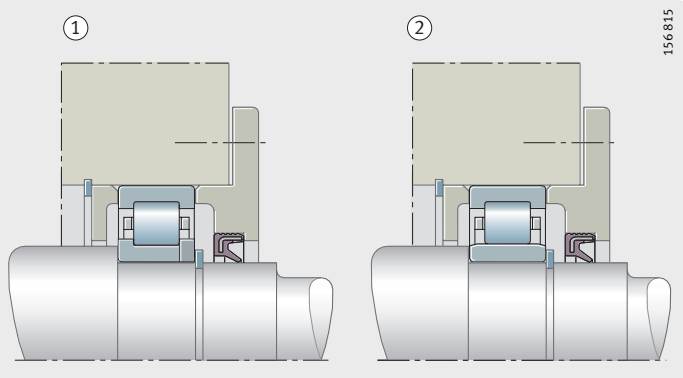


Figure 21
Locating bearing
Outer ring axially located by retaining rings



① Locating bearing
② Non-locating bearing

Figure 22
Axial location by geometrical locking

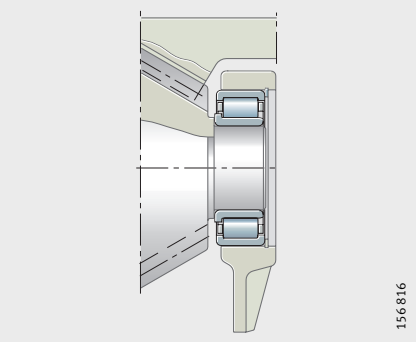


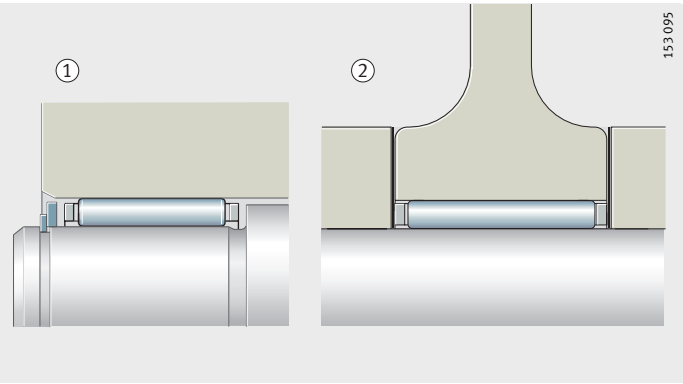
Figure 23
Non-locating bearing
Inner ring rib prevents axial creep to one side

Needle roller and cage assemblies
Caution!

Axial running surfaces should be precision machined (R_a2) and wear resistant.

A washer should be fitted against retaining and snap rings.

Sufficient interference must be ensured between the snap ring and washer.



① Location by snap ring and washer
② Location by adjacent construction

Figure 24
Axial location of needle roller and cage assemblies

Drawn cup needle roller bearings, needle roller bearings without ribs, needle roller bearings, inner rings

Location by snap ring and shaft shoulder. Sufficient interference must be ensured between the snap ring and end face of the inner ring.

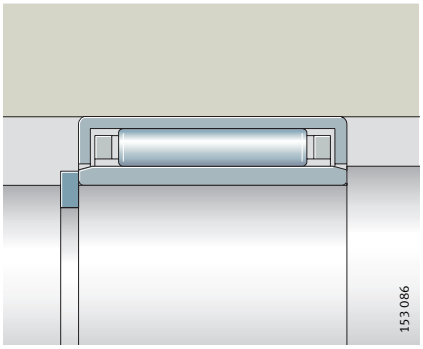
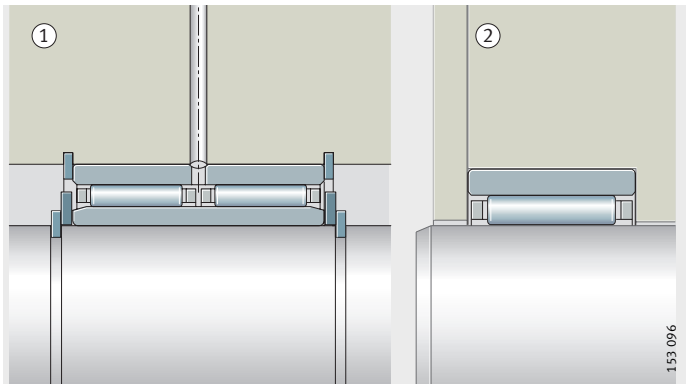


Figure 25
Axial location by snap ring and shaft shoulder



① Axial location by snap rings
② Axial location by abutment shoulder

Figure 26
Axial location of bearing rings

Combined needle roller bearings
Caution!

Axial support of bearing rings on both sides is particularly important for locating bearings and bearings with a split inner ring or split outer ring.

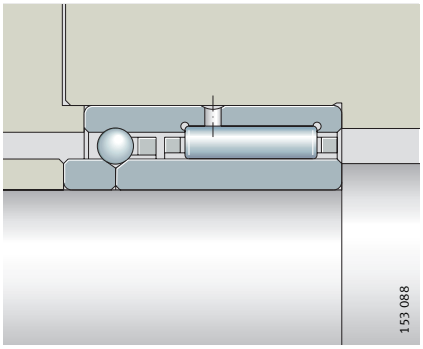


Figure 27
Locating bearing
Axial support of bearing rings on both sides

Adjusted and floating bearing arrangements

Since bearings in adjusted and floating arrangements support axial forces in one direction only, the bearing rings only need to be supported on one side. Counterguidance is performed by a second, symmetrically arranged bearing, *Figure 28* and *Figure 29*.
Shaft nuts, ring nuts, covers or spacer washers can be used as adjustment elements.

In floating bearing arrangements, lateral movement of the rings is prevented by shaft or housing shoulders, covers, snap rings etc., *Figure 29*.

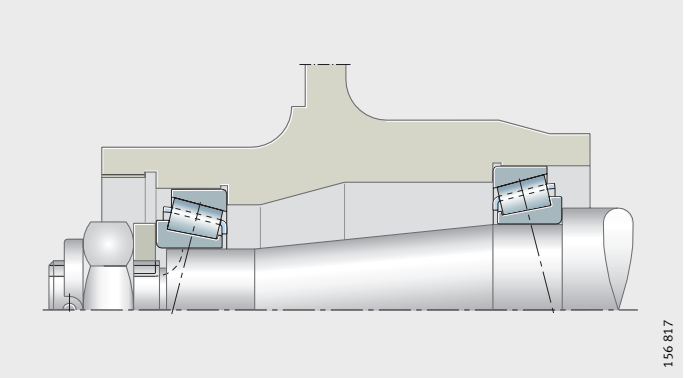
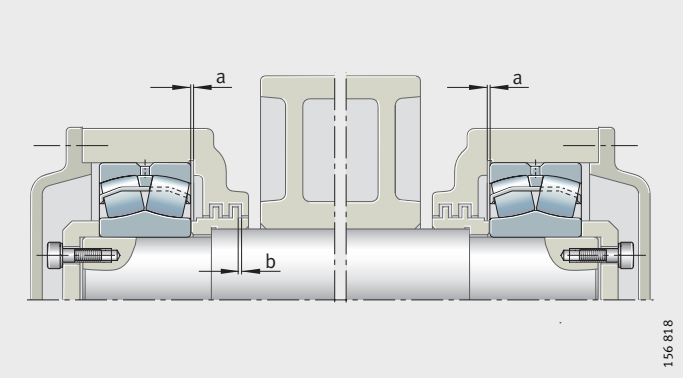


Figure 28
Axial location in adjusted bearing arrangement



a = guidance clearance;
a < b (b = axial labyrinth gap)

Figure 29
Axial location in floating bearing arrangement

Seals

Sealing has a considerable influence on the operating life of a bearing arrangement. It is intended to retain the lubricant in the bearing and prevent the ingress of contaminants into the bearing.

Contaminants may have various effects:

- A large quantity of very small, abrasive particles causes wear in the bearing. The increase in the operating clearance and noise level then bring the operating life of the bearing to an end.
- Large, overrolled hard particles reduce the fatigue life since pittings occur at the indentation points under high bearing loads.

A basic distinction is made between contact and non-contact seals in the adjacent construction and the bearing.

Non-contact seals in the adjacent construction

With non-contact seals, there is no friction in the lubricant gap other than that due to lubricant friction itself.
The seals do not undergo wear and remain capable of operation for a long period. Since they generate no heat, non-contact seals are also suitable for very high speeds.

Gap seals

A simple design, although adequate in many cases, is a narrow seal gap between the shaft and housing, *Figure 30*.

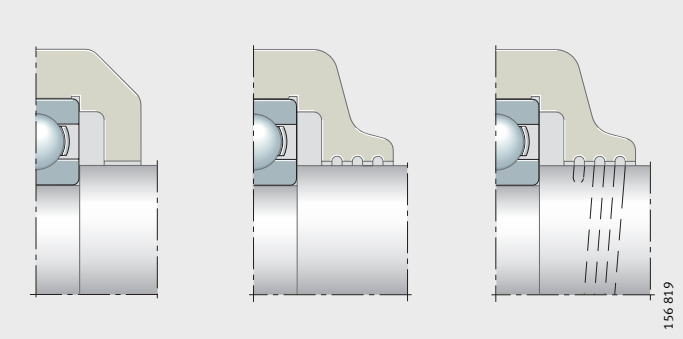


Figure 30
Simple gap seal

Labyrinth seals

A considerably greater sealing effect than with gap seals is achieved by labyrinths incorporating gaps filled with grease, *Figure 31*.

In contaminated environments, grease should be pressed from the interior into the seal gap at short intervals.

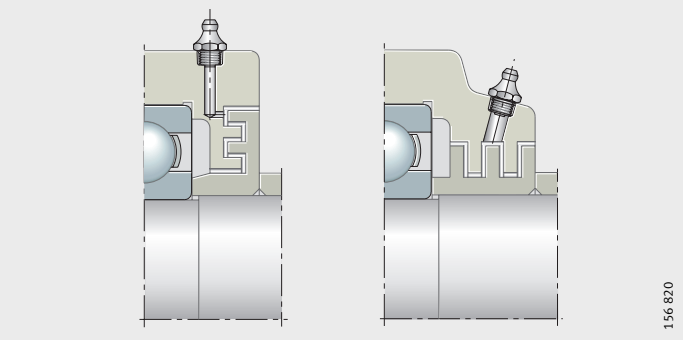


Figure 31
Labyrinth seals

Splash ring

Where oil lubrication is used with a horizontal shaft, splash rings are suitable for preventing the escape of oil, *Figure 32*.

The oil outlet hole on the underside of the seal location must be sufficiently large that it cannot be clogged by contamination.

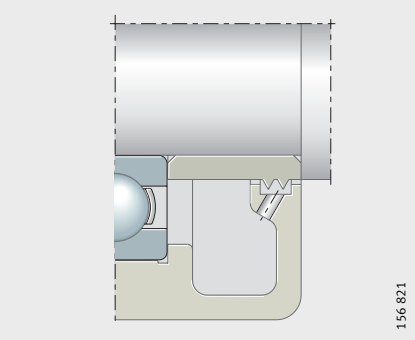


Figure 32
Splash ring

Flinger shields

Co-rotating flinger shields have the effect of shielding the seal gap from heavy contamination, *Figure 33*.

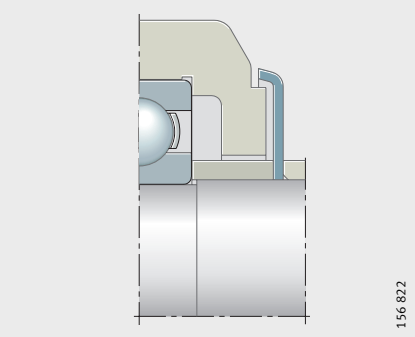


Figure 33
Flinger shields

Baffle plates

Stationary baffle plates ensure that grease remains in the area around the bearing, *Figure 34*.

The grease collar that forms at the seal gap protects the bearing against contamination.

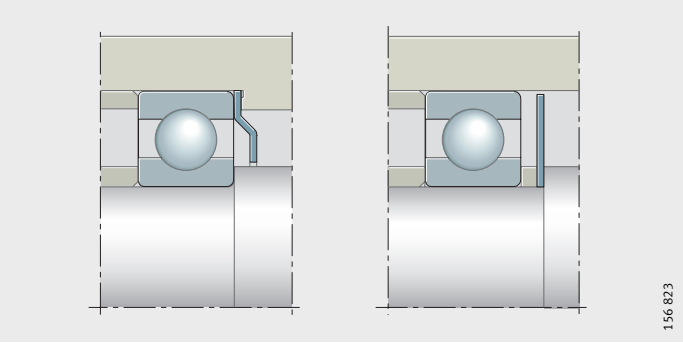


Figure 34
Rigid baffle plates

Lamellar rings

Lamellar rings made from steel and radially sprung either outwards or inwards require little mounting space, *Figure 35*. They give protection against loss of grease and ingress of contamination and are also used as an outer seal against spray water.

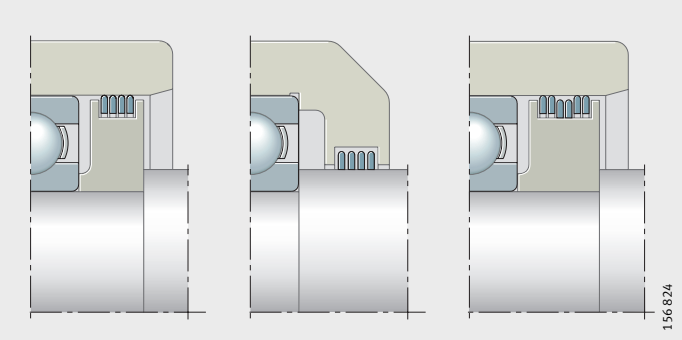


Figure 35
Lamellar rings

Non-contact seals in the bearing

Sealing shields in the bearing

Sealing shields, *Figure 36*, are compact sealing elements fitted on one or both sides of the bearing.

Bearings with sealing shields on both sides (suffix 2Z) are supplied with a grease filling.

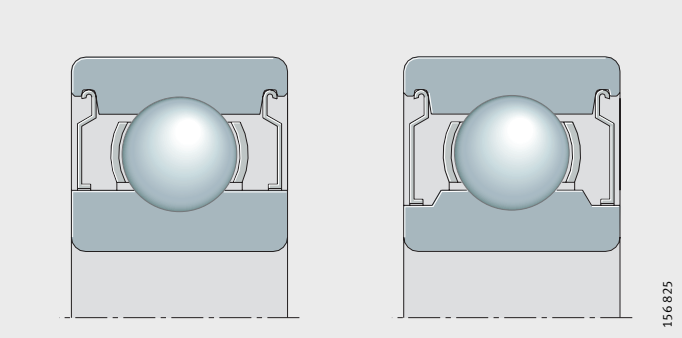


Figure 36
Sealing shields, suffix 2Z

BRS seals

Bearings with BRS seals are supplied by agreement only, *Figure 37*.

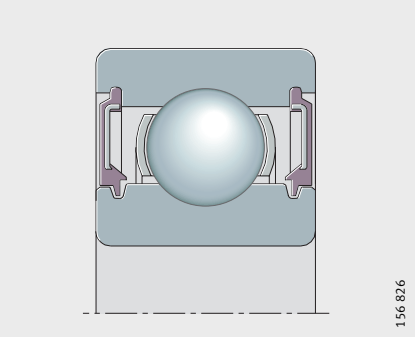


Figure 37
BRS seals, suffix 2BRS

The friction in this case is as low as that in bearings with sealing shields. They have the advantage over these, however, that the outer elastic rim gives good sealing when fitted in the slot in the outer ring. This is important with a rotating outer ring since the base oil is separated from the soap suspension by centrifugal force and would escape through the unsealed metallic seat in the outer ring if sealing shields were fitted.

Contact seals in the adjacent construction

Contact seals are in contact with the running surface under contact force (normally radial). The contact force should be kept small to avoid an excessive increase in frictional torque and temperature. The frictional torque and temperature as well as the wear of the seal are also affected by the lubrication condition at the running surface, its roughness and the sliding speed.

With grease lubrication

Felt rings are simple sealing elements that have proved effective primarily with grease lubrication, *Figure 38*. They are impregnated with oil before fitting and give particularly good sealing against dust. In unfavourable environmental conditions, two felt rings are arranged adjacent to each other. Felt rings and annular slots are standardised according to DIN 5 419.

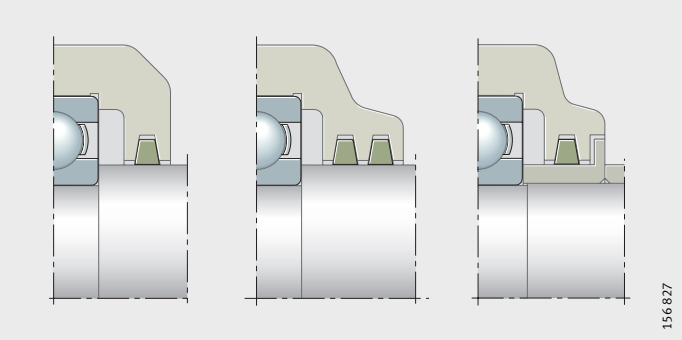


Figure 38
Felt rings or felt strips

With oil lubrication

If oil lubrication is used, sealing is primarily carried out with rotary shaft seals to DIN 3 760 and DIN 3 761, *Figure 39*. The seal collar with one lip is pressed against the shaft running surface by a spring.

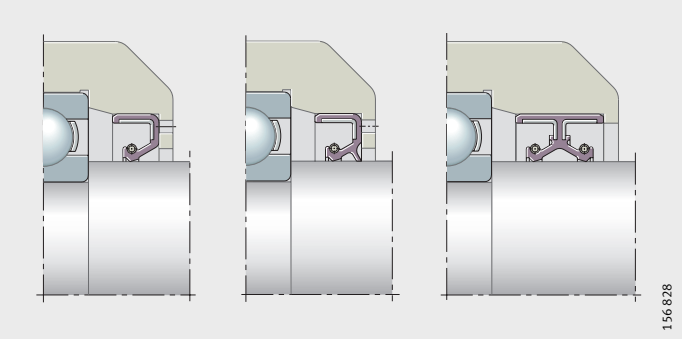
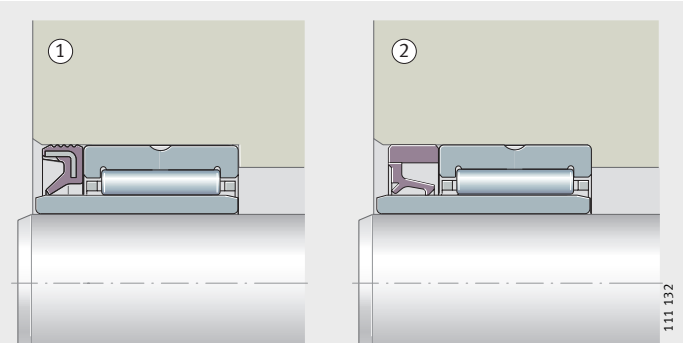


Figure 39
Rotary shaft seals

If the principal objective is to prevent escape of lubricant, the lip is arranged on the inner side of the bearing arrangement.
A sealing ring with an additional protective lip also prevents the ingress of contamination. Seal lips made from the conventional material nitrile butadiene rubber (NBR) are suitable with oil lubrication for circumferential speeds up to 12 m/s.

INA sealing rings for needle roller bearings

These compact sealing rings are matched to INA needle roller bearings and are suitable for circumferential speeds at the running surface of up to 10 m/s, *Figure 40*. INA inner rings are recommended as sealing ring raceways.



① INA sealing ring G
② INA sealing ring SD

Figure 40
INA sealing rings for needle roller bearings

Lip seal with axial sealing action

The V ring is a lip seal with axial sealing action, *Figure 41*. During fitting, this single piece rubber ring is pushed under tension along the shaft until its lip is in axial contact with the housing wall. The seal lip acts simultaneously as a flinger shield.

Axial lip seals are unaffected by radial misalignment and slight skewing of the shaft.

Rotating V rings are suitable with grease lubrication for circumferential speeds up to 12 m/s, stationary V rings up to 20 m/s. For circumferential speeds over 8 m/s, the V ring must be axially abutted and, from 12 m/s, it must be radially clamped in addition.

V rings are frequently used as outer seals in order to keep contamination away from a rotary shaft seal.

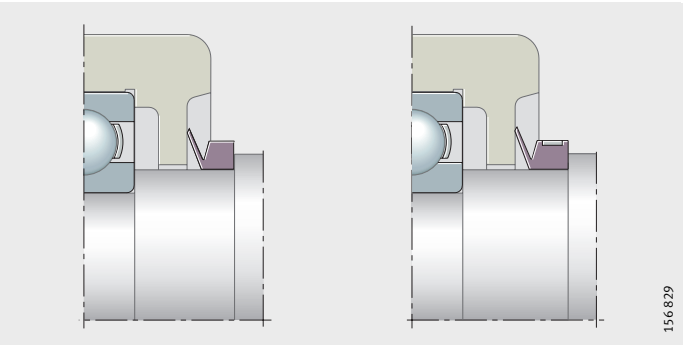


Figure 41
V ring

Axial spring seals

When using grease lubrication, effective sealing can also be achieved by means of axial spring seals, *Figure 42*. The thin sheet metal washers are clamped to the end face of the inner ring or outer ring and are axially sprung against the other bearing ring.

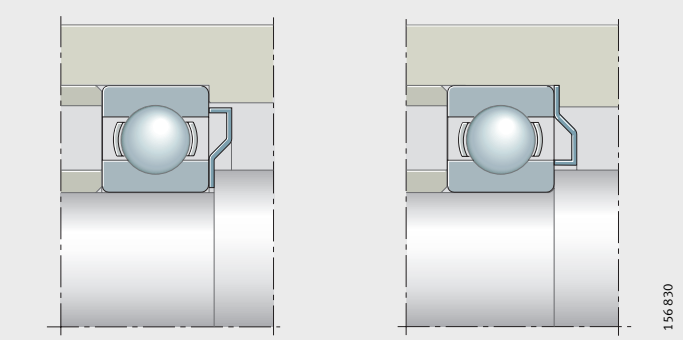


Figure 42
Spring seals

Contact seals in the bearing

Sealing washers

Bearings fitted with one or two sealing washers allow simple designs, *Figure 43*. The washers are suitable for giving protection against dust, contamination, damp atmospheres and slight pressure differentials.

Sealing washers are used, for example, in maintenance-free bearings with grease filling.

The sealing washer design RSR made from acrylonitrile butadiene rubber (NBR), normally used in deep groove ball bearings, is located under slight contact pressure against a cylindrically ground inner ring bore.

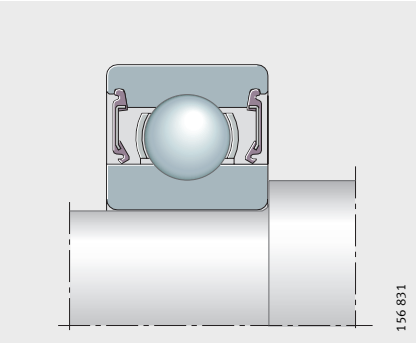


Figure 43
Sealing washers 2RSR

Fitting and dismantling

Handling

Rolling bearings are precision products. These products must be handled with care before and during fitting in order to maintain their full performance capacity.

Rolling bearings are preserved using an anti-corrosion agent with a mineral oil base, dry preserved using VCI paper or provided with a long term preservative for overseas transport.

The preservative and packaging used with rolling bearings must be matched to each other to maintain the characteristics of the bearings for as long as possible.

Storage of rolling bearings

During storage, measures must be taken to prevent action by aggressive media such as gases, mist or aerosols of acids, alkalis or salts. Direct sunlight should also be avoided since, apart from the harmful effects of UV radiation, it can lead to wide temperature fluctuations in the packaging.

Parts must be stored in dry, clean rooms with the temperature as constant as possible.

In order to prevent condensation, the following permissible conditions should be adhered to:

- temperature between +6 °C and +25 °C, for short periods +30 °C
- temperature differences between day and night ≦ 8 K
- relative humidity of max. 65%.

The storage period for greased and sealed bearings is limited by the shelf life of the grease and the sealing ring material.

Permissible storage periods for rolling bearings

With normal preservation, bearings can be stored for up to 5 years if the above conditions are fulfilled. If the permissible storage period is exceeded, it is recommended that the bearing should be checked for preservative condition and for corrosion. By agreement, we will give information on the risk assessment relating to the continued storage or use of older bearings.

In special cases, special preservatives are used that permit shorter or longer storage periods than the normal preservation.

Bearings sealed on both sides with sealing shields (suffix 2Z) or sealing washers (suffix 2RSR) should not, where possible, be stored up to the limit of their normal storage capability. The greases used for filling may undergo changes in their chemical-physical behaviour during storage as a result of ageing. Even if the minimum performance capacity remains, the safety reserves of the grease may have diminished. Further relevant information is given in the section Lubrication.

Fitting and dismantling

Unpacking of rolling bearings

Perspiration from handling leads to corrosion. Hands should be kept clean and dry and gloves worn if necessary.

Bearings should only be removed from their original packaging immediately before assembly. If bearings are removed from multi-item packaging with dry preservation, the package must be closed again immediately afterwards, since the protective vapour phase is only effective in closed packaging.

Caution! Bearings should be oiled or greased immediately after unpacking.

Compatibility, miscibility

The anti-corrosion agent in rolling bearings with an oil-based preservative is compatible and miscible with oils and greases with a mineral oil base. Compatibility should be checked if synthetic lubricants or thickeners other than lithium or lithium complex soaps are used.

If there is an incompatibility, the anti-corrosion oil should be washed out before greasing, especially in the case of lubricants with a PTFE/alkoxyfluoroether base and thickeners based on polycarbamide. Bearings should be washed out if the lubricant is changed or the rolling bearings are contaminated.

If in doubt, please consult the relevant lubricant manufacturer.

Cleaning of rolling bearings

Caution! If cleaning is to be carried out, the legal regulations relating to environmental protection, health and safety at work etc. must be observed. The specifications of the cleaning agent manufacturer, for example on handling, must be observed. The design and safety guidelines in the product sections must be observed.

Cleaning should be carried out using brushes, paint brushes or lint-free cloths. If the bearings contain resinous oil or grease residues, precleaning by mechanical means followed by treatment with an aqueous, strongly alkaline cleaning agent is recommended.

The following are suitable for degreasing and washing of rolling bearings:

- aqueous neutral, acidic or alkaline cleaning agents. Check the compatibility of alkaline agents with aluminium components before cleaning
- organic cleaning agents such as paraffin oil free from water and acid, petroleum ether (not petrol), spirit, dewatering fluids, freon 12 substitutes, cleaning agents containing chlorinated hydrocarbons.

Caution! Paraffin oil, petroleum ether, spirit and dewatering fluids are flammable and alkaline agents are corrosive. The use of chlorinated hydrocarbons is associated with the risk of fire, explosion and decomposition as well as with health hazards.

These hazards and appropriate protective measures are described comprehensively in datasheet ZH1/425 of the Hauptverband der gewerblichen Berufsgenossenschaften (German Federation of Institutions for Statutory Accident Insurance and Prevention).

Caution! Rolling bearings must be dried and preservative applied immediately after cleaning – risk of corrosion.

Fitting

Comprehensive information on fitting and dismantling is given in the publications WL 80 100, Mounting of Rolling Bearings and WL 80 250, Equipment and Services for the Mounting and Maintenance of Rolling Bearings.

For more extensive work, a fitting manual should be available that precisely describes all relevant work. The manual should also contain details on means of transport, fitting equipment, measurement tools, type and quantity of lubricant and a precise description of the fitting procedure.

Guidelines for fitting

- Before fitting, familiarise yourself with the design by means of the final assembly drawing.
- Before fitting, check whether the bearing presented for fitting corresponds to the data in the drawing.
- The assembly area must be kept clean and free from dust.
- Protect bearings from dust, contaminants and moisture. Contaminants have a detrimental influence on the running and operating life of rolling bearings.
- Check the housing bore and shaft seat of the axis for dimensional and geometrical accuracy and cleanliness.
- Wipe away any anti-corrosion agent from the seating and contact surfaces, wash anti-corrosion agent out of tapered bores.
- Lightly oil the bearing ring seating surfaces.
- Check that the shaft and housing bore have a lead chamfer of 10° to 15°.
- Do not cool the bearings excessively, since moisture due to condensation can lead to corrosion in the bearings and bearing seats.
- After fitting, provide the rolling bearings with lubricant.
- Check the correct functioning of the bearing arrangement.

Fitting of rolling bearings with cylindrical seats

Caution! Avoid applying direct blows to the bearing rings with a hammer.

In non-separable bearings, apply the fitting forces to the ring with a tight fit, which should also be fitted first, *Figure 1*.

If the inner ring of a non-separable bearing will have a tight fit, press the bearing onto the shaft first. Then push the bearing together with the shaft into the housing (fit clearance).

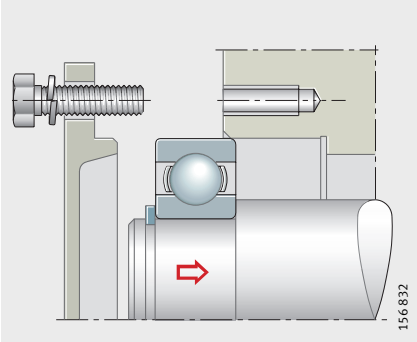


Figure 1
In non-separable bearings, fit the ring with the tight fit first (tight fit for the inner ring in this case)

In separable bearings, *Figure 2*, fitting is easier; both rings can be fitted individually. Rotating the ring while fitting to give a screwdriver effect will help to avoid scraping marks.

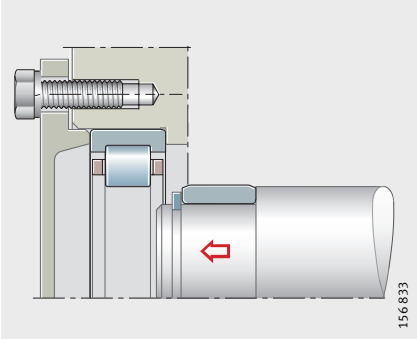


Figure 2
In cylindrical roller bearings, the rings are fitted individually (tight fit)

Cold fitting of bearings by pressing

Bearings up to a bore diameter of approx. 80 mm can be pressed onto the shaft while cold for normal tight fits (mechanical or hydraulic presses), *Figure 3*.

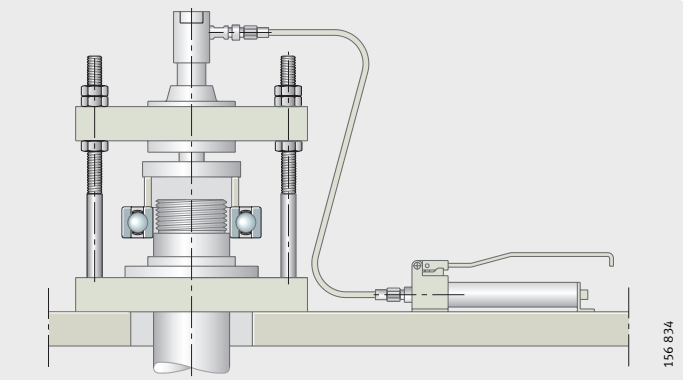
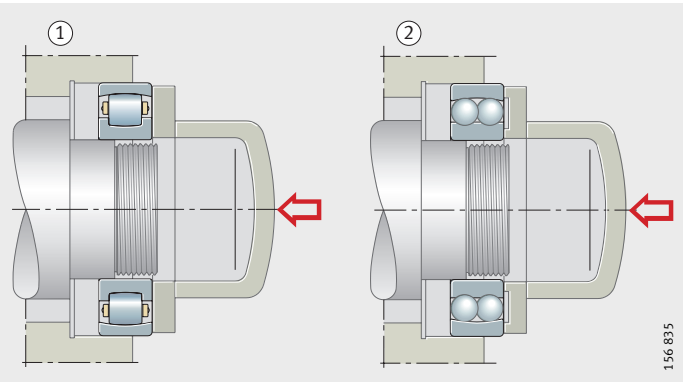


Figure 3
Fitting of deep groove ball bearing using hydraulic press

If a press is not available, the bearings can be fitted by means of a hammer and mounting sleeve.

In bearings with an angular adjustment facility, tilting of the outer ring is prevented by a mounting disc that is in contact with both bearing rings, *Figure 4*. In bearings with axially protruding cages or balls (e.g. some self-aligning ball bearings), the disc must have a turned recess, *Figure 4* ②.



① Without turned recess, for barrel roller bearings
② With turned recess, for some self-aligning ball bearings

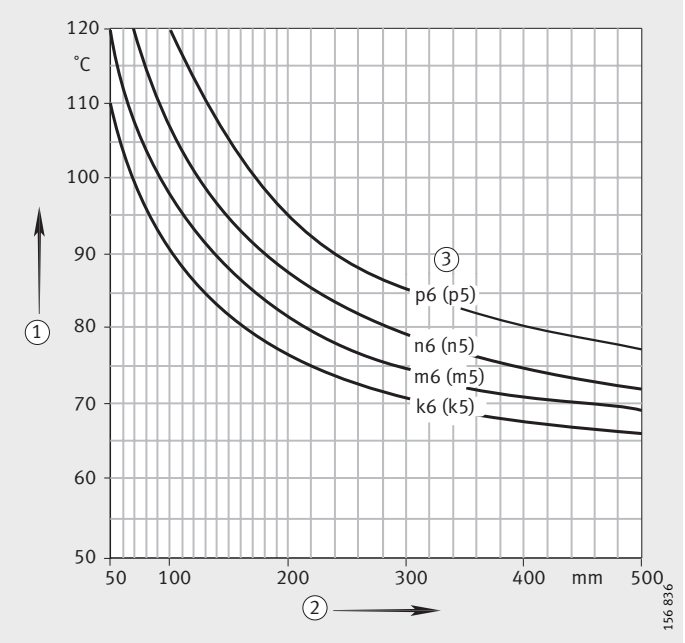
Figure 4
Fitting of bearings by simultaneously pressing onto shaft and pushing into housing with the aid of a mounting disc

Fitting and dismantling

Heating of bearings

Bearings with a cylindrical bore should be heated before fitting if a tight fit on the shaft is intended and excessive effort is required for pressing by mechanical means. The heating temperature required for problem-free fitting is shown as a function of bearing bore diameter in *Figure 5*.

The data are valid for maximum fit interference, a room temperature of +20 °C and an excess temperature safety margin of 30 K.



① Heating temperature
② Bearing diameter d
③ Shaft tolerance

Figure 5
Heating temperature

Induction heating devices

Induction heating devices are particularly suitable for achieving rapid, safe and clean heating. These devices are used mainly in volume fitting work.

Heating plate

As an interim measure, individual bearings can be heated on an electric heating plate. The bearing is covered with a metal sheet and turned several times. A thermostatic controller is absolutely necessary.

Heating cabinet

Safe, clean heating of bearings can be carried out in a thermostatically controlled hot air or heating cabinet.
This method is mainly used for small and medium sized bearings. The heating times are relatively long.

Oil bath

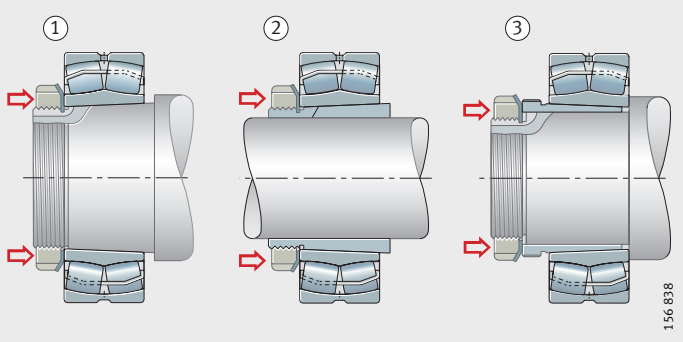
With the exception of sealed, greased bearings and high precision bearings, rolling bearings of all sizes and type can be heated in an oil bath. A thermostatic controller is advisable (temperature +80 °C to +100 °C). In order to achieve uniform heating, the bearings should be laid on a grid or suspended in the oil bath.

Caution! Risk of accidents, environmental pollution by oil vapour, flammability of hot oil, risk of bearing contamination.

Fitting of rolling bearings with tapered bore

Bearings with a tapered bore are mounted either directly on the tapered shaft seat or by means of an adapter sleeve or extraction sleeve on a cylindrical shaft, *Figure 6* ①, ②, ③.

Small bearings (with a bore of up to approx. 80 mm) are driven up the tapered shaft seat or adapter sleeve using a locknut.
The tight fit is achieved by the axial pressing of the inner ring.
The nut is tightened using, for example, a hook wrench.
Small extraction sleeves can also be pressed into the gap between the shaft and inner ring bore using a locknut.



Fitting
① using a locknut,
② on an adapter sleeve using the adapter sleeve nut,
③ on an extraction sleeve using a locknut

Figure 6
Fitting of rolling bearings with tapered bore

Reduction in radial internal clearance

The reduction in radial internal clearance as a result of inner ring expansion is used as a means of checking the tight fit.
In spherical roller bearings, the radial internal clearance (s_r) must be measured simultaneously over both rows of rollers, *Figure 7*.
Alternatively, the axial displacement is measured.

Values for reduction in radial internal clearance and displacement in spherical roller bearings: see section Spherical roller bearings.

For the measurement of radial internal clearance, aids such as feeler gauges FEELER.GAUGE100 and FEELER.GAUGE300 are suitable.

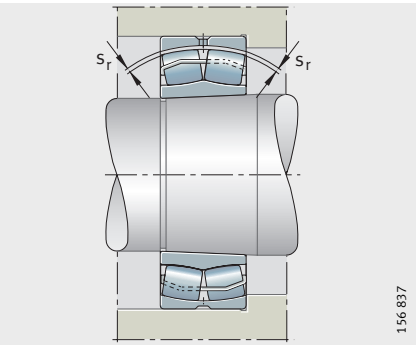


Figure 7
Radial internal clearance (s_r) in spherical roller bearings

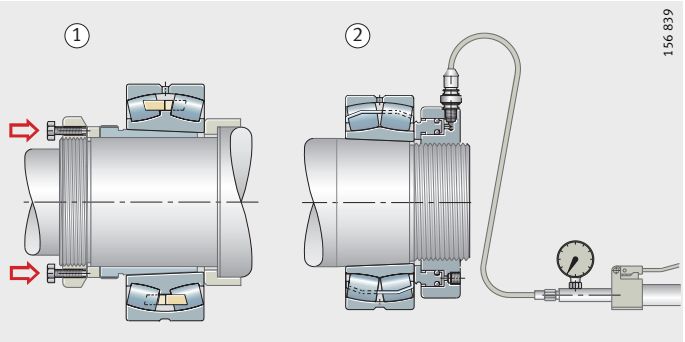
Fitting and dismantling

Fitting using pressure screws or hydraulic tool

Even in the case of medium sized bearings, the forces required to tighten nuts are considerable. In such cases, fitting can be made easier by using locknuts with pressure screws (not suitable for spherical roller bearings of E1 design, *Figure 8* ①).

For the fitting of large bearings, a hydraulic device should be used to drive up the bearing or press in the sleeve, *Figure 8* ②.

Hydraulic nuts are available for all common threaded sleeves and shafts.



Fitting on an extraction sleeve
① using a locknut and pressure screws and on a tapered shaft
② using a hydraulic nut

Figure 8
Fitting of rolling bearings with tapered bore

Hydraulic method

The hydraulic method gives considerable assistance in the fitting and particularly in the dismantling of bearings with a bore of approx. 160 mm and above.

For fitting, an oil with a viscosity of 75 mm^2/s at +20 °C (nominal viscosity 32 mm^2/s at +40 °C) is recommended.

Guidelines for dismantling

Comprehensive information on fitting and dismantling is given in the publications WL 80 100, Mounting of Rolling Bearings and WL 80 250, Equipment and Services for the Mounting and Maintenance of Rolling Bearings.

Dismantling should be taken into consideration in the original design of the bearing location. If bearing rings are to be mounted with a tight fit, slots should be provided in the shaft or housing bore to facilitate removal of the bearing rings.

If the bearing is to be reused, the following guidelines should be taken into consideration:

- do not use a concentrated or “hard” flame
- do not apply direct blows to the bearing rings
- do not apply fitting forces through the rolling elements
- carefully clean the bearings after dismantling.

Dismantling of rolling bearings on cylindrical seats

If the bearings and adjacent parts are to be reused, the extraction tool should be applied to the ring fitted with a tight fit.

In non-separable bearings, the ring fitted with a drive fit is dismantled and the ring with a tight fit is then removed.

Extraction of small bearings

For the extraction of small bearings, mechanical extraction devices, *Figure 9* or hydraulic presses are suitable. Dismantling is made easier if there are extraction slots on the shaft or housing so that the extraction tool can be applied to the bearing ring fitted with a tight fit.

Special devices are available for those cases where extraction slots are not present.

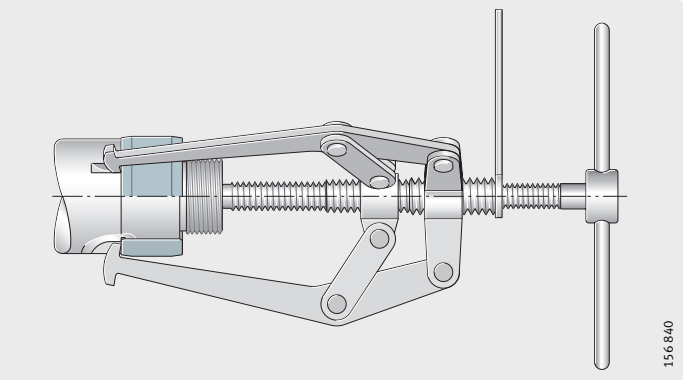


Figure 9
Extraction device with three adjustable arms for the extraction of separable bearings

Extraction of inner rings using an induction device

Induction heating devices are used mainly to extract the shrink-fitted inner rings of cylindrical roller bearings, *Figure 10*.

Heating is achieved quickly and the rings are loosened easily without the transfer of substantial heat to the shaft.



Figure 10
Induction heating device for extraction of cylindrical roller bearing inner rings

Fitting and dismantling

Heating rings

Heating rings made from light metal with radial slots can be used to dismantle the inner rings of cylindrical roller bearings that have no ribs or only one rigid rib, *Figure 11*.

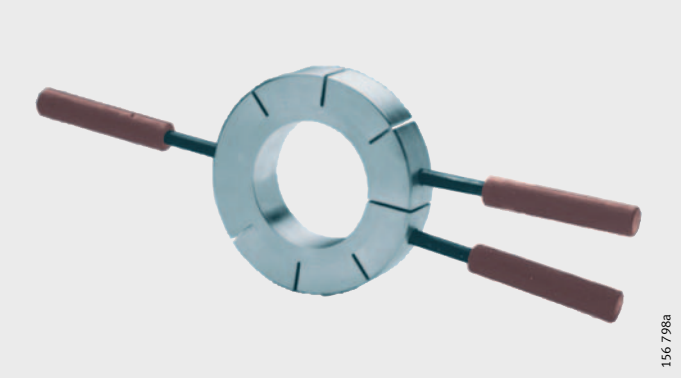


Figure 11
Heating rings are suitable for the extraction of cylindrical roller bearing inner rings

Heating rings are heated on an electric heating plate to between +200 °C and +300 °C, pushed over the bearing ring to be extracted and clamped in place using the grips. Once the press fit on the shaft has been eliminated, both rings are removed together.

Caution! The bearing ring must be removed from the heating ring immediately after extraction in order to prevent overheating.

Flames

If an induction device is not available and there are no oil ducts for the hydraulic method, the inner rings of separable bearings can if necessary be heated for extraction by means of a flame, preferably using a ring burner.

Caution! This should be done with extreme care since the rings are sensitive to uneven heating and localised overheating.

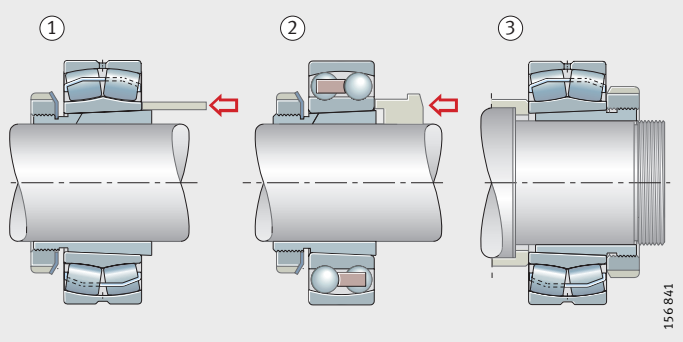
Dismantling of rolling bearings with tapered bore

Mechanical dismantling

Where bearings are mounted directly on a tapered shaft seat or on an adapter sleeve, the locking effect of the shaft or adapter sleeve nut must be loosened first. The nut is then unscrewed by the amount of the drive-up distance. The inner ring is then driven off the sleeve or shaft, for example using a hammer and metal drift or impact block, *Figure 12* ①, ②.

If an impact block is used, this avoids the risk of slipping.

Bearings located using extraction sleeves are dismantled with the aid of the extraction nut, *Figure 12* ③.



① Metal drift
② Impact block
③ Extraction nut

Figure 12
Dismantling of bearings

Fitting and dismantling

Large bearings located using an extraction sleeve require considerable force. In this case, locknuts with additional pressure screws can be used, *Figure 13* ①. A disc is inserted between the inner ring and pressure screws.

Hydraulic dismantling

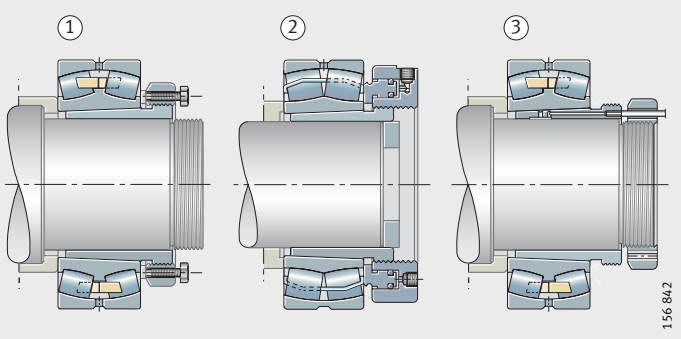
An easier and more economical method is the dismantling of extraction sleeves using hydraulic nuts, *Figure 13* ②.
The protruding extraction sleeve is supported by a heavy-section ring.

The dismantling of large bearings can be made easier by using the hydraulic method, *Figure 13* ③, and *Figure 14*. Oil is pressed between the fit surfaces. The adjacent parts can then moved in relation to each other by applying only slight force and without the risk of surface damage.

Tapered shafts must be provided with appropriate oil slots and feed holes. Oil injectors are sufficient to generate the pressure required.

Caution! The extraction sleeve becomes loose abruptly. Leave the nut on the shaft.

Large adapter and extraction sleeves already have the appropriate slots and holes. In this case, a pump must be used to generate the oil pressure required.



Dismantling of an extraction sleeve
① using a nut and pressure screws,
② using a hydraulic nut,
dismantling of a spherical roller bearing from the extraction sleeve
③ using the hydraulic method

Figure 13
Dismantling of an extraction sleeve

Suitable oils

For dismantling, the oil used should have a viscosity of approx. 150 mm^2/s at +20 °C (nominal viscosity 46 mm^2/s at +40 °C).

Fretting corrosion can be dissolved by rust-dissolving additives in the oil.

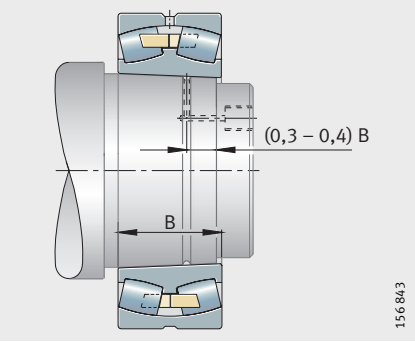


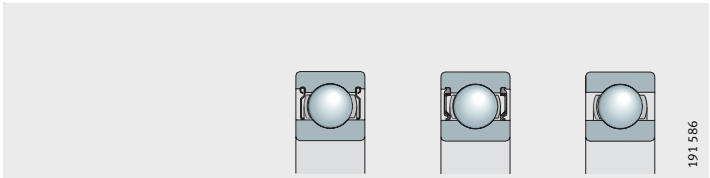
Figure 14
Arrangement of oil ducts in the hydraulic method for dismantling of a spherical roller bearing from a tapered shaft seat

Disposal of bearings after dismantling

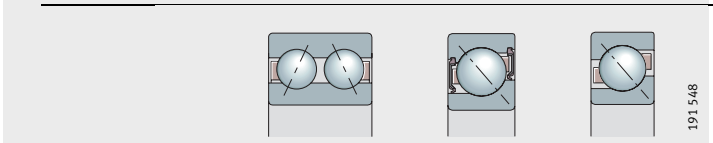
If the bearings are not to be reused after dismantling, they should be separated into their constituent parts. Grease, seals and plastic parts should be disposed of in accordance with the relevant waste product guidelines.

Bearing rings and rolling elements can be sent for recycling.


191 545
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Deep groove ball bearings



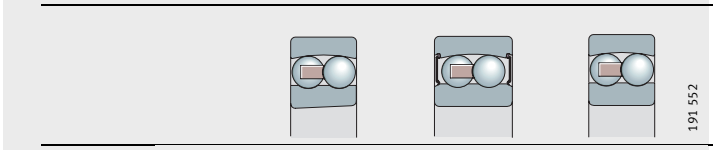
Angular contact ball bearings



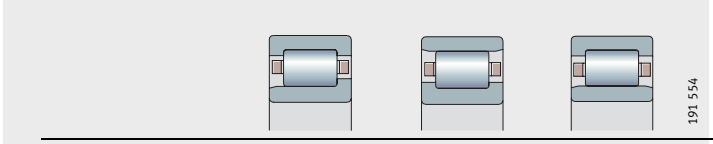
Spindle bearings



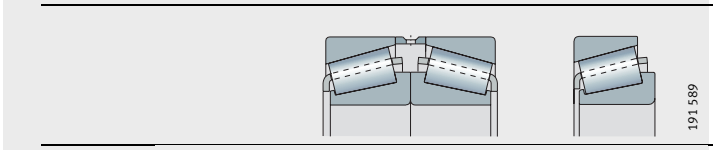
Four point contact bearings



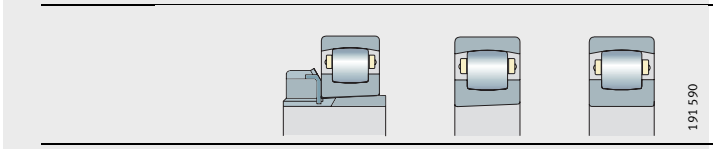
Self-aligning ball bearings



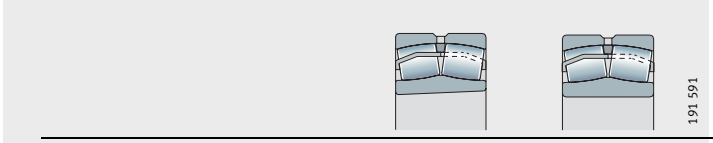
Cylindrical roller bearings



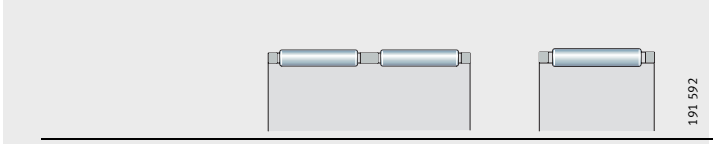
Tapered roller bearings



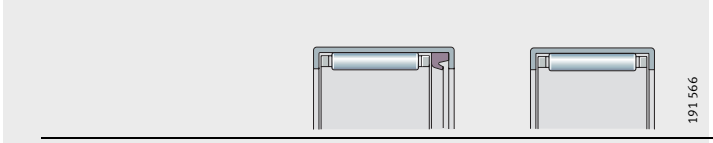
Barrel roller bearings



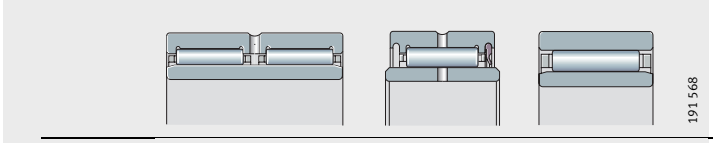
Spherical roller bearings



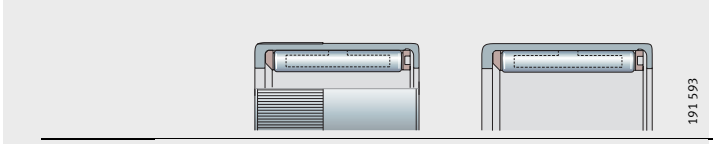
Needle roller and cage assemblies



Drawn cup needle roller bearings



Machined needle roller bearings
Inner rings

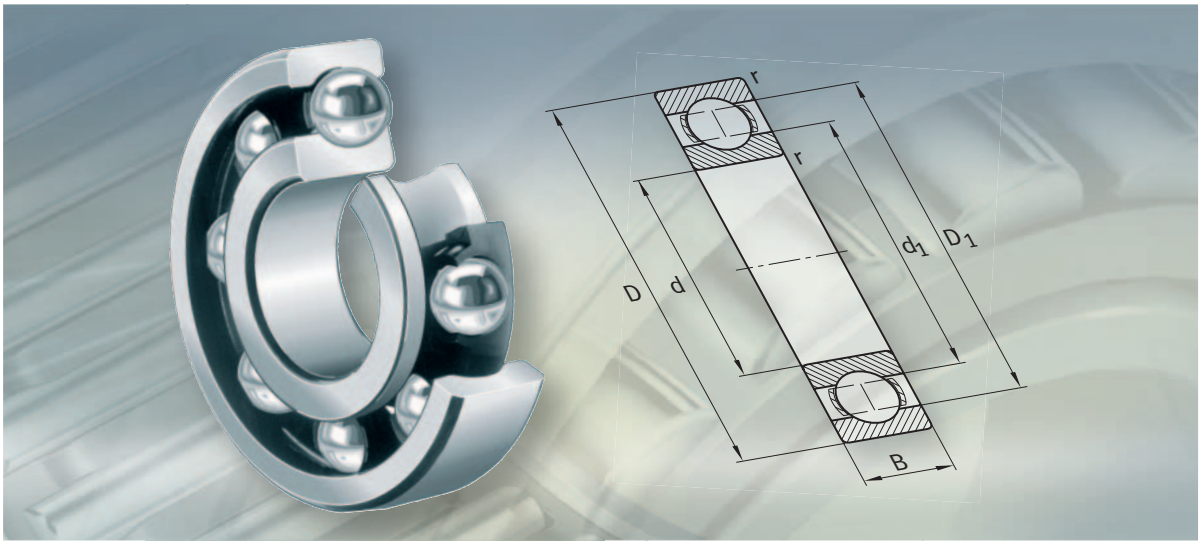


Drawn cup roller clutches



Sealing rings

FAG



Deep groove ball bearings

Single row
Double row

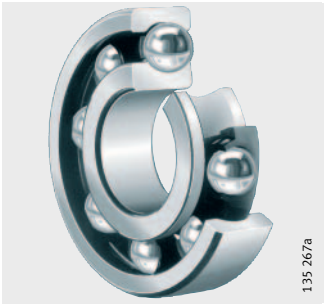
Deep groove ball bearings

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Features	Radial and axial load capacity	185
	Single row deep groove ball bearings	186
	Double row deep groove ball bearings	187
	Operating temperature	187
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	Mounting dimensions	192
Accuracy		193
	Radial internal clearance of bearings with cylindrical bore	194
Dimension tables	Deep groove ball bearings, single row	196
	Deep groove ball bearings, double row	224

Product overview Deep groove ball bearings

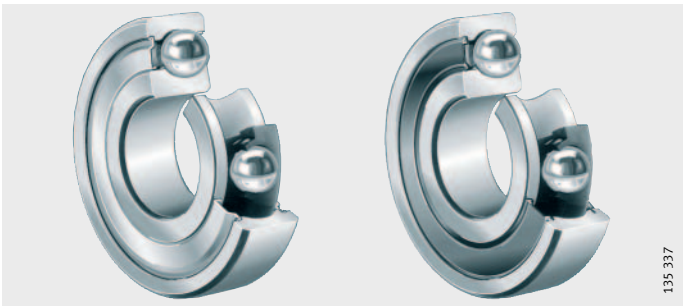
Single row

160, 60, 62, 63, 64, 618, 619



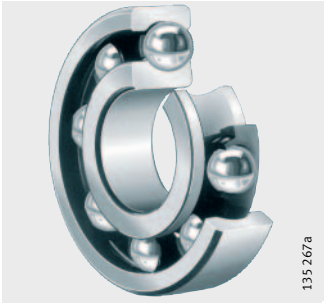
Gap seals Lip seals

60..-2Z, 62..-2Z, 63..-2Z, 618..-2Z, 619..-2Z, 60..-2RSR, 62(622)..-2RSR, 63(623)..-2RSR, 618(619)..-2RSR

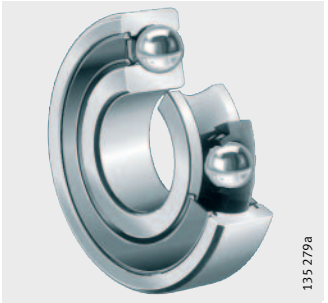


Corrosion-resistant design Lip seals

S60, S62, S63

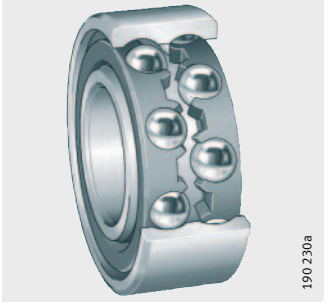


S60..-2RSR, S62..-2RSR, S63..-2RSR



Double row

42..-B, 43..-B



Deep groove ball bearings



Features

Deep groove ball bearings are versatile, self-retaining bearings with solid outer rings, inner rings and ball and cage assemblies.

These products, which are of simple design, robust in operation and easy to maintain, are available in single and double row designs and in open and sealed variants. Due to the manufacturing processes used, open bearings can have turned recesses in the outer ring for seals or shields.

Due to their low frictional torque, deep groove ball bearings are suitable for high speeds.

Radial and axial load capacity

Due to the raceway geometry and the balls used as rolling elements, deep groove ball bearings can support axial loads in both directions as well as radial loads. Axial load carrying capacity, page 192.

Compensation of angular misalignments

The angular adjustment facility of single row deep groove ball bearings is limited, so the bearing positions must be well aligned.

Misalignments can lead to unfavourable ball running and induce additional loads in the bearing that shorten the operating life.

In order to keep these loads at a low level, only small adjustment angles are permissible – dependent on the load – for single row deep groove ball bearings, see table Load and adjustment angle.

Caution! Due to their internal construction, double row deep groove ball bearings do not have an angular adjustment facility. When using these bearings, therefore, misalignments are not permissible.

Load and adjustment angle for single row deep groove ball bearings

Series	Adjustment angle	
	Low loads	High loads
62, 622, 63, 623, 64	5′ to 10′	8′ to 16′
618, 619, 160, 60	2′ to 6′	5′ to 10′

Deep groove ball bearings

Single row deep groove ball bearings

Single row deep groove ball bearings are the most frequently used type of rolling bearing. They are produced in numerous sizes and designs and are particularly economical.

Sealing/lubrication

Bearings without seals are suitable for high to very high speeds.

Deep groove ball bearings with the suffix 2Z have gap seals on both sides. These bearings are greased using a high quality grease, lubricated for life and suitable for high speeds.

Bearings with the suffix 2RSR have lip seals on both sides made from nitrile butadiene rubber NBR.
These designs are greased using a high quality grease, lubricated for life and suitable for moderate speeds.

By agreement, we can supply bearings with non-contact BRS seals on both sides (suffix 2BRS). The frictional behaviour of these bearings is just as favourable as that of bearings with Z seals. If the inner ring is stationary and the outer ring rotates, the lubricant loss is smaller than that in bearings with Z seals.

Corrosion-resistant deep groove ball bearings

In deep groove ball bearings of series S60, S62 and S63, the cages and the inner and outer rings are made from corrosion-resistant steel X70Cr13, while the balls are made from high alloy chromium steel X102CrMo17.

These bearings are resistant to water, water vapour, alkalis, photographic developers and in certain cases to acids.

Corrosion-resistant deep groove ball bearings are available in open and sealed designs.

In the case of bearings sealed on both sides (suffix 2RSR) in particular, the resistance to acids is limited by the sealing ring material nitrile butadiene rubber NBR.

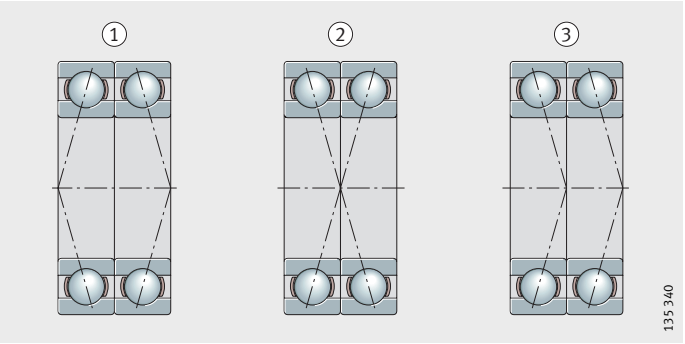
Matched single row deep groove ball bearings

By agreement, deep groove ball bearings of series 160, 60, 62, 63, 64 and 618 are available in various arrangements as matched pairs of bearings, *Figure 1*.

Sets in an O arrangement (suffix DB) can support axial loads in both directions as well as tilting moments.

Sets in an X arrangement (suffix DF) can support axial loads in both directions but are not suitable for tilting moments.

For high axial loads from one direction, pairs of bearings in a tandem arrangement are suitable (suffix DT).



① O arrangement, DB
② X arrangement, DF
③ Tandem arrangement, DT

Figure 1
Matched sets

Double row deep groove ball bearings

Double row deep groove ball bearings correspond in their structure and function to a pair of single row deep groove ball bearings. They are designed for high to very high speeds and are used where the load carrying capacity of single row deep groove ball bearings is not sufficient.

Double row deep groove ball bearings are wider than single row deep groove ball bearings of the same bore and outside diameter but have a significantly higher load carrying capacity.

Sealing/lubrication

The bearings are not sealed and are greased using a high quality grease.

Operating temperature

Deep groove ball bearings without seals can be used up to an operating temperature of +120 °C. For applications at temperatures above +120 °C, please contact us. Bearings with a diameter D of more than 240 mm are dimensionally stable up to +200 °C.

Deep groove ball bearings with lip seals can be used at operating temperatures from –30 °C to +110 °C, limited by the grease and sealing ring material.

Bearings with gap seals can be used from –30 °C to +120 °C.

Caution! Bearings with cages made from glass fibre reinforced polyamide are suitable for operating temperatures up to +120 °C.

Deep groove ball bearings

Cages

Single row deep groove ball bearings without a cage suffix have a sheet steel cage.

Deep groove ball bearings with ball-guided solid brass cages are indicated by the suffix M.

Suffix Y indicates bearings with a sheet brass cage.

Double row deep groove ball bearings have cages made from glass fibre reinforced polyamide (suffix TVH).

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures. The oil change intervals must be observed.

Cage/bore code

Series	Sheet steel cage	Sheet brass cage	Solid brass cage	Cage made from glass fibre reinforced polyamide
	Bore code			
42	–	–	–	all
43	–	–	–	all
60	up to 30, 34	–	32, from 36	–
62	up to 30	–	from 32	–
63	up to 24	–	from 26	–
64	up to 14	–	from 15	–
160	up to 52	–	from 56	–
618	–	up to 24	from 64	–
619	up to 16	–	–	–
622	up to 10	–	–	–
623	up to 10	–	–	–

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffix	Description	Design
B	Modified internal construction	Standard
M	Solid brass cage, ball-guided	Standard
DB	Two deep groove ball bearings in O arrangement, matched clearance-free	Special design[1)]
DF	Two deep groove ball bearings in X arrangement, matched clearance-free	Special design[1)]
DT	Two deep groove ball bearings in tandem arrangement, matched clearance-free	Special design[1)]
2RSR	Lip seals on both sides	Standard
RSR	Lip seal on one side	Special design[1)]
BRS	Labyrinth seal	Special design[1)]
TVH	Cage made from glass fibre reinforced polyamide	Standard
Y	Sheet brass cage	Standard
2Z	Gap seals on both sides	Standard
Z	Gap seal on one side	Special design[1)]

1) Available by agreement.

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = X \cdot F_r + Y \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load
e, X, Y –
Factors: see table Factors e, X, Y.

The values according to the table e, X, Y are valid for normal fits:
- Shaft machined to j5 or k5, housing machined to J6.

Factors e, X and Y

$\frac{f_0 \cdot F_a}{C_{0r}}$	Factor for radial internal clearance								
	CN			C3			C4		
	e	X	Y	e	X	Y	e	X	Y
0,3	0,22	0,56	2	0,32	0,46	1,7	0,4	0,44	1,4
0,5	0,24	0,56	1,8	0,35	0,46	1,56	0,43	0,44	1,31
0,9	0,28	0,56	1,58	0,39	0,46	1,41	0,45	0,44	1,23
1,6	0,32	0,56	1,4	0,43	0,46	1,27	0,48	0,44	1,16
3	0,36	0,56	1,2	0,48	0,46	1,14	0,52	0,44	1,08
6	0,43	0,56	1	0,54	0,46	1	0,56	0,44	1

C_{0r} N
Basic static load rating according to dimension tables
f_0 –
Factor: see table Factor f_0 for deep groove ball bearings, page 191
F_a N
Axial dynamic bearing load.



Factor f_0 for deep groove ball bearings

Bore code	Factor f_0										
	618	619	160	60	62	622	63	623	64	42	43
3	–	–	–	–	12,9	–	–	–	–	–	–
4	–	–	–	–	12,2	–	12,4	–	–	–	–
5	–	–	–	–	13,2	–	12,2	–	–	–	–
6	–	–	–	–	13	–	–	–	–	–	–
7	–	–	–	13	12,4	–	–	–	–	–	–
8	–	–	–	12,4	13	–	–	–	–	–	–
9	–	–	–	13	12,4	–	–	–	–	–	–
00	–	–	–	12,4	12,1	12,1	11,3	–	–	12,1	–
01	–	–	–	13	12,3	12,2	11,1	–	–	12,7	–
02	–	–	13,9	13,9	13,1	13,1	12,1	12,1	–	13,4	12,8
03	–	–	14,3	14,3	13,1	13,1	12,3	12,2	12,4	13,1	13,1
04	–	–	14,9	13,9	13,1	13,1	12,4	12,1	13	13,8	13,1
05	–	–	15,4	14,5	13,8	13,8	12,4	12,4	13,1	14,3	13,2
06	–	–	15,2	14,8	13,8	13,8	13	13	12,2	14,3	13,8
07	–	–	15,6	14,8	13,8	13,8	13,1	13,1	12,1	14,5	13,1
08	–	15,4	16	15,3	14	14	13	13	12,2	14,9	13,2
09	16,2	15,7	15,9	15,4	14,3	14,1	13	13	12,1	15,3	13,9
10	16,1	16	16,1	15,6	14,3	14,3	13	13	13,1	15,5	13,8
11	16,2	16	16,1	15,4	14,3	–	12,9	–	13,2	15,5	13,8
12	16,3	16,1	16,3	15,5	14,3	–	13,1	–	13,2	15,4	13,8
13	16,2	16,3	16,4	15,7	14,3	–	13,2	–	13,2	15,3	–
14	16,1	16,1	16,2	15,5	14,4	–	13,2	–	13,3	15,5	–
15	16	16,2	16,4	15,7	14,7	–	13,2	–	13,3	15,7	–
16	15,9	16,4	16,4	15,6	14,6	–	13,2	–	12,3	15,7	–
17	16,2	–	16,4	15,7	14,7	–	13,1	–	12,3	15,7	–
18	16,1	–	16,3	15,6	14,5	–	13,9	–	12,2	15,5	–
19	16	–	16,5	15,7	14,4	–	13,9	–	–	–	–
20	16	–	16,5	15,9	14,4	–	13,8	–	–	–	–
21	15,9	–	16,3	15,8	14,3	–	13,8	–	–	–	–
22	16,1	–	16,3	15,6	14,3	–	13,8	–	–	–	–
24	16	–	16,5	15,9	14,8	–	13,5	–	–	–	–
26	–	–	16,4	15,8	14,5	–	13,6	–	–	–	–
28	–	–	16,5	16	14,8	–	13,6	–	–	–	–
30	–	–	16,4	16	15,2	–	13,7	–	–	–	–
32	–	–	16,5	16	15,2	–	13,9	–	–	–	–
34	–	–	16,4	15,7	15,3	–	13,9	–	–	–	–
36	–	–	16,3	15,6	15,3	–	13,9	–	–	–	–
38	–	–	16,4	15,8	15	–	14	–	–	–	–
40	–	–	16,3	15,6	15,3	–	14,1	–	–	–	–
44	–	–	16,3	15,6	15,2	–	14,1	–	–	–	–
48	–	–	16,5	15,8	15,2	–	14,2	–	–	–	–
52	–	–	16,4	15,7	15,2	–	–	–	–	–	–

Continued
Factor f_0 for deep groove ball bearings

Bore code	Factor f_0										
	618	619	160	60	62	622	63	623	64	42	43
56	–	–	16,5	15,9	15,3	–	–	–	–	–	–
60	–	–	16,4	15,7	–	–	–	–	–	–	–
64	15,9	–	16,5	15,9	–	–	–	–	–	–	–
68	15,9	–	16,3	15,8	–	–	–	–	–	–	–
72	15,8	–	16,4	15,9	–	–	–	–	–	–	–
76	16	–	16,5	–	–	–	–	–	–	–	–
80	15,9	–	–	–	–	–	–	–	–	–	–
84	15,9	–	–	–	–	–	–	–	–	–	–
88	15,8	–	–	–	–	–	–	–	–	–	–
92	16	–	–	–	–	–	–	–	–	–	–
96	16	–	–	–	–	–	–	–	–	–	–
/500	15,9	–	–	–	–	–	–	–	–	–	–
/530	15,9	–	–	–	–	–	–	–	–	–	–
/560 ... /850	15,8	–	–	–	–	–	–	–	–	–	–

Equivalent static bearing load

For bearings under static loading, the following applies:

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leqq 0{,}8$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 0{,}8$	$P_0 = 0{,}6 \cdot F_{0r} + 0{,}5 \cdot F_{0a}$

P_0 N
Equivalent static bearing load for combined load

F_{0a} N
Axial static bearing load

F_{0r} N
Radial static bearing load.

Axial load carrying capacity

Deep groove ball bearings are also suitable for axial loads.

Caution! If the bearing is subjected to high loads and high speeds, a reduced life as well as increased friction and bearing temperature must be taken into consideration.

Minimum radial load

In order to ensure slippage-free operation, the bearings must be subjected to a minimum radial load. This applies particularly in the case of high speeds and high accelerations. In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}01$ is necessary for ball bearings with cage.

Mounting dimensions

The dimension tables give the maximum radius dimension r_a and the diameters of the abutment shoulders D_a, d_a.

Accuracy

The main dimensions of single row deep groove ball bearings correspond to DIN 625-1, the main dimensions of double row deep groove ball bearings to DIN 625-3.

The dimensional and running tolerances correspond to tolerance class PN to DIN 620.

The width tolerance of matched bearings is different from this standard: see table Width tolerance.

Width tolerance of bearing rings in matched bearings

Bore diameter d mm		Width deviation Δ_{Bs} µm	
over	incl.	min.	max.
–	18	0	−250
18	50	0	−300
50	80	0	−450
80	120	0	−550
120	180	0	−750
180	250	0	−950
250	315	0	−1050
315	400	0	−1350
400	500	0	−1650

Radial internal clearance of bearings with cylindrical bore

The radial internal clearance corresponds to internal clearance group CN.

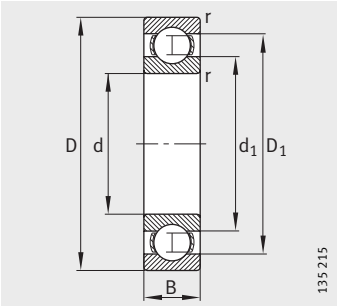
Radial internal clearance to DIN 620-4

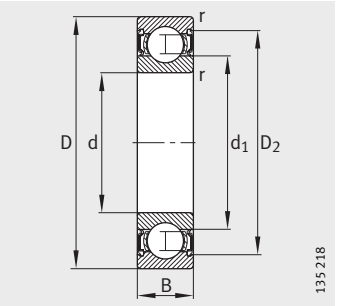
Bore d mm		Radial internal clearance							
		C2 µm		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
2,5	6	0	7	2	13	8	23	–	–
6	10	0	7	2	13	8	23	14	29
10	18	0	9	3	18	11	25	18	33
18	24	0	10	5	20	13	28	20	36
24	30	1	11	5	20	13	28	23	41
30	40	1	11	6	20	15	33	28	46
40	50	1	11	6	23	18	36	30	51
50	65	1	15	8	28	23	43	38	61
65	80	1	15	10	30	25	51	46	71
80	100	1	18	12	36	30	58	53	84
100	120	2	20	15	41	36	66	61	97
120	140	2	23	18	48	41	81	71	114
140	160	2	23	18	53	46	91	81	130
160	180	2	25	20	61	53	102	91	147
180	200	2	30	25	71	63	117	107	163
200	225	4	32	28	82	73	132	120	187
225	250	4	36	31	92	87	152	140	217
250	280	4	39	36	97	97	162	152	237
280	315	8	45	42	110	110	180	175	260
315	355	8	50	50	120	120	200	200	290
355	400	8	60	60	140	140	230	230	330
400	450	10	70	70	160	160	260	260	370
450	500	10	80	80	180	180	290	290	410
500	560	20	90	90	200	200	320	320	460
560	630	20	100	100	220	220	350	350	510
630	710	30	120	120	250	250	390	390	560
710	800	30	130	130	280	280	440	440	620
800	900	30	150	150	310	310	490	490	690



Deep groove ball bearings

Single row
Open or sealed

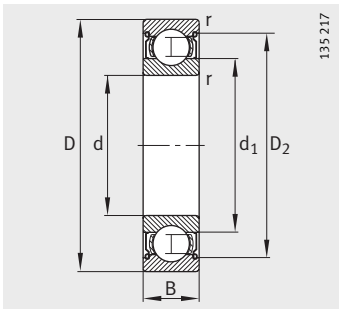




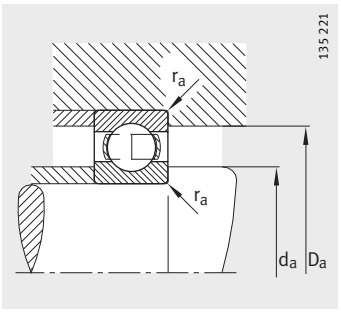
2RSR seal

Dimension table · Dimensions in mm

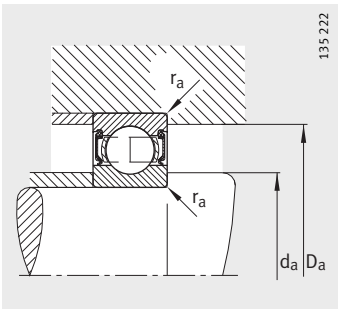
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
623	0,001	**3**	10	4	0,15	7,7	–	5
623-2RSR	0,001	**3**	10	4	0,15	–	8,2	5
623-2Z	0,001	**3**	10	4	0,15	–	8,2	5
624	0,003	**4**	13	5	0,2	10,5	–	7
624-2RSR	0,003	**4**	13	5	0,2	–	11,2	7
624-2Z	0,004	**4**	13	5	0,2	–	11,2	7
634	0,006	**4**	16	5	0,3	12,5	–	8,5
634-2RSR	0,006	**4**	16	5	0,3	–	13,2	8,5
634-2Z	0,006	**4**	16	5	0,3	–	13,2	8,5
625	0,005	**5**	16	5	0,3	12,5	–	8,5
625-2RSR	0,005	**5**	16	5	0,3	–	13,2	8,5
625-2Z	0,005	**5**	16	5	0,3	–	13,2	8,5
635	0,008	**5**	19	6	0,3	15,5	–	10,8
635-2RSR	0,008	**5**	19	6	0,3	–	16,7	10,8
635-2Z	0,029	**5**	19	6	0,3	–	16,7	10,8
626	0,008	**6**	19	6	0,3	15,5	–	10,6
626-2RSR	0,008	**6**	19	6	0,3	–	16,7	10,6
626-2Z	0,029	**6**	19	6	0,3	–	16,7	10,6
607	0,007	**7**	19	6	0,3	15,5	–	10,6
607-2RSR	0,007	**7**	19	6	0,3	–	16,7	10,6
607-2Z	0,008	**7**	19	6	0,3	–	16,7	10,6
627	0,011	**7**	22	7	0,3	18	–	12,4
627-2RSR	0,011	**7**	22	7	0,3	–	19,1	12,4
627-2Z	0,012	**7**	22	7	0,3	–	19,1	12,4
608	0,01	**8**	22	7	0,3	18	–	12,4
608-2RSR	0,01	**8**	22	7	0,3	–	19,1	12,4
608-2Z	0,011	**8**	22	7	0,3	–	19,1	12,4
609	0,015	**9**	24	7	0,3	19,6	–	14
609-2RSR	0,016	**9**	24	7	0,3	–	20,5	14
609-2Z	0,016	**9**	24	7	0,3	–	20,5	14
629	0,02	**9**	26	8	0,3	21,4	–	14,7
629-2RSR	0,021	**9**	26	8	0,3	–	22,5	14,7
629-2Z	0,021	**9**	26	8	0,3	–	22,5	14,7
6000	0,019	**10**	26	8	0,3	21,4	–	14,7
6000-2RSR	0,02	**10**	26	8	0,3	–	22,5	14,7
6000-2Z	0,02	**10**	26	8	0,3	–	22,5	14,7



2Z seal



Mounting dimensions
Open design

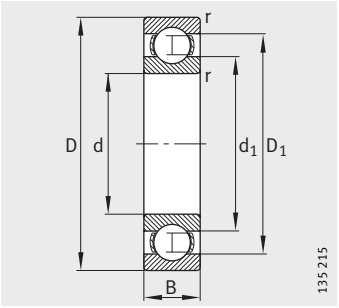


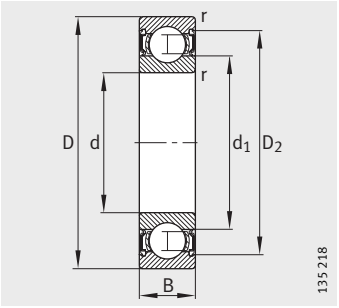
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
4,4	8,6	0,15	640	220	10,6	53 000	57 000
4,4	8,6	0,15	640	220	10,6	32 000	–
4,4	8,6	0,15	640	220	10,6	45 000	57 000
5,8	11,2	0,2	1 290	490	24,6	45 000	46 500
5,8	11,2	0,2	1 290	490	24,6	26 000	–
5,8	11,2	0,2	1 290	490	24,6	38 000	46 500
6,4	13,6	0,3	1 730	670	35,5	43 000	35 000
6,4	13,6	0,3	1 730	670	35,5	24 000	–
6,4	13,6	0,3	1 730	670	35,5	36 000	35 000
7,4	13,6	0,3	1 320	440	22,4	43 000	36 500
7,4	13,6	0,3	1 320	440	22,4	24 000	–
7,4	13,6	0,3	1 320	440	22,4	36 000	36 500
7,4	16,6	0,3	2 600	1 100	53	40 000	31 500
7,4	16,6	0,3	2 600	1 100	53	22 000	–
7,4	16,6	0,3	2 600	1 100	53	32 000	31 500
8,4	16,6	0,3	2 600	1 100	53	38 000	32 500
8,4	16,6	0,3	2 600	1 100	53	22 000	–
8,4	16,6	0,3	2 600	1 100	53	32 000	32 500
9	17	0,3	2 600	1 100	53	38 000	34 500
9	17	0,3	2 600	1 100	53	22 000	–
9	17	0,3	2 600	1 100	53	32 000	35 500
9,4	19,6	0,3	3 250	1 370	72	36 000	30 000
9,4	19,6	0,3	3 250	1 370	72	20 000	–
9,4	19,6	0,3	3 250	1 370	72	30 000	30 000
10	20	0,3	3 250	1 370	72	36 000	31 500
10	20	0,3	3 250	1 370	72	20 000	–
10	20	0,3	3 250	1 370	72	30 000	32 500
11	22	0,3	3 650	1 630	89	36 000	28 500
11	22	0,3	3 650	1 630	89	20 000	–
11	22	0,3	3 650	1 630	89	30 000	29 000
11,4	23,6	0,3	4 550	1 960	93	34 000	25 500
11,4	23,6	0,3	4 550	1 960	93	19 000	–
11,4	23,6	0,3	4 550	1 960	93	28 000	25 500
12	24	0,3	4 550	1 960	93	34 000	28 500
12	24	0,3	4 550	1 960	93	19 000	–
12	24	0,3	4 550	1 960	93	28 000	28 500

Deep groove ball bearings

Single row
Open or sealed

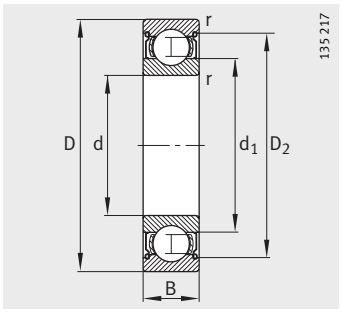




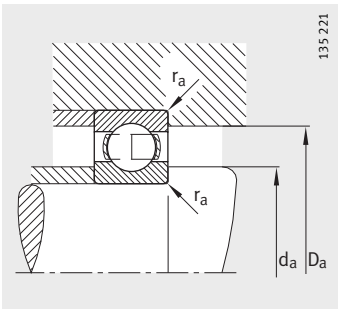
2RSR seal

Dimension table (continued) · Dimensions in mm

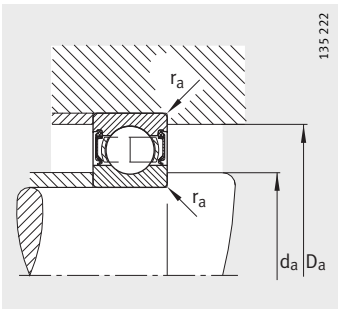
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
S6000	0,019	**10**	26	8	0,3	21,4	–	14,7
S6000-2RSR	0,02	**10**	26	8	0,3	–	22,5	14,7
6200	0,031	**10**	30	9	0,6	24	–	16,7
6200-2RSR	0,032	**10**	30	9	0,6	–	25	16,7
6200-2Z	0,032	**10**	30	9	0,6	–	25	16,7
S6200	0,031	**10**	30	9	0,6	24	–	16,7
S6200-2RSR	0,034	**10**	30	9	0,6	–	25	16,7
62200-2RSR	0,048	**10**	30	14	0,6	–	25	16,7
6300	0,055	**10**	35	11	0,6	27	–	18,1
6300-2RSR	0,057	**10**	35	11	0,6	–	28,6	18,1
6300-2Z	0,057	**10**	35	11	0,6	–	28,6	18,1
S6300	0,056	**10**	35	11	0,6	27	–	18,1
S6300-2RSR	0,058	**10**	35	11	0,6	–	28,6	18,1
6001	0,02	**12**	28	8	0,3	23,5	–	16,7
6001-2RSR	0,022	**12**	28	8	0,3	–	24,5	16,7
6001-2Z	0,02	**12**	28	8	0,3	–	24,5	16,7
S6001	0,021	**12**	28	8	0,3	23,5	–	16,7
S6001-2RSR	0,023	**12**	28	8	0,3	–	24,5	16,7
6201	0,037	**12**	32	10	0,6	25,8	–	18,3
6201-2RSR	0,039	**12**	32	10	0,6	–	27,4	18,3
6201-2Z	0,039	**12**	32	10	0,6	–	27,4	18,3
S6201	0,038	**12**	32	10	0,6	25,8	–	18,3
S6201-2RSR	0,04	**12**	32	10	0,6	–	27,4	18,3
62201-2RSR	0,051	**12**	32	14	0,6	–	27,4	18,3
6301	0,062	**12**	37	12	1	29,6	–	19,5
6301-2RSR	0,064	**12**	37	12	1	–	31,4	19,5
6301-2Z	0,064	**12**	37	12	1	–	31,4	19,5
S6301	0,063	**12**	37	12	1	29,6	–	19,5
S6301-2RSR	0,065	**12**	37	12	1	–	31,4	19,5
16002	0,027	**15**	32	8	0,3	26,9	–	20,5
6002	0,031	**15**	32	9	0,3	26,9	–	20,5
6002-2RSR	0,033	**15**	32	9	0,3	–	28,4	20,5
6002-2Z	0,033	**15**	32	9	0,3	–	28,4	20,5
S6002	0,029	**15**	32	9	0,3	26,9	–	20,5
S6002-2RSR	0,031	**15**	32	9	0,3	–	28,4	20,5
6202	0,043	**15**	35	11	0,6	29,3	–	21,1
6202-2RSR	0,045	**15**	35	11	0,6	–	30,9	21,1



2Z seal



Mounting dimensions
Open design

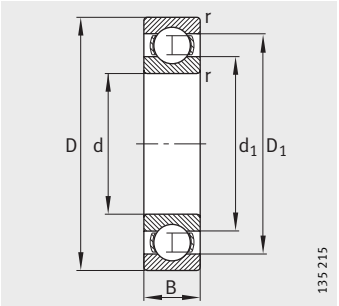


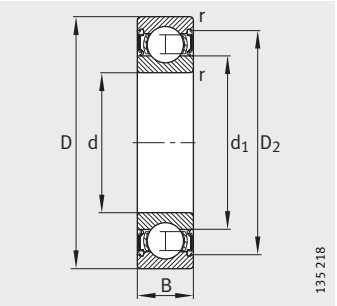
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
12	24	0,3	4 550	1 960	93	34 000	27 500
12	24	0,3	4 550	1 960	93	19 000	–
14,2	25,8	0,6	6 000	2 600	171	32 000	23 400
14,2	25,8	0,6	6 000	2 600	171	17 000	–
14,2	25,8	0,6	6 000	2 600	171	26 000	23 400
14,2	25,8	0,6	6 000	2 600	171	32 000	23 400
14,2	25,8	0,6	6 000	2 600	171	17 000	–
14,2	25,8	0,6	6 000	2 600	158	17 000	–
14,2	30,8	0,6	8 150	3 450	230	56 000	21 100
14,2	30,8	0,6	8 150	3 450	230	15 000	–
14,2	30,8	0,6	8 150	3 450	230	22 000	21 100
14,2	30,8	0,6	8 150	3 450	230	56 000	21 100
14,2	30,8	0,6	8 150	3 450	230	15 000	–
14	26	0,3	5 100	2 360	130	32 000	25 000
14	26	0,3	5 100	2 360	130	18 000	–
14	26	0,3	5 100	2 360	130	26 000	25 000
14	26	0,3	5 100	2 360	130	32 000	24 200
14	26	0,3	5 100	2 360	130	18 000	–
16,2	27,8	0,6	6 950	3 100	198	30 000	22 200
16,2	27,8	0,6	6 950	3 100	198	16 000	–
16,2	27,8	0,6	6 950	3 100	198	24 000	22 200
16,2	27,8	0,6	6 950	3 100	198	30 000	22 200
16,2	27,8	0,6	6 950	3 100	198	16 000	–
16,2	27,8	0,6	6 950	3 100	198	16 000	–
17,6	31,4	1	9 650	4 150	280	53 000	20 000
17,6	31,4	1	9 650	4 150	280	13 000	–
17,6	31,4	1	9 650	4 150	280	20 000	20 000
17,6	31,4	1	9 650	4 150	280	53 000	20 000
17,6	31,4	1	9 650	4 150	280	13 000	–
17	30	0,3	5 600	2 850	144	30 000	20 000
17	30	0,3	5 600	2 850	134	30 000	22 000
17	30	0,3	5 600	2 850	134	16 000	–
17	30	0,3	5 600	2 850	134	24 000	22 000
17	30	0,3	5 600	2 850	134	30 000	21 500
17	30	0,3	5 600	2 850	134	16 000	–
19,2	30,8	0,6	7 800	3 750	220	26 000	20 200
19,2	30,8	0,6	7 800	3 750	220	14 000	–

Deep groove ball bearings

Single row
Open or sealed

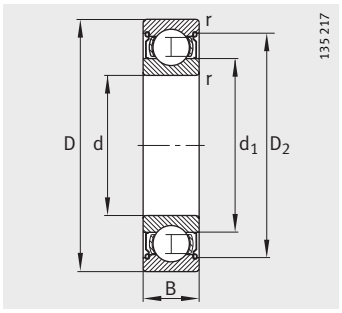




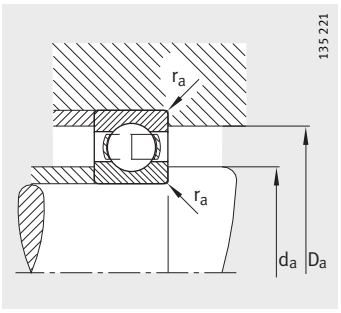
2RSR seal

Dimension table (continued) · Dimensions in mm

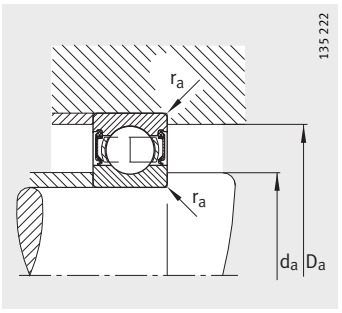
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6202-2Z	0,045	**15**	35	11	0,6	–	30,9	21,1
S6202	0,043	**15**	35	11	0,6	29,3	–	21,1
S6202-2RSR	0,045	**15**	35	11	0,6	–	30,9	21,1
62202-2RSR	0,057	**15**	35	14	0,6	–	30,9	21,1
6302	0,088	**15**	42	13	1	33,5	–	23,6
6302-2RSR	0,09	**15**	42	13	1	–	35	23,6
6302-2Z	0,09	**15**	42	13	1	–	35	23,6
S6302	0,088	**15**	42	13	1	33,5	–	23,6
S6302-2RSR	0,09	**15**	42	13	1	–	35	23,6
62302-2RSR	0,114	**15**	42	17	1	–	35	23,6
16003	0,03	**17**	35	8	0,3	29,5	–	22,7
6003	0,038	**17**	35	10	0,3	29,5	–	22,7
6003-2RSR	0,04	**17**	35	10	0,3	–	30,8	22,7
6003-2Z	0,04	**17**	35	10	0,3	–	30,8	22,7
S6003	0,038	**17**	35	10	0,3	29,5	–	22,7
S6003-2RSR	0,04	**17**	35	10	0,3	–	30,8	22,7
6203	0,065	**17**	40	12	0,6	33,1	–	24
6203-2RSR	0,067	**17**	40	12	0,6	–	34,4	24
6203-2Z	0,067	**17**	40	12	0,6	–	34,4	24
S6203	0,065	**17**	40	12	0,6	33,1	–	24
S6203-2RSR	0,067	**17**	40	12	0,6	–	34,4	24
62203-2RSR	0,087	**17**	40	16	0,6	–	34,4	24
6303	0,114	**17**	47	14	1	37,9	–	26,2
6303-2RSR	0,118	**17**	47	14	1	–	39,3	26,2
6303-2Z	0,117	**17**	47	14	1	–	39,3	26,2
S6303	0,111	**17**	47	14	1	37,9	–	26,2
S6303-2RSR	0,115	**17**	47	14	1	–	39,3	26,2
62303-2RSR	0,154	**17**	47	19	1	–	39,3	26,2
6403	0,269	**17**	62	17	1,1	50,2	–	36,4
16004	0,05	**20**	42	8	0,3	34,7	–	27,2
6004	0,069	**20**	42	12	0,6	35,5	–	26,6
6004-2RSR	0,071	**20**	42	12	0,6	–	37,4	26,6
6004-2Z	0,071	**20**	42	12	0,6	–	37,4	26,6
S6004	0,065	**20**	42	12	0,6	35,5	–	26,6
S6004-2RSR	0,067	**20**	42	12	0,6	–	37,4	26,6
6204	0,106	**20**	47	14	1	38,4	–	28,8
6204-2RSR	0,11	**20**	47	14	1	–	41	28,8



2Z seal



Mounting dimensions
Open design

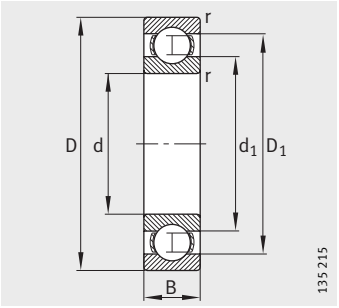


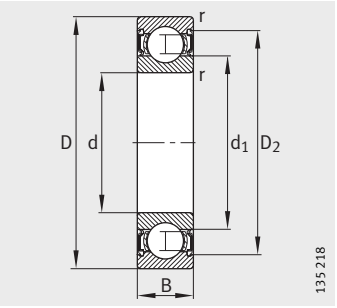
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
19,2	30,8	0,6	7 800	3 750	220	20 000	20 200
19,2	30,8	0,6	7 800	3 750	220	26 000	20 200
19,2	30,8	0,6	7 800	3 750	220	14 000	–
19,2	30,8	0,6	7 800	3 750	220	14 000	–
20,6	36,4	1	11 400	5 400	350	43 000	17 500
20,6	36,4	1	11 400	5 400	350	12 000	–
20,6	36,4	1	11 400	5 400	350	18 000	17 500
20,6	36,4	1	11 400	5 400	350	43 000	17 500
20,6	36,4	1	11 400	5 400	350	12 000	–
20,6	36,4	1	11 400	5 400	350	12 000	–
19	33	0,3	6 000	3 250	157	28 000	17 700
19	33	0,3	6 000	3 250	157	28 000	21 000
19	33	0,3	6 000	3 250	157	14 000	–
19	33	0,3	6 000	3 250	157	22 000	21 000
19	33	0,3	6 000	3 250	157	28 000	20 300
19	33	0,3	6 000	3 250	157	14 000	–
21,2	35,8	0,6	9 500	4 750	275	22 000	18 100
21,2	35,8	0,6	9 500	4 750	275	12 000	–
21,2	35,8	0,6	9 500	4 750	275	18 000	18 100
21,2	35,8	0,6	9 500	4 750	275	22 000	18 100
21,2	35,8	0,6	9 500	4 750	275	12 000	–
21,2	35,8	0,6	9 500	4 750	280	12 000	–
22,6	41,4	1	13 400	6 550	425	30 000	15 900
22,6	41,4	1	13 400	6 550	425	11 000	–
22,6	41,4	1	13 400	6 550	425	16 000	15 900
22,6	41,4	1	13 400	6 550	425	30 000	15 900
22,6	41,4	1	13 400	6 550	425	11 000	–
22,6	41,4	1	13 400	6 550	425	11 000	–
26	53	1	22 400	11 400	750	28 000	13 700
22	40	0,3	6 950	4 050	202	22 000	14 300
23,2	38,8	0,6	9 300	5 000	285	20 000	18 900
23,2	38,8	0,6	9 300	5 000	285	12 000	–
23,2	38,8	0,6	9 300	5 000	285	17 000	18 900
23,2	38,8	0,6	9 300	5 000	285	20 000	18 200
23,2	38,8	0,6	9 300	5 000	285	12 000	–
25,6	41,4	1	12 700	6 550	440	18 000	16 300
25,6	41,4	1	12 700	6 550	440	10 000	–

Deep groove ball bearings

Single row
Open or sealed

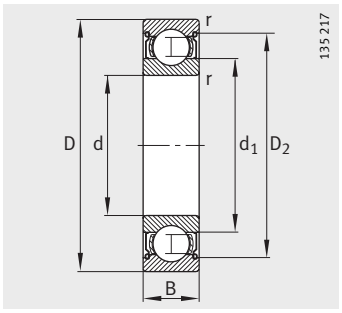




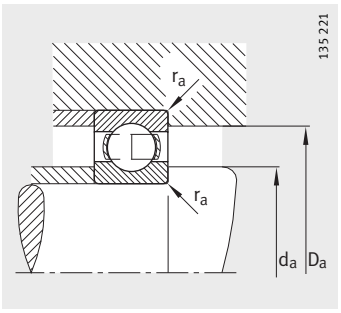
2RSR seal

Dimension table (continued) · Dimensions in mm

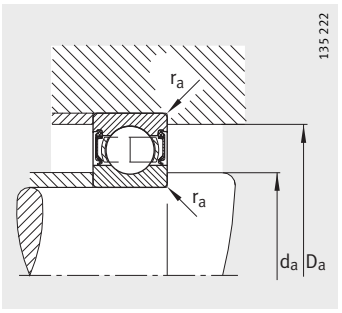
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6204-2Z	0,11	**20**	47	14	1	–	41	28,8
S6204	0,105	**20**	47	14	1	38,4	–	28,8
S6204-2RSR	0,109	**20**	47	14	1	–	41	28,8
62204-2RSR	0,139	**20**	47	18	1	–	41	28,8
6304	0,151	**20**	52	15	1,1	41,9	–	30,3
6304-2RSR	0,155	**20**	52	15	1,1	–	44,4	30,3
6304-2Z	0,155	**20**	52	15	1,1	–	44,4	30,3
S6304	0,153	**20**	52	15	1,1	41,9	–	30,3
62304-2RSR	0,209	**20**	52	21	1,1	–	44,4	30,3
6404	0,414	**20**	72	19	1,1	59,6	–	44,6
16005	0,055	**25**	47	8	0,3	39,7	–	32,2
6005	0,081	**25**	47	12	0,6	40,2	–	32
6005-2RSR	0,085	**25**	47	12	0,6	–	42,5	32
6005-2Z	0,083	**25**	47	12	0,6	–	42,5	32
S6005	0,082	**25**	47	12	0,6	40,2	–	32
S6005-2RSR	0,084	**25**	47	12	0,6	–	42,5	32
6205	0,129	**25**	52	15	1	43,6	–	33,5
6205-2RSR	0,133	**25**	52	15	1	–	45,4	33,5
6205-2Z	0,133	**25**	52	15	1	–	45,4	33,5
S6205	0,129	**25**	52	15	1	43,6	–	33,5
S6205-2RSR	0,133	**25**	52	15	1	–	45,4	33,5
62205-2RSR	0,157	**25**	52	18	1	–	45,4	33,5
6305	0,234	**25**	62	17	1,1	50,2	–	36,4
6305-2RSR	0,242	**25**	62	17	1,1	–	52,5	36,4
6305-2Z	0,24	**25**	62	17	1,1	–	52,5	36,4
S6305	0,237	**25**	62	17	1,1	50,2	–	36,4
S6305-2RSR	0,245	**25**	62	17	1,1	–	52,5	36,4
62305-2RSR	0,272	**25**	62	24	1,1	–	52,5	36,4
6405	0,549	**25**	80	21	1,5	65,5	–	49,3
16006	0,082	**30**	55	9	0,3	47,5	–	37,7
6006	0,122	**30**	55	13	1	47,2	–	38,3
6006-2RSR	0,126	**30**	55	13	1	–	49,2	38,3
6006-2Z	0,126	**30**	55	13	1	–	49,2	38,3
S6006	0,109	**30**	55	13	1	47,2	–	38,3
6206	0,195	**30**	62	16	1	52,1	–	40
6206-2RSR	0,201	**30**	62	16	1	–	54,9	40
6206-2Z	0,201	**30**	62	16	1	–	54,9	40



2Z seal



Mounting dimensions
Open design

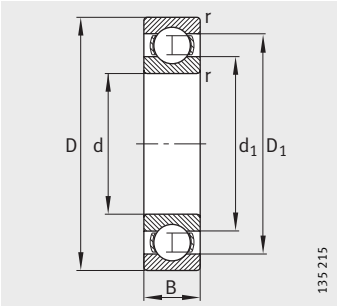


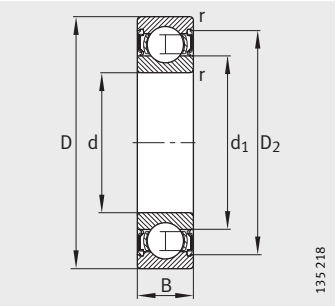
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
25,6	41,4	1	12 700	6 550	440	15 000	16 300
25,6	41,4	1	12 700	6 550	440	18 000	16 300
25,6	41,4	1	12 700	6 550	440	10 000	–
25,6	41,4	1	12 700	6 550	385	10 000	–
27	45	1	16 000	7 800	530	34 000	14 400
27	45	1	16 000	7 800	530	9 500	–
27	45	1	16 000	7 800	530	14 000	14 400
27	45	1	16 000	7 800	530	34 000	14 400
27	45	1	16 000	7 800	495	9 500	–
27	65	1	29 000	16 300	1 020	24 000	12 100
27	45	0,3	7 200	4 650	215	19 000	12 000
28,2	43,8	0,6	10 000	5 850	305	36 000	15 800
28,2	43,8	0,6	10 000	5 850	305	10 000	–
28,2	43,8	0,6	10 000	5 850	305	15 000	15 800
28,2	43,8	0,6	10 000	5 850	305	36 000	15 200
28,2	43,8	0,6	10 000	5 850	305	10 000	–
30,6	46,4	1	14 000	7 800	510	17 000	14 400
30,6	46,4	1	14 000	7 800	510	9 000	–
30,6	46,4	1	14 000	7 800	510	14 000	14 400
30,6	46,4	1	14 000	7 800	510	17 000	14 400
30,6	46,4	1	14 000	7 800	510	9 000	–
30,6	46,4	1	14 000	7 800	415	9 000	–
32	55	1	22 400	11 400	750	28 000	12 300
32	55	1	22 400	11 400	750	7 500	–
32	55	1	22 400	11 400	750	11 000	12 300
32	55	1	22 400	11 400	750	28 000	12 300
32	55	1	22 400	11 400	750	7 500	–
32	55	1	22 400	11 400	750	7 500	–
36	71	1,5	33 500	19 000	1 250	20 000	11 000
32	53	0,3	11 200	7 350	365	16 000	10 400
34,6	50,4	1	12 700	8 000	390	32 000	13 600
34,6	50,4	1	12 700	8 000	390	8 500	–
34,6	50,4	1	12 700	8 000	390	13 000	13 600
34,6	50,4	1	12 700	8 000	390	32 000	13 100
35,6	56,4	1	19 300	11 200	680	14 000	12 000
35,6	56,4	1	19 300	11 200	680	7 500	–
35,6	56,4	1	19 300	11 200	680	11 000	12 000

Deep groove ball bearings

Single row
Open or sealed

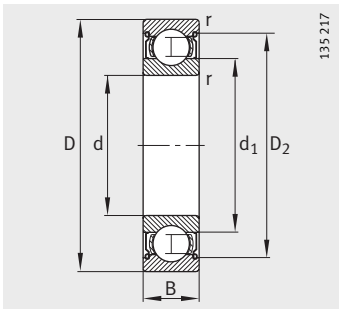




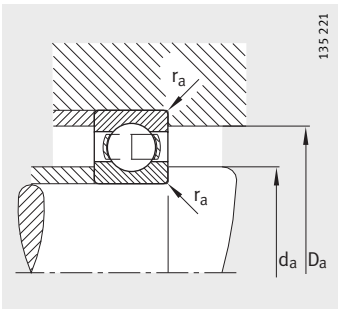
2RSR seal

Dimension table (continued) · Dimensions in mm

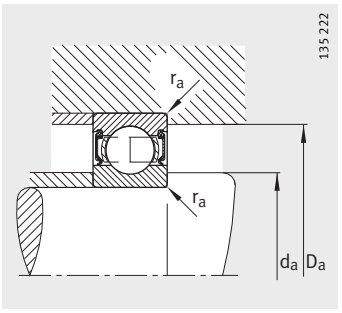
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
S6206	0,205	**30**	62	16	1	52,1	–	40
S6206-2RSR	0,211	**30**	62	16	1	–	54,9	40
62206-2RSR	0,245	**30**	62	20	1	–	54,9	40
6306	0,355	**30**	72	19	1,1	59,6	–	44,6
6306-2RSR	0,365	**30**	72	19	1,1	–	61,6	44,6
6306-2Z	0,363	**30**	72	19	1,1	–	61,6	44,6
S6306	0,355	**30**	72	19	1,1	59,6	–	44,6
S6306-2RSR	0,365	**30**	72	19	1,1	–	61,6	44,6
62306-2RSR	0,499	**30**	72	27	1,1	–	61,6	44,6
16007	0,105	**35**	62	9	0,3	53,5	–	43,7
6007	0,157	**35**	62	14	1	53,3	–	43,2
6007-2RSR	0,163	**35**	62	14	1	–	55,4	43,2
6007-2Z	0,163	**35**	62	14	1	–	55,4	43,2
S6007	0,157	**35**	62	14	1	53,3	–	43,2
S6007-2RSR	0,163	**35**	62	14	1	–	55,4	43,2
6207	0,291	**35**	72	17	1,1	60,7	–	47,2
6207-2RSR	0,301	**35**	72	17	1,1	–	63,3	47,2
6207-2Z	0,299	**35**	72	17	1,1	–	63,3	47,2
S6207	0,285	**35**	72	17	1,1	60,7	–	47,2
S6207-2RSR	0,303	**35**	72	17	1,1	–	63,3	47,2
62207-2RSR	0,393	**35**	72	23	1,1	–	63,3	47,2
6307	0,471	**35**	80	21	1,5	65,5	–	49,3
6307-2RSR	0,483	**35**	80	21	1,5	–	67,6	49,3
6307-2Z	0,481	**35**	80	21	1,5	–	67,6	49,3
S6307	0,471	**35**	80	21	1,5	65,5	–	49,3
S6307-2RSR	0,483	**35**	80	21	1,5	–	67,6	49,3
62307-2RSR	0,687	**35**	80	31	1,5	–	67,6	49,3
6407	0,971	**35**	100	25	1,5	83,3	–	62
61908	0,11	**40**	62	12	0,6	55,3	–	46,6
61908-2RSR	0,11	**40**	62	12	0,6	–	56,6	46,6
61908-2Z	0,11	**40**	62	12	0,6	–	56,6	46,6
16008	0,12	**40**	68	9	0,3	59,3	–	49,4
6008	0,194	**40**	68	15	1	59,1	–	49,3
6008-2RSR	0,202	**40**	68	15	1	–	61,6	49,3
6008-2Z	0,2	**40**	68	15	1	–	61,6	49,3
S6008	0,196	**40**	68	15	1	59,1	–	49,3
6208	0,372	**40**	80	18	1,1	67,5	–	53



2Z seal



Mounting dimensions
Open design

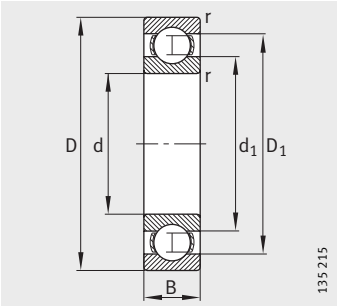


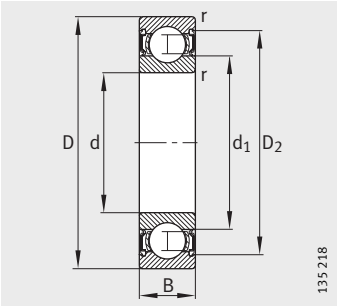
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
35,6	56,4	1	19 300	11 200	680	14 000	12 000
35,6	56,4	1	19 300	11 200	680	7 500	–
35,6	56,4	1	19 300	11 200	680	7 500	–
37	65	1	29 000	16 300	1 020	24 000	10 800
37	65	1	29 000	16 300	1 020	6 300	–
37	65	1	29 000	16 300	1 020	9 500	10 800
37	65	1	29 000	16 300	1 020	24 000	10 800
37	65	1	29 000	16 300	1 020	6 300	–
37	65	1	29 000	16 300	1 020	6 300	–
37	60	0,3	12 200	8 800	415	14 000	8 900
39,6	57,4	1	16 000	10 200	550	28 000	12 100
39,6	57,4	1	16 000	10 200	550	7 500	–
39,6	57,4	1	16 000	10 200	550	11 000	12 100
39,6	57,4	1	16 000	10 200	550	28 000	11 600
39,6	57,4	1	16 000	10 200	550	7 500	–
42	65	1	25 500	15 300	920	24 000	10 300
42	65	1	25 500	15 300	920	6 300	–
42	65	1	25 500	15 300	920	9 500	10 300
42	65	1	25 500	15 300	920	24 000	10 300
42	65	1	25 500	15 300	920	6 300	–
42	65	1	25 500	15 300	920	6 300	–
44	71	1,5	33 500	19 000	1 250	20 000	9 900
44	71	1,5	33 500	19 000	1 250	5 600	–
44	71	1,5	33 500	19 000	1 250	8 500	9 900
44	71	1,5	33 500	19 000	1 250	20 000	9 900
44	71	1,5	33 500	19 000	1 250	5 600	–
44	71	1,5	33 500	19 000	1 250	5 600	–
46	89	1,5	53 000	31 500	2 180	16 000	8 900
43,2	58,8	0,6	13 700	10 000	540	28 000	10 000
43,2	58,8	0,6	13 700	10 000	540	7 000	–
43,2	58,8	0,6	13 700	10 000	540	11 000	10 000
42	66	0,3	13 200	10 200	465	13 000	7 800
44,6	63,4	1	16 600	11 600	580	26 000	11 100
44,6	63,4	1	16 600	11 600	580	6 700	–
44,6	63,4	1	16 600	11 600	580	10 000	11 100
44,6	63,4	1	16 600	11 600	580	26 000	10 700
47	73	1	29 000	18 000	1 050	20 000	9 300

Deep groove ball bearings

Single row
Open or sealed

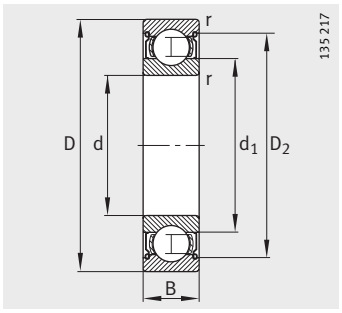




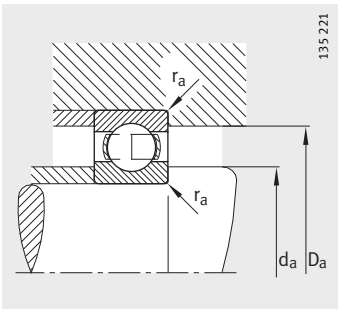
2RSR seal

Dimension table (continued) · Dimensions in mm

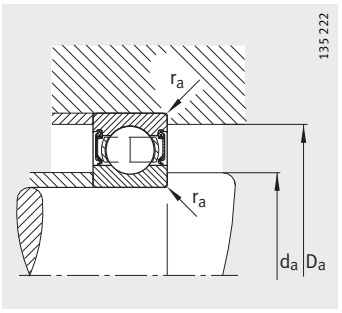
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6208-2RSR	0,384	**40**	80	18	1,1	–	70,4	53
6208-2Z	0,382	**40**	80	18	1,1	–	70,4	53
S6208	0,372	**40**	80	18	1,1	67,5	–	53
S6208-2RSR	0,384	**40**	80	18	1,1	–	70,4	53
62208-2RSR	0,478	**40**	80	23	1,1	–	70,4	53
6308	0,64	**40**	90	23	1,5	74,6	–	55,6
6308-2RSR	0,654	**40**	90	23	1,5	–	76,5	55,6
6308-2Z	0,654	**40**	90	23	1,5	–	76,5	55,6
S6308	0,641	**40**	90	23	1,5	74,6	–	55,6
62308-2RSR	0,903	**40**	90	33	1,5	–	76,5	55,6
61809-Y	0,039	**45**	58	7	0,3	54,1	–	49,1
61809-2RSR-Y	0,039	**45**	58	7	0,3	–	55,4	49,1
61809-2Z-Y	0,039	**45**	58	7	0,3	–	55,4	49,1
61909	0,13	**45**	68	12	0,6	60,8	–	52,1
61909-2RSR	0,13	**45**	68	12	0,6	–	62,1	52,1
61909-2Z	0,13	**45**	68	12	0,6	–	62,1	52,1
16009	0,167	**45**	75	10	0,6	65,6	–	55
6009	0,247	**45**	75	16	1	65,5	–	54,2
6009-2RSR	0,257	**45**	75	16	1	–	68	54,2
6009-2Z	0,253	**45**	75	16	1	–	68	54,2
S6009	0,234	**45**	75	16	1	65,5	–	54,2
S6009-2RSR	0,244	**45**	75	16	1	–	67,9	54,2
6209	0,429	**45**	85	19	1,1	71,8	–	57,2
6209-2RSR	0,441	**45**	85	19	1,1	–	74,6	57,2
6209-2Z	0,441	**45**	85	19	1,1	–	74,6	57,2
S6209	0,429	**45**	85	19	1,1	71,8	–	57,2
S6209-2RSR	0,441	**45**	85	19	1,1	–	74,6	57,2
62209-2RSR	0,522	**45**	85	23	1,1	–	74,6	57,2
6309	0,849	**45**	100	25	1,5	83,3	–	62,3
6309-2RSR	0,867	**45**	100	25	1,5	–	85,6	62
6309-2Z	0,869	**45**	100	25	1,5	–	85,6	62
S6309	0,859	**45**	100	25	1,5	83,3	–	62
S6309-2RSR	0,879	**45**	100	25	1,5	–	85,6	62
62309-2RSR	1,2	**45**	100	36	1,5	–	85,6	62
6409	1,98	**45**	120	29	2	100,9	–	75,5
61810-Y	0,052	**50**	65	7	0,3	60,5	–	55,1
61810-2RSR-Y	0,052	**50**	65	7	0,3	–	61,8	55,1



2Z seal



Mounting dimensions
Open design

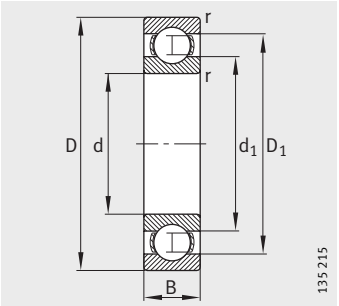


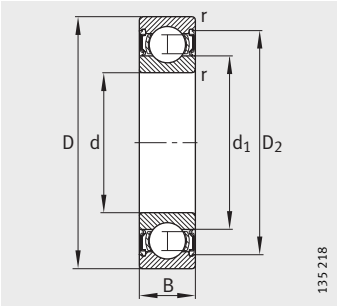
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
47	73	1	29 000	18 000	1 050	5 600	–
47	73	1	29 000	18 000	1 050	8 500	9 300
47	73	1	29 000	18 000	1 050	20 000	9 300
47	73	1	29 000	18 000	1 050	5 600	–
47	73	1	29 000	18 000	1 050	5 600	–
49	81	1,5	42 500	25 000	1 640	18 000	9 000
49	81	1,5	42 500	25 000	1 640	5 000	–
49	81	1,5	42 500	25 000	1 640	7 500	9 000
49	81	1,5	42 500	25 000	1 640	18 000	9 000
49	81	1,5	42 500	25 000	1 640	5 000	–
47	56	0,3	6 400	5 600	285	14 000	9 000
47	56	0,3	6 400	5 600	285	7 500	–
47	56	0,3	6 400	5 600	285	11 000	9 000
48,2	64,8	0,6	14 000	10 800	570	26 000	8 900
48,2	64,8	0,6	14 000	10 800	570	6 700	–
48,2	64,8	0,6	14 000	10 800	570	10 000	8 900
48,2	71,8	0,6	15 600	12 200	580	22 000	7 300
49,6	70,4	1	20 000	14 300	730	22 000	10 200
49,6	70,4	1	20 000	14 300	730	6 000	–
49,6	70,4	1	20 000	14 300	730	9 000	10 200
49,6	70,4	1	20 000	14 300	730	22 000	9 700
49,6	70,4	1	20 000	14 300	730	6 000	–
52	78	1	31 000	20 400	1 150	19 000	8 700
52	78	1	31 000	20 400	1 150	5 300	–
52	78	1	31 000	20 400	1 150	8 000	8 700
52	78	1	31 000	20 400	1 150	19 000	8 700
52	78	1	31 000	20 400	1 150	5 300	–
52	78	1	31 000	20 400	1 150	5 300	–
54	91	1,5	53 000	31 500	2 180	16 000	8 300
54	91	1,5	53 000	31 500	2 180	4 500	–
54	91	1,5	53 000	31 500	2 180	6 700	8 300
54	91	1,5	53 000	31 500	2 180	16 000	8 300
54	91	1,5	53 000	31 500	2 180	4 500	–
54	91	1,5	53 000	31 500	2 180	4 500	–
58	107	2	76 500	47 500	3 050	13 000	7 600
52	63	0,3	6 800	6 300	265	13 000	8 000
52	63	0,3	6 800	6 300	265	6 700	–

Deep groove ball bearings

Single row
Open or sealed

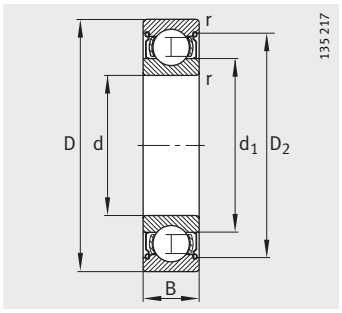




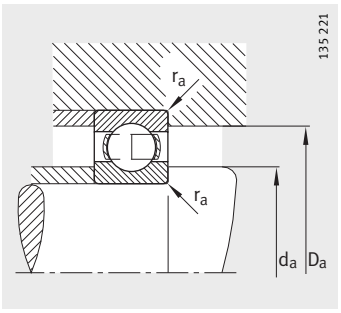
2RSR seal

Dimension table (continued) · Dimensions in mm

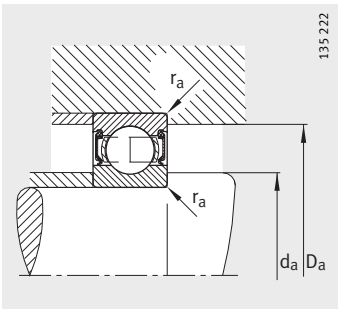
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
61810-2Z-Y	0,052	**50**	65	7	0,3	–	61,8	55,1
61910	0,13	**50**	72	12	0,6	65,5	–	56,6
61910-2RSR	0,13	**50**	72	12	0,6	–	68,6	56,6
16010	0,181	**50**	80	10	0,6	70,6	–	60,1
6010	0,272	**50**	80	16	1	70,1	–	59,8
6010-2RSR	0,283	**50**	80	16	1	–	72,9	59,8
6010-2Z	0,282	**50**	80	16	1	–	72,9	59,8
S6010	0,26	**50**	80	16	1	70,1	–	59,8
S6010-2RSR	0,271	**50**	80	16	1	–	72,9	59,8
6210	0,466	**50**	90	20	1,1	77,9	–	62
6210-2RSR	0,48	**50**	90	20	1,1	–	80	62
6210-2Z	0,478	**50**	90	20	1,1	–	80	62
S6210	0,469	**50**	90	20	1,1	77,9	–	62
62210-2RSR	0,543	**50**	90	23	1,1	–	80	62
6310	1,1	**50**	110	27	2	91,6	–	68,3
6310-2RSR	1,12	**50**	110	27	2	–	95,1	68
6310-2Z	1,12	**50**	110	27	2	–	95,1	68
S6310-2RSR	1,11	**50**	110	27	2	–	95,1	68
62310-2RSR	1,55	**50**	110	40	2	–	95,1	68,3
6410	1,96	**50**	130	31	2,1	108,4	–	81,6
61811-Y	0,084	**55**	72	9	0,3	66,5	–	60,6
61811-2RSR-Y	0,084	**55**	72	9	0,3	–	68,6	60,6
61811-2Z-Y	0,084	**55**	72	9	0,3	–	68,6	60,6
61911	0,18	**55**	80	13	1	72,3	–	62,6
61911-2RSR	0,18	**55**	80	13	1	–	74,2	62,6
16011	0,266	**55**	90	11	0,6	78	–	67,1
6011	0,397	**55**	90	18	1,1	78,9	–	66,2
6011-2RSR	0,41	**55**	90	18	1,1	–	81,5	66,2
6011-2Z	0,409	**55**	90	18	1,1	–	81,5	66,2
S6011	0,403	**55**	90	18	1,1	78,9	–	66,2
6211	0,618	**55**	100	21	1,5	86,1	–	68,9
6211-2RSR	0,632	**55**	100	21	1,5	–	88,2	68,7
6211-2Z	0,632	**55**	100	21	1,5	–	88,2	68,7
S6211	0,617	**55**	100	21	1,5	86,1	–	68,7
6311	1,39	**55**	120	29	2	100,9	–	75,5
6311-2RSR	1,43	**55**	120	29	2	–	104,3	75,2
6311-2Z	1,43	**55**	120	29	2	–	104,3	75,2



2Z seal



Mounting dimensions
Open design

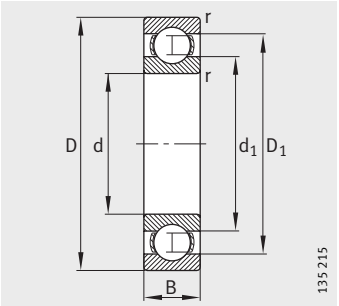


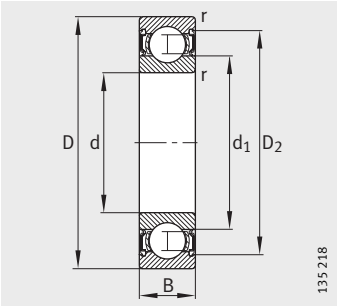
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
52	63	0,3	6 800	6 300	265	9 300	8 000
53,2	68,8	0,6	14 600	11 800	600	22 000	8 100
53,2	68,8	0,6	14 600	11 800	600	6 000	–
53,2	76,8	0,6	16 000	13 200	610	20 000	6 700
54,6	75,4	1	20 800	15 600	770	20 000	9 300
54,6	75,4	1	20 800	15 600	770	5 600	–
54,6	75,4	1	20 800	15 600	770	8 500	9 300
54,6	75,4	1	20 800	15 600	770	20 000	8 900
54,6	75,4	1	20 800	15 600	770	5 600	–
57	83	1	36 500	24 000	1 420	18 000	8 200
57	83	1	36 500	24 000	1 420	4 800	–
57	83	1	36 500	24 000	1 420	7 500	8 200
57	83	1	36 500	24 000	1 420	18 000	8 200
57	83	1	36 500	24 000	1 420	4 800	–
61	99	2	62 000	38 000	2 600	14 000	7 700
61	99	2	62 000	38 000	2 600	4 000	–
61	99	2	62 000	38 000	2 600	6 000	7 700
61	99	2	62 000	38 000	2 600	4 000	–
61	99	2	62 000	38 000	2 600	4 000	–
64	116	2,1	81 500	52 000	3 400	12 000	7 200
57	70	0,3	9 000	8 500	375	11 000	8 000
57	70	0,3	9 000	8 500	375	6 000	–
57	70	0,3	9 000	8 500	375	9 000	8 000
59,6	75,4	1	16 600	14 000	700	19 000	7 500
59,6	75,4	1	16 600	14 000	700	5 600	–
58,2	86,8	0,6	19 300	16 300	780	18 000	6 200
61	84	1	28 500	21 200	1 120	18 000	8 700
61	84	1	28 500	21 200	1 120	5 000	–
61	84	1	28 500	21 200	1 120	7 500	8 300
61	84	1	28 500	21 200	1 120	18 000	8 300
64	91	1,5	43 000	29 000	1 720	16 000	7 500
64	91	1,5	43 000	29 000	1 720	4 300	–
64	91	1,5	43 000	29 000	1 720	6 700	7 500
64	91	1,5	43 000	29 000	1 720	16 000	7 500
66	109	2	76 500	47 500	3 050	13 000	7 100
66	109	2	76 500	47 500	3 050	3 600	–
66	109	2	76 500	47 500	3 050	5 300	7 100

Deep groove ball bearings

Single row
Open or sealed

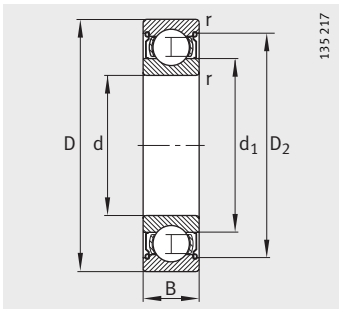




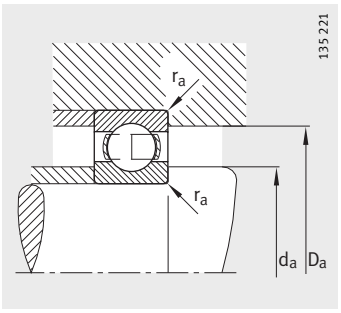
2RSR seal

Dimension table (continued) · Dimensions in mm

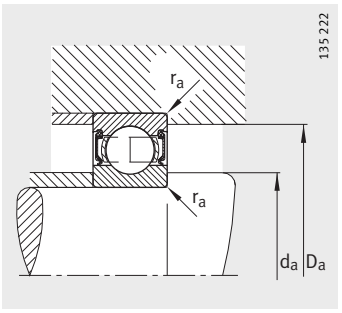
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6411	1,38	**55**	140	33	2,1	117,5	–	88,6
61812-Y	0,105	**60**	78	10	0,3	72,6	–	65,6
61812-2RSR-Y	0,105	**60**	78	10	0,3	–	74,5	65,6
61812-2Z-Y	0,105	**60**	78	10	0,3	–	74,5	65,6
61912	0,19	**60**	85	13	1	77,3	–	67,6
61912-2RSR	0,19	**60**	85	13	1	–	79,2	67,6
16012	0,283	**60**	95	11	0,6	82,9	–	72,1
6012	0,419	**60**	95	18	1,1	83,9	–	71,3
6012-2RSR	0,432	**60**	95	18	1,1	–	86	71,3
6012-2Z	0,431	**60**	95	18	1,1	–	86	71,3
S6012	0,416	**60**	95	18	1,1	83,8	–	71,4
6212	0,791	**60**	110	22	1,5	95,6	–	76,1
6212-2RSR	0,809	**60**	110	22	1,5	–	97,7	75,8
6212-2Z	0,807	**60**	110	22	1,5	–	97,7	75,8
S6212	0,795	**60**	110	22	1,5	95,6	–	75,8
6312	1,75	**60**	130	31	2,1	108,4	–	81,6
6312-2RSR	1,79	**60**	130	31	2,1	–	113,1	81,3
6312-2Z	1,79	**60**	130	31	2,1	–	113,1	81,3
6412	2,83	**60**	150	35	2,1	126,3	–	95,1
61813-Y	0,13	**65**	85	10	0,6	78,6	–	71,6
61813-2RSR-Y	0,13	**65**	85	10	0,6	–	80,5	71,6
61813-2Z-Y	0,13	**65**	85	10	0,6	–	80,5	71,6
61913	0,2	**65**	90	13	1	82,3	–	72,6
61913-2RSR	0,2	**65**	90	13	1	–	84,2	72,6
16013	0,302	**65**	100	11	0,6	87,9	–	77,1
6013	0,448	**65**	100	18	1,1	88,8	–	76,2
6013-2RSR	0,463	**65**	100	18	1,1	–	91,5	76,2
6013-2Z	0,464	**65**	100	18	1,1	–	91,5	76,2
6213	1	**65**	120	23	1,5	103,1	–	82,3
6213-2RSR	1,03	**65**	120	23	1,5	–	106,3	82
6213-2Z	1,03	**65**	120	23	1,5	–	106,3	82
6313	2,14	**65**	140	33	2,1	117,5	–	88,6
6313-2RSR	2,18	**65**	140	33	2,1	–	122,2	88,3
6313-2Z	2,18	**65**	140	33	2,1	–	122,2	88,3
6413	3,49	**65**	160	37	2,1	133,2	–	101,7
61814-Y	0,14	**70**	90	10	0,6	83,6	–	76,6
61814-2RSR-Y	0,14	**70**	90	10	0,6	–	85,5	76,6



2Z seal



Mounting dimensions
Open design

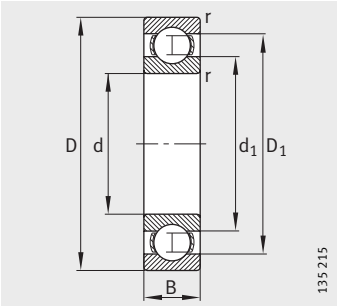


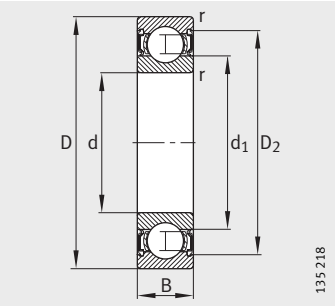
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
69	126	2,1	93 000	60 000	3 950	11 000	6 700
62	76	0,3	11 800	11 000	485	9 500	8 000
62	76	0,3	11 800	11 000	485	5 600	–
62	76	0,3	11 800	11 000	485	8 000	8 000
64,6	80,4	1	16 300	14 300	700	18 000	6 900
64,6	80,4	1	16 300	14 300	700	5 000	–
63,2	91,8	0,6	20 000	17 600	820	17 000	5 700
66	89	1	29 000	23 200	1 190	17 000	8 000
66	89	1	29 000	23 200	1 190	4 500	–
66	89	1	29 000	23 200	1 190	7 000	8 000
66	89	1	29 000	23 200	1 190	16 000	7 600
69	101	1,5	52 000	36 000	2 240	14 000	6 800
69	101	1,5	52 000	36 000	2 240	4 000	–
69	101	1,5	52 000	36 000	2 240	6 000	6 800
69	101	1,5	52 000	36 000	2 220	14 000	6 800
72	118	2,1	81 500	52 000	3 400	12 000	6 700
72	118	2,1	81 500	52 000	3 400	3 400	–
72	118	2,1	81 500	52 000	3 400	5 000	6 700
74	136	2,1	104 000	68 000	4 450	10 000	6 400
68,2	81,8	0,6	12 200	12 000	520	9 000	7 000
68,2	81,8	0,6	12 200	12 000	520	5 000	–
68,2	81,8	0,6	12 200	12 000	520	7 500	7 000
69,6	85,4	1	20 000	17 600	860	17 000	6 400
69,6	85,4	1	20 000	17 600	860	4 800	–
68,2	96,8	0,6	21 200	19 600	910	16 000	5 300
71	94	1	30 500	25 000	1 270	15 000	7 500
71	94	1	30 500	25 000	1 270	4 300	–
71	94	1	30 500	25 000	1 270	6 300	7 500
74	111	1,5	60 000	41 500	2 550	13 000	6 300
74	111	1,5	60 000	41 500	2 550	3 600	–
74	111	1,5	60 000	41 500	2 550	5 300	6 300
77	128	2,1	93 000	60 000	3 950	11 000	6 400
77	128	2,1	93 000	60 000	3 950	3 000	–
77	128	2,1	93 000	60 000	3 950	4 500	6 400
79	146	2,1	114 000	76 500	4 650	9 500	6 100
73,2	86,8	0,6	12 500	12 500	540	8 500	6 700
73,2	86,8	0,6	12 500	12 500	540	4 800	–

Deep groove ball bearings

Single row
Open or sealed

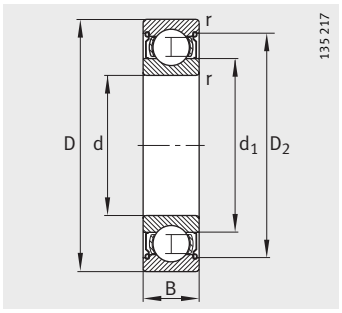




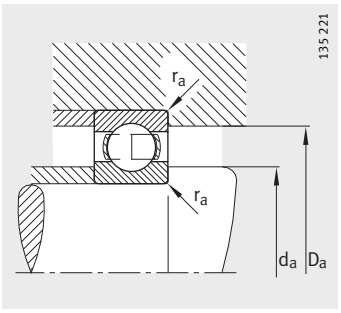
2RSR seal

Dimension table (continued) · Dimensions in mm

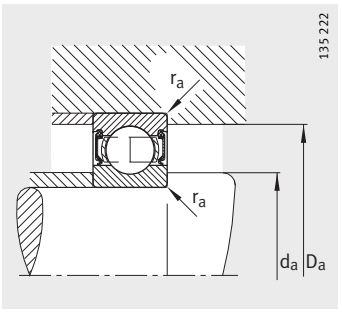
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
61814-2Z-Y	0,14	**70**	90	10	0,6	–	85,5	76,6
61914	0,34	**70**	100	16	1	90,9	–	79,1
61914-2RSR	0,34	**70**	100	16	1	–	92,8	79,1
16014	0,438	**70**	110	13	0,6	96,2	–	83,7
6014	0,622	**70**	110	20	1,1	97,3	–	82,8
6014-2Z	0,642	**70**	110	20	1,1	–	100	82,8
6214	1,09	**70**	125	24	1,5	108	–	87,1
6214-2RSR	1,11	**70**	125	24	1,5	–	110,7	86,8
6214-2Z	1,11	**70**	125	24	1,5	–	110,7	86,8
6314	2,55	**70**	150	35	2,1	126,3	–	95,1
6314-2RSR	2,6	**70**	150	35	2,1	–	130,2	94,8
6314-2Z	2,6	**70**	150	35	2,1	–	130,2	94,8
6414	5,06	**70**	180	42	3	151,6	–	114,4
61815-Y	0,15	**75**	95	10	0,6	88,7	–	81,6
61815-2RSR-Y	0,15	**75**	95	10	0,6	–	90,5	81,6
61815-2Z-Y	0,15	**75**	95	10	0,6	–	90,5	81,6
61915	0,356	**75**	105	16	1	96,2	–	84,1
61915-2RSR	0,356	**75**	105	16	1	–	98,2	84,1
16015	0,463	**75**	115	13	0,6	101,2	–	88,7
6015	0,654	**75**	115	20	1,1	102,6	–	88,1
6015-2RSR	0,678	**75**	115	20	1,1	–	105,3	88,1
6015-2Z	0,676	**75**	115	20	1,1	–	105,3	88,1
6215	1,19	**75**	130	25	1,5	112,8	–	92,5
6215-2RSR	1,22	**75**	130	25	1,5	–	115,5	92,1
6215-2Z	1,21	**75**	130	25	1,5	–	115,5	92,1
6315	3,18	**75**	160	37	2,1	133,2	–	101,8
6315-2RSR	3,18	**75**	160	37	2,1	–	137,2	101,8
6315-2Z	3,23	**75**	160	37	2,1	–	137,2	101,4
6415-M	7	**75**	190	45	3	151,6	–	114,4
61816-Y	0,155	**80**	100	10	0,6	93,7	–	86,6
61816-2RSR-Y	0,155	**80**	100	10	0,6	–	95,5	86,6
61816-2Z-Y	0,155	**80**	100	10	0,6	–	95,5	86,6
61916	0,379	**80**	110	16	1	100,8	–	89,1
16016	0,609	**80**	125	14	0,6	110,7	–	96,9
6016	0,845	**80**	125	22	1,1	111	–	94
6016-2Z	0,893	**80**	125	22	1,1	–	113,7	93,7
6216	1,46	**80**	140	26	2	121,3	–	98,8



2Z seal



Mounting dimensions
Open design

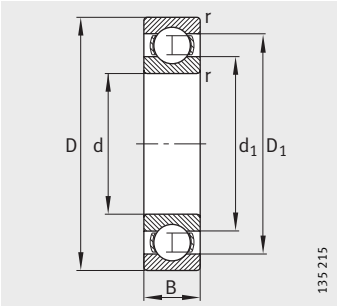


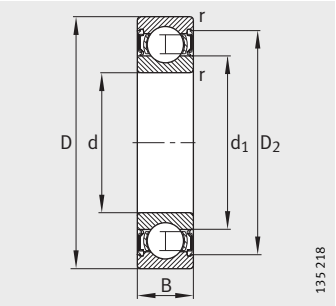
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
73,2	86,8	0,6	12 500	12 500	540	7 000	6 700
74,6	95,4	1	27 000	23 200	1 160	15 000	6 400
74,6	95,4	1	27 000	23 200	1 160	4 300	–
73,2	106,8	0,6	28 000	25 000	1 230	14 000	5 300
76	104	1	38 000	31 000	1 850	14 000	7 200
76	104	1	38 000	31 000	1 850	6 000	7 200
79	116	1,5	62 000	44 000	2 900	12 000	6 100
79	116	1,5	62 000	44 000	2 900	3 400	–
79	116	1,5	62 000	44 000	2 900	5 000	6 100
82	138	2,1	104 000	68 000	4 450	10 000	6 100
82	138	2,1	104 000	68 000	4 450	2 800	–
82	138	2,1	104 000	68 000	4 450	4 300	6 100
86	164	2,5	132 000	96 500	5 800	8 500	5 700
78,2	91,8	0,6	12 900	13 400	690	8 000	6 000
78,2	91,8	0,6	12 900	13 400	690	4 500	–
78,2	91,8	0,6	12 900	13 400	690	6 700	6 000
79,6	100,4	1	28 000	25 000	1 230	14 000	6 700
79,6	100,4	1	28 000	25 000	1 230	4 000	–
78,2	111,8	0,6	28 500	27 000	1 290	13 000	4 900
81	109	1	39 000	33 500	1 960	13 000	6 700
81	109	1	39 000	33 500	1 960	3 800	–
81	109	1	39 000	33 500	1 960	5 600	6 700
84	121	1,5	65 500	49 000	3 350	11 000	5 900
84	121	1,5	65 500	49 000	3 350	3 200	–
84	121	1,5	65 500	49 000	3 350	4 800	5 900
87	148	2,1	114 000	76 500	4 650	9 500	5 800
87	148	2,1	114 000	76 500	4 650	7 000	–
87	148	2,1	114 000	76 500	4 650	4 000	5 800
91	174	2,5	132 000	96 500	5 800	8 500	5 600
83,2	96,8	0,6	12 900	13 700	600	7 500	5 600
83,2	96,8	0,6	12 900	13 700	600	4 300	–
83,2	96,8	0,6	12 900	13 700	600	6 300	5 600
84,6	105,4	1	28 500	27 000	1 290	13 000	6 300
83,2	121,8	0,6	32 000	31 000	1 510	13 000	4 700
86	119	1	47 500	40 000	2 340	12 000	6 500
86	119	1	47 500	40 000	2 340	5 000	6 500
91	129	2	72 000	54 000	3 450	11 000	5 500

Deep groove ball bearings

Single row
Open or sealed

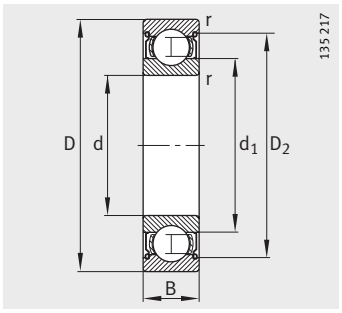




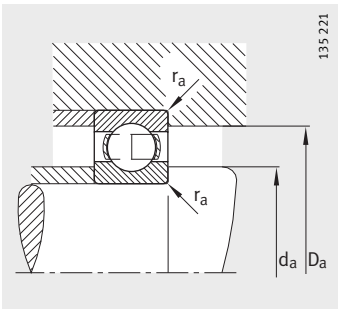
2RSR seal

Dimension table (continued) · Dimensions in mm

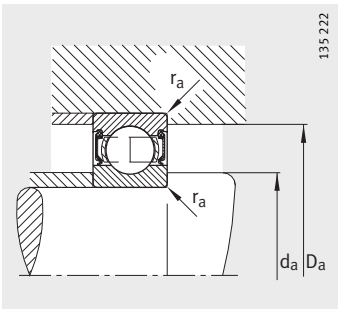
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6216-2Z	1,49	**80**	140	26	2	–	124,5	98,5
6316	3,75	**80**	170	39	2,1	141,8	–	108,6
6316-2RSR	3,75	**80**	170	39	2,1	–	145,5	108,6
6316-2Z	3,82	**80**	170	39	2,1	–	145,5	108,2
6416-M	8,29	**80**	200	48	3	162,1	–	117,9
61817-Y	0,27	**85**	110	13	1	101,7	–	93,2
61817-2RSR-Y	0,27	**85**	110	13	1	–	104,2	93,2
61817-2Z-Y	0,27	**85**	110	13	1	–	104,2	93,2
16017	0,666	**85**	130	14	0,6	113,8	–	101,6
6017	0,917	**85**	130	22	1,1	116	–	99,6
6017-2RSR	0,917	**85**	130	22	1,1	–	119,2	99,6
6017-2Z	0,94	**85**	130	22	1,1	–	119,2	99,2
6217	1,87	**85**	150	28	2	129,7	–	106,2
6217-2RSR	1,87	**85**	150	28	2	–	133,8	106,2
6217-2Z	1,91	**85**	150	28	2	–	133,8	106,2
6317	4,25	**85**	180	41	3	151,6	–	114,4
6317-2RSR	4,25	**85**	180	41	3	–	154,9	114,4
6317-2Z	4,33	**85**	180	41	3	–	154,9	114
6417-M	9,6	**85**	210	52	4	173	–	123,4
61818-Y	0,28	**90**	115	13	1	106,7	–	98,2
61818-2RSR-Y	0,28	**90**	115	13	1	–	109,2	98,2
61818-2Z-Y	0,28	**90**	115	13	1	–	109,2	98,2
16018	0,866	**90**	140	16	1	122,7	–	107,6
6018	1,21	**90**	140	24	1,5	123,7	–	106,6
6018-2RSR	1,21	**90**	140	24	1,5	–	126,8	106,6
6018-2Z	1,23	**90**	140	24	1,5	–	126,8	106,2
6218	2,21	**90**	160	30	2	139,4	–	112,3
6218-2RSR	2,21	**90**	160	30	2	–	143,4	112,3
6218-2Z	2,26	**90**	160	30	2	–	143,4	112,3
6318	5,43	**90**	190	43	3	157,1	–	123,8
6318-2RSR	5,43	**90**	190	43	3	–	160,7	123,8
6318-2Z	5,53	**90**	190	43	3	–	160,7	123,3
6418-M	11,7	**90**	225	54	4	184	–	132,2
61819-Y	0,295	**95**	120	13	1	112	–	103,2
61819-2RSR-Y	0,295	**95**	120	13	1	–	114,2	103,2
61819-2Z-Y	0,295	**95**	120	13	1	–	114,2	103,2
16019	0,922	**95**	145	16	1	128,3	–	113,8



2Z seal



Mounting dimensions
Open design

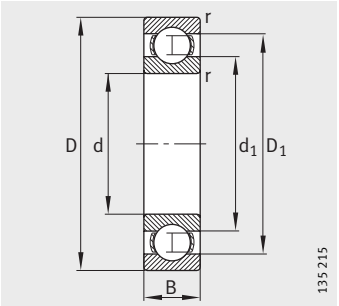


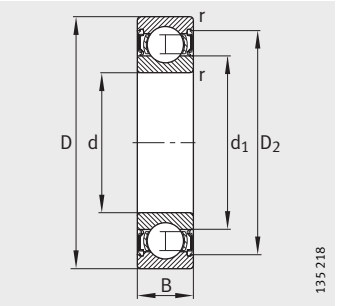
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
91	129	2	72 000	54 000	3 450	4 500	5 500
92	158	2,1	122 000	86 500	5 200	9 000	5 500
92	158	2,1	122 000	86 500	5 200	6 700	–
92	158	2,1	122 000	86 500	5 200	3 800	5 500
96	184	2,5	163 000	125 000	6 900	7 500	5 400
89,6	105,4	1	19 300	20 000	960	6 700	6 000
89,6	105,4	1	19 300	20 000	960	3 800	–
89,6	105,4	1	19 300	20 000	960	5 600	6 000
88,2	126,8	0,6	34 000	33 500	1 570	12 000	4 400
91	124	1	49 000	43 000	2 430	11 000	6 100
91	124	1	49 000	43 000	2 430	3 200	–
91	124	1	49 000	43 000	2 430	4 800	6 100
96	139	2	83 000	64 000	4 050	10 000	5 300
96	139	2	64 000	83 000	4 050	2 800	–
96	139	2	83 000	64 000	4 050	4 300	5 300
99	166	2,5	132 000	96 500	5 800	8 000	5 300
99	166	2,5	132 000	96 500	5 800	6 300	–
99	166	2,5	132 000	96 500	5 800	3 400	5 300
105	190	3	173 000	137 000	7 500	7 000	5 300
94,6	110,4	1	19 600	20 400	990	6 300	5 600
94,6	110,4	1	19 600	20 400	990	3 600	–
94,6	110,4	1	19 600	20 400	990	5 300	5 600
94,6	135,4	1	41 500	39 000	1 870	11 000	4 400
97	133	1,5	58 500	50 000	2 650	11 000	6 000
97	133	1,5	58 500	50 000	2 650	3 000	–
97	133	1,5	58 500	50 000	2 650	4 500	6 000
101	149	2	96 500	72 000	4 200	9 000	5 100
101	149	2	96 500	72 000	4 200	2 600	–
101	149	2	96 500	72 000	4 200	3 800	5 100
104	176	2,5	134 000	102 000	5 800	8 000	5 100
104	176	2,5	134 000	102 000	5 800	6 000	–
104	176	2,5	134 000	102 000	5 800	3 400	5 100
110	205	3	196 000	163 000	8 900	6 700	4 900
99,6	115,4	1	20 000	21 200	1 100	6 300	5 300
99,6	115,4	1	20 000	21 200	1 100	3 400	–
99,6	115,4	1	20 000	21 200	1 100	5 300	5 300
99,6	140,4	1	40 000	40 500	1 990	11 000	4 200

Deep groove ball bearings

Single row
Open or sealed

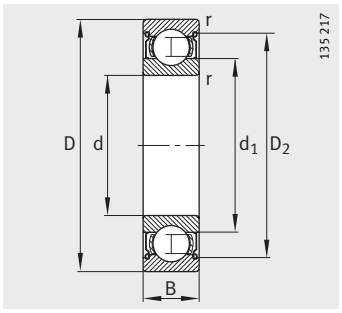




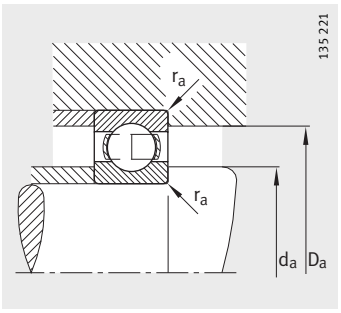
2RSR seal

Dimension table (continued) · Dimensions in mm

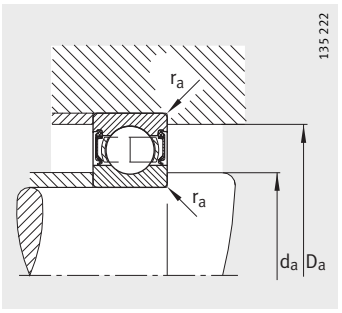
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6019	1,27	**95**	145	24	1,5	129	–	111
6019-2RSR	1,27	**95**	145	24	1,5	–	131,8	111
6219	2,73	**95**	170	32	2,1	146,6	–	118,3
6219-2RSR	2,73	**95**	170	32	2,1	–	150,9	118,3
6219-2Z	2,79	**95**	170	32	2,1	–	150,9	118,3
6319	6,23	**95**	200	45	3	166,9	–	129,1
6319-2Z	7,14	**95**	200	45	3	–	170,4	128,7
61820-Y	0,31	**100**	125	13	1	116,7	–	108,2
61820-2RSR-Y	0,31	**100**	125	13	1	–	119,2	108,2
61820-2Z-Y	0,31	**100**	125	13	1	–	119,2	108,2
16020	0,956	**100**	150	16	1	132,7	–	117,6
6020	1,32	**100**	150	24	1,5	134	–	116,6
6020-2RSR	1,32	**100**	150	24	1,5	–	137,3	116,6
6020-2Z	1,35	**100**	150	24	1,5	–	137,3	116,2
6220	3,3	**100**	180	34	2,1	154,8	–	124,7
6220-2RSR	3,3	**100**	180	34	2,1	–	158,9	124,7
6220-2Z	3,36	**100**	180	34	2,1	–	158,9	124,7
6320	7,67	**100**	215	47	3	179	–	138,6
6320-2Z	7,78	**100**	215	47	3	–	184,6	138,1
61821-Y	0,33	**105**	130	13	1	121,7	–	113,2
61821-2RSR-Y	0,33	**105**	130	13	1	–	124,2	113,2
61821-2Z-Y	0,33	**105**	130	13	1	–	124,2	113,2
16021	1,24	**105**	160	18	1	141,2	–	124,2
6021	1,67	**105**	160	26	2	142,4	–	122,1
6021-2Z	1,7	**105**	160	26	2	–	145,3	121,7
6221	3,88	**105**	190	36	2,1	163,2	–	131,9
6221-2Z	3,99	**105**	190	36	2,1	–	168,1	131,5
6321	8,7	**105**	225	49	3	187	–	144,5
61822-Y	0,5	**110**	140	16	1	130,3	–	119,7
61822-2RSR-Y	0,5	**110**	140	16	1	–	133,3	119,7
61822-2Z-Y	0,5	**110**	140	16	1	–	133,3	119,7
16022	1,52	**110**	170	19	1	149,5	–	130,7
6022	2,06	**110**	170	28	2	150,9	–	129,2
6022-2RSR	2,06	**110**	170	28	2	–	155	129,2
6022-2Z	2,11	**110**	170	28	2	–	155	128,7
6222	4,64	**110**	200	38	2,1	171,6	–	138,5
6222-2Z	4,8	**110**	200	38	2,1	–	177,2	138



2Z seal



Mounting dimensions
Open design

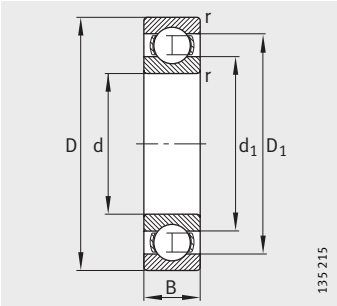


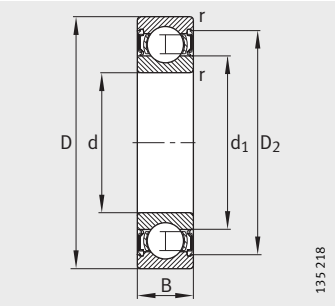
Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
102	138	1,5	60 000	54 000	2 800	10 000	5 800
102	138	1,5	60 000	54 000	2 800	2 800	–
107	158	2,1	108 000	81 500	4 700	8 500	4 950
107	158	2,1	108 000	81 500	4 700	2 400	–
107	158	2,1	108 000	81 500	4 700	3 600	4 950
109	186	2,5	146 000	114 000	6 400	7 500	4 950
109	186	2,5	146 000	114 000	6 400	3 200	4 950
104,6	120,4	1	20 000	22 000	1 010	6 000	5 000
104,6	120,4	1	20 000	22 000	1 010	3 400	–
104,6	120,4	1	20 000	22 000	1 010	5 000	5 000
104,6	145,4	1	44 000	44 000	1 990	10 000	4 000
107	143	1,5	60 000	54 000	2 700	9 500	5 400
107	143	1,5	60 000	54 000	2 700	2 800	–
107	143	1,5	60 000	54 000	2 700	4 000	5 400
112	168	2,1	122 000	93 000	5 400	8 000	4 800
112	168	2,1	122 000	93 000	5 400	2 400	–
112	168	2,1	122 000	93 000	5 400	3 400	4 800
114	201	2,5	163 000	134 000	7 400	7 000	4 650
114	201	2,5	163 000	134 000	7 400	3 000	4 650
109,6	125,4	1	20 800	23 600	1 060	5 600	4 800
109,6	125,4	1	20 800	23 600	1 060	3 200	–
109,6	125,4	1	20 800	23 600	1 060	4 800	4 800
109,6	155,4	1	54 000	54 000	2 390	9 500	3 950
113,8	151,2	2	71 000	64 000	3 100	9 000	5 300
113,8	151,2	2	71 000	64 000	3 100	3 800	5 300
117	178	2,1	132 000	104 000	5 700	7 500	4 650
117	178	2,1	132 000	104 000	5 700	3 200	4 650
119	211	2,5	173 000	146 000	7 500	6 700	4 500
114,6	135,4	1	28 000	30 500	1 320	5 000	5 000
114,6	135,4	1	28 000	30 500	1 320	3 000	–
114,6	135,4	1	28 000	30 500	1 320	4 300	5 000
114,6	165,4	1	57 000	57 000	2 800	9 000	3 850
118,8	161,2	2	80 000	71 000	3 450	8 500	5 200
118,8	161,2	2	80 000	71 000	3 450	2 400	–
118,8	161,2	2	80 000	71 000	3 450	3 600	5 200
122	188	2,1	143 000	116 000	6 300	7 000	4 550
122	188	2,1	143 000	116 000	6 300	3 000	4 550

Deep groove ball bearings

Single row
Open or sealed

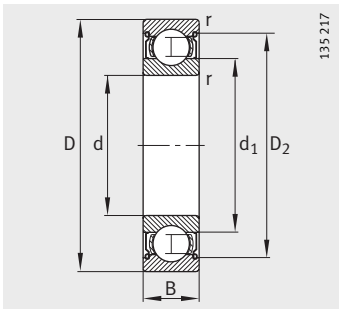




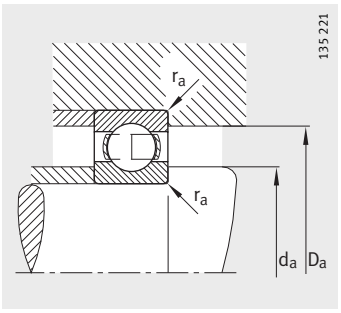
2RSR seal

Dimension table (continued) · Dimensions in mm

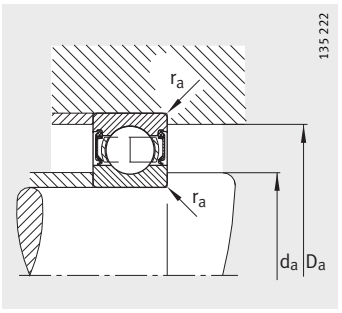
Designation	Mass	Dimensions						
	m	d	D	B	r	D_1	D_2	d_1
	≈kg				min.	≈	≈	≈
6322	10,3	**110**	240	50	3	197,4	–	153,4
6322-2RSR	10,3	**110**	240	50	3	–	203,1	153,4
6322-2Z	10,5	**110**	240	50	3	–	203,1	152,9
61824-Y	0,55	**120**	150	16	1	140,6	–	129,7
61824-2Z-Y	0,55	**120**	150	16	1	–	143,3	129,7
16024	1,62	**120**	180	19	1	159,5	–	140,7
6024	2,18	**120**	180	28	2	161,2	–	139,9
6024-2RSR	2,18	**120**	180	28	2	–	165,4	139,9
6024-2Z	2,23	**120**	180	28	2	–	165,4	139,4
6224	5,62	**120**	215	40	2,1	184,9	–	151,6
6224-2Z	5,62	**120**	215	40	2,1	–	190,5	151,6
6324	12,8	**120**	260	55	3	214,9	–	165,1
16026	2,41	**130**	200	22	1,1	176,7	–	154,7
6026	3,42	**130**	200	33	2	177,9	–	153,3
6026-2RSR	3,42	**130**	200	33	2	–	182,1	153,3
6026-2Z	3,4	**130**	200	33	2	–	182,1	152,9
6226	6,24	**130**	230	40	3	198,6	–	161,4
6226-2Z	6,24	**130**	230	40	3	–	203,5	161,4
6326-M	18,3	**130**	280	58	4	231,2	–	178,9
61828-Y	0,86	**140**	175	18	1,1	163,7	–	151,3
16028	2,55	**140**	210	22	1,1	186,6	–	164,8
6028	3,57	**140**	210	33	2	187,5	–	162,3
6028-2Z	3,65	**140**	210	33	2	–	191,3	161,9
6228	8,07	**140**	250	42	3	213,7	–	175,9
6328-M	22,3	**140**	300	62	4	248,7	–	191,3
16030	3,17	**150**	225	24	1,1	199,6	–	176
6030	4,32	**150**	225	35	2,1	201,4	–	174,4
6230	10,3	**150**	270	45	3	229,1	–	191,6
6330-M	26,5	**150**	320	65	4	266,1	–	205,6
16032	3,8	**160**	240	25	1,5	212,4	–	187,3
6032-M	6,16	**160**	240	38	2,1	214,6	–	186,2
6032-2RSR	6,16	**160**	240	38	2,1	–	219,7	186,2
6232-M	14,7	**160**	290	48	3	244,8	–	205
6332-M	31,8	**160**	340	68	4	280,9	–	219,7
16034	5,15	**170**	260	28	1,5	228,6	–	202,3
6034	7,13	**170**	260	42	2,1	231,2	–	199,4
6234-M	18,3	**170**	310	52	4	260,7	–	219,1



2Z seal



Mounting dimensions
Open design

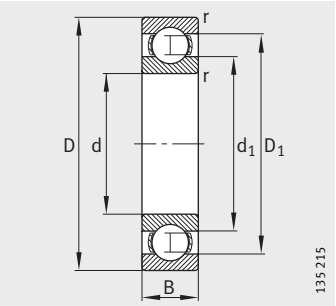


Mounting dimensions
Sealed design

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
124	226	2,5	190 000	166 000	8 600	6 300	4 150
124	226	2,5	190 000	166 000	8 600	4 500	–
124	226	2,5	190 000	166 000	8 600	2 600	4 150
124,6	145,4	1	29 000	32 500	1 370	4 800	4 500
124,6	145,4	1	29 000	32 500	1 370	4 000	4 500
124,6	175,4	1	61 000	64 000	3 000	8 000	3 550
128,8	171,2	2	83 000	78 000	3 550	8 000	4 750
128,8	171,2	2	83 000	78 000	3 550	2 200	–
128,8	171,2	2	83 000	78 000	3 550	3 400	4 750
132	203	2,1	146 000	122 000	6 200	6 700	4 300
132	203	2,1	146 000	122 000	6 200	2 800	4 300
134	246	2,5	212 000	190 000	9 000	6 000	3 850
136	194	1	78 000	81 500	3 650	7 500	3 450
138,8	191,2	2	106 000	100 000	4 850	7 000	4 650
138,8	191,2	2	106 000	100 000	4 850	2 000	–
138,8	191,2	2	106 000	100 000	4 850	3 000	4 650
144	216	2,5	166 000	146 000	7 500	6 300	3 900
144	216	2,5	166 000	146 000	7 500	2 600	3 900
147	263	3	228 000	216 000	9 800	5 600	3 500
146	169	1	39 000	46 500	1 750	4 000	4 000
146	204	1	80 000	86 500	3 700	7 000	3 200
148,8	201,2	2	108 000	108 000	4 950	6 700	4 350
148,8	201,2	2	108 000	108 000	4 950	2 800	4 350
154	236	2,5	176 000	166 000	8 100	6 000	3 600
157	283	3	255 000	245 000	11 100	5 300	3 250
156	219	1	91 500	98 000	3 650	6 700	3 100
160,2	214,8	2,1	122 000	125 000	5 400	6 300	3 850
164	256	2,5	176 000	170 000	7 800	5 600	3 350
167	303	3	280 000	290 000	13 100	4 800	3 000
167	233	1,5	102 000	114 000	4 600	6 300	2 950
170,2	229,8	2,1	134 000	137 000	5 800	6 300	3 750
170,2	229,8	2,1	134 000	137 000	5 800	1 700	–
174	276	2,5	200 000	204 000	8 900	5 600	3 100
177	323	3	300 000	325 000	14 000	4 300	2 800
177	253	1,5	122 000	137 000	5 400	6 000	2 850
180,2	249,8	2,1	170 000	173 000	7 400	5 600	3 550
187	293	3	212 000	224 000	9 400	5 300	2 950

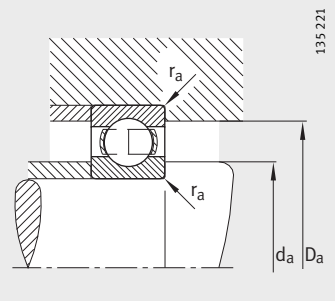
Deep groove ball bearings

Single row
Open



Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
6334-M	37,3	**170**	360	72	4	298	232,6
16036	6,92	**180**	280	31	2	238,8	211,9
6036-M	10,6	**180**	280	46	2,1	249,3	211,8
6236-M	19	**180**	320	52	4	272	228,7
6336-M	43	**180**	380	75	4	317	245,2
16038	7,04	**190**	290	31	2	255,1	225,8
6038-M	11,3	**190**	290	46	2,1	257,9	222,6
6238-M	22,6	**190**	340	55	4	291,5	239,9
6338-M	50,4	**190**	400	78	5	330,5	260,2
16040	9	**200**	310	34	2	276,4	244,5
6040-M	14,4	**200**	310	51	2,1	276,3	234,8
6240-M	27	**200**	360	58	4	306,5	254,9
6340-M	56,6	**200**	420	80	5	345,9	274,7
16044	11,8	**220**	340	37	2,1	298,1	262,8
6044-M	18,8	**220**	340	56	3	303,1	258,1
6244-M	37,9	**220**	400	65	4	337,6	282,2
6344-M	73,7	**220**	460	88	5	383	299,4
16048	12,7	**240**	360	37	2,1	317,4	283,1
6048-M	20,5	**240**	360	56	3	321,9	278,8
6248-M	51,3	**240**	440	72	4	369,6	309,9
6348-M	96,4	**240**	500	95	5	411,3	328,7
16052	19,1	**260**	400	44	3	351,2	310
6052-M	29,8	**260**	400	65	4	357	304,6
6252-M	68,4	**260**	480	80	5	402,4	337,3
16056-M	23,2	**280**	420	44	3	370,6	329,9
6056-M	31,7	**280**	420	65	4	377,5	324,1
6256-M	72,9	**280**	500	80	5	423	356,7
16060-M	32,6	**300**	460	50	4	404	357,3
6060-M	44,5	**300**	460	74	4	410,8	350,8
61864-M	11,3	**320**	400	38	2,1	373,8	347
16064-M	34,9	**320**	480	50	4	423,1	377,7
6064-M	47,4	**320**	480	74	4	430,8	370,9
61868-M	12	**340**	420	38	2,1	394,2	366,7
16068-M	47,5	**340**	520	57	4	457,1	403,6
6068-M	63,2	**340**	520	82	5	469,6	402,3
61872-M	12,8	**360**	440	38	2,1	413	387,7
16072-M	49,4	**360**	540	57	4	478,1	423,5

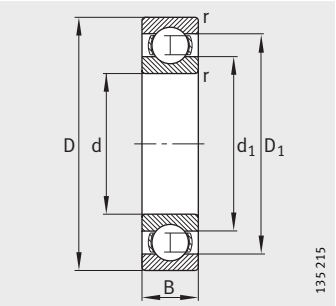


Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
187	343	3	325 000	365 000	14 700	4 000	2 600
188,8	271,2	2	132 000	146 000	5 200	5 600	2 800
190,2	269,8	2,1	190 000	200 000	8 200	5 600	3 300
197	303	3	224 000	245 000	10 300	4 800	2 750
197	363	3	355 000	405 000	16 300	3 800	2 440
198,8	281,2	2	150 000	166 000	6 300	5 300	2 650
200,2	279,8	2,1	196 000	212 000	8 500	5 300	3 150
207	323	3	255 000	280 000	11 600	4 300	2 600
210	380	4	375 000	440 000	17 500	3 600	2 300
208,8	301,2	2	176 000	204 000	7 300	4 800	2 550
210,2	299,8	2,1	216 000	245 000	9 600	4 800	3 000
217	343	3	270 000	310 000	12 400	4 000	2 430
220	400	4	380 000	465 000	18 000	3 400	2 170
230,2	329,8	2,1	200 000	240 000	8 400	4 300	2 310
232,4	327,6	2,5	245 000	290 000	11 100	4 000	2 700
237	383	3	300 000	355 000	13 500	3 600	2 200
240	440	4	440 000	560 000	20 000	3 200	1 960
250,2	349,8	2,1	204 000	255 000	8 500	3 800	2 100
252,4	347,6	2,5	255 000	315 000	11 400	3 800	2 450
257	423	3	360 000	475 000	16 700	3 400	1 980
260	480	4	465 000	620 000	21 800	3 000	1 800
272,4	387,6	2,5	236 000	310 000	9 900	3 600	1 960
274,6	385,4	3	300 000	390 000	13 300	3 400	2 260
280	460	4	405 000	560 000	19 200	3 000	1 820
292,4	407,6	2,5	240 000	325 000	10 100	3 400	1 800
294,6	405,4	3	320 000	440 000	14 400	3 400	2 060
291	489	4	425 000	600 000	20 300	3 000	1 690
314,6	445,4	3	300 000	430 000	12 700	3 200	1 670
314,6	445,4	3	365 000	510 000	16 700	3 000	1 930
330,2	389,8	2,1	156 000	220 000	6 500	3 400	1 710
334,6	465,4	3	305 000	455 000	13 000	3 000	1 550
334,6	465,4	3	380 000	560 000	17 400	3 000	1 790
350,2	409,8	2,1	156 000	220 000	6 600	3 200	1 590
354,6	505,4	3	355 000	550 000	17 800	2 800	1 460
358	502	4	440 000	695 000	20 800	2 800	1 660
370,2	429,8	2,1	160 000	236 000	6 900	3 200	1 480
374,6	525,4	3	365 000	585 000	15 700	2 800	1 370

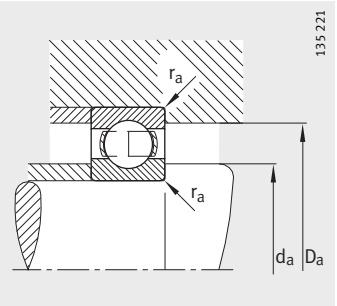
Deep groove ball bearings

Single row
Open



Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
6072-M	66,2	**360**	540	82	5	489	423,7
61876-M	20,6	**380**	480	46	2,1	445,9	414,1
16076-M	51,7	**380**	560	57	4	498	443,5
61880-M	21,5	**400**	500	46	2,1	467,3	433,7
61884-M	22,8	**420**	520	46	2,1	485,8	454,3
61888-M	23,8	**440**	540	46	2,1	505,9	474,2
61892-M	35,8	**460**	580	56	3	540,9	500,2
61896-M	37,3	**480**	600	56	3	560,9	520,3
618/500-M	38,7	**500**	620	56	3	580,9	540,4
618/530-M	41,3	**530**	650	56	3	610,8	570,4
618/560-M	35,1	**560**	680	56	3	640,7	600,4
618/600-M	54,2	**600**	730	60	3	687,8	643,6
618/630-M	75,9	**630**	780	69	4	730,5	681,1
618/670-M	80,4	**670**	820	69	4	770,3	721,1
618/710-M	96	**710**	870	74	4	818,9	762,7
618/750-M	114	**750**	920	78	5	864,9	806,7
618/800-M	136	**800**	980	82	5	921,8	860
618/850-M	144	**850**	1 030	82	5	971,9	910

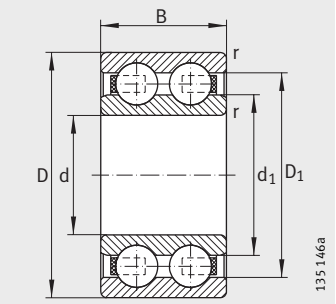


Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
378	522	4	455 000	735 000	21 500	2 600	1 560
390,2	469,8	2,1	220 000	320 000	8 900	3 000	1 430
394,6	545,4	3	375 000	620 000	16 100	2 600	1 290
410,2	489,8	2,1	220 000	335 000	8 900	2 800	1 300
430,2	509,8	2,1	224 000	345 000	9 200	2 800	1 260
450,2	529,8	2,1	228 000	355 000	9 400	2 600	1 190
472,4	567,6	2,5	290 000	480 000	12 000	2 400	1 170
492,4	587,6	2,5	290 000	500 000	12 100	2 200	1 110
512,4	607,6	2,5	300 000	510 000	12 300	2 000	1 060
542,4	637,6	2,5	305 000	550 000	12 800	2 000	980
572,4	667,6	2,5	310 000	560 000	13 500	1 900	930
612,4	717,6	2,5	355 000	670 000	15 000	1 800	850
644,6	765,4	3	400 000	780 000	17 500	1 600	830
684,6	805,4	3	405 000	815 000	17 700	1 500	760
724,6	855,4	3	465 000	980 000	20 000	1 400	720
768	902	4	510 000	1 120 000	22 600	1 300	680
818	962	4	550 000	1 270 000	23 800	1 300	630
868	1 012	4	560 000	1 290 000	23 900	1 200	580

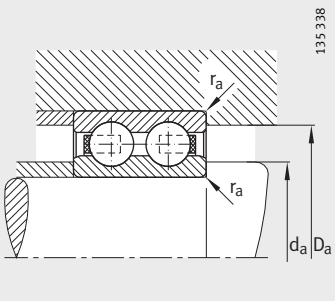
Deep groove ball bearings

Double row



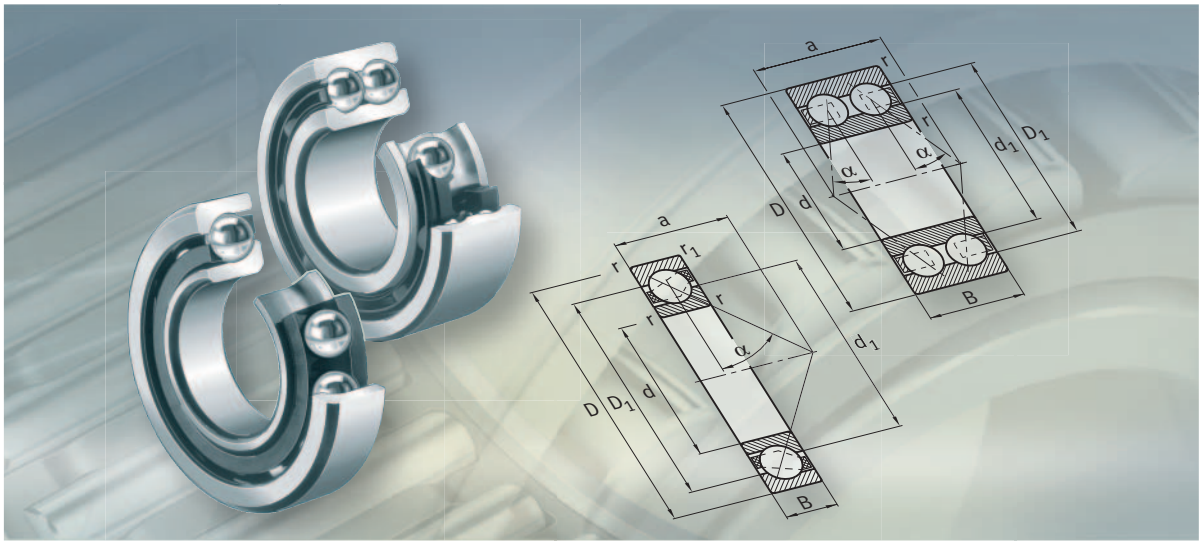
Dimension table · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
4200-B-TVH	0,054	**10**	30	14	0,6	23,9	16,6
4201-B-TVH	0,057	**12**	32	14	0,6	25,9	18,6
4202-B-TVH	0,065	**15**	35	14	0,6	28,9	21,6
4302-B-TVH	0,116	**15**	42	17	1	33,5	24,2
4203-B-TVH	0,098	**17**	40	16	0,6	33,2	24
4303-B-TVH	0,16	**17**	47	19	1	39,1	28,7
4204-B-TVH	0,143	**20**	47	18	1	39,5	30,2
4304-B-TVH	0,211	**20**	52	21	1,1	43,1	31,5
4205-B-TVH	0,166	**25**	52	18	1	44	34,7
4305-B-TVH	0,336	**25**	62	24	1,1	51,7	38,4
4206-B-TVH	0,467	**30**	62	20	1	52,5	41,3
4306-B-TVH	0,51	**30**	72	27	1,1	61,1	46,6
4207-B-TVH	0,407	**35**	72	23	1,1	60,1	47,7
4307-B-TVH	0,758	**35**	80	31	1,5	66,9	49,2
4208-B-TVH	0,545	**40**	80	23	1,1	66,6	54,2
4308-B-TVH	1,03	**40**	90	33	1,5	75,5	55,7
4209-B-TVH	0,592	**45**	85	23	1,1	71,6	59,2
4309-B-TVH	1,23	**45**	100	36	1,5	86,8	66,7
4210-B-TVH	0,587	**50**	90	23	1,1	77,6	65,2
4310-B-TVH	1,62	**50**	110	40	2	96,2	73,6
4211-B-TVH	0,86	**55**	100	25	1,5	84,7	71,4
4311-B-TVH	2,06	**55**	120	43	2	105,3	80,4
4212-B-TVH	1,09	**60**	110	28	1,5	95,3	79,8
4312-B-TVH	2,51	**60**	130	46	2,1	113,8	87,7
4213-B-TVH	1,6	**65**	120	31	1,5	101,9	84,2
4214-B-TVH	1,7	**70**	125	31	1,5	109,4	91,7
4215-B-TVH	1,72	**75**	130	31	1,5	115,4	97,7
4216-B-TVH	2,14	**80**	140	33	2	124	105,2
4217-B-TVH	2,7	**85**	150	36	2	132,8	112,7
4218-B-TVH	3,7	**90**	160	40	2	140,2	117,6



Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
min.	max.	max.	N	N	N	min^{-1}
14,2	25,8	0,6	9 150	5 200	315	24 000
16,2	27,8	0,6	9 300	5 500	330	20 000
19,2	30,8	0,6	10 400	6 700	370	18 000
20,6	36,4	1	14 600	9 150	550	17 000
21,2	35,8	0,6	14 600	9 500	550	17 000
22,6	41,4	1	19 600	13 200	770	15 000
25,6	41,4	1	18 000	12 700	690	14 000
27	45	1	23 200	16 000	940	13 000
30,6	46,4	1	19 300	14 600	740	12 000
32	55	1	31 500	22 400	1 330	10 000
35,6	56,4	1	26 000	20 800	1 170	9 500
37	65	1	40 000	30 500	1 840	8 500
42	65	1	32 000	26 000	1 460	8 500
44	71	1,5	51 000	38 000	2 260	8 000
47	73	1	34 000	30 000	1 570	7 500
49	81	1,5	63 000	48 000	2 900	7 000
52	78	1	36 000	33 500	1 690	7 000
54	91	1,5	72 000	60 000	3 600	6 000
57	83	1	37 500	36 500	1 810	6 300
61	99	2	90 000	75 000	4 450	5 300
64	91	1,5	36 500	43 000	2 260	5 600
66	109	2	104 000	90 000	5 400	5 000
69	101	1,5	57 000	58 500	2 850	5 000
72	118	2,1	120 000	106 000	6 200	4 500
74	111	1,5	67 000	67 000	3 350	4 800
79	116	1,5	69 500	73 500	3 600	4 500
84	121	1,5	73 500	80 000	3 750	4 300
91	129	2	80 000	90 000	4 350	4 000
96	139	2	93 000	106 000	5 100	3 800
101	149	2	112 000	122 000	5 900	3 600



Angular contact ball bearings

Single row
Double row

Angular contact ball bearings

X-life

Single row angular contact ball bearings

230

In single row angular contact ball bearings, the raceways are arranged such that the forces are transmitted at a particular contact angle – oblique to the radial plane – from one raceway to the other.

The axial load carrying capacity increases with the contact angle. Due to the large contact angle, single row angular contact ball bearings are more suitable than deep groove ball bearings for supporting large axial forces acting in one direction.

Single row angular contact ball bearings can support radial loads and unilateral axial loads. They are adjusted against a second bearing that provides counterguidance.

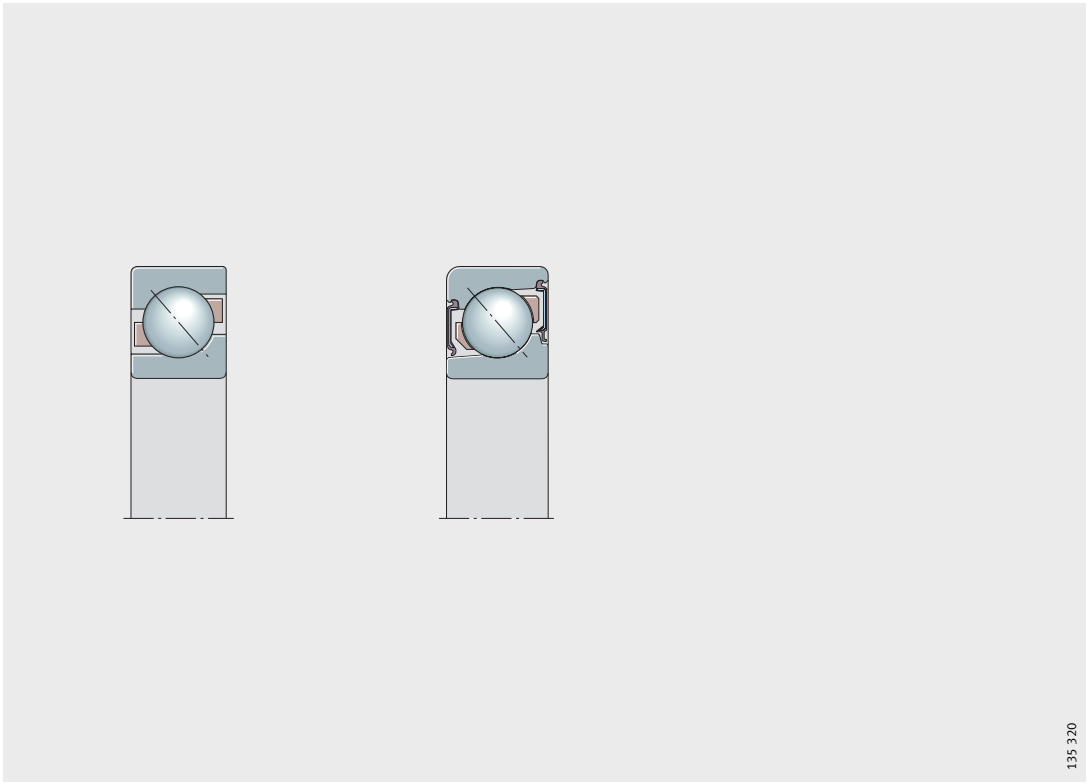
Double row angular contact ball bearings

248

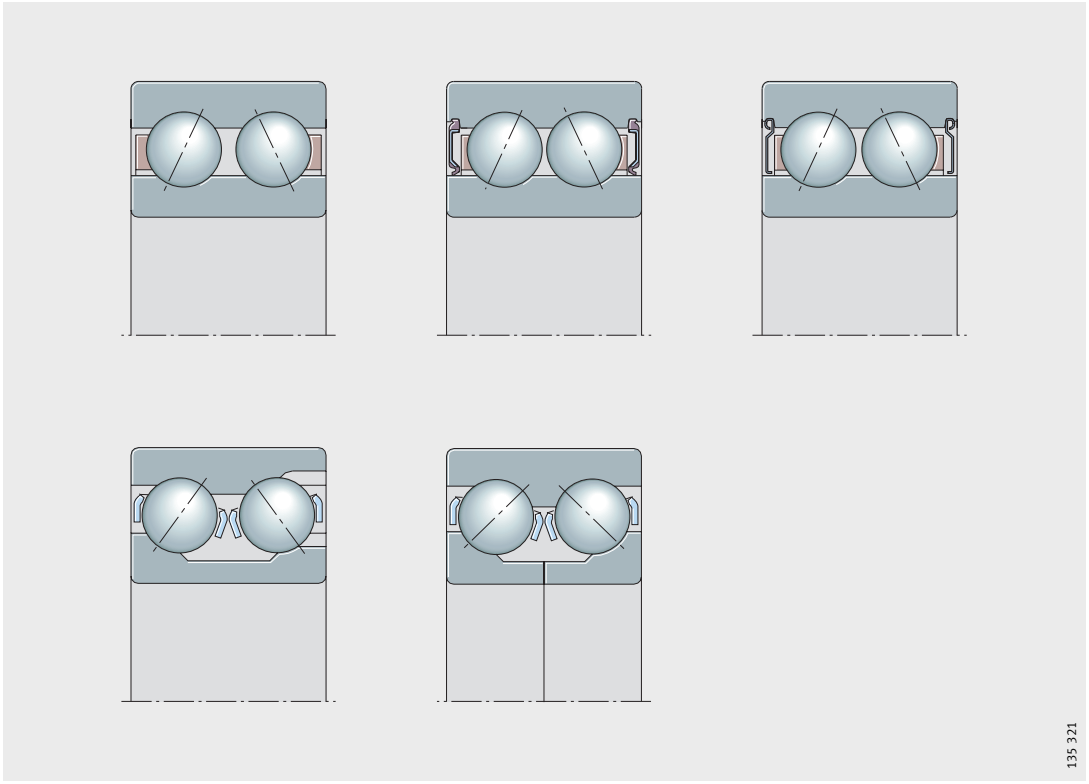
Double row angular contact ball bearings are similar in design to a pair of single row angular contact ball bearings in an O arrangement. In this case, the apexes of the cones formed by the ball pressure lines point outwards.

Double row bearings can support high radial forces as well as axial forces in both directions and are particularly suitable for rigid axial guidance arrangements.

Depending on the series, the bearings are designed with or without filling slots.

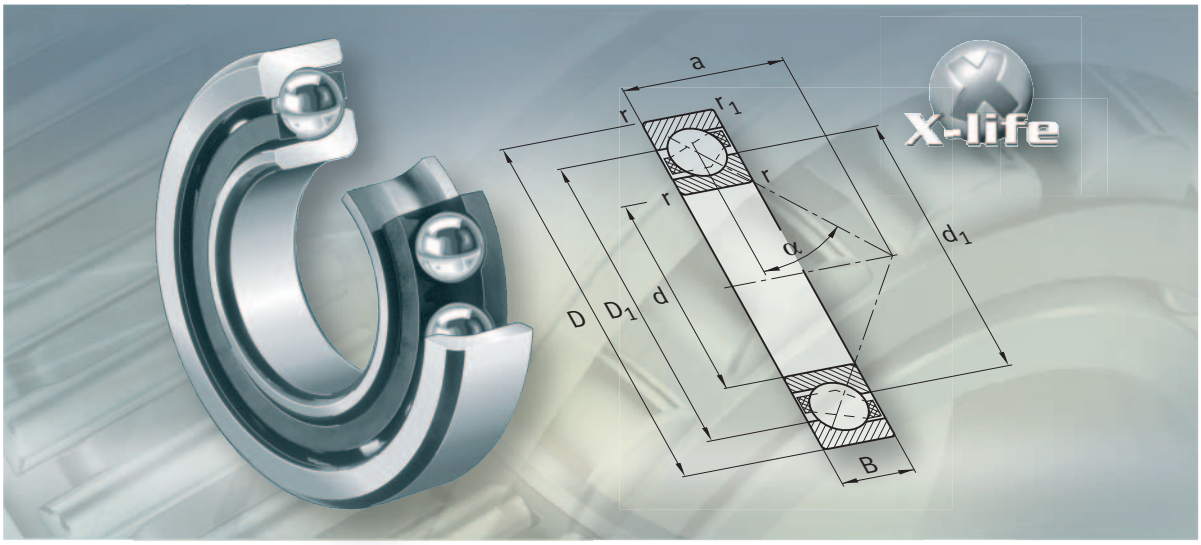


135 320



135 321

FAG



Single row angular contact ball bearings



Single row angular contact ball bearings

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Product overview	Single row angular contact ball bearings	232
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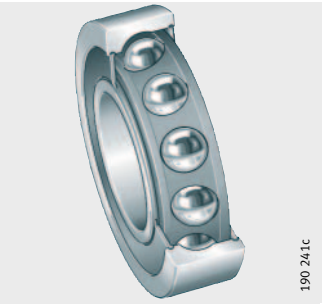
Single row

718..-B, 70..-B, 72..-B, 73..-B



Lip seals

70..-B-2RS, 72..-B-2RS, 73..-B-2RS



Single row angular contact ball bearings



Features

Single row angular contact ball bearings are self-retaining units with solid inner and outer rings and ball and cage assemblies with polyamide, sheet metal or brass cages. The raceways of the inner and outer rings are offset from each other along the bearing axis. The bearings are available in open and sealed designs. Their angular adjustment facility is very limited.

X-life

Many sizes of angular contact ball bearings are classified as X-life products. These bearings are indicated in the dimension tables.

Bearings of X-life quality have an improved raceway geometry and optimised surfaces. This gives a significant increase in the fatigue limit load of the bearings. When calculating the expanded adjusted rating life, values up to 50% higher can thus be achieved. In certain applications, this means that a smaller bearing arrangement can be designed.

Radial and axial load capacity

Single row angular contact ball bearings can support axial forces in one direction and high radial forces. They must be axially adjusted against a second bearing fitted in a mirror image arrangement.

The axial load carrying capacity is dependent on the contact angle; i. e. the larger the angle, the higher the load to which the bearing can be subjected. Due to the contact angle of 40°, these bearings can support high axial loads.

Universal design

Single row angular contact ball bearings of universal design have the suffix UA, UL or UO and are intended for fitting in pairs in an X, O or tandem arrangement or fitting in groups. These bearings can be fitted in any arrangement required.

The suffix UA indicates small axial internal clearance, suffix UL indicates slight preload and suffix UO indicates freedom from clearance in an X or O arrangement.

When ordering bearings, the total quantity of bearings must be stated, not the number of bearing pairs or bearing groups.

Matched bearings

Sets without an intermediate ring are available in an O arrangement (DB), X arrangement (DF) or tandem arrangement (DT).

When ordering bearings, the number of sets must be stated, not the number of single bearings.

Sealing/lubrication

Bearings with the suffix 2RS have lip seals on both sides. RS contact seals are suitable for giving protection against dust, contamination and damp atmospheres. The bearings are greased with a high quality grease and are lubricated for life.

Bearings without seals or with seals on one side are not greased. They can be lubricated with grease or oil.

Operating temperature

Open angular contact ball bearings can be used at operating temperatures from –30 °C to +150 °C. Bearings with a diameter $D > 240$ mm are dimensionally stable up to +200 °C.

Caution!

Angular contact ball bearings with cages made from glass fibre reinforced polyamide are suitable for operating temperatures up to +120 °C, restricted by the cage material.

Sealed bearings are suitable for operating temperatures from –30 °C to +110 °C, restricted by the lubricant and the seal material.

Single row angular contact ball bearings

Cages

Angular contact ball bearings with solid cages made from glass fibre reinforced polyamide have the suffix TVP or TVH.

Solid brass cages have the suffix MP.

The bearings are also available with universally applicable sheet steel window cages (suffix JP).

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

Cage/bore code

Series	Solid window cage made from polyamide[1)]	Solid window cage made from brass[1)]	Sheet steel cage[1)]
	Bore code		
718..-B	06 to 16	–	–
70..-B	all	–	–
72..-B	up to 20, 22 to 26	21, from 28	up to 22
73..-B	up to 20, 22 to 26	21, from 28	up to 22

1) Other cage designs available by agreement.
In such cages, suitability for high speeds and high temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffix	Description	Design
B	Modified internal construction	Standard
JP	Sheet steel cage	Standard
MP	Solid brass cage	Standard
DB	Two angular contact ball bearings in O arrangement, matched clearance-free	Special design[1)]
DF	Two angular contact ball bearings in X arrangement, matched clearance-free	Special design[1)]
DT	Two angular contact ball bearings in tandem arrangement, matched	Special design[1)]
TVH TVP	Solid cage made from glass fibre reinforced polyamide	Standard
UA	Universal design for fitting in pairs, bearing pair has small axial internal clearance in O and X arrangement	Standard
UL	Universal design for fitting in pairs, bearing pair has slight preload in O and X arrangement	Standard
UO	Universal design for fitting in pairs, bearing pair is clearance-free in O and X arrangement	Standard
P5	Bearing in tolerance class P5	Special design[1)]
2RS	Contact seals on both sides	Standard

1) Available by agreement.

Design and safety guidelines
Calculation of axial force

Under radial load, an internal axial force is induced in the bearing that must be supported by a second bearing and taken into consideration when calculating the equivalent bearing load.

Depending on the bearing arrangement (O or X arrangement), the axial force must first be determined for bearings adjusted clearance-free without preload, see table Load ratio and axial bearing load, page 236 and *Figure 1*, *Figure 2*.

The following preconditions apply:

- The radial forces act at the central pressure points and are positive
- Bearing A is subjected to a radial load F_{rA}, bearing B to F_{rB}
- F is an external axial force acting on bearing A.

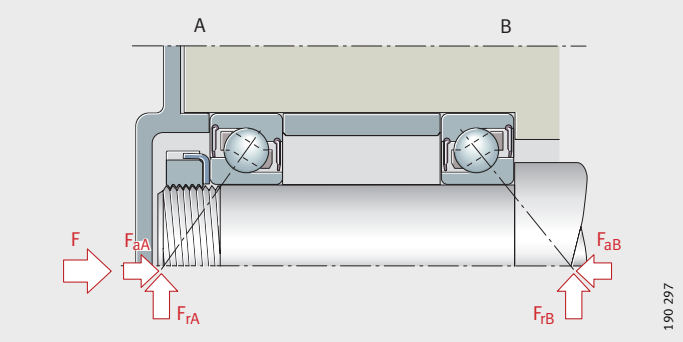


Figure 1
Bearings in O arrangement

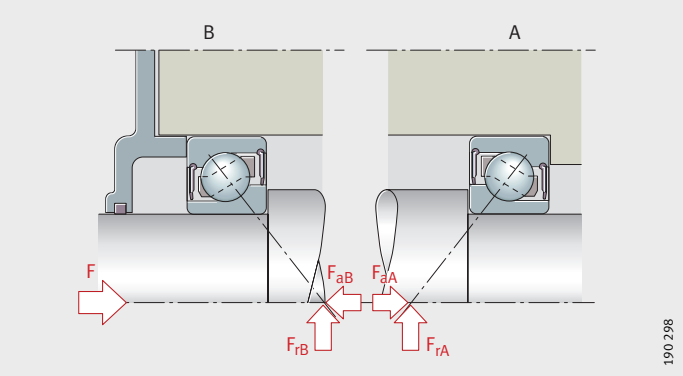


Figure 2
Bearings in X arrangement

Load ratio and axial bearing load

Load ratio[3]		Axial force F_a[1] [3]	
Radial bearing load	External axial force	Bearing A	Bearing B
$\frac{F_{rA}}{Y_A} \leqq \frac{F_{rB}}{Y_B}$	$F \geqq 0$	$F_a = F + 0{,}5 \cdot \frac{F_{rB}}{Y_B}$	[2]
$\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$	$F > 0{,}5 \cdot \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_a = F + 0{,}5 \cdot \frac{F_{rB}}{Y_B}$	[2]
	$F \leqq 0{,}5 \cdot \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	[2]	$F_a = 0{,}5 \cdot \frac{F_{rA}}{Y_A} - F$

1) Axial force F_a, to be used in calculation of the equivalent dynamic bearing load.

2) If no formula is given, the axial force is not taken into consideration.

3) For bearings of series 718..-B, 70..-B, 72..-B and 73..-B, the axial load component factor for Y = 0,57 is used in the formulae.

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Contact angle 40°

Bearing arrangement	Load ratio	Equivalent dynamic load
Single bearing[1]	$\frac{F_a}{F_r} \leqq 1{,}14$	$P = F_r$
	$\frac{F_a}{F_r} > 1{,}14$	$P = 0{,}35 \cdot F_r + 0{,}57 \cdot F_a$
Bearing pair in O or X arrangement	$\frac{F_a}{F_r} \leqq 1{,}14$	$P = F_r + 0{,}55 \cdot F_a$
	$\frac{F_a}{F_r} > 1{,}14$	$P = 0{,}57 \cdot F_r + 0{,}93 \cdot F_a$

1) Calculation of axial force for single bearing: see table Load ratio and axial bearing load.

P N
Equivalent dynamic bearing load for combined load

F_a N
Axial dynamic bearing load

F_r N
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

Contact angle 40°

Bearing arrangement	Load ratio	Equivalent static load
Single bearing	$\frac{F_{0a}}{F_{0r}} \leqq 1{,}9$	$P_0 = F_{0r}$
	$\frac{F_{0a}}{F_{0r}} > 1{,}9$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}26 \cdot F_{0a}$
Bearing pair in O or X arrangement	–	$P_0 = F_{0r} + 0{,}52 \cdot F_{0a}$

P_0 N
Equivalent static bearing load for combined load

F_{0a} N
Axial static bearing load

F_{0r} N
Radial static bearing load.

Basic dynamic and static load ratings for bearing pairs

If two bearings of the same size and design are fitted immediately adjacent to each other in an O or X arrangement, the basic dynamic load rating C_r and basic static load rating C_{0r} of the bearing pair are as follows:

- $C_r = 1{,}625 \cdot C_{r\ \text{single bearing}}$
- $C_{0r} = 2 \cdot C_{0r\ \text{single bearing}}$

Minimum radial load

In order to ensure slippage-free operation, the bearings must be subjected to a minimum radial load. This applies particularly in the case of high speeds and high accelerations. In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}01$ is necessary for ball bearings with cage.

Speeds

For greased and sealed bearings, the speeds are lower than in the case of unsealed bearings.

Caution! The limiting speeds n_G given in the dimension tables must not be exceeded.

Bearings in universal design

Bearings with the suffix UA, UL and UO can be used in an X, O or tandem arrangement. The operating speed of the bearing pair is then approximately 20% below the calculated permissible operating speed of the single bearing.

The limiting speed n_G is possible if the less favourable thermal balance of the bearing pair is taken into consideration.

Accuracy

The main dimensions of the bearings conform to DIN 628-1.

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620-2.

Tolerances for universal designs and for matched bearings

In addition to the normal tolerance (no tolerance suffix), angular contact ball bearings of universal designs UO, UL or UA are also available by agreement in tolerance class P5 (suffix P5-UL or P5-UA).

The following exceptions apply: bore tolerances for bearings of all tolerance classes uniformly to P5 (no special suffix), width tolerances for universal bearings and matched bearings according to the following table:

Ring width tolerance

Bore d mm		Width deviation Δ_{Bs} µm			
		PN		P5	
over	incl.	min.	max.	min.	max.
–	50	0	–250	0	–250
50	80	0	–380	0	–250
80	120	0	–380	0	–380
120	180	0	–500	0	–380
180	315	0	–500	0	–500

Axial internal clearance or preload of universal design

The axial internal clearance and preload of series 70..-B, 72..-B and 73..-B of universal design, in pairs in an X or O arrangement, are shown in the table Axial internal clearance/preload, page 239.

The axial internal clearance or freedom from clearance do not apply to fitted bearing pairs. If rigid fits are used, this leads to reduced axial internal clearance or increased preload of the bearing pair.



Axial internal clearance/ preload

Bore code	Axial internal clearance or preload of bearing pair Nominal dimension µm					Preload $F_{v\,max}$ N		
	UA	UO	UL			UL		
	70B, 72B, 73B		70B	72B	73B	70B	72B	73B
	Tolerance classes					Tolerance class		
	PN, P6, P5		P5	P5	P5	P5	P5	P5
00	22	0	–	–3	–	–	38	–
01	24	0	–	–4	–5	–	53	82
02	24	0	–	–4	–5	–	62	99
03	24	0	–	–4	–6	–	77	123
04	28	0	–4	–5	–6	103	103	146
05	34	0	–4	–4	–6	115	112	200
06	34	0	–5	–5	–7	141	157	250
07	40	0	–5	–6	–7	172	208	300
08	40	0	–5	–6	–8	200	246	385
09	44	0	–	–6	–9	–	277	462
10	44	0	–	–6	–10	–	288	535
11	46	0	–	–7	–10	–	358	600
12	46	0	–	–7	–10	–	431	692
13	46	0	–	–8	–11	–	492	785
14	50	0	–	–8	–11	–	535	877
15	50	0	–	–8	–12	–	523	977
16	50	0	–	–8	–12	–	615	1077
17	54	0	–	–8	–13	–	692	1154
18	54	0	–	–9	–13	–	815	1231
19	54	0	–	–10	–14	–	892	1331
20	54	0	–	–11	–14	–	992	1485
21	58	0	–	–11	–14	–	1100	1538
22	58	0	–	–12	–15	–	1177	1723
24	58	0	–	–12	–16	–	1277	1923
26	60	0	–	–12	–17	–	1431	2115
28	60	0	–	–12	–17	–	1508	2308
30	60	0	–	–13	–18	–	1723	2500
32	60	0	–	–13	–18	–	1815	2769
34	70	0	–	–14	–19	–	2038	3115

Tolerances for axial internal clearance or preload

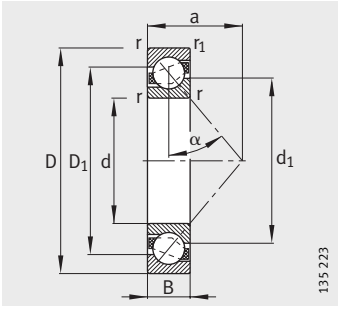
Tolerances for axial internal clearance or preload for angular contact ball bearings of universal design fitted in pairs in X and O arrangement.

Tolerance in µm

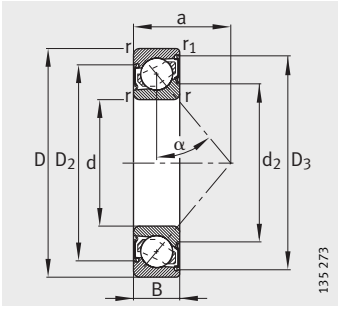
Bore code	Series 70B, 72B		Series 73B	
	Tolerance classes			
	PN, P6	P5	PN, P6	P5
00 to 09	+8	+6	+8	+6
10 to 11	+8	+6	+12	+10
12 to 34	+12	+10	+12	+10

Angular contact ball bearings

Single row
Open or sealed



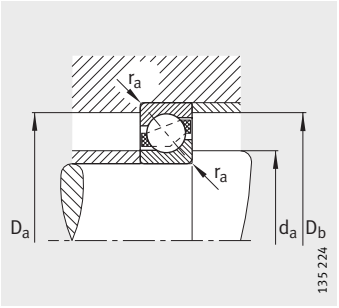
70..-B, 72..-B, 73..-B
α =40°



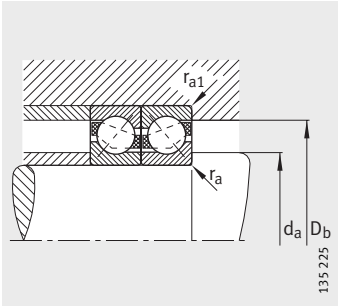
70..-B-2RS, 72..-B-2RS,
73..-B-2RS
2RS seal

Dimension table · Dimensions in mm

Designation		Mass	Dimensions								
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	D_1 ≈	D_2 ≈	D_3 ≈	d_1 ≈
7200-B-JP	**XL**	0,033	**10**	30	9	0,6	0,3	22,1	–	–	18
7200-B-TVP	**XL**	0,032	**10**	30	9	0,6	0,3	22,1	–	–	18
7200-B-2RS-TVP	**XL**	0,032	**10**	30	9	0,6	0,3	–	23,3	25,6	–
7201-B-JP	**XL**	0,038	**12**	32	10	0,6	0,3	24,6	–	–	19,5
7201-B-TVP	**XL**	0,035	**12**	32	10	0,6	0,3	24,6	–	–	19,5
7201-B-2RS-TVP	**XL**	0,037	**12**	32	10	0,6	0,3	–	25,9	28,8	–
7301-B-JP	**XL**	0,066	**12**	37	12	1	0,6	27,2	–	–	22,1
7301-B-TVP	**XL**	0,06	**12**	37	12	1	0,6	27,2	–	–	22,1
7202-B-JP	**XL**	0,047	**15**	35	11	0,6	0,3	27,6	–	–	22,5
7202-B-TVP	**XL**	0,044	**15**	35	11	0,6	0,3	27,6	–	–	22,5
7202-B-2RS-TVP	**XL**	0,044	**15**	35	11	0,6	0,3	–	29,2	32,1	–
7302-B-JP	**XL**	0,088	**15**	42	13	1	0,6	31,8	–	–	25,5
7302-B-TVP	**XL**	0,082	**15**	42	13	1	0,6	31,8	–	–	25,5
7302-B-2RS-TVP	**XL**	0,082	**15**	42	13	1	0,6	–	33,3	38,1	–
7203-B-JP	**XL**	0,069	**17**	40	12	0,6	0,6	31,2	–	–	26,2
7203-B-TVP	**XL**	0,065	**17**	40	12	0,6	0,6	31,2	–	–	26,2
7203-B-2RS-TVP	**XL**	0,065	**17**	40	12	0,6	0,6	–	33,1	36,3	–
7303-B-JP	**XL**	0,117	**17**	47	14	1	0,6	35,8	–	–	28,5
7303-B-TVP	**XL**	0,109	**17**	47	14	1	0,6	35,8	–	–	28,5
7303-B-2RS-TVP	**XL**	0,109	**17**	47	14	1	0,6	–	37,2	42,6	–
7004-B-TVP	**XL**	0,06	**20**	42	12	0,6	0,3	34,7	–	–	29,1
7004-B-2RS-TVP	**XL**	0,061	**20**	42	12	0,6	0,3	–	37,1	40,9	–
7204-B-JP	**XL**	0,111	**20**	47	14	1	0,6	36,6	–	–	30,4
7204-B-TVP	**XL**	0,104	**20**	47	14	1	0,6	36,6	–	–	30,4
7204-B-2RS-TVP	**XL**	0,104	**20**	47	14	1	0,6	–	39,1	43	–
7304-B-JP	**XL**	0,152	**20**	52	15	1,1	0,6	39,9	–	–	32,4
7304-B-TVP	**XL**	0,143	**20**	52	15	1,1	0,6	39,9	–	–	32,4
7304-B-2RS-TVP	**XL**	0,143	**20**	52	15	1,1	0,6	–	41,4	47,1	–
7005-B-TVP	**XL**	0,071	**25**	47	12	0,6	0,3	39,7	–	–	34,1
7005-B-2RS-TVP	**XL**	0,071	**25**	47	12	0,6	0,3	–	41,5	45,9	–
7205-B-JP	**XL**	0,135	**25**	52	15	1	0,6	41,6	–	–	35,4
7205-B-TVP	**XL**	0,127	**25**	52	15	1	0,6	41,6	–	–	35,4
7205-B-2RS-TVP	**XL**	0,127	**25**	52	15	1	0,6	–	44,1	48	–
7305-B-JP	**XL**	0,242	**25**	62	17	1,1	0,6	48,1	–	–	39,3
7305-B-TVP	**XL**	0,223	**25**	62	17	1,1	0,6	48,1	–	–	39,3
7305-B-2RS-TVP	**XL**	0,231	**25**	62	17	1,1	0,6	–	50,4	57,1	–



Mounting dimensions

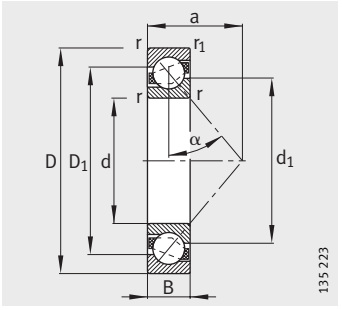


Mounting dimensions

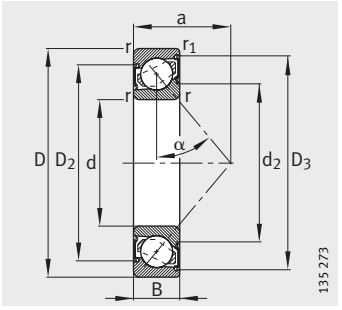
		Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_2	a	d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈	≈	min.	max.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	13	14,2	25,8	27,6	0,6	0,3	5 000	2 600	174	32 000	22 600
–	13	14,2	25,8	27,6	0,6	0,3	5 000	2 600	174	32 000	22 600
15,5	13	14,2	25,8	27,6	0,6	0,3	5 000	2 600	174	15 000	–
–	14	16,2	27,8	29,6	0,6	0,3	6 950	3 550	241	28 000	21 200
–	14	16,2	27,8	29,6	0,6	0,3	6 950	3 550	241	28 000	21 200
17	14	16,2	27,8	29,6	0,6	0,3	6 950	3 550	241	14 000	–
–	16	17,6	31,4	32,8	1	0,6	10 600	5 300	355	24 000	16 400
–	16	17,6	31,4	32,8	1	0,6	10 600	5 300	355	24 000	16 400
–	16	19,2	30,8	32,6	0,6	0,3	8 000	4 450	300	24 000	19 200
–	16	19,2	30,8	32,6	0,6	0,3	8 000	4 450	300	24 000	19 200
19,7	16	19,2	30,8	32,6	0,6	0,3	8 000	4 450	300	12 000	–
–	18	20,6	36,4	37,8	1	0,6	13 200	7 200	485	20 000	14 300
–	18	20,6	36,4	37,8	1	0,6	13 200	7 200	485	20 000	14 300
22,9	18	20,6	36,4	37,8	1	0,6	13 200	7 200	485	11 000	–
–	18	21,2	35,8	35,8	0,6	0,6	10 000	5 700	380	20 000	17 200
–	18	21,2	35,8	35,8	0,6	0,6	10 000	5 700	380	20 000	17 200
22,9	18	21,2	35,8	35,8	0,6	0,6	10 000	5 700	380	11 000	–
–	20	22,6	41,4	42,8	1	0,6	16 300	9 000	610	18 000	12 900
–	20	22,6	41,4	42,8	1	0,6	16 300	9 000	610	18 000	12 900
26,1	20	22,6	41,4	42,8	1	0,6	16 300	9 000	610	9 500	–
–	12	23,2	38,8	40	0,6	0,3	13 400	7 500	470	18 000	–
25,9	12	23,2	38,8	40	0,6	0,3	13 400	7 500	470	9 500	–
–	21	25,6	41,4	42,8	1	0,6	13 400	7 800	520	18 000	15 400
–	21	25,6	41,4	42,8	1	0,6	13 400	7 800	520	18 000	15 400
26,8	21	25,6	41,4	42,8	1	0,6	13 400	7 800	520	9 000	–
–	23	27	45	47,8	1	0,6	19 000	11 000	750	17 000	11 600
–	23	27	45	47,8	1	0,6	19 000	11 000	750	17 000	11 600
30	23	27	45	47,8	1	0,6	19 000	11 000	750	8 500	–
–	21	28,2	43,8	45	0,6	0,3	15 000	9 300	580	16 000	–
30,9	21	28,2	43,8	45	0,6	0,3	15 000	9 300	580	8 000	–
–	24	30,6	46,4	47,8	1	0,6	14 600	9 300	600	16 000	13 600
–	24	30,6	46,4	47,8	1	0,6	14 600	9 300	600	16 000	13 600
31,8	24	30,6	46,4	47,8	1	0,6	14 600	9 300	600	8 000	–
–	27	32	55	57,8	1	0,6	26 000	15 800	1 070	14 000	9 900
–	27	32	55	57,8	1	0,6	26 000	15 800	1 070	14 000	9 900
35,8	27	32	55	57,8	1	0,6	26 000	15 800	1 070	7 000	–

Angular contact ball bearings

Single row
Open or sealed



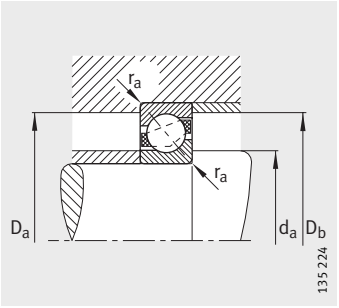
718..-B, 70..-B, 72..-B, 73..-B
$\alpha = 40°$



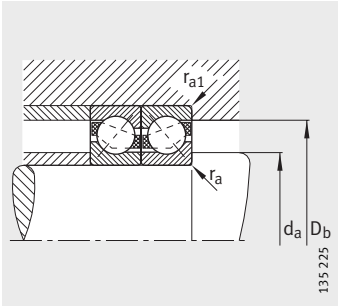
70..-B-2RS, 72..-B-2RS,
73..-B-2RS
2RS seal

Dimension table (continued) · Dimensions in mm

Designation		Mass	Dimensions								
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	D_1 ≈	D_2 ≈	D_3 ≈	d_1 ≈
71806-B-TVH	–	0,025	**30**	42	7	0,3	0,2	37,3	–	–	34,7
7006-B-TVP	**XL**	0,109	**30**	55	13	1	0,6	46,9	–	–	40,7
7006-B-2RS-TVP	**XL**	0,109	**30**	55	13	1	0,6	–	48,8	53,6	–
7206-B-JP	**XL**	0,202	**30**	62	16	1	0,6	49,8	–	–	42,8
7206-B-TVP	**XL**	0,196	**30**	62	16	1	0,6	49,8	–	–	42,8
7206-B-2RS-TVP	**XL**	0,203	**30**	62	16	1	0,6	–	51,9	57	–
7306-B-JP	**XL**	0,362	**30**	72	19	1,1	0,6	56	–	–	46,5
7306-B-TVP	**XL**	0,341	**30**	72	19	1,1	0,6	56	–	–	46,5
7306-B-2RS-TVP	**XL**	0,341	**30**	72	19	1,1	0,6	–	58,6	65,9	–
71807-B-TVH	–	0,027	**35**	47	7	0,3	0,2	42,3	–	–	39,7
7007-B-TVP	**XL**	0,14	**35**	62	14	1	0,6	53,2	–	–	46,5
7007-B-2RS-TVP	**XL**	0,14	**35**	62	14	1	0,6	–	55	60,4	–
7207-B-JP	**XL**	0,3	**35**	72	17	1,1	0,6	57,9	–	–	49,5
7207-B-TVP	**XL**	0,282	**35**	72	17	1,1	0,6	57,9	–	–	49,5
7207-B-2RS-TVP	**XL**	0,282	**35**	72	17	1,1	0,6	–	60,2	66,5	–
7307-B-JP	**XL**	0,475	**35**	80	21	1,5	1	63,1	–	–	52,7
7307-B-TVP	**XL**	0,447	**35**	80	21	1,5	1	63,1	–	–	52,7
7307-B-2RS-TVP	**XL**	0,447	**35**	80	21	1,5	1	–	64,7	73,5	–
71808-B-TVH	–	0,029	**40**	52	7	0,3	0,2	47,3	–	–	44,7
7008-B-TVP	**XL**	0,17	**40**	68	15	1	0,6	58,6	–	–	51,3
7008-B-2RS-TVP	**XL**	0,17	**40**	68	15	1	0,6	–	60,5	66,3	–
7208-B-JP	**XL**	0,387	**40**	80	18	1,1	0,6	64,7	–	–	55,7
7208-B-TVP	**XL**	0,367	**40**	80	18	1,1	0,6	64,7	–	–	55,7
7208-B-2RS-TVP	**XL**	0,367	**40**	80	18	1,1	0,6	–	67	73,8	–
7308-B-JP	**XL**	0,646	**40**	90	23	1,5	1	71,7	–	–	59,2
7308-B-TVP	**XL**	0,61	**40**	90	23	1,5	1	71,7	–	–	59,2
7308-B-2RS-TVP	**XL**	0,61	**40**	90	23	1,5	1	–	73,9	83,3	–
71809-B-TVH	–	0,033	**45**	58	7	0,3	0,2	52,8	–	–	50,2
7209-B-JP	**XL**	0,428	**45**	85	19	1,1	0,6	70	–	–	60,5
7209-B-TVP	**XL**	0,405	**45**	85	19	1,1	0,6	70	–	–	60,5
7309-B-JP	**XL**	0,878	**45**	100	25	1,5	1	79,8	–	–	66,7
7309-B-TVP	**XL**	0,813	**45**	100	25	1,5	1	79,8	–	–	66,7



Mounting dimensions

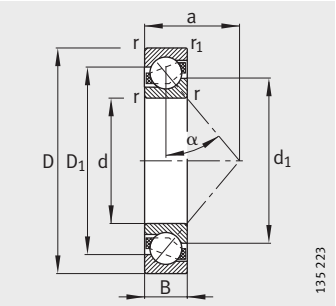


Mounting dimensions

		Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_2	a	d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈	≈	min.	max.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	18,6	32	40	40,6	0,3	0,2	5 600	4 550	295	17 000	–
–	24	34,6	50,4	51,8	1	0,6	18 300	12 500	770	14 000	–
38,2	24	34,6	50,4	51,8	1	0,6	18 300	12 500	770	6 700	–
–	27	35,6	56,4	57,8	1	0,6	20 400	14 100	950	13 000	11 300
–	27	35,6	56,4	57,8	1	0,6	20 400	14 100	950	13 000	11 300
39,8	27	35,6	56,4	57,8	1	0,6	20 400	14 100	950	6 300	–
–	31	37	65	67,8	1	0,6	33 000	22 100	1 490	11 000	8 700
–	31	37	65	67,8	1	0,6	33 000	22 100	1 490	11 000	8 700
42,8	31	37	65	67,8	1	0,6	33 000	22 100	1 490	6 000	–
–	20,7	37	45	45,6	0,3	0,2	6 000	5 300	350	15 000	–
–	27	39,6	57,4	58,8	1	0,6	22 400	16 000	1 000	12 000	–
44	27	39,6	57,4	58,8	1	0,6	22 400	16 000	1 000	6 000	–
–	31	42	65	67,8	1	0,6	27 000	19 000	1 280	11 000	9 600
–	31	42	65	67,8	1	0,6	27 000	19 000	1 280	11 000	9 600
45,8	31	42	65	67,8	1	0,6	27 000	19 000	1 280	5 600	–
–	35	44	71	74,4	1,5	1	40 000	27 500	1 860	9 500	7 900
–	35	44	71	74,4	1,5	1	40 000	27 500	1 860	9 500	7 900
49,2	35	44	71	74,4	1,5	1	40 000	27 500	1 860	5 000	–
–	22,8	42	50	50,6	0,3	0,2	6 300	5 850	395	13 000	–
–	30	44,6	63,4	64,8	1	0,6	26 000	18 600	1 180	10 000	–
48,8	30	44,6	63,4	64,8	1	0,6	26 000	18 600	1 180	5 300	–
–	34	47	73	75,8	1	0,6	32 000	23 500	1 580	9 500	8 600
–	34	47	73	75,8	1	0,6	32 000	23 500	1 580	9 500	8 600
52	34	47	73	75,8	1	0,6	32 000	23 500	1 580	5 000	–
–	39	49	81	84,4	1,5	1	50 000	34 500	2 320	8 500	7 200
–	39	49	81	84,4	1,5	1	50 000	34 500	2 320	8 500	7 200
55,6	39	49	81	84,4	1,5	1	50 000	34 500	2 320	4 500	–
–	25,1	47	56	56,6	0,3	0,2	6 550	6 550	450	13 000	–
–	37	52	78	80,8	1	0,6	36 000	27 000	1 810	8 500	8 000
–	37	52	78	80,8	1	0,6	36 000	27 000	1 810	8 500	8 000
–	43	54	91	95	1,5	1	61 000	43 000	2 900	7 500	6 600
–	43	54	91	94,4	1,5	1	61 000	43 000	2 900	7 500	6 600

Angular contact ball bearings

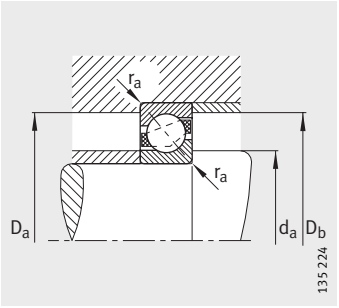
Single row
Open



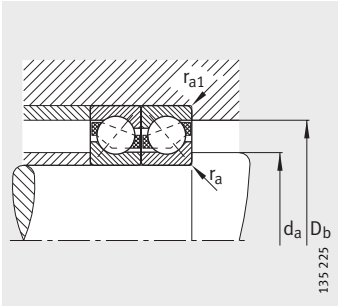
718..-B, 72..-B, 73..-B
α =40°

Dimension table (continued) · Dimensions in mm

Designation		Mass	Dimensions							
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	D_1 ≈	d_1 ≈	a ≈
71810-B-TVH	–	0,043	**50**	65	7	0,3	0,2	59,3	56,7	27,8
7210-B-JP	**XL**	0,493	**50**	90	20	1,1	0,6	74,8	66,2	39
7210-B-TVP	**XL**	0,458	**50**	90	20	1,1	0,6	74,8	66,2	39
7310-B-JP	**XL**	1,13	**50**	110	27	2	1	87,6	73,1	47
7310-B-TVP	**XL**	1,05	**50**	110	27	2	1	87,6	73,1	47
71811-B-TVH	–	0,058	**55**	72	9	0,3	0,2	65,3	61,7	31,1
7211-B-JP	**XL**	0,645	**55**	100	21	1,5	1	83	72,6	43
7211-B-TVP	**XL**	0,604	**55**	100	21	1,5	1	83	72,6	43
7311-B-JP	**XL**	1,46	**55**	120	29	2	1	95,3	80,3	51
7311-B-TVP	**XL**	1,38	**55**	120	29	2	1	95,3	80,3	51
71812-B-TVH	–	0,07	**60**	78	10	0,3	0,2	70,8	67,2	33,9
7212-B-JP	**XL**	0,847	**60**	110	22	1,5	1	91,1	79,5	47
7212-B-TVP	**XL**	0,78	**60**	110	22	1,5	1	91,1	79,5	47
7312-B-JP	**XL**	1,74	**60**	130	31	2,1	1,1	103,4	87,3	55
7312-B-TVP	**XL**	1,72	**60**	130	31	2,1	1,1	103,4	87,3	55
71813-B-TVH	–	0,085	**65**	85	10	0,6	0,3	77	73	36,5
7213-B-JP	**XL**	1,08	**65**	120	23	1,5	1	98,9	86	51
7213-B-TVP	**XL**	1	**65**	120	23	1,5	1	98,9	86	51
7313-B-JP	**XL**	2,22	**65**	140	33	2,1	1,1	112	95	60
7313-B-TVP	**XL**	2,12	**65**	140	33	2,1	1,1	112	95	60
71814-B-TVH	–	0,091	**70**	90	10	0,6	0,3	82	78	38,5
7214-B-JP	**XL**	1,17	**70**	125	24	1,5	1	104,7	91	53
7214-B-TVP	**XL**	1,08	**70**	125	24	1,5	1	104,7	91	53
7314-B-JP	**XL**	2,76	**70**	150	35	2,1	1,1	120,1	101,9	64
7314-B-TVP	**XL**	2,58	**70**	150	35	2,1	1,1	120,1	101,9	64
71815-B-TVH	–	0,096	**75**	95	10	0,6	0,3	87	83	40,6
7215-B-JP	**XL**	1,25	**75**	130	25	1,5	1	109,2	96,5	56
7215-B-TVP	**XL**	1,16	**75**	130	25	1,5	1	109,2	96,5	56
7315-B-JP	**XL**	3,29	**75**	160	37	2,1	1,1	128,5	108,8	68
7315-B-TVP	**XL**	3,1	**75**	160	37	2,1	1,1	128,5	108,8	68
71816-B-TVH	–	0,101	**80**	100	10	0,6	0,3	92	88	42,7
7216-B-JP	**XL**	1,53	**80**	140	26	2	1	117,8	102,9	59
7216-B-TVP	**XL**	1,42	**80**	140	26	2	1	117,8	102,9	59
7316-B-JP	**XL**	3,86	**80**	170	39	2,1	1,1	136,7	115,7	72
7316-B-TVP	**XL**	3,66	**80**	170	39	2,1	1,1	136,7	115,7	72



Mounting dimensions

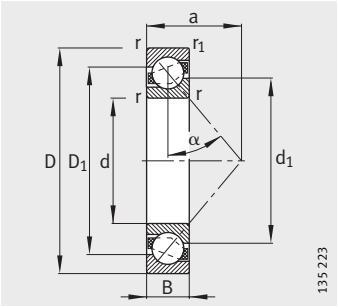


Mounting dimensions

Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
52	63	63,6	0,3	0,2	6 950	7 350	520	9 500	–
57	83	85,8	1	0,6	37 500	28 500	1 920	8 000	7 600
57	83	85,8	1	0,6	37 500	28 500	1 920	8 000	7 600
61	99	104,4	2	1	70 000	50 000	3 400	7 000	6 100
61	99	104,4	2	1	70 000	50 000	3 400	7 000	6 100
57	70	70,6	0,3	0,2	11 800	11 800	760	9 000	–
64	91	94,4	1,5	1	46 500	38 500	2 600	7 000	6 900
64	91	94,4	1,5	1	46 500	38 500	2 600	7 000	6 900
66	109	114,4	2	1	80 000	61 000	4 100	6 300	5 700
66	109	114,4	2	1	80 000	61 000	4 100	6 300	5 700
62	76	76,6	0,3	0,2	12 200	12 900	840	8 000	–
69	101	104,4	1,5	1	56 000	45 000	3 050	6 300	6 200
69	101	104,4	1,5	1	56 000	45 000	3 050	6 300	6 200
72	118	123	2,1	1	90 000	66 900	4 650	5 600	5 400
72	118	123	2,1	1	90 000	66 900	4 650	5 600	5 400
68,2	81,8	83	0,6	0,3	15 300	16 000	970	7 500	–
74	111	114,4	1,5	1	64 000	55 000	3 700	6 000	5 700
74	111	114,4	1,5	1	64 000	55 000	3 700	6 000	5 700
77	128	133	2,1	1	103 000	82 000	5 400	5 300	5 100
77	128	133	2,1	1	103 000	82 000	5 400	5 300	5 100
73,2	86,8	88	0,6	0,3	16 000	17 300	1 070	7 000	–
79	116	119,4	1,5	1	69 500	62 000	4 200	5 600	5 500
79	116	119,4	1,5	1	69 500	62 000	4 200	5 600	5 500
82	138	143	2,1	1	117 000	93 000	6000	5 000	4 800
82	138	143	2,1	1	117 000	93 000	6 000	5 000	4 800
78,2	91,8	93	0,6	0,3	16 300	18 000	1 140	6 300	–
84	121	124,4	1,5	1	68 000	62 000	4 100	5 300	5 400
84	121	124,4	1,5	1	68 000	62 000	4 100	5 300	5 400
87	148	153	2,1	1	130 000	107 000	6 700	4 500	4 550
87	148	153	2,1	1	130 000	107 000	6 700	4 500	4 550
83,2	96,8	98	0,6	0,3	16 600	19 000	1 200	6 000	–
91	129	134,4	2	1	80 000	72 000	4 650	5 000	5 000
91	129	134,4	2	1	80 000	72 000	4 650	5 000	5 000
92	158	163	2,1	1	144 000	124 000	7 500	4 300	4 350
92	158	163	2,1	1	144 000	124 000	7 500	4 300	4 350

Angular contact ball bearings

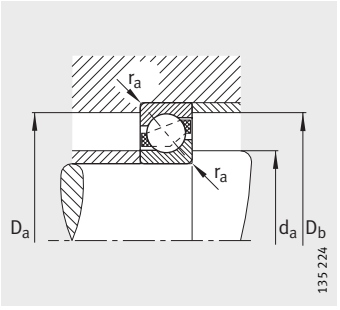
Single row
Open



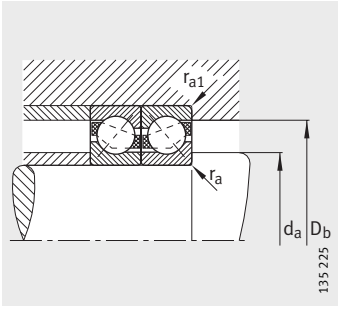
72..-B, 73..-B
α =40°

Dimension table (continued) · Dimensions in mm

Designation		Mass	Dimensions							
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	D_1 ≈	d_1 ≈	a ≈
7217-B-JP	**XL**	1,94	**85**	150	28	2	1	125	110,6	63
7217-B-TVP	**XL**	1,82	**85**	150	28	2	1	125	110,6	63
7317-B-JP	**XL**	4,4	**85**	180	41	3	1,1	144	122	76
7317-B-TVP	**XL**	4,26	**85**	180	41	3	1,1	144	122	76
7218-B-JP	**XL**	2,38	**90**	160	30	2	1	133,4	117,5	67
7218-B-TVP	**XL**	2,21	**90**	160	30	2	1	133,4	117,5	67
7318-B-JP	**XL**	5,14	**90**	190	43	3	1,1	153	129,7	80
7318-B-TVP	**XL**	5	**90**	190	43	3	1,1	153	129,7	80
7219-B-JP	**XL**	2,64	**95**	170	32	2,1	1,1	142	124,9	72
7219-B-TVP	**XL**	2,64	**95**	170	32	2,1	1,1	142	124,9	72
7319-B-JP	**XL**	5,93	**95**	200	45	3	1,1	160,1	136,7	84
7319-B-TVP	**XL**	5,78	**95**	200	45	3	1,1	160,1	136,7	84
7220-B-JP	**XL**	3,45	**100**	180	34	2,1	1,1	149,6	131,9	76
7220-B-TVP	**XL**	3,17	**100**	180	34	2,1	1,1	149,6	131,9	76
7320-B-JP	**XL**	7,38	**100**	215	47	3	1,1	172,3	145,8	90
7320-B-TVP	**XL**	7,16	**100**	215	47	3	1,1	172,3	145,8	90
7221-B-MP	**XL**	4,18	**105**	190	36	2,1	1,1	157,7	138,2	80
7321-B-MP	**XL**	9	**105**	225	49	3	1,1	179,6	153,5	94
7222-B-JP	**XL**	4,7	**110**	200	38	2,1	1,1	165,7	144,9	84
7222-B-TVP	**XL**	4,44	**110**	200	38	2,1	1,1	165,7	144,9	84
7322-B-JP	**XL**	9,97	**110**	240	50	3	1,1	191,5	161,9	98
7322-B-TVP	**XL**	9,74	**110**	240	50	3	1,1	191,5	161,9	98
7224-B-TVP	**XL**	5,31	**120**	215	40	2,1	1,1	179,5	157,2	90
7324-B-TVP	**XL**	12,5	**120**	260	55	3	1,1	207,7	175,9	107
7226-B-TVP	**XL**	6,12	**130**	230	40	3	1,1	191,8	169,2	96
7326-B-TVP	**XL**	15,1	**130**	280	58	4	1,5	222,5	188,5	115
7228-B-MP	**XL**	8,55	**140**	250	42	3	1,1	207,5	183,5	103
7328-B-MP	–	20,5	**140**	300	62	4	1,5	240,2	203,9	123
7230-B-MP	**XL**	10,9	**150**	270	45	3	1,1	223,5	197,5	111
7330-B-MP	–	24,8	**150**	320	65	4	1,5	256,5	217,8	131
7232-B-MP	–	13,5	**160**	290	48	3	1,1	238	212	118
7332-B-MP	–	29	**160**	340	68	4	1,5	272,2	232,4	139
7234-B-MP	–	16,7	**170**	310	52	4	1,5	256,5	226,9	127
7334-B-MP	–	34,4	**170**	360	72	4	1,5	291,6	248,4	147



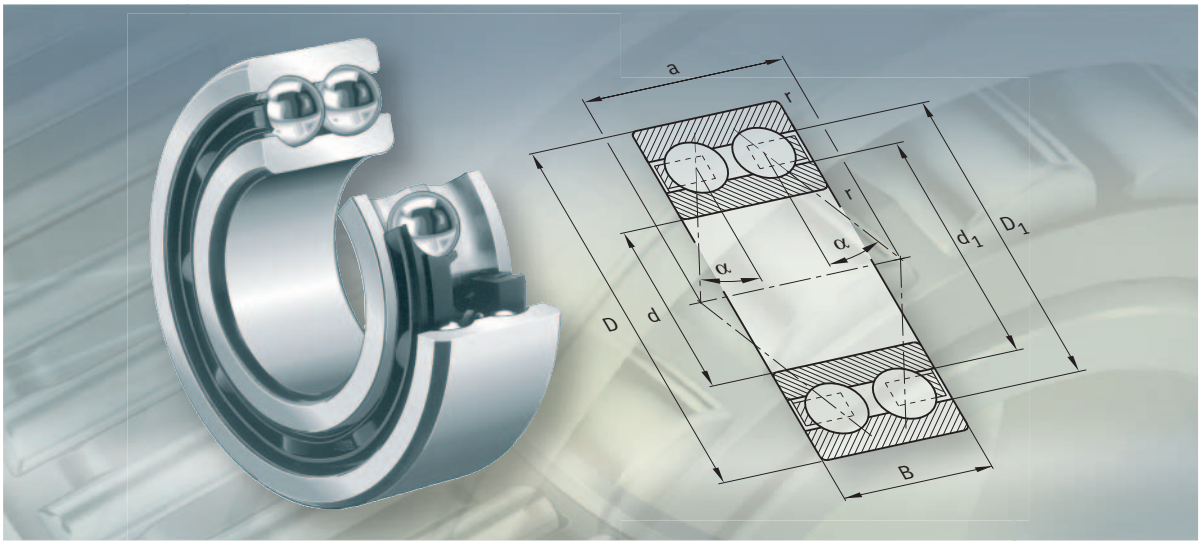
Mounting dimensions



Mounting dimensions

Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
96	139	144,4	2	1	90 000	86 000	5 300	4 500	4 800
96	139	144,4	2	1	90 000	86 000	5 300	4 500	4 800
99	166	173	2,5	1	155 000	138 000	8 100	4 000	4 150
99	166	173	2,5	1	155 000	138 000	8 100	4 000	4 150
101	149	154,4	2	1	106 000	98 000	5 900	4 300	4 600
101	149	154,4	2	1	106 000	98 000	5 900	4 300	4 600
104	176	183	2,5	1	167 000	155 000	8 800	3 800	4 000
104	176	183	2,5	1	167 000	155 000	8 800	3 800	4 000
107	158	163	2,1	1	116 000	106 000	6 200	4 000	4 500
107	158	163	2,1	1	116 000	106 000	6 200	4 000	4 500
109	186	193	2,5	1	176 000	167 000	9 300	3 800	3 850
109	186	193	2,5	1	176 000	167 000	9 300	3 800	3 850
112	168	173	2,1	1	137 000	132 000	7 500	3 800	4 250
112	168	173	2,1	1	132 000	124 000	7 100	3 800	4 250
114	201	208	2,5	1	199 000	197 000	10 600	3 600	3 600
114	201	208	2,5	1	199 000	197 000	10 600	3 600	3 600
117	178	183	2,1	1	144 000	142 000	7 900	6 000	4 150
119	211	218	2,5	1	209 000	214 000	11 200	5 300	3 500
122	188	193	2,1	1	155 000	154 000	8 300	3 600	4 050
122	188	193	2,1	1	155 000	154 000	8 300	3 600	4 050
124	226	233	2,5	1	232 000	245 000	12 500	3 400	3 200
124	226	233	2,5	1	232 000	245 000	12 500	3 400	3 200
132	203	208	2,1	1	169 000	178 000	9 300	3 400	3 800
134	246	253	2,5	1	255 000	285 000	13 900	3 200	2 950
144	216	223	2,5	1	186 000	204 000	10 300	3 200	3 400
147	263	271	3	1,5	285 000	325 000	15 400	3 000	2 650
154	236	243	2,5	1	198 000	231 000	11 100	4 800	3 200
157	283	291	3	1,5	300 000	345 000	12 700	4 300	2 450
164	256	263	2,5	1	227 000	275 000	12 800	4 500	2 900
167	303	311	3	1,5	325 000	390 000	14 200	3 800	2 250
174	276	283	2,5	1	236 000	280 000	10 400	4 300	2 700
177	323	331	3	1,5	360 000	450 000	15 100	3 600	2 070
187	293	301	3	1,5	265 000	325 000	11 700	3 800	2 500
187	343	351	3	1,5	405 000	530 000	18 100	3 200	1 910

FAG



Double row angular contact ball bearings

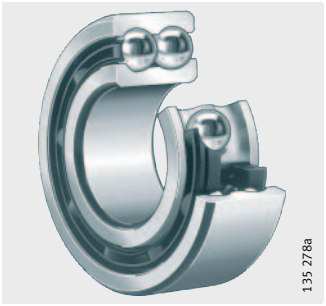


Double row angular contact ball bearings

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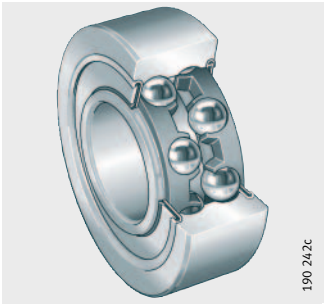
Double row

38..-B, 30..-B, 32..-B, 33..-B

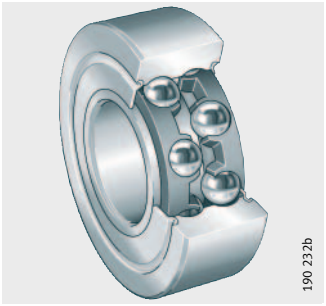


Lip seals or gap seals

38..-B-2RSR, 30..-B-2RSR, 32..-B-2RSR, 33..-B-2RSR

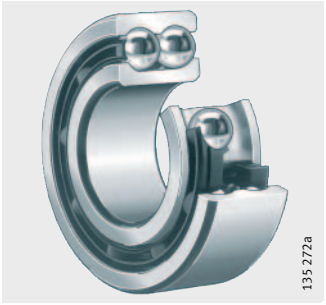


38..-B-2Z, 30..-B-2Z, 32..-B-2Z, 33..-B-2Z



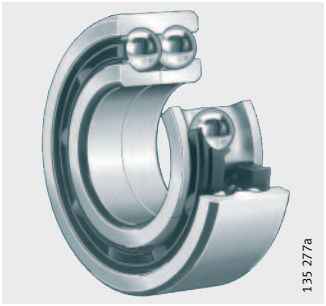
With filling slot

32, 33



Split inner ring

33..-DA



Double row angular contact ball bearings



Features

Double row angular contact ball bearings are units with solid inner and outer rings and ball and cage assemblies with polyamide, sheet steel or brass cages. Their construction is similar to a pair of single row angular contact ball bearings in an O arrangement but they are narrower to a certain extent. They differ in the size of the contact angle and the design of the bearing rings.

The bearings are available in open and sealed designs. Due to the manufacturing processes used, open bearings can have turned recesses in the outer ring for seals or shields. Sealed bearings are maintenance-free and therefore allow particularly economical bearing arrangements.

The angular adjustment facility of the angular contact ball bearings is very limited.

Radial and axial load capacity

Double row angular contact ball bearings can support axial forces in both directions and high radial forces. They are particularly suitable for bearing arrangements where rigid axial guidance is required.

The axial load carrying capacity is dependent on the contact angle; i.e. the larger the angle (α = 25°, 35° and 45°), the higher the axial load to which the bearing can be subjected.

Without filling slot

Bearings of series 38..-B, 30..-B, 32..-B and 33..-B are self-retaining and do not have filling slots in the end faces of the bearing rings. The contact angle α = 25°. Their axial load carrying capacity is the same in both directions. These bearings are highly versatile.

With filling slot

Angular contact ball bearings of series 32 und 33 are self-retaining and have filling slots on one side. The contact angle α = 35°.

Caution!

These series must be fitted such that the main load direction is supported by the raceways without filling slots.

With split inner ring

Bearings of series 33..-DA have a split inner ring. Due to the contact angle of α = 45°, they can support high axial forces in both directions.

The inner ring halves are matched to the particular bearing and must not be interchanged with those of other bearings of the same size.

Sealing/lubrication

Series 38..-B, 30..-B, 32..-B and 33..-B with suffix 2RSR are sealed by lip seals on both sides. Contact seals are suitable for giving protection against dust, contamination and damp atmospheres.

Series with the suffix 2Z have gap seals on both sides.

Sealed bearings are greased with a high quality grease and are lubricated for life. Bearings without seals can be lubricated with grease or oil.

Operating temperature

Open bearings are suitable for operating temperatures from –30 °C to +150 °C.

Caution! Bearings with cages made from glass fibre reinforced polyamide are suitable for operating temperatures up to +120 °C, restricted by the cage material.

Bearings with suffix 2RSR are suitable for operating temperatures up to +110 °C, restricted by the lubricant and seal material.

Cages

Bearings without a cage suffix have standard cages made from sheet steel.

Angular contact ball bearings with cages made from glass fibre reinforced polyamide have the suffix TVH.

Bearings with ball-guided solid brass cages are indicated by the suffix M. Solid brass cages guided on the outer ring have the suffix MA.

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

Cage/bore code

Series	Polyamide cage[1)]	Solid brass cage[1)]	Sheet steel cage[1)]
	Bore code		
32	–	19, 21, 22	17, 18, 20
33	–	17, 19, 20, 22	14 to 16, 18
30..-B	up to 08	–	–
32..-B	up to 16	–	–
33..-B	up to 13	–	–
38..-B	up to 16	–	–
33..-DA	05	08, 10, 11	06, 07, 09, from 12

1) Other cage designs available by agreement.
In such cages, suitability for high speeds and high temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffix	Description	Design
B	Modified internal construction, contact angle $\alpha = 25°$, without filling slot	Standard
C2	Axial Internal clearance C2	Special design[1)]
C3	Axial Internal clearance C3	Special design[1)]
DA	Inner ring split	Standard
M	Solid brass cage, ball-guided	Standard
MA	Solid brass cage, guidance on outer ring	Standard
TVH	Solid polyamide snap cage, ball-guided	Standard
2RSR	Lip seals on both sides	Standard
2Z	Gap seals on both sides	Standard

1) Available by agreement.

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Contact angle 25°

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq 0{,}68$	$P = F_r + 0{,}92 \cdot F_a$
$\frac{F_a}{F_r} > 0{,}68$	$P = 0{,}67 \cdot F_r + 1{,}41 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Contact angle 35°

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq 0{,}95$	$P = F_r + 0{,}66 \cdot F_a$
$\frac{F_a}{F_r} > 0{,}95$	$P = 0{,}6 \cdot F_r + 1{,}07 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Contact angle 45°

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq 1{,}33$	$P = F_r + 0{,}47 \cdot F_a$
$\frac{F_a}{F_r} > 1{,}33$	$P = 0{,}54 \cdot F_r + 0{,}81 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

Contact angle 25°

$$P_0 = F_{0r} + 0{,}76 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load.

Contact angle 35°

$$P_0 = F_{0r} + 0{,}58 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load.

Contact angle 45°

$$P_0 = F_{0r} + 0{,}44 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load.

Minimum radial load

In order to ensure slippage-free operation, the bearings must be subjected to a minimum radial load. This applies particularly in the case of high speeds and high accelerations. In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}01$ is necessary for ball bearings with cage.

Speeds

The reference speed n_B can be exceeded up to the limiting speed n_G if permitted by the operating conditions. If the reference speed in the tables is higher than the limiting speed, the higher value cannot be used.

In bearings with lip seals 2RSR, the speed is limited by the permissible sliding speed of the sealing lips, so only the limiting speed is given in the dimension tables.

Caution! The limiting speed n_G given in the dimension tables must not be exceeded.



Accuracy

The main dimensions of the bearings conform to DIN 628-3.

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620-2.

Axial internal clearance

Double row angular contact ball bearings of the basic design have the normal axial internal clearance (CN). Bearings are available by agreement with an axial internal clearance larger (C3) or smaller (C2) than normal.

Bearings with a split inner ring are intended for higher axial loads. In general, they have a tighter fit than unsplit bearings. Their normal internal clearance corresponds to internal clearance group C3 for unsplit bearings.

Axial internal clearance to DIN 628-3 for bearings with unsplit inner ring

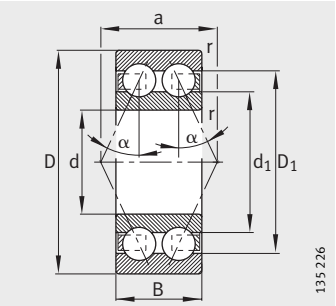
Bore d mm		Axial internal clearance					
		C2 µm		CN µm		C3 µm	
over	incl.	min.	max.	min.	max.	min.	max.
–	10	1	11	5	21	12	28
10	18	1	12	6	23	13	31
18	24	2	14	7	25	16	34
24	30	2	15	8	27	18	37
30	40	2	16	9	29	21	40
40	50	2	18	11	33	23	44
50	65	3	22	13	36	26	48
65	80	3	24	15	40	30	54
80	100	3	26	18	46	35	63
100	120	4	30	22	53	42	73

Axial internal clearance for bearings with split inner ring

Bore d mm		Axial internal clearance					
		C2 µm		CN µm		C3 µm	
over	incl.	min.	max.	min.	max.	min.	max.
24	30	8	27	16	35	27	46
30	40	9	29	18	38	30	50
40	50	11	33	22	44	36	58
50	65	13	36	25	48	40	63
65	80	15	40	29	54	46	71

Angular contact ball bearings

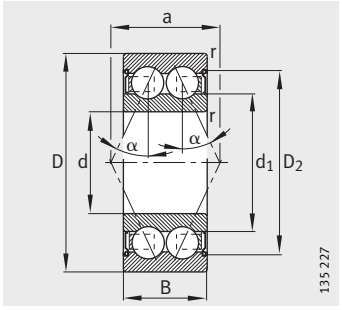
Double row
Open or sealed



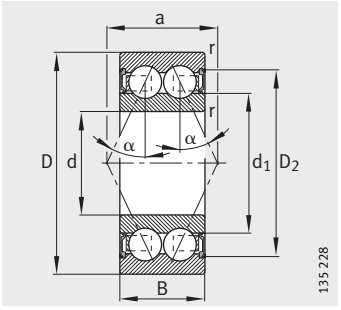
30..-B, 38..-B, 32..-B
α =25°

Dimension table · Dimensions in mm

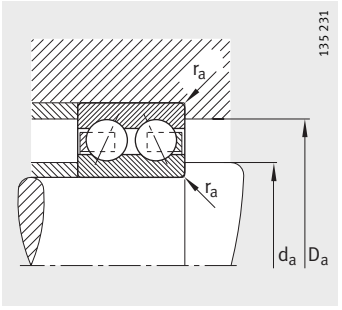
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
30/5-B-TVH	0,008	**5**	14	7	0,2	–	–	7,5	6,3
30/5-B-2Z-TVH	0,008	**5**	14	7	0,2	–	–	7,5	6,3
30/5-B-2RSR-TVH	0,008	**5**	14	7	0,2	–	–	7,5	6,3
30/6-B-TVH	0,01	**6**	17	9	0,3	–	–	8,3	8,8
30/6-B-2Z-TVH	0,01	**6**	17	9	0,3	–	–	8,3	8,8
30/6-B-2RSR-TVH	0,01	**6**	17	9	0,3	–	–	8,3	8,8
30/7-B-TVH	0,012	**7**	19	10	0,3	–	–	9	10
30/7-B-2Z-TVH	0,012	**7**	19	10	0,3	–	–	9	10
30/7-B-2RSR-TVH	0,012	**7**	19	10	0,3	–	–	9	10
30/8-B-TVH	0,02	**8**	22	11	0,3	–	–	10,5	10,7
30/8-B-2Z-TVH	0,02	**8**	22	11	0,3	–	–	10,5	10,7
30/8-B-2RSR-TVH	0,02	**8**	22	11	0,3	–	–	10,5	10,7
3800-B-TVH	0,008	**10**	19	7	0,3	–	–	13	8,1
3800-B-2Z-TVH	0,008	**10**	19	7	0,3	–	–	13	8,1
3800-B-2RSR-TVH	0,008	**10**	19	7	0,3	–	–	13	8,1
3000-B-TVH	0,022	**10**	26	12	0,3	–	–	13,5	12,3
3000-B-2Z-TVH	0,022	**10**	26	12	0,3	–	–	13,5	12,3
3000-B-2RSR-TVH	0,022	**10**	26	12	0,3	–	–	13,5	12,3
3200-B-TVH	0,05	**10**	30	14	0,6	23,9	–	17,9	15
3200-B-2Z-TVH	0,051	**10**	30	14	0,6	–	25,3	17,9	15
3801-B-TVH	0,008	**12**	21	7	0,3	–	–	15	8,9
3801-B-2Z-TVH	0,008	**12**	21	7	0,3	–	–	15	8,9
3801-B-2RSR-TVH	0,008	**12**	21	7	0,3	–	–	15	8,9
3001-B-TVH	0,025	**12**	28	12	0,3	–	–	15,5	13
3001-B-2Z-TVH	0,025	**12**	28	12	0,3	–	–	15,5	13
3001-B-2RSR-TVH	0,025	**12**	28	12	0,3	–	–	15,5	13
3201-B-TVH	0,051	**12**	32	15,9	0,6	25,7	–	18,3	17
3201-B-2Z-TVH	0,053	**12**	32	15,9	0,6	–	28,1	18,3	17



30..-B-2Z, 38..-B-2Z, 32-B-2Z
$\alpha = 25°$



30..-B-2RSR, 32-B-2RSR,
38..-B-2RSR
$\alpha = 25°$

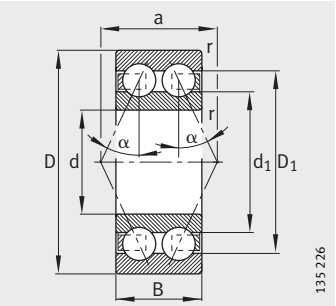


Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
6,4	12,6	0,2	1 810	950	48,5	30 000	23 500
6,4	12,6	0,2	1 810	950	48,5	24 000	23 500
6,4	12,6	0,2	1 810	950	48,5	15 000	–
8	15	0,3	3 100	1 420	72	28 000	22 500
8	15	0,3	3 100	1 420	72	22 000	22 500
8	15	0,3	3 100	1 420	72	15 000	–
9	17	0,3	3 650	1 700	86	26 000	21 000
9	17	0,3	3 650	1 700	86	20 000	21 000
9	17	0,3	3 650	1 700	86	15 000	–
10	20	0,3	5 200	2 650	133	26 000	20 000
10	20	0,3	5 200	2 650	133	19 000	20 000
10	20	0,3	5 200	2 650	133	14 000	–
12	17	0,3	2 120	1 400	71	26 000	21 100
12	17	0,3	2 120	1 400	71	18 000	21 100
12	17	0,3	2 120	1 400	71	16 000	–
12	24	0,3	5 700	3 250	164	24 000	17 500
12	24	0,3	5 700	3 250	164	17 000	17 500
12	24	0,3	5 700	3 250	164	14 000	–
14,2	25,8	0,6	7 800	4 550	223	22 000	20 900
14,2	25,8	0,6	7 800	4 550	223	16 000	20 900
14	19	0,3	2 190	1 550	79	24 000	18 100
14	19	0,3	2 190	1 550	79	17 000	18 100
14	19	0,3	2 190	1 550	79	15 000	–
14	26	0,3	6 200	3 750	191	22 000	15 500
14	26	0,3	6 200	3 750	191	16 000	15 500
14	26	0,3	6 200	3 750	191	13 000	–
16,2	27,8	0,6	10 600	5 850	295	20 000	20 000
16,2	27,8	0,6	10 600	5 850	295	15 000	20 000

Angular contact ball bearings

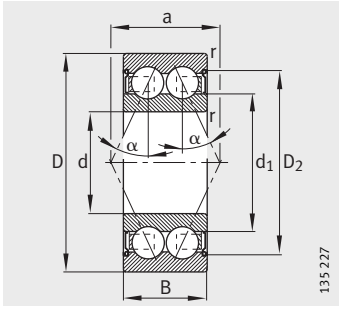
Double row
Open or sealed



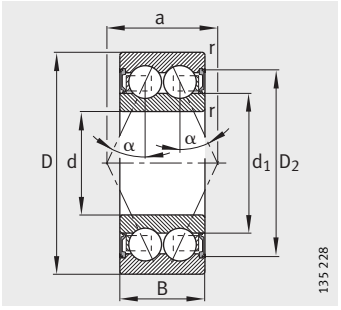
38..-B, 30..-B, 32..-B, 33..-B
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

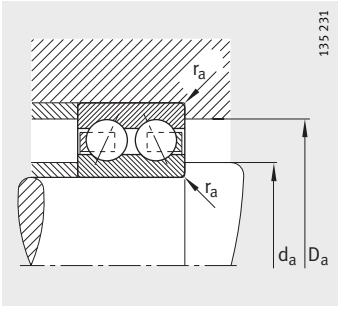
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3802-B-TVH	0,009	**15**	24	7	0,3	–	–	18	10,1
3802-B-2Z-TVH	0,009	**15**	24	7	0,3	–	–	18	10,1
3802-B-2RSR-TVH	0,009	**15**	24	7	0,3	–	–	18	10,1
3002-B-TVH	0,036	**15**	32	13	0,3	–	–	20,4	14,8
3002-B-2Z-TVH	0,036	**15**	32	13	0,3	–	–	20,4	14,8
3002-B-2RSR-TVH	0,036	**15**	32	13	0,3	–	–	20,4	14,8
3202-B-TVH	0,065	**15**	35	15,9	0,6	28,8	–	21,1	18
3202-B-2Z-TVH	0,067	**15**	35	15,9	0,6	–	31,6	21,1	18
3202-B-2RSR-TVH	0,067	**15**	35	15,9	0,6	–	31,6	21,1	18
3302-B-TVH	0,124	**15**	42	19	1	34,5	–	25,6	21
3803-B-TVH	0,015	**17**	26	7	0,3	–	–	20	10,9
3803-B-2Z-TVH	0,015	**17**	26	7	0,3	–	–	20	10,9
3803-B-2RSR-TVH	0,015	**17**	26	7	0,3	–	–	20	10,9
3003-B-TVH	0,042	**17**	35	14	0,3	–	–	21,6	15,5
3003-B-2Z-TVH	0,042	**17**	35	14	0,3	–	–	21,6	15,5
3003-B-2RSR-TVH	0,042	**17**	35	14	0,3	–	–	21,6	15,5
3203-B-TVH	0,093	**17**	40	17,5	0,6	33,1	–	24	20
3203-B-2Z-TVH	0,095	**17**	40	17,5	0,6	–	35,1	24	20
3203-B-2RSR-TVH	0,095	**17**	40	17,5	0,6	–	35,1	24	20
3303-B-TVH	0,177	**17**	47	22,2	1	37,7	–	26,2	24
3804-B-TVH	0,02	**20**	32	10	0,3	–	–	24,3	14,3
3804-B-2Z-TVH	0,02	**20**	32	10	0,3	–	–	24,3	14,3
3804-B-2RSR-TVH	0,02	**20**	32	10	0,3	–	–	24,3	14,3
3004-B-TVH	0,08	**20**	42	16	0,6	–	–	25,2	19,1
3004-B-2Z-TVH	0,08	**20**	42	16	0,6	–	–	25,2	19,1
3004-B-2RSR-TVH	0,08	**20**	42	16	0,6	–	–	25,2	19,1
3204-B-TVH	0,154	**20**	47	20,6	1	38,7	–	28,9	24
3204-B-2Z-TVH	0,16	**20**	47	20,6	1	–	41,1	28,9	24
3204-B-2RSR-TVH	0,158	**20**	47	20,6	1	–	41,1	28,9	24
3304-B-TVH	0,217	**20**	52	22,2	1,1	42,7	–	31,2	26
3304-B-2Z-TVH	0,222	**20**	52	22,2	1,1	–	45,1	31,2	26
3304-B-2RSR-TVH	0,221	**20**	52	22,2	1,1	–	45,1	31,2	26



38..-B-2Z, 30..-B-2Z,
32..-B-2Z, 33..-B-2Z
$\alpha = 25°$



38..-B-2RSR, 30..-B-2RSR,
32..-B-2RSR, 33..-B-2RSR
$\alpha = 25°$

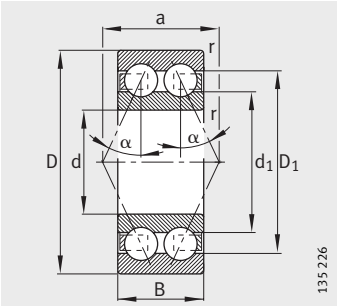


Mounting dimensions

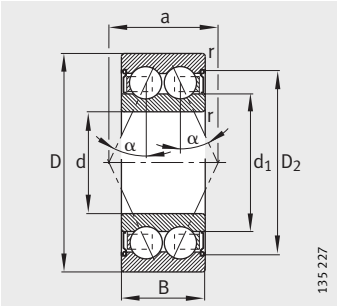
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
17	22	0,3	2 430	1 960	99	22 000	14 800
17	22	0,3	2 430	1 960	99	16 000	14 800
17	22	0,3	2 430	1 960	99	14 000	–
17	30	0,3	8 600	5 400	275	20 000	13 200
17	30	0,3	8 600	5 400	275	15 000	13 200
17	30	0,3	8 600	5 400	275	12 000	–
19,2	30,8	0,6	11 800	7 100	360	19 000	17 100
19,2	30,8	0,6	11 800	7 100	360	14 000	17 100
19,2	30,8	0,6	11 800	7 100	360	12 000	–
20,6	36,4	1	16 300	10 000	460	16 000	12 000
19	24	0,3	2 480	2 080	107	19 000	13 200
19	24	0,3	2 480	2 080	107	14 000	13 200
19	24	0,3	2 480	2 080	107	12 000	–
19	33	0,3	9 200	6 200	315	18 000	12 200
19	33	0,3	9 200	6 200	315	13 000	12 200
19	33	0,3	9 200	6 200	315	11 000	–
21,2	35,8	0,6	14 600	9 000	420	17 000	15 400
21,2	35,8	0,6	14 600	9 000	420	12 000	15 400
21,2	35,8	0,6	14 600	9 000	420	10 000	–
22,6	41,4	1	20 800	12 500	570	15 000	11 400
22	30	0,3	5 800	4 850	245	17 000	12 700
22	30	0,3	5 800	4 850	245	12 000	12 700
22	30	0,3	5 800	4 850	245	10 000	–
23,2	38,8	0,6	14 500	9 600	485	16 000	10 600
23,2	38,8	0,6	14 500	9 600	485	11 000	10 600
23,2	38,8	0,6	14 500	9 600	485	9 000	–
25,6	41,4	1	19 600	12 500	610	15 000	13 900
25,6	41,4	1	19 600	12 500	610	10 000	13 900
25,6	41,4	1	19 600	12 500	610	8 500	–
27	45	1	23 200	15 000	690	13 000	9 900
27	45	1	23 200	15 000	690	9 000	9 900
27	45	1	23 200	15 000	690	8 000	–

Angular contact ball bearings

Double row
Open or sealed
Split inner ring



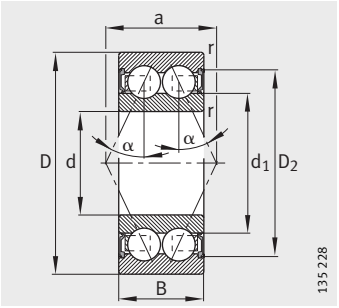
38..-B, 30..-B, 32..-B, 33..-B
$\alpha = 25°$



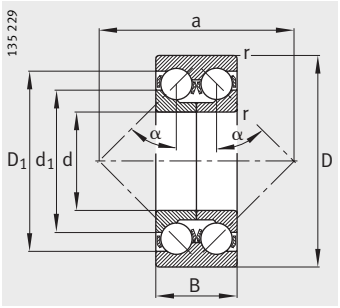
38..-B-2Z, 30..-B-2Z,
32..-B-2Z, 33..-B-2Z
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

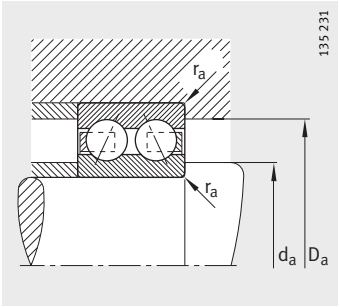
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3805-B-TVH	0,025	**25**	37	10	0,3	–	–	28,3	15,9
3805-B-2Z-TVH	0,025	**25**	37	10	0,3	–	–	28,3	15,9
3805-B-2RSR-TVH	0,025	**25**	37	10	0,3	–	–	28,3	15,9
3005-B-TVH	0,1	**25**	47	16	0,6	–	–	29,8	21,2
3005-B-2Z-TVH	0,1	**25**	47	16	0,6	–	–	29,8	21,2
3005-B-2RSR-TVH	0,1	**25**	47	16	0,6	–	–	29,8	21,2
3205-B-TVH	0,178	**25**	52	20,6	1	43,7	–	33,9	26
3205-B-2Z-TVH	0,182	**25**	52	20,6	1	–	46,1	33,9	26
3205-B-2RSR-TVH	0,182	**25**	52	20,6	1	–	46,1	33,9	26
3305-B-TVH	0,353	**25**	62	25,4	1,1	50	–	37,2	31
3305-B-2Z-TVH	0,359	**25**	62	25,4	1,1	–	53,1	37,2	31
3305-B-2RSR-TVH	0,359	**25**	62	25,4	1,1	–	53,1	37,2	31
3305-DA-TVP	0,341	**25**	62	25,4	1,1	51,8	–	47,5	56
3806-B-TVH	0,03	**30**	42	10	0,3	–	–	32,8	18,1
3806-B-2Z-TVH	0,03	**30**	42	10	0,3	–	–	32,8	18,1
3806-B-2RSR-TVH	0,03	**30**	42	10	0,3	–	–	32,8	18,1
3006-B-TVH	0,16	**30**	55	19	1	–	–	35,6	24,8
3006-B-2Z-TVH	0,16	**30**	55	19	1	–	–	35,6	24,8
3006-B-2RSR-TVH	0,16	**30**	55	19	1	–	–	35,6	24,8
3206-B-TVH	0,289	**30**	62	23,8	1	52,1	–	40	31
3206-B-2Z-TVH	0,295	**30**	62	23,8	1	–	55,7	40	31
3206-B-2RSR-TVH	0,296	**30**	62	23,8	1	–	55,7	40	31
3306-B-TVH	0,548	**30**	72	30,2	1,1	58,9	–	44	36
3306-B-2Z-TVH	0,558	**30**	72	30,2	1,1	–	62,5	44	36
3306-B-2RSR-TVH	0,558	**30**	72	30,2	1,1	–	62,5	44	36
3306-DA	0,657	**30**	72	30,2	1,1	61,5	–	55,2	67



38..-B-2RSR, 30..-B-2RSR,
32..-B-2RSR, 33..-B-2RSR
$\alpha = 25°$



33..-DA
Split inner ring
$\alpha = 45°$

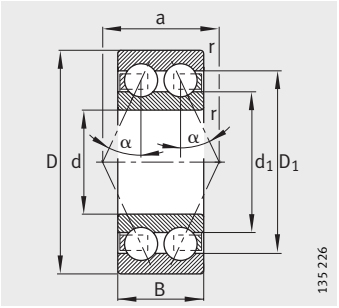


Mounting dimensions

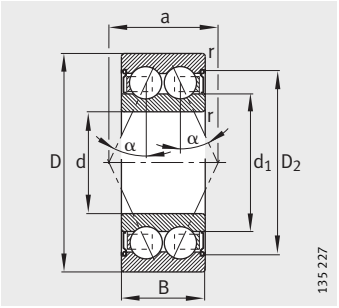
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
27	35	0,3	6 000	5 600	280	14 000	10 300
27	35	0,3	6 000	5 600	280	9 500	10 300
27	35	0,3	6 000	5 600	280	8 500	–
28,2	43,8	0,6	15 500	11 100	560	13 000	8 900
28,2	43,8	0,6	15 500	11 100	560	9 000	8 900
28,2	43,8	0,6	15 500	11 100	560	8 000	–
30,6	46,4	1	21 200	14 600	710	12 000	11 800
30,6	46,4	1	21 200	14 600	710	8 500	11 800
30,6	46,4	1	21 200	14 600	710	7 500	–
32	55	1	30 000	20 000	900	10 000	8 500
32	55	1	30 000	20 000	900	7 500	8 500
32	55	1	30 000	20 000	900	6 700	–
32	55	1	30 000	23 200	1270	10 000	8 400
32	40	0,3	6 300	6 100	320	11 000	8 700
32	40	0,3	6 300	6 100	320	8 000	8 700
32	40	0,3	6 300	6 100	320	7 000	–
34,6	50,4	1	20 300	15 600	790	10 000	18 000
34,6	50,4	1	20 300	15 600	790	7 500	18 000
34,6	50,4	1	20 300	15 600	790	6 700	–
35,6	56,4	1	30 000	21 200	980	9 500	10 300
35,6	56,4	1	30 000	21 200	980	7 000	10 300
35,6	56,4	1	30 000	21 200	980	6 300	–
37	65	1	41 500	28 500	1310	8 500	7 800
37	65	1	41 500	28 500	1310	6 300	7 800
37	65	1	41 500	28 500	1310	5 600	–
37	65	1	41 500	34 500	2070	8 500	7 600

Angular contact ball bearings

Double row
Open or sealed
Split inner ring



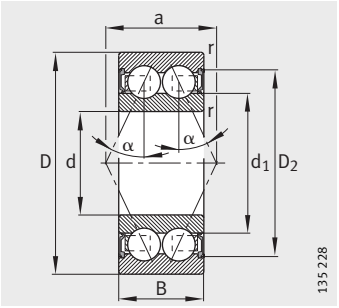
38..-B, 30..-B, 32..-B, 33..-B
$\alpha = 25°$



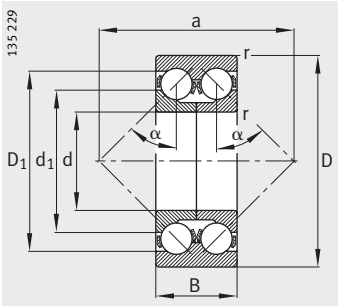
38..-B-2Z, 30..-B-2Z,
32..-B-2Z, 33..-B-2Z
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

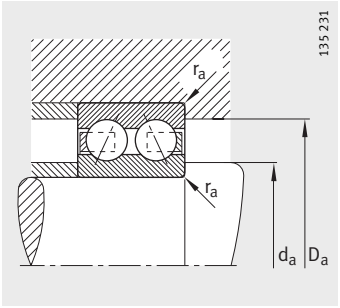
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3807-B-TVH	0,035	**35**	47	10	0,3	–	–	38,5	20
3807-B-2Z-TVH	0,035	**35**	47	10	0,3	–	–	38,5	20
3807-B-2RSR-TVH	0,035	**35**	47	10	0,3	–	–	38,5	20
3007-B-TVH	0,2	**35**	62	20	1	–	–	41,7	27,8
3007-B-2Z-TVH	0,2	**35**	62	20	1	–	–	41,7	27,8
3007-B-2RSR-TVH	0,2	**35**	62	20	1	–	–	41,7	27,8
3207-B-TVH	0,446	**35**	72	27	1,1	60,6	–	47,2	36
3207-B-2Z-TVH	0,454	**35**	72	27	1,1	–	64,2	47,2	36
3207-B-2RSR-TVH	0,454	**35**	72	27	1,1	–	64,2	47,2	36
3307-B-TVH	0,657	**35**	80	34,9	1,5	65,5	–	49,3	41
3307-B-2Z-TVH	0,667	**35**	80	34,9	1,5	–	68,5	49,3	41
3307-B-2RSR-TVH	0,739	**35**	80	34,9	1,5	–	68,5	49,3	41
3307-DA	0,889	**35**	80	34,9	1,5	69,6	–	62	75
3808-B-TVH	0,04	**40**	52	10	0,3	–	–	43,4	22,4
3808-B-2Z-TVH	0,04	**40**	52	10	0,3	–	–	43,4	22,4
3808-B-2RSR-TVH	0,04	**40**	52	10	0,3	–	–	43,4	22,4
3008-B-TVH	0,25	**40**	68	21	1	–	–	46,7	30,8
3008-B-2Z-TVH	0,25	**40**	68	21	1	–	–	46,7	30,8
3008-B-2RSR-TVH	0,25	**40**	68	21	1	–	–	46,7	30,8
3208-B-TVH	0,594	**40**	80	30,2	1,1	67,9	–	53	41
3208-B-2Z-TVH	0,604	**40**	80	30,2	1,1	–	71,3	53	41
3208-B-2RSR-TVH	0,605	**40**	80	30,2	1,1	–	71,3	53	41
3308-B-TVH	0,984	**40**	90	36,5	1,5	74,6	–	55,6	46
3308-B-2Z-TVH	0,998	**40**	90	36,5	1,5	–	77,4	55,6	46
3308-B-2RSR-TVH	0,998	**40**	90	36,5	1,5	–	77,4	55,6	46
3308-DA-MA	1,19	**40**	90	36,5	1,5	79,4	–	72,5	85



38..-B-2RSR, 30..-B-2RSR,
32..-B-2RSR, 33..-B-2RSR
$\alpha = 25°$



33..-DA
Split inner ring
$\alpha = 45°$

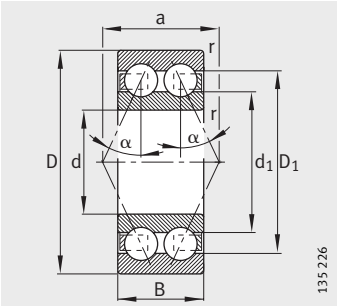


Mounting dimensions

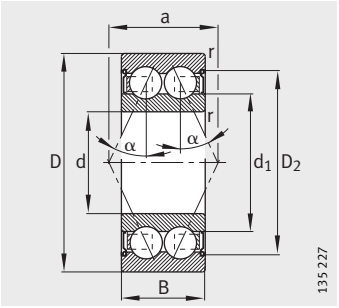
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
37	45	0,3	6 700	7 000	370	9 500	7 400
37	45	0,3	6 700	7 000	370	7 000	7 400
37	45	0,3	6 700	7 000	370	6 000	–
39,6	57,4	1	24 500	19 400	980	9 000	6 600
39,6	57,4	1	24 500	19 400	980	6 700	6 600
39,6	57,4	1	24 500	19 400	980	5 600	–
42	65	1	39 000	28 500	1 370	8 500	9 200
42	65	1	39 000	28 500	1 370	6 300	9 200
42	65	1	39 000	28 500	1 370	5 300	–
44	71	1,5	51 000	34 500	1 650	7 500	7 300
44	71	1,5	51 000	34 500	1 650	5 600	7 300
44	71	1,5	51 000	34 500	1 650	5 000	–
44	71	1,5	50 000	41 500	2 480	7 500	7 200
42	50	0,3	7 000	7 800	425	8 500	6 500
42	50	0,3	7 000	7 800	425	6 300	6 500
42	50	0,3	7 000	7 800	425	5 300	–
44,6	63,4	1	25 500	21 700	1 100	8 000	6 300
44,6	63,4	1	25 500	21 700	1 100	6 000	6 300
44,6	63,4	1	25 500	21 700	1 100	5 000	–
47	73	1	48 000	36 500	1 840	7 500	8 500
47	73	1	48 000	36 500	1 840	5 600	8 500
47	73	1	48 000	36 500	1 840	4 800	–
49	81	1,5	62 000	45 000	2 500	6 700	6 400
49	81	1,5	62 000	45 000	2 500	5 000	6 400
49	81	1,5	62 000	45 000	2 500	4 500	–
49	81	1,5	62 000	53 000	3 150	6 300	6 300

Angular contact ball bearings

Double row
Open or sealed
Split inner ring



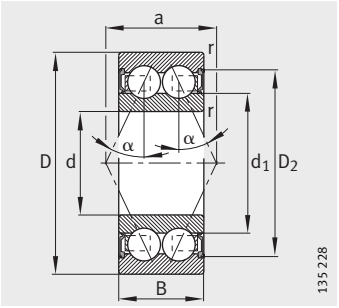
38..-B, 32..-B, 33..-B
α =25°



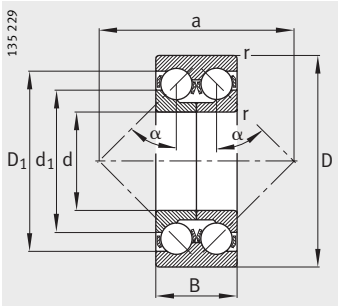
38..-B-2Z, 32..-B-2Z, 33..-B-2Z
α = 25°

Dimension table (continued) · Dimensions in mm

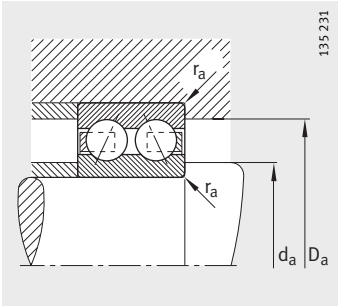
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3809-B-TVH	0,053	**45**	58	10	0,3	–	–	48,6	24,2
3809-B-2Z-TVH	0,053	**45**	58	10	0,3	–	–	48,6	24,2
3809-B-2RSR-TVH	0,053	**45**	58	10	0,3	–	–	48,6	24,2
3209-B-TVH	0,628	**45**	85	30,2	1,1	72,9	–	57,2	43
3209-B-2Z-TVH	0,64	**45**	85	30,2	1,1	–	75,5	57,2	43
3209-B-2RSR-TVH	0,64	**45**	85	30,2	1,1	–	75,5	57,2	43
3309-B-TVH	1,34	**45**	100	39,7	1,5	81,5	–	62,3	50
3309-B-2RSR-TVH	1,36	**45**	100	39,7	1,5	–	86,5	62	50
3309-DA	1,55	**45**	100	39,7	1,5	86,7	–	78,6	93
3810-B-TVH	0,07	**50**	65	12	0,3	–	–	55,1	27,1
3810-B-2Z-TVH	0,07	**50**	65	12	0,3	–	–	55,1	27,1
3810-B-2RSR-TVH	0,07	**50**	65	12	0,3	–	–	55,1	27,1
3210-B-TVH	0,68	**50**	90	30,2	1,1	77,9	–	62	45
3210-B-2Z-TVH	0,692	**50**	90	30,2	1,1	–	80,9	62	45
3210-B-2RSR-TVH	0,693	**50**	90	30,2	1,1	–	80,9	62	45
3310-B-TVH	1,8	**50**	110	44,4	2	89,5	–	68,3	55
3310-DA-MA	2,24	**50**	110	44,4	2	96,9	–	87,6	104
3811-B-TVH	0,09	**55**	72	13	0,3	–	–	61,9	30,7
3811-B-2Z-TVH	0,09	**55**	72	13	0,3	–	–	61,9	30,7
3811-B-2RSR-TVH	0,09	**55**	72	13	0,3	–	–	61,9	30,7
3211-B-TVH	0,954	**55**	100	33,3	1,5	85,3	–	69	50
3211-B-2RSR-TVH	0,969	**55**	100	33,3	1,5	–	89,1	68,7	50
3311-B-TVH	2,32	**55**	120	49,2	2	98,4	–	75,2	61
3311-B-2Z-TVH	2,36	**55**	120	49,2	2	–	105,2	75,2	61
3311-B-2RSR-TVH	2,35	**55**	120	49,2	2	–	105,2	75,2	61
3311-DA-MA	2,85	**55**	120	49,2	2	105,3	–	94,6	111



38..-B-2RSR, 32..-B-2RSR,
33..-B-2RSR
$\alpha = 45°$



33..-DA
Split inner ring
$\alpha = 45°$

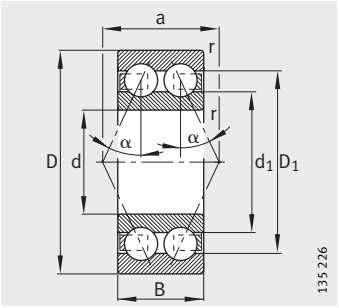


Mounting dimensions

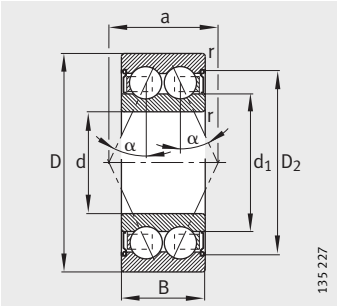
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
47	56	0,3	7 200	8 300	465	7 500	5 700
47	56	0,3	7 200	8 300	465	5 600	5 700
47	56	0,3	7 200	8 300	465	5 000	–
52	78	1	48 000	37 500	1 800	6 700	7 800
52	78	1	48 000	37 500	1 800	5 000	7 800
52	78	1	48 000	37 500	1 800	4 500	–
54	91	1,5	68 000	51 000	2 750	6 000	6 000
54	91	1,5	68 000	51 000	2 950	4 000	–
54	91	1,5	75 000	64 000	3 400	6 000	5 800
52	63	0,3	8 700	10 400	580	7 000	5 600
52	63	0,3	8 700	10 400	580	5 300	5 600
52	63	0,3	8 700	10 400	580	4 500	–
57	83	1	51 000	42 500	2 120	6 300	7 100
57	83	1	51 000	42 500	2 120	4 800	7 100
57	83	1	51 000	42 500	2 120	4 000	–
61	99	2	81 500	62 000	3 450	5 300	5 700
61	99	2	90 000	85 000	5 200	5 300	5 500
57	70	0,3	12 100	15 700	880	6 300	5 100
57	70	0,3	12 100	15 700	880	4 500	5 100
57	70	0,3	12 100	15 700	880	4 300	–
64	91	1,5	58 500	49 000	2 390	5 600	6 600
64	91	1,5	58 500	49 000	2 390	3 800	–
66	109	2	102 000	78 000	4 250	5 000	5 400
66	109	2	102 000	78 000	4 250	3 800	5 400
66	109	2	102 000	78 000	4 250	3 400	–
66	109	2	110 000	100 000	5 400	5 000	5 200

Angular contact ball bearings

Double row
Open or sealed
Split inner ring



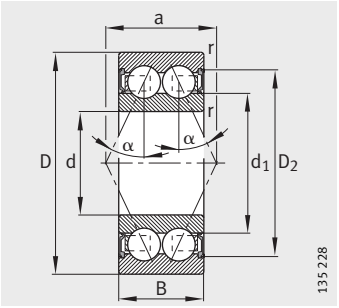
38..-B, 32..-B, 33..-B
α =25°



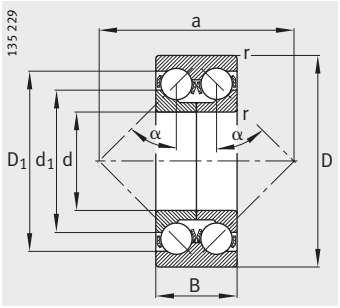
38..-B-2Z, 32..-B-2Z
α = 25°

Dimension table (continued) · Dimensions in mm

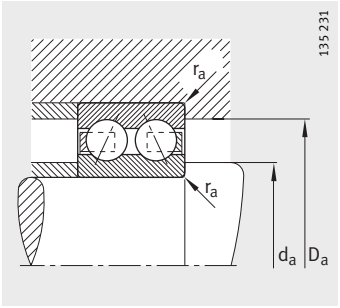
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3812-B-TVH	0,14	**60**	78	14	0,3	–	–	65,9	33,2
3812-B-2Z-TVH	0,14	**60**	78	14	0,3	–	–	65,9	33,2
3812-B-2RSR-TVH	0,14	**60**	78	14	0,3	–	–	65,9	33,2
3212-B-TVH	1,27	**60**	110	36,5	1,5	94,5	–	75,8	55
3212-B-2Z-TVH	1,29	**60**	110	36,5	1,5	–	98,6	75,8	55
3212-B-2RSR-TVH	1,29	**60**	110	36,5	1,5	–	98,6	75,8	55
3312-B-TVH	2,92	**60**	130	54	2,1	108,7	–	81,6	67
3312-B-2RSR-TVH	2,92	**60**	130	54	2,1	–	113,1	81,6	67
3312-DA	3,39	**60**	130	54	2,1	115,8	–	101,7	122
3813-B-TVH	0,16	**65**	85	15	0,6	–	–	71,2	36,2
3813-B-2Z-TVH	0,16	**65**	85	15	0,6	–	–	71,2	36,2
3813-B-2RSR-TVH	0,16	**65**	85	15	0,6	–	–	71,2	36,2
3213-B-TVH	1,64	**65**	120	38,1	1,5	103,9	–	84,8	60
3213-B-2RSR-TVH	1,66	**65**	120	38,1	1,5	–	107,2	84,5	60
3313-B-TVH	3,63	**65**	140	58,7	2,1	117,6	–	88,6	71
3313-DA	4,38	**65**	140	58,7	2,1	124,3	–	110,2	131
3814-B-TVH	0,19	**70**	90	15	0,6	–	–	76,5	38,5
3814-B-2Z-TVH	0,19	**70**	90	15	0,6	–	–	76,5	38,5
3814-B-2RSR-TVH	0,19	**70**	90	15	0,6	–	–	76,5	38,5
3214-B-TVH	1,8	**70**	125	39,7	1,5	106,3	–	87	62
3314	5,03	**70**	150	63,5	2,1	131,9	–	98,5	109
3314-DA	5,36	**70**	150	63,5	2,1	132,4	–	118,2	141
3815-B-TVH	0,21	**75**	95	15	0,6	–	–	81,2	40,4
3815-B-2Z-TVH	0,21	**75**	95	15	0,6	–	–	81,2	40,4
3815-B-2RSR-TVH	0,21	**75**	95	15	0,6	–	–	81,2	40,4
3215-B-TVH	1,91	**75**	130	41,3	1,5	112,6	–	92,4	65
3315	6,07	**75**	160	68,3	2,1	141,2	–	105,5	117



38..-B-2RSR, 32..-B-2RSR,
33..-B-2RSR
$\alpha = 25°$



33..-DA
Split inner ring
$\alpha = 45°$

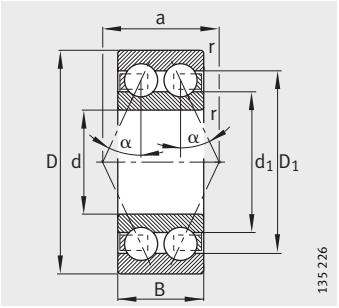


Mounting dimensions

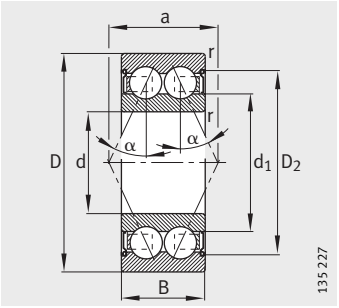
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
62	76	0,3	14 500	17 500	960	5 600	4 800
62	76	0,3	14 500	17 500	960	4 300	4 800
62	76	0,3	14 500	17 500	960	3 800	–
69	101	1,5	72 000	61 000	3 450	5 000	6 200
69	101	1,5	72 000	61 000	3 450	3 800	6 200
69	101	1,5	72 000	61 000	3 450	3 400	–
72	118	2,1	125 000	98 000	5 200	4 500	5 100
72	118	2,1	125 000	98 000	5 200	3 000	–
72	118	2,1	127 000	118 000	6 500	4 500	4 950
68,2	81,8	0,6	17 700	21 400	1 120	5 000	4 500
68,2	81,8	0,6	17 700	21 400	1 120	4 000	4 500
68,2	81,8	0,6	17 700	21 400	1 120	3 600	–
74	111	1,5	80 000	73 500	3 700	4 500	5 700
74	111	1,5	80 000	73 500	3 700	3 000	–
77	128	2,1	143 000	112 000	6 100	4 300	4 850
77	128	2,1	143 000	137 000	7 200	4 300	4 750
73,2	86,8	0,6	19 200	23 800	1 300	5 000	4 200
73,2	86,8	0,6	19 200	23 800	1 300	3 800	4 200
73,2	86,8	0,6	19 200	23 800	1 300	3 400	–
79	116	1,5	83 000	76 500	4 000	4 500	5 500
82	138	2,1	163 000	167 000	8 800	4 000	4 500
82	138	2,1	163 000	156 000	8 200	4 000	4 550
78,2	91,8	0,6	19 400	24 400	1 370	4 800	3 950
78,2	91,8	0,6	19 400	24 400	1 370	3 600	3 950
78,2	91,8	0,6	19 400	24 400	1 370	3 200	–
89,3	116,6	1,5	91 500	85 000	4 250	4 300	5 300
87	148	2,1	185 000	192 000	9 700	3 800	4 350

Angular contact ball bearings

Double row
Open or sealed



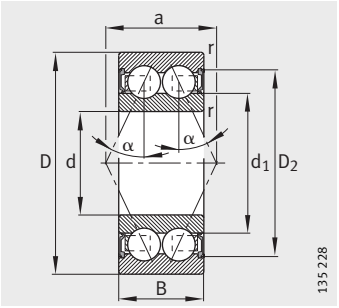
38..-B, 32..-B
$\alpha = 25°$



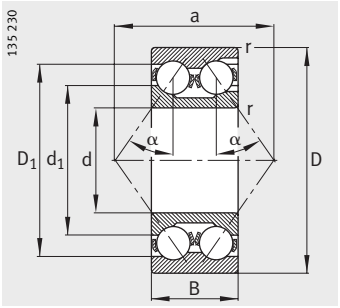
38..-B-2Z, 32..-B-2Z
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

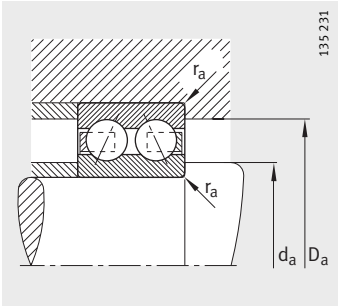
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	a
	≈kg				min.	≈	≈	≈	≈
3816-B-TVH	0,23	**80**	100	15	0,6	–	–	85,5	42,2
3816-B-2Z-TVH	0,23	**80**	100	15	0,6	–	–	85,5	42,2
3816-B-2RSR-TVH	0,23	**80**	100	15	0,6	–	–	85,5	42,2
3216-B-TVH	2,45	**80**	140	44,4	2	120,3	–	98,5	69
3216-B-2Z-TVH	2,48	**80**	140	44,4	2	–	125,4	98,5	69
3316	7,26	**80**	170	68,3	2,1	149,7	–	111,8	123
3217	3,44	**85**	150	49,2	2	135,1	–	108,5	106
3317-M	8,78	**85**	180	73	3	160	–	119,6	131
3218	4,22	**90**	160	52,4	2	143,7	–	115,6	113
3318	9,23	**90**	190	73	3	168,2	–	126,1	136
3219-M	5,31	**95**	170	55,6	2,1	152,8	–	122,2	120
3319-M	11,4	**95**	200	77,8	3	177,3	–	133	143
3220	6,19	**100**	180	60,3	2,1	163,7	–	131	127
3320-M	14,6	**100**	215	82,6	3	188,7	–	142,5	153
3221-M	7,78	**105**	190	65,1	2,1	172,9	–	138	135
3222-M	9,23	**110**	200	69,8	2,1	180,1	–	143,3	144
3322-M	20	**110**	240	92,1	3	209,6	–	161,5	171



38..-B-2RSR
$\alpha = 25°$



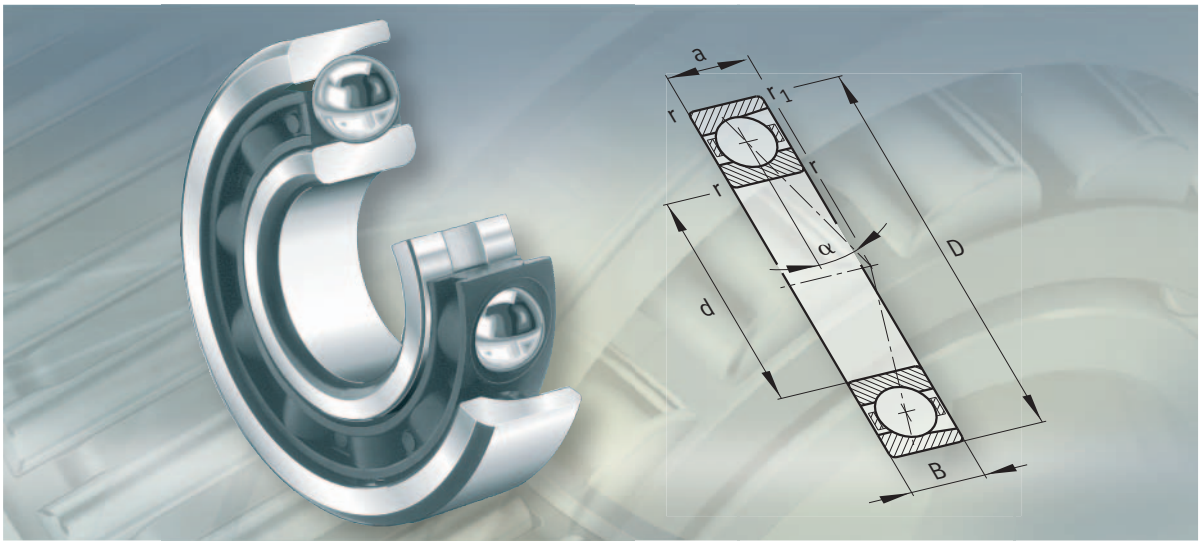
32, 33
$\alpha = 35°$



Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	max.	N	N	N	min^{-1}	min^{-1}
83,2	96,8	0,6	19 600	25 500	1 420	4 500	3 650
83,2	96,8	0,6	19 600	25 500	1 420	3 400	3 650
83,2	96,8	0,6	19 600	25 500	1 420	3 000	–
91	129	2	98 000	93 000	4 950	4 000	5 100
91	129	2	98 000	93 000	4 950	3 000	5 100
92	158	2,1	209 000	213 000	11 500	3 600	3 950
96	139	2	126 000	151 000	7 300	3 800	4 750
99	166	2,5	223 000	229 000	10 900	3 400	3 750
104	146	2	140 000	169 000	7 900	3 600	4 550
104	176	2,5	245 000	275 000	12 800	3 200	3 400
107	158	2,1	156 000	186 000	8 600	3 400	4 400
109	186	2,5	260 000	285 000	12 900	3 200	3 250
112	168	2,1	181 000	224 000	10 000	3 200	4 200
114	201	2,5	270 000	320 000	13 900	3 000	3 000
117	178	2,1	213 000	247 000	11 100	3 200	4 000
122	188	2,1	229 000	280 000	12 100	3 000	3 800
124	226	2,5	320 000	385 000	16 000	2 600	2 700

FAG



Spindle bearings

Spindle bearings

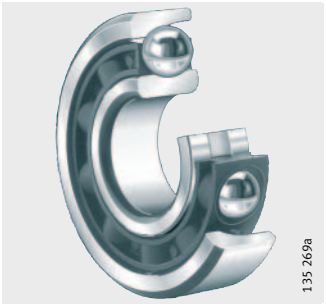


		Page
Product overview	Spindle bearings	272
Features	Radial and axial load capacity	273
	Standard spindle bearings	273
	High speed spindle bearings	273
	X-life ultra bearings	273
	Universal designs	274
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	Suffixes	274
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	Equivalent static bearing load	277
	Static load safety factor	277
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	Spindle bearings with ceramic balls	294
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	High speed spindle bearings with ceramic balls, sealed	308

Product overview Spindle bearings

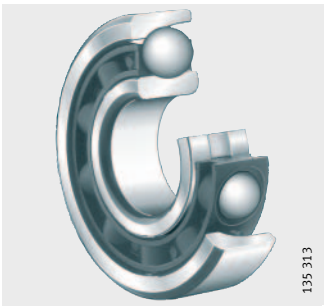
Standard spindle bearings

B719, B70, B72



With ceramic balls

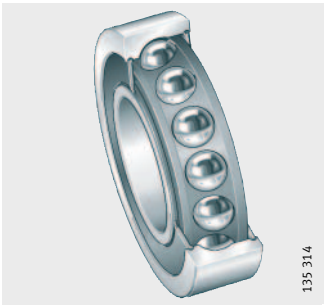
HCB719, HCB70, HCB72



High speed spindle bearings

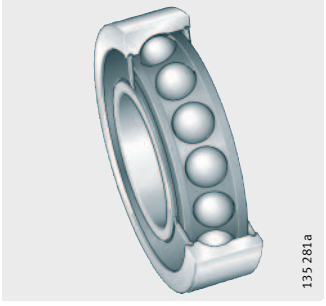
Sealed

HSS719, HSS70



With ceramic balls, sealed

HCS719, HCS70



Spindle bearings



Features

Spindle bearings are single row angular contact ball bearings, comprising solid inner and outer rings and ball and cage assemblies with solid window cages. They cannot be dismantled. The bearings are available in open and sealed designs.

Spindle bearings have restricted tolerances. They are particularly suitable for bearing arrangements with very high requirements for guidance accuracy and suitability for high speeds. They have proved extremely suitable for spindle bearing arrangements in machine tools.

Radial and axial load capacity

The bearings can support axial forces in one direction as well as radial forces. Spindle bearings used in an O or X arrangement can support axial forces in both directions and moments. Bearings in a tandem arrangement can only support axial loads in one direction.

Spindle bearings are available with a contact angle $\alpha = 15°$ (suffix C) or $\alpha = 25°$ (suffix E).

Standard spindle bearings

Standard spindle bearings B70, B719 and B72 have steel balls.

With ceramic balls

Spindle bearings HCB70, HCB719 and HCB72 have balls in standard sizes made from ceramic (hybrid bearings).

Sealing/lubrication

Spindle bearings B70..-2RSD, B719..-2RSD, B72..-2RSD, HCB70..-2RSD, HCB719..-2RSD and HCB72..-2RSD are sealed on both sides by gap seals. They are greased with a FAG polycarbamide grease and are maintenance-free.

High speed spindle bearings

High speed spindle bearings HSS70 and HSS719 have smaller steel balls.

With ceramic balls

High speed spindle bearings HCS70 and HCS719 with ceramic balls (hybrid bearings) are also available.

These four series thus achieve higher speeds, have lower friction and heat generation, place less strain on the lubricant and have a longer operating life.

Sealing/lubrication

The bearings are sealed on both sides by gap seals. They are greased with a FAG polycarbamide grease and are maintenance-free.

Unsealed bearings of series HS70 and HS719 as well as HC70 and HC719 are also available.

X-life ultra bearings

X-life ultra bearings have bearing rings made from a corrosion-resistant steel that contains nitrogen and has a particularly fine structure (prefix X) and ceramic balls. They fulfil very high requirements for speed and load carrying capacity. The bearings have longer life compared to conventional bearings. Most series of spindle bearings are available as X-life ultra bearings.

For a more detailed description, see Catalogue AC 41 130 Super Precision Bearings.

Spindle bearings

Universal designs

Spindle bearings of universal design are intended for mounting in pairs or groups in X, O or tandem arrangements.

Bearings with the suffix UL are designed for slight preload in an X or O arrangement.

Caution! The preload is altered by mounting and the operating conditions.

Ordering data

When ordering, the number of individual bearings must be stated.

Operating temperature

Caution! The bearings are suitable for operating temperatures from –30 °C to +100 °C, restricted by the seal and cage material.

The operating temperature must be taken into consideration when selecting the lubricant.

Cages

Spindle bearings have solid window cages made from laminated fabric or high performance plastic (suffix T). The cage is guided on the outer ring.

Caution! Check the chemical resistance of the seal or cage material to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of the cages and seals at high temperatures.

The oil change intervals must be observed.

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffixes	Description
C	Contact angle 15°
E	Contact angle 25°
H	High preload[1)]
L	Slight preload[1)]
M	Moderate preload[1)]
P4S	Tolerance class P4S
T	Solid window cage made from hard fabric or high performance plastic
UL	Universal design, for example for fitting in pairs, bearing pair has slight preload in O and X arrangement[1)]
2RSD	Spindle bearing with sealing shields on both sides (in series B and HCB)

1) For preload values, see Catalogue AC 41 130, Super Precision Bearings.

Design and safety guidelines
Equivalent dynamic bearing load



For bearings under dynamic loading, the following applies:

Bearings with contact angle 15°

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = 0{,}44 \cdot F_r + Y \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load
e, Y –
Factors: see table.

Factors e and Y

$\frac{f_0 \cdot F_a}{i \cdot C_{0r}}$	Factors	
	e	Y
0,3	0,4	1,4
0,5	0,43	1,31
0,9	0,45	1,23
1,6	0,48	1,16
3	0,52	1,08
6	0,56	1

f_0 –
Factor: see table, page 276
i –
Number of bearings supporting axial load
C_{0r} N
Basic static load rating according to dimension tables.

Bearings with contact angle 25°

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq 0{,}68$	$P = F_r$
$\frac{F_a}{F_r} > 0{,}68$	$P = 0{,}41 \cdot F_r + 0{,}87 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Factor f_0 for bearings with contact angle 15°

Bore code	Factor f_0				
	B70..-C HCB70..-C	B719..-C HCB719..-C	B72..-C HCB72..-C	HSS70..-C HCS70..-C	HSS719..-C HCS719..-C
00	12,6	14,2	12,3	15,5	15,3
01	13,2	14,7	12,9	15,5	15,7
02	14,1	14,5	13,6	15,8	15,8
03	14,3	14,8	13,9	15,9	16
04	14,3	14,2	13,8	16,1	16,2
05	14,9	14,9	14,4	16,2	16,5
06	15,1	15,4	14,3	16,3	16,4
07	15,4	15,9	14,6	16,5	16,4
08	15,7	15,5	14,2	16,5	16,2
09	15,5	15,8	14,2	16,5	16,3
10	15,7	16	14,4	16,5	16,2
11	15,5	16	14,5	16,5	16,1
12	15,6	16,2	14,4	16,4	16,2
13	15,9	16,4	14,5	16,4	16,1
14	15,6	16,2	14,6	16,4	16,1
15	15,8	16,3	14,8	16,3	16,1
16	15,7	16,4	14,8	16,3	16,1
17	15,9	16,3	14,9	16,3	16
18	15,7	16,4	14,8	16,3	16
19	15,9	16,4	14,9	16,3	15,9
20	16	16,5	14,5	16,2	16
21	15,9	16,4	14,5	16,3	15,9
22	15,8	16,4	14,5	16,2	16
24	16	16,4	14,9	16,3	15,9
26	15,9	16,4	14,7	16,2	15,9
28	16	16,4	15	–	–
30	16	16,3	15,3	–	–
32	16,2	16,4	15,3	–	–
34	15,9	16,5	15,4	–	–
36	15,7	16,4	15,4	–	–
38	15,9	16,4	15,2	–	–
40	15,8	16,2	15,4	–	–
44	15,7	16,4	15,3	–	–
48	15,9	16,5	–	–	–

Equivalent static bearing load

For bearings under static loading, the following applies:



Bearings with contact angle 15°

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leqq 1{,}09$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 1{,}09$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}46 \cdot F_{0a}$

Bearings with contact angle 25°

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leqq 1{,}3$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 1{,}3$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}38 \cdot F_{0a}$

Static load safety factor

In order to achieve sufficiently smooth running, a static load safety factor $S_0 > 3$ is necessary.

$$S_0 = \frac{C_{0r}}{P_0}$$

C_{0r} N
Basic static load rating according to dimension tables.
If using several bearings, $C_{0r} = i \cdot C_{0r\ single\ bearing}$, i = number of single bearings

P_0 N
Equivalent static load.

Speeds

The speeds of the bearing arrangements are dependent on:

- the preload of the bearings
- the elastic or rigid arrangement of the bearings in the spindle
- mounting as single bearings or in pairs
- the lubricants
- the cooling of the bearings.

Caution! The speeds stated in the dimension tables are guide values for single bearings under elastic preload and low loads.

The limiting speeds n_G in the dimension tables apply for lubrication with grease or for minimal quantity lubrication with oil and must not be exceeded.

For a more detailed description, see Catalogue AC 41 130, Super Precision Bearings.

Bearing sets

Universal bearings of the same sort (same bore and outside diameter) are available as sets. They can be used in any arrangement (O, X, tandem) as shown on page 278, *Figure 1* to *Figure 3*.

Sets with slight preload have the following designations:

- duplex; suffix DUL (2 bearings)
- triplex; suffix TUL (3 bearings)
- quadruplex; suffix QUL (4 bearings).

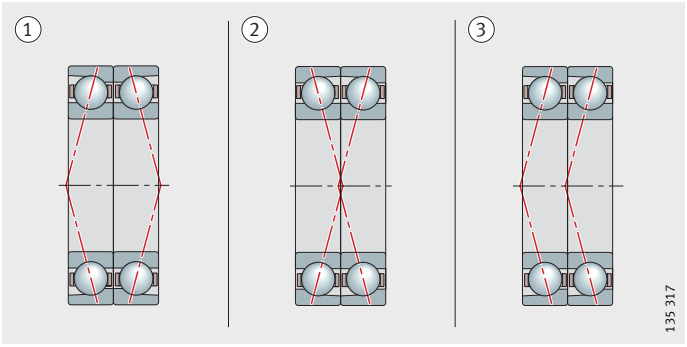
Ordering data When ordering bearings, the number of sets must be stated, not the number of single bearings.

Spindle bearings

Ready-to-fit bearing sets

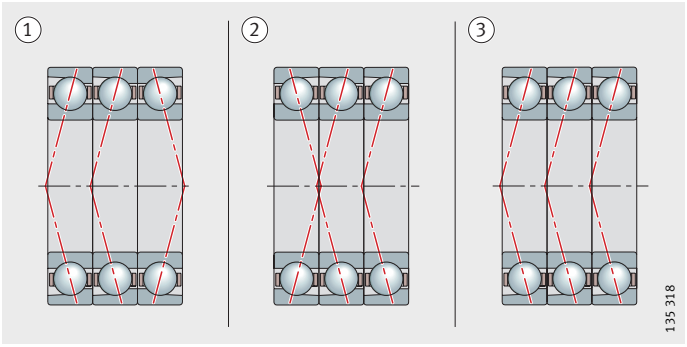
In ready-to-fit bearing sets, the bearings are supplied for use in a specifically defined arrangement.

Caution! The bearings must be fitted in the arrangement ordered.



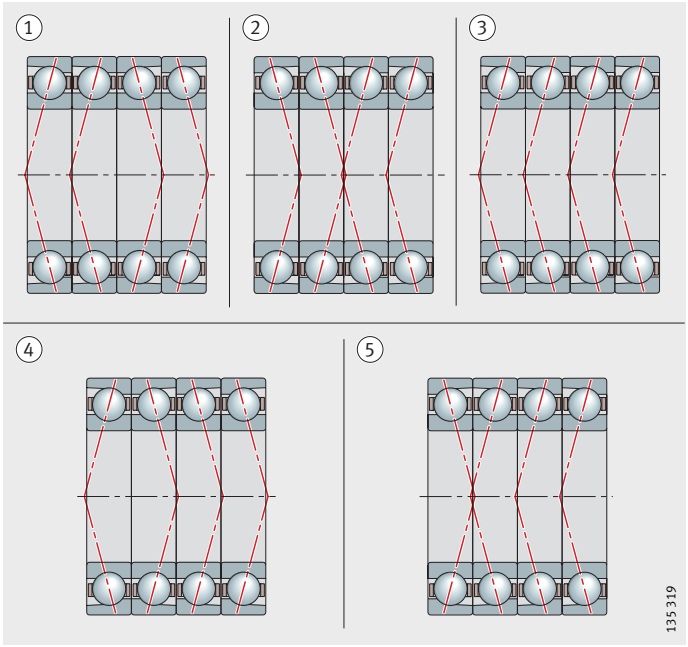
① DBL, O arrangement
② DFL, X arrangement
③ DTL, tandem arrangement

Figure 1
Sets of 2 bearings



① TBTL, combination of O arrangement and tandem arrangement
② TFTL, combination of X arrangement and tandem arrangement
③ TTL, tandem arrangement

Figure 2
Sets of 3 bearings



① QBCL, O arrangement
② QFCL, X arrangement
③ QTL, tandem arrangement
④ QBTL, combination of O arrangement and tandem arrangement
⑤ QFTL, combination of X arrangement and tandem arrangement

Figure 3
Sets of 4 bearings

Ordering example

1-HSS7012-C-T-P4S-DBL
Description: two spindle bearings in O arrangement, slight preload.

Accuracy

The main dimensions of the bearings conform to DIN 628-1.
The dimensional tolerances of the bearings correspond to tolerance class P4, the running tolerances correspond to tolerance class P2 to DIN 620-2.

Deviations from the nominal dimensions for the bore, outside diameter and bearing width are indicated on the end faces of the inner and outer rings and on the packaging, where they are stated in the sequence “bore/outside diameter/bearing width”.



Inner ring tolerances

Bore d mm		Bore deviation Δ_{dmp} µm		Width deviation Δ_{Bs} µm		Width variation V_{Bs} µm	Radial runout K_{ia} µm	Axial runout	
								S_d µm	S_{ia} µm
over	incl.								
–	10	0	−4	0	−100	1,5	1,5	1,5	1,5
10	18	0	−4	0	−100	1,5	1,5	1,5	1,5
18	30	0	−5	0	−120	1,5	2,5	1,5	2,5
30	50	0	−6	0	−120	1,5	2,5	1,5	2,5
50	80	0	−7	0	−150	1,5	2,5	1,5	2,5
80	120	0	−8	0	−200	2,5	2,5	2,5	2,5
120	150	0	−10	0	−250	2,5	2,5	2,5	2,5
150	180	0	−10	0	−250	4	5	4	5
180	250	0	−12	0	−300	5	5	5	5

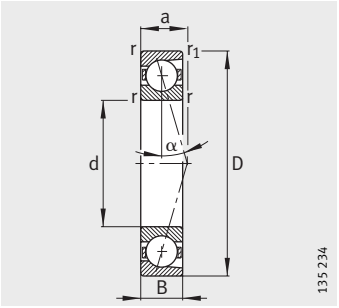
Outer ring tolerances

Outside diameter D mm		Outside diameter deviation Δ_{Dmp} µm		Width variation V_{Cs} µm	Radial runout K_{ea} µm	Axial runout	
						S_D µm	S_{ea} µm
over	incl.						
18	30	0	−5	1,5	2,5	1,5	2,5
30	50	0	−6	1,5	2,5	1,5	2,5
50	80	0	−7	1,5	4	1,5	4
80	120	0	−8	2,5	5	2,5	5
120	150	0	−9	2,5	5	2,5	5
150	180	0	−10	2,5	5	2,5	5
180	250	0	−11	4	7	4	7
250	315	0	−13	5	7	5	7
315	400	0	−15	7	8	7	8

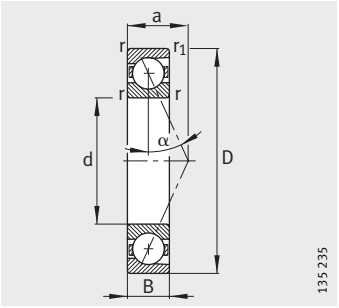
The width deviation Δ_{Cs} is identical to Δ_{Bs} of the corresponding inner ring.

Spindle bearings

With steel balls



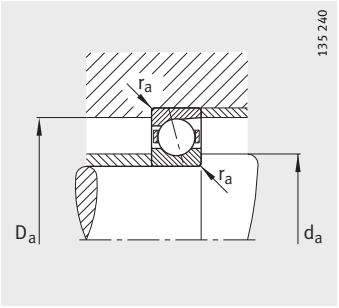
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



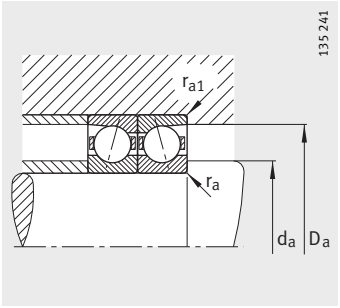
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71900-C-T-P4S	0,009	**10**	22	6	0,3	0,3	5
B71900-E-T-P4S	0,009	**10**	22	6	0,3	0,3	7
B7000-C-T-P4S	0,019	**10**	26	8	0,3	0,3	6
B7000-E-T-P4S	0,019	**10**	26	8	0,3	0,3	8
B7200-C-T-P4S	0,031	**10**	30	9	0,6	0,6	7
B7200-E-T-P4S	0,031	**10**	30	9	0,6	0,6	9
B71901-C-T-P4S	0,01	**12**	24	6	0,3	0,3	5
B71901-E-T-P4S	0,01	**12**	24	6	0,3	0,3	7
B7001-C-T-P4S	0,021	**12**	28	8	0,3	0,3	5
B7001-E-T-P4S	0,021	**12**	28	8	0,3	0,3	6
B7201-C-T-P4S	0,038	**12**	32	10	0,6	0,6	8
B7201-E-T-P4S	0,037	**12**	32	10	0,6	0,6	10
B71902-C-T-P4S	0,015	**15**	28	7	0,3	0,3	6
B71902-E-T-P4S	0,015	**15**	28	7	0,3	0,3	9
B7002-C-T-P4S	0,03	**15**	32	9	0,3	0,3	8
B7002-E-T-P4S	0,03	**15**	32	9	0,3	0,3	10
B7202-C-T-P4S	0,044	**15**	35	11	0,6	0,6	9
B7202-E-T-P4S	0,044	**15**	35	11	0,6	0,6	11
B71903-C-T-P4S	0,017	**17**	30	7	0,3	0,3	7
B71903-E-T-P4S	0,017	**17**	30	7	0,3	0,3	9
B7003-C-T-P4S	0,039	**17**	35	10	0,3	0,3	9
B7003-E-T-P4S	0,039	**17**	35	10	0,3	0,3	11
B7203-C-T-P4S	0,066	**17**	40	12	0,6	0,6	10
B7203-E-T-P4S	0,066	**17**	40	12	0,6	0,6	13
B71904-C-T-P4S	0,036	**20**	37	9	0,3	0,3	8
B71904-E-T-P4S	0,036	**20**	37	9	0,3	0,3	11
B7004-C-T-P4S	0,068	**20**	42	12	0,6	0,6	10
B7004-E-T-P4S	0,068	**20**	42	12	0,6	0,6	13
B7204-C-T-P4S	0,105	**20**	47	14	1	1	12
B7204-E-T-P4S	0,105	**20**	47	14	1	1	15
B71905-C-T-P4S	0,042	**25**	42	9	0,3	0,3	9
B71905-E-T-P4S	0,042	**25**	42	9	0,3	0,3	12
B7005-C-T-P4S	0,081	**25**	47	12	0,6	0,6	11
B7005-E-T-P4S	0,081	**25**	47	12	0,6	0,6	14
B7205-C-T-P4S	0,13	**25**	52	15	1	1	13
B7205-E-T-P4S	0,13	**25**	52	15	1	1	17



Mounting dimensions

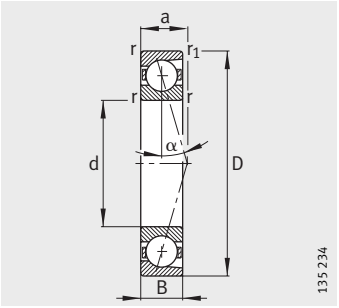


Mounting dimensions

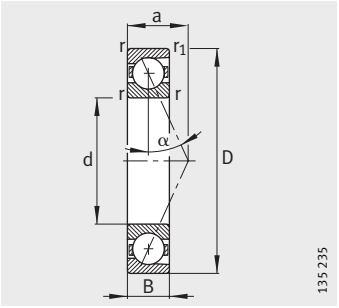
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
13	19,5	0,3	0,3	3 000	1 530	110	70 000	110 000
13	19,5	0,3	0,3	2 900	1 460	105	63 000	95 000
14	22	0,3	0,1	4 250	2 080	151	60 000	90 000
14	22	0,3	0,1	4 050	2 000	145	56 000	85 000
14,5	25,5	0,6	0,6	5 850	2 900	305	53 000	80 000
14,5	25,5	0,6	0,6	5 600	2 800	295	48 000	70 000
15	21,5	0,3	0,3	3 350	1 860	135	60 000	90 000
15	21,5	0,3	0,3	3 200	1 760	128	56 000	85 000
16,5	24,5	0,3	0,1	4 750	2 600	188	56 000	85 000
16,5	24,5	0,3	0,1	4 550	2 500	180	50 000	75 000
16,5	27,5	0,6	0,6	7 650	3 900	400	50 000	75 000
16,5	27,5	0,6	0,6	7 350	3 750	385	45 000	67 000
18	25,5	0,3	0,3	5 000	2 900	209	50 000	75 000
18	25,5	0,3	0,3	4 800	2 750	200	45 000	67 000
19	29	0,3	0,1	6 200	3 400	248	48 000	70 000
19	29	0,3	0,1	6 000	3 250	237	43 000	63 000
19,5	30,5	0,6	0,6	9 650	5 000	520	45 000	67 000
19,5	30,5	0,6	0,6	9 300	4 800	510	40 000	60 000
20	27,5	0,3	0,3	5 300	3 150	229	48 000	70 000
20	27,5	0,3	0,3	5 000	3 000	219	43 000	63 000
21	32	0,3	0,1	8 650	4 900	360	43 000	63 000
21	32	0,3	0,1	8 300	4 750	345	38 000	56 000
22,5	34,5	0,6	0,6	10 800	5 850	600	38 000	56 000
22,5	34,5	0,6	0,6	10 400	5 600	580	36 000	53 000
24	33,5	0,3	0,3	7 350	4 550	330	38 000	56 000
24	33,5	0,3	0,3	6 950	4 400	315	36 000	53 000
25	37	0,6	0,3	10 400	6 000	435	36 000	53 000
25	37	0,6	0,3	10 000	5 700	415	32 000	48 000
26,5	40,5	1	1	14 600	8 150	820	32 000	48 000
26,5	40,5	1	1	14 000	7 800	790	30 000	45 000
29	38,5	0,3	0,3	8 150	5 700	415	32 000	48 000
29	38,5	0,3	0,3	7 800	5 500	395	30 000	45 000
30	42	0,6	0,3	14 600	9 150	660	30 000	45 000
30	42	0,6	0,3	13 700	8 650	640	28 000	43 000
31,5	45,5	1	1	15 600	9 300	950	28 000	43 000
31,5	45,5	1	1	15 000	9 000	910	26 000	40 000

Spindle bearings

With steel balls



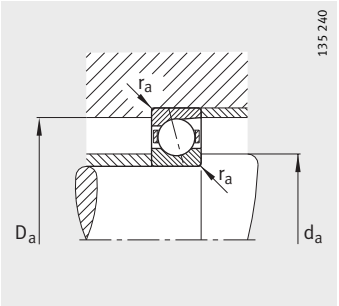
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



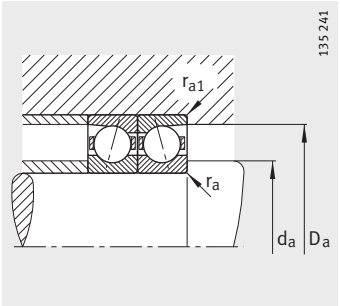
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71906-C-T-P4S	0,049	**30**	47	9	0,3	0,3	10
B71906-E-T-P4S	0,049	**30**	47	9	0,3	0,3	14
B7006-C-T-P4S	0,12	**30**	55	13	1	1	12
B7006-E-T-P4S	0,12	**30**	55	13	1	1	17
B7206-C-T-P4S	0,197	**30**	62	16	1	1	14
B7206-E-T-P4S	0,196	**30**	62	16	1	1	19
B71907-C-T-P4S	0,083	**35**	55	10	0,6	0,6	11
B71907-E-T-P4S	0,082	**35**	55	10	0,6	0,6	16
B7007-C-T-P4S	0,159	**35**	62	14	1	1	14
B7007-E-T-P4S	0,159	**35**	62	14	1	1	18
B7207-C-T-P4S	0,28	**35**	72	17	1,1	1,1	16
B7207-E-T-P4S	0,279	**35**	72	17	1,1	1,1	21
B71908-C-T-P4S	0,113	**40**	62	12	0,6	0,6	13
B71908-E-T-P4S	0,113	**40**	62	12	0,6	0,6	18
B7008-C-T-P4S	0,196	**40**	68	15	1	1	15
B7008-E-T-P4S	0,195	**40**	68	15	1	1	20
B7208-C-T-P4S	0,376	**40**	80	18	1,1	1,1	17
B7208-E-T-P4S	0,375	**40**	80	18	1,1	1,1	23
B71909-C-T-P4S	0,127	**45**	68	12	0,6	0,6	14
B71909-E-T-P4S	0,127	**45**	68	12	0,6	0,6	19
B7009-C-T-P4S	0,24	**45**	75	16	1	1	16
B7009-E-T-P4S	0,24	**45**	75	16	1	1	22
B7209-C-T-P4S	0,401	**45**	85	19	1,1	1,1	18
B7209-E-T-P4S	0,4	**45**	85	19	1,1	1,1	25
B71910-C-T-P4S	0,132	**50**	72	12	0,6	0,6	14
B71910-E-T-P4S	0,132	**50**	72	12	0,6	0,6	20
B7010-C-T-P4S	0,259	**50**	80	16	1	1	17
B7010-E-T-P4S	0,258	**50**	80	16	1	1	23
B7210-C-T-P4S	0,455	**50**	90	20	1,1	1,1	19
B7210-E-T-P4S	0,453	**50**	90	20	1,1	1,1	26



Mounting dimensions

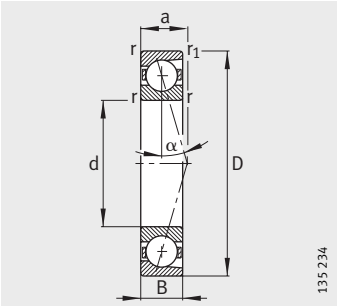


Mounting dimensions

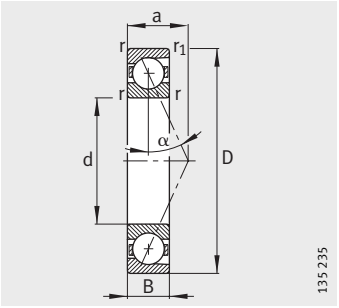
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
34	43,5	0,3	0,3	8 650	6 550	480	28 000	43 000
34	43,5	0,3	0,3	8 150	6 300	455	26 000	40 000
36	49	1	0,3	15 000	10 200	750	26 000	40 000
36	49	1	0,3	14 300	9 800	720	24 000	38 000
37,5	54,5	1	1	23 200	14 600	1 540	24 000	38 000
37,5	54,5	1	1	22 000	14 000	1 470	22 000	36 000
40	51,5	0,6	0,6	11 800	9 500	700	24 000	38 000
40	51,5	0,6	0,6	11 000	9 000	660	22 000	36 000
41	56	1	0,3	19 000	13 700	990	22 000	36 000
41	56	1	0,3	18 300	12 900	940	20 000	34 000
44	63	1	1	25 500	18 000	1 880	20 000	34 000
44	63	1	1	24 500	17 000	1 790	19 000	32 000
45	58,5	0,6	0,6	17 600	13 700	1 020	22 000	36 000
45	58,5	0,6	0,6	16 600	13 200	970	20 000	34 000
46	62	1	0,3	20 400	16 000	1 150	20 000	34 000
46	62	1	0,3	19 600	15 000	1 100	19 000	32 000
48	72	1	1	32 000	22 400	1 660	18 000	30 000
48	72	1	1	30 500	21 600	1 580	17 000	28 000
50	63,5	0,6	0,6	18 600	15 600	1 150	19 000	32 000
50	63,5	0,6	0,6	17 600	15 000	1 090	18 000	30 000
51	69	1	0,3	27 500	21 200	1 530	18 000	30 000
51	69	1	0,3	26 500	20 000	1 460	17 000	28 000
52,5	78	1	1	33 500	24 500	1 820	17 000	28 000
52,5	78	1	1	32 000	23 600	1 740	15 000	24 000
55	67,5	0,6	0,6	19 000	16 600	1 210	18 000	30 000
55	67,5	0,6	0,6	18 000	15 600	1 230	16 000	26 000
56	74	1	0,3	28 500	22 800	1 660	17 000	28 000
56	74	1	0,3	27 000	21 600	1 580	15 000	24 000
57	83	1	1	43 000	31 500	2 300	16 000	26 000
57	83	1	1	40 500	30 500	2 200	14 000	22 000

Spindle bearings

With steel balls



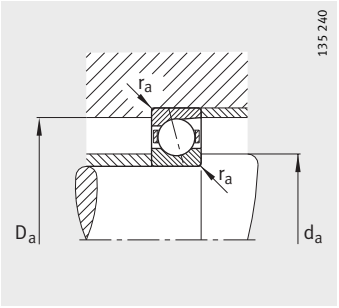
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



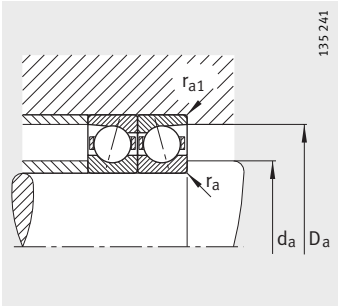
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71911-C-T-P4S	0,182	**55**	80	13	1	1	16
B71911-E-T-P4S	0,181	**55**	80	13	1	1	22
B7011-C-T-P4S	0,374	**55**	90	18	1,1	1,1	19
B7011-E-T-P4S	0,373	**55**	90	18	1,1	1,1	26
B7211-C-T-P4S	0,609	**55**	100	21	1,5	1,5	21
B7211-E-T-P4S	0,599	**55**	100	21	1,5	1,5	29
B71912-C-T-P4S	0,196	**60**	85	13	1	1	16
B71912-E-T-P4S	0,195	**60**	85	13	1	1	23
B7012-C-T-P4S	0,397	**60**	95	18	1,1	1,1	19
B7012-E-T-P4S	0,396	**60**	95	18	1,1	1,1	27
B7212-C-T-P4S	0,795	**60**	110	22	1,5	1,5	23
B7212-E-T-P4S	0,793	**60**	110	22	1,5	1,5	31
B71913-C-T-P4S	0,202	**65**	90	13	1	1	17
B71913-E-T-P4S	0,202	**65**	90	13	1	1	25
B7013-C-T-P4S	0,421	**65**	100	18	1,1	1,1	20
B7013-E-T-P4S	0,42	**65**	100	18	1,1	1,1	28
B7213-C-T-P4S	1,01	**65**	120	23	1,5	1,5	24
B7213-E-T-P4S	1,01	**65**	120	23	1,5	1,5	33
B71914-C-T-P4S	0,332	**70**	100	16	1	1	19
B71914-E-T-P4S	0,331	**70**	100	16	1	1	28
B7014-C-T-P4S	0,595	**70**	110	20	1,1	1,1	22
B7014-E-T-P4S	0,593	**70**	110	20	1,1	1,1	31
B7214-C-T-P4S	1,1	**70**	125	24	1,5	1,5	25
B7214-E-T-P4S	1,1	**70**	125	24	1,5	1,5	35
B71915-C-T-P4S	0,352	**75**	105	16	1	1	20
B71915-E-T-P4S	0,351	**75**	105	16	1	1	29
B7015-C-T-P4S	0,618	**75**	115	20	1,1	1,1	23
B7015-E-T-P4S	0,616	**75**	115	20	1,1	1,1	32
B7215-C-T-P4S	1,21	**75**	130	25	1,5	1,5	26
B7215-E-T-P4S	1,2	**75**	130	25	1,5	1,5	36



Mounting dimensions

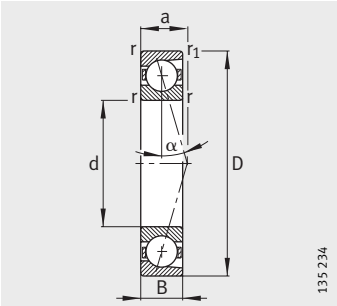


Mounting dimensions

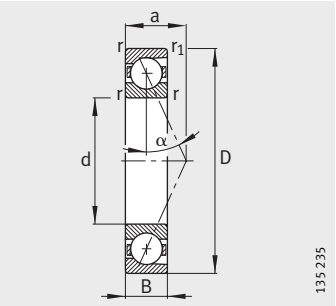
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
60	75,5	0,6	0,6	22 800	20 400	1 490	16 000	26 000
60	75,5	0,6	0,6	21 600	19 300	1 410	15 000	24 000
62	83	1	0,6	38 000	31 000	2 270	15 000	24 000
62	83	1	0,6	36 000	29 000	2 160	14 000	22 000
63	92	1,5	1,5	46 500	37 500	2 700	14 000	22 000
63	92	1,5	1,5	44 000	35 500	2 600	13 000	20 000
65	80,5	0,6	0,6	24 000	22 800	1 650	15 000	24 000
65	80,5	0,6	0,6	22 800	21 600	1 560	14 000	22 000
67	88	1	0,6	39 000	33 500	2 440	14 000	22 000
67	88	1	0,6	36 500	31 500	2 320	13 000	20 000
69,5	101,5	1,5	1,5	55 000	44 000	3 200	13 000	20 000
69,5	101,5	1,5	1,5	52 000	42 500	3 050	12 000	19 000
70	85,5	0,6	0,6	24 500	24 000	1 740	14 000	22 000
70	85,5	0,6	0,6	22 800	22 400	1 640	13 000	20 000
72	93	1	0,6	40 000	35 500	2 600	13 000	20 000
72	93	1	0,6	38 000	33 500	2 480	12 000	19 000
75,5	109,5	1,5	1,5	67 000	54 000	3 950	12 000	19 000
75,5	109,5	1,5	1,5	64 000	52 000	3 750	11 000	18 000
76	94,5	0,6	0,6	33 500	32 500	2 360	13 000	20 000
76	94,5	0,6	0,6	31 500	31 000	2 240	12 000	19 000
77	102	1	0,6	50 000	43 000	3 150	12 000	19 000
77	102	1	0,6	46 500	41 500	3 000	11 000	18 000
80	115	1,5	1,5	69 500	58 500	4 250	11 000	18 000
80	115	1,5	1,5	65 500	56 000	4 050	10 000	17 000
81	99,5	0,6	0,6	34 000	34 500	2 490	12 000	19 000
81	99,5	0,6	0,6	32 000	32 500	2 360	11 000	18 000
82	107	1	0,6	51 000	46 500	3 350	12 000	19 000
82	107	1	0,6	48 000	44 000	3 200	11 000	18 000
85	120	1,5	1,5	72 000	63 000	4 550	11 000	18 000
85	120	1,5	1,5	68 000	60 000	4 300	9 500	16 000

Spindle bearings

With steel balls



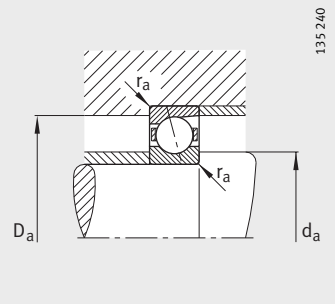
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



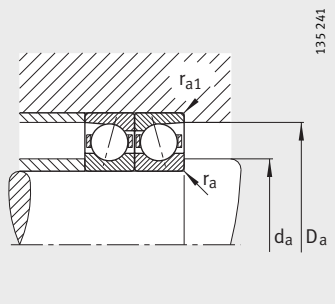
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71916-C-T-P4S	0,367	**80**	110	16	1	1	21
B71916-E-T-P4S	0,366	**80**	110	16	1	1	30
B7016-C-T-P4S	0,837	**80**	125	22	1,1	1,1	25
B7016-E-T-P4S	0,834	**80**	125	22	1,1	1,1	35
B7216-C-T-P4S	1,43	**80**	140	26	2	2	28
B7216-E-T-P4S	1,42	**80**	140	26	2	2	39
B71917-C-T-P4S	0,526	**85**	120	18	1,1	1,1	23
B71917-E-T-P4S	0,524	**85**	120	18	1,1	1,1	33
B7017-C-T-P4S	0,878	**85**	130	22	1,1	1,1	25
B7017-E-T-P4S	0,875	**85**	130	22	1,1	1,1	36
B7217-C-T-P4S	1,81	**85**	150	28	2	2	30
B7217-E-T-P4S	1,8	**85**	150	28	2	2	42
B71918-C-T-P4S	0,558	**90**	125	18	1,1	1,1	23
B71918-E-T-P4S	0,556	**90**	125	18	1,1	1,1	34
B7018-C-T-P4S	1,14	**90**	140	24	1,5	1,5	27
B7018-E-T-P4S	1,13	**90**	140	24	1,5	1,5	39
B7218-C-T-P4S	2,2	**90**	160	30	2	2	32
B7218-E-T-P4S	2,19	**90**	160	30	2	2	44
B71919-C-T-P4S	0,576	**95**	130	18	1,1	1,1	24
B71919-E-T-P4S	0,575	**95**	130	18	1,1	1,1	35
B7019-C-T-P4S	1,18	**95**	145	24	1,5	1,5	28
B7019-E-T-P4S	1,18	**95**	145	24	1,5	1,5	40
B7219-C-T-P4S	2,73	**95**	170	32	2,1	2,1	34
B7219-E-T-P4S	2,72	**95**	170	32	2,1	2,1	47
B71920-C-T-P4S	0,784	**100**	140	20	1,1	1,1	26
B71920-E-T-P4S	0,781	**100**	140	20	1,1	1,1	38
B7020-C-T-P4S	1,24	**100**	150	24	1,5	1,5	29
B7020-E-T-P4S	1,23	**100**	150	24	1,5	1,5	41
B7220-C-T-P4S	3,21	**100**	180	34	2,1	2,1	36
B7220-E-T-P4S	3,2	**100**	180	34	2,1	2,1	50



Mounting dimensions

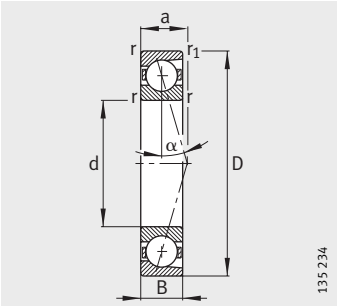


Mounting dimensions

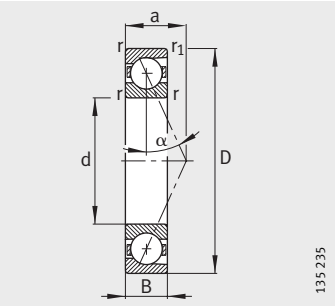
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
86	104	0,6	0,6	34 500	36 000	2 600	12 000	19 000
86	104	0,6	0,6	32 500	34 000	2 470	11 000	18 000
88	117	1	0,6	63 000	58 500	4 150	11 000	18 000
88	117	1	0,6	60 000	55 000	3 950	9 500	16 000
91	129	2	2	93 000	78 000	5 400	10 000	17 000
91	129	2	2	88 000	73 500	5 100	9 000	15 000
92	114	0,6	0,6	45 000	46 500	3 400	11 000	18 000
92	114	0,6	0,6	42 500	44 000	3 200	9 500	16 000
93	122	1	0,6	65 500	62 000	4 300	10 000	17 000
93	122	1	0,6	62 000	58 500	4 100	9 000	15 000
98	138	2	2	96 500	85 000	5 600	9 000	15 000
98	138	2	2	91 500	80 000	5 400	8 000	13 000
97	119	0,6	0,6	45 500	49 000	3 450	10 000	17 000
97	119	0,6	0,6	43 000	46 500	3 300	9 000	15 000
100	131	1,5	0,6	76 500	72 000	4 900	9 500	16 000
100	131	1,5	0,6	72 000	68 000	4 650	8 500	14 000
104	147	2	2	122 000	104 000	6 900	8 500	14 000
104	147	2	2	116 000	100 000	6 600	7 500	12 000
102	124	0,6	0,6	46 500	51 000	3 550	9 500	16 000
102	124	0,6	0,6	44 000	48 000	3 350	8 500	14 000
105	136	1,5	0,6	78 000	76 500	5 100	9 000	15 000
105	136	1,5	0,6	75 000	72 000	4 850	8 000	13 000
110,5	154	2	2	127 000	114 000	7 300	8 000	13 000
110,5	154	2	2	122 000	108 000	6 900	7 000	11 000
107	133	0,6	0,6	58 500	64 000	4 200	9 000	15 000
107	133	0,6	0,6	55 000	60 000	3 950	8 000	13 000
110	141	1,5	0,6	81 500	81 500	5 300	8 500	14 000
110	141	1,5	0,6	76 500	76 500	5 000	7 500	12 000
114,5	165,5	2,1	2,1	132 000	122 000	7 600	7 500	12 000
114,5	165,5	2,1	2,1	125 000	116 000	7 300	6 700	10 000

Spindle bearings

With steel balls



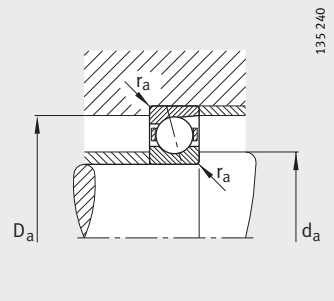
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



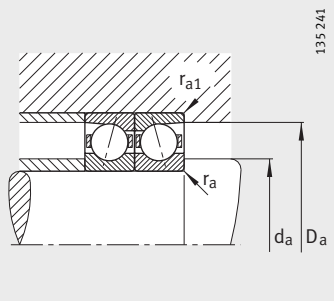
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71921-C-T-P4S	0,814	**105**	145	20	1,1	1,1	27
B71921-E-T-P4S	0,813	**105**	145	20	1,1	1,1	39
B7021-C-T-P4S	1,52	**105**	160	26	2	2	31
B7021-E-T-P4S	1,51	**105**	160	26	2	2	44
B7221-C-T-P4S	3,89	**105**	190	36	2,1	2,1	38
B7221-E-T-P4S	3,88	**105**	190	36	2,1	2,1	52
B71922-C-T-P4S	0,848	**110**	150	20	1,1	1,1	27
B71922-E-T-P4S	0,845	**110**	150	20	1,1	1,1	40
B7022-C-T-P4S	1,94	**110**	170	28	2	2	33
B7022-E-T-P4S	1,94	**110**	170	28	2	2	47
B7222-C-T-P4S	4,59	**110**	200	38	2,1	2,1	40
B7222-E-T-P4S	4,58	**110**	200	38	2,1	2,1	55
B71924-C-T-P4S	1,16	**120**	165	22	1,1	1,1	30
B71924-E-T-P4S	1,16	**120**	165	22	1,1	1,1	44
B7024-C-T-P4S	2,07	**120**	180	28	2	2	34
B7024-E-T-P4S	2,06	**120**	180	28	2	2	49
B7224-C-T-P4S	5,29	**120**	215	40	2,1	2,1	43
B7224-E-T-P4S	5,27	**120**	215	40	2,1	2,1	59
B71926-C-T-P4S	1,52	**130**	180	24	1,5	1,5	33
B71926-E-T-P4S	1,52	**130**	180	24	1,5	1,5	48
B7026-C-T-P4S	3,15	**130**	200	33	2	2	39
B7026-E-T-P4S	3,14	**130**	200	33	2	2	55
B7226-C-T-P4S	6,1	**130**	230	40	3	3	44
B7226-E-T-P4S	6,08	**130**	230	40	3	3	62
B71928-C-T-P4S	1,63	**140**	190	24	1,5	1,5	34
B71928-E-T-P4S	1,62	**140**	190	24	1,5	1,5	50
B7028-C-T-P4S	3,34	**140**	210	33	2	2	40
B7028-E-T-P4S	3,33	**140**	210	33	2	2	57
B7228-C-T-P4S	7,87	**140**	250	42	3	3	47
B7228-E-T-P4S	7,85	**140**	250	42	3	3	66
B71930-C-T-P4S	2,49	**150**	210	28	2	1	38
B71930-E-T-P4S	2,49	**150**	210	28	2	1	56
B7030-C-T-P4S	3,99	**150**	225	35	2,1	2,1	43
B7030-E-T-P4S	3,98	**150**	225	35	2,1	2,1	61
B7230-C-T-P4S	10,1	**150**	270	45	3	3	51
B7230-E-T-P4S	10,1	**150**	270	45	3	3	71



Mounting dimensions

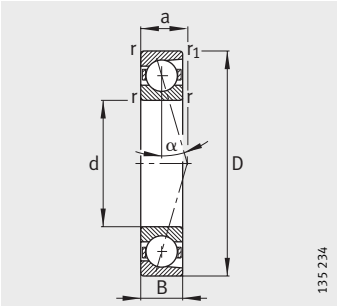


Mounting dimensions

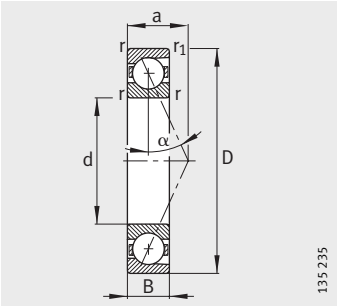
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
112	138	0,6	0,6	58 500	64 000	4 150	8 500	14 000
112	138	0,6	0,6	55 000	60 000	3 900	7 500	12 000
116	150	2	1	83 000	85 000	5 400	8 000	13 000
116	150	2	1	78 000	81 500	5 200	7 000	11 000
120,5	174,5	2,1	2,1	163 000	146 000	8 800	7 000	11 000
120,5	174,5	2,1	2,1	156 000	140 000	8 400	6 300	9 500
117	143	0,6	0,6	58 500	67 000	4 250	8 000	13 000
117	143	0,6	0,6	56 000	63 000	4 000	7 500	12 000
121	159	2	1	110 000	110 000	6 700	7 500	12 000
121	159	2	1	104 000	104 000	6 400	6 700	10 000
126,5	183,5	2,1	2,1	163 000	150 000	8 700	6 700	10 000
126,5	183,5	2,1	2,1	153 000	143 000	8 300	6 000	9 000
128	157	0,6	0,6	73 500	85 000	5 100	7 000	11 000
128	157	0,6	0,6	69 500	80 000	4 850	6 700	10 000
131	169	2	1	112 000	116 000	6 900	6 700	10 000
131	169	2	1	106 000	110 000	6 500	6 300	9 500
140	195	2,1	2,1	204 000	196 000	11 000	6 000	9 000
140	195	2,1	2,1	196 000	186 000	10 500	5 300	8 000
139	171	0,6	0,6	71 000	81 500	4 750	6 700	10 000
139	171	0,6	0,6	67 000	75 000	4 500	6 000	9 000
142	189	2	1	143 000	150 000	8 600	6 000	9 000
142	189	2	1	137 000	143 000	8 100	5 600	8 500
148	211,5	2,5	2,5	212 000	216 000	11 600	5 600	8 500
148	211,5	2,5	2,5	204 000	204 000	11 000	5 000	7 500
149	181	0,6	0,6	73 500	86 500	5 000	6 000	9 000
149	181	0,6	0,6	69 500	81 500	4 750	5 600	8 500
152	199	2	1	146 000	160 000	8 800	5 600	8 500
152	199	2	1	140 000	150 000	8 400	5 000	7 500
163	226,5	2,5	2,5	220 000	232 000	12 100	5 000	7 500
163	226,5	2,5	2,5	212 000	224 000	11 500	4 500	6 700
160	199	1	1	122 000	143 000	7 700	5 600	8 500
160	199	1	1	114 000	134 000	7 300	5 000	7 500
163	213	2,1	1	183 000	193 000	10 300	5 300	8 000
163	213	2,1	1	173 000	186 000	9 800	4 800	7 000
178	241,5	2,5	2,5	228 000	255 000	12 600	4 500	6 700
178	241,5	2,5	2,5	216 000	240 000	12 000	4 000	6 000

Spindle bearings

With steel balls



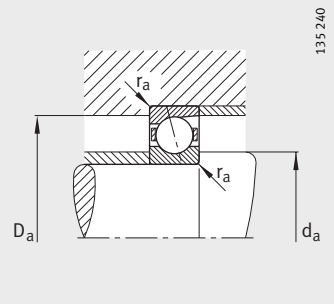
B719..-C, B70..-C, B72..-C
$\alpha = 15°$



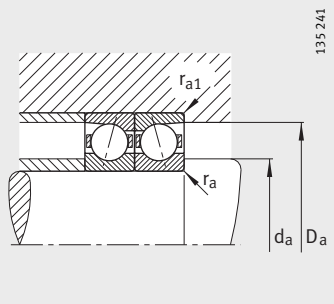
B719..-E, B70..-E, B72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71932-C-T-P4S	2,62	**160**	220	28	2	1	40
B71932-E-T-P4S	2,61	**160**	220	28	2	1	58
B7032-C-T-P4S	5,01	**160**	240	38	2,1	2,1	46
B7032-E-T-P4S	4,99	**160**	240	38	2,1	2,1	66
B7232-C-T-P4S	12,9	**160**	290	48	3	3	54
B7232-E-T-P4S	12,9	**160**	290	48	3	3	76
B71934-C-T-P4S	2,78	**170**	230	28	2	1,5	41
B71934-E-T-P4S	2,77	**170**	230	28	2	1,5	61
B7034-C-T-P4S	6,51	**170**	260	42	2,1	2,1	50
B7034-E-T-P4S	6,48	**170**	260	42	2,1	2,1	71
B7234-C-T-P4S	15,6	**170**	310	52	4	4	58
B7234-E-T-P4S	15,6	**170**	310	52	4	4	82
B71936-C-T-P4S	4,13	**180**	250	33	2	1	45
B71936-E-T-P4S	4,11	**180**	250	33	2	1	67
B7036-C-T-P4S	8,77	**180**	280	46	2,1	2,1	54
B7036-E-T-P4S	8,74	**180**	280	46	2,1	2,1	77
B7236-C-T-P4S	16,3	**180**	320	52	4	4	60
B7236-E-T-P4S	16,3	**180**	320	52	4	4	84
B71938-C-T-P4S	4,31	**190**	260	33	2	1	47
B71938-E-T-P4S	4,29	**190**	260	33	2	1	69
B7038-C-T-P4S	9,18	**190**	290	46	2,1	2,1	55
B7038-E-T-P4S	9,15	**190**	290	46	2,1	2,1	79
B7238-C-T-P4S	20	**190**	340	55	4	4	63
B7238-E-T-P4S	19,9	**190**	340	55	4	4	89
B71940-C-T-P4S	6,03	**200**	280	38	2,1	1,1	51
B71940-E-T-P4S	6,01	**200**	280	38	2,1	1,1	75
B7040-C-T-P4S	11,6	**200**	310	51	2,1	2,1	60
B7040-E-T-P4S	11,5	**200**	310	51	2,1	2,1	85
B7240-C-T-P4S	24,1	**200**	360	58	4	4	67
B7240-E-T-P4S	24,1	**200**	360	58	4	4	94



Mounting dimensions

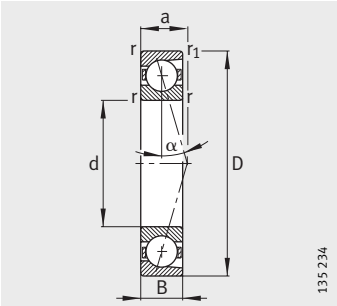


Mounting dimensions

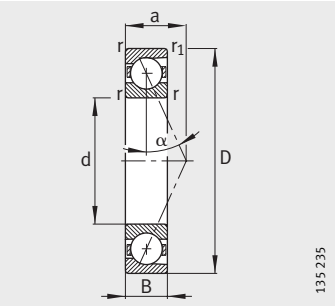
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
170	209	1	1	125 000	150 000	7 900	5 000	7 500
170	209	1	1	116 000	140 000	7 500	4 800	7 000
174	228	2	1	190 000	208 000	10 600	4 800	7 000
174	228	2	1	176 000	196 000	10 100	4 300	6 300
191	259	2,5	2,5	245 000	285 000	13 800	4 300	6 300
191	259	2,5	2,5	232 000	270 000	13 200	3 800	5 600
180	219	1	1	129 000	163 000	8 300	4 800	7 000
180	219	1	1	122 000	150 000	7 900	4 300	6 300
185	246	2	1	236 000	270 000	13 300	4 500	6 700
185	246	2	1	224 000	255 000	12 600	4 000	6 000
205	275	3	3	300 000	360 000	16 800	3 800	5 600
205	275	3	3	280 000	345 000	16 000	3 600	5 300
192	238	1	1	163 000	204 000	10 200	4 500	6 700
192	238	1	1	156 000	193 000	9 700	4 000	6 000
196	264	2	1	245 000	285 000	13 800	4 000	6 000
196	264	2	1	232 000	275 000	13 100	3 800	5 600
213,5	286,5	3	3	305 000	390 000	17 600	3 800	5 600
213,5	286,5	3	3	290 000	365 000	16 800	3 400	5 000
202	247	1	1	166 000	212 000	10 400	4 300	6 300
202	247	1	1	156 000	200 000	9 900	3 800	5 600
206	274	2	1	250 000	305 000	14 300	3 800	5 600
206	274	2	1	236 000	290 000	13 600	3 600	5 300
223,5	306,5	3	3	315 000	415 000	18 300	3 400	5 000
223,5	306,5	3	3	300 000	390 000	17 400	3 200	4 800
214	266	1	1	204 000	255 000	11 900	3 800	5 600
214	266	1	1	193 000	240 000	11 300	3 600	5 300
217	293	2	1	305 000	390 000	17 500	3 600	5 300
217	293	2	1	290 000	365 000	16 700	3 200	4 800
238,5	321,5	3	3	325 000	440 000	19 000	3 200	4 800
238,5	321,5	3	3	310 000	415 000	18 000	3 000	4 500

Spindle bearings

With steel balls



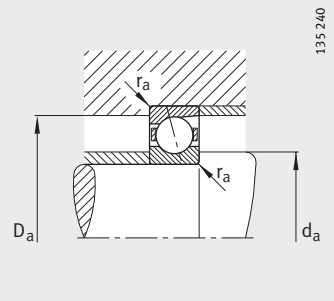
B719..-C, B70..-C, B72..-C
α = 15°



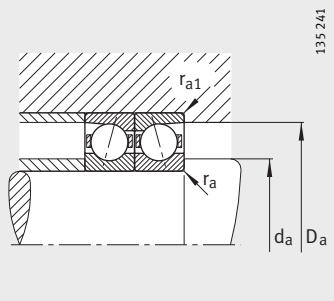
B719..-E, B70..-E, B72..-E
α = 25°

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B71944-C-T-P4S	6,57	**220**	300	38	2,1	1,1	54
B71944-E-T-P4S	6,55	**220**	300	38	2,1	1,1	80
B7044-C-T-P4S	15,7	**220**	340	56	3	3	66
B7044-E-T-P4S	15,6	**220**	340	56	3	3	93
B7244-C-T-P4S	33	**220**	400	65	4	4	74
B7244-E-T-P4S	32,9	**220**	400	65	4	4	105
B71948-C-T-P4S	7,08	**240**	320	38	2,1	1,1	57
B71948-E-T-P4S	7,06	**240**	320	38	2,1	1,1	84
B7048-C-T-P4S	16,7	**240**	360	56	3	3	68
B7048-E-T-P4S	16,7	**240**	360	56	3	3	98



Mounting dimensions

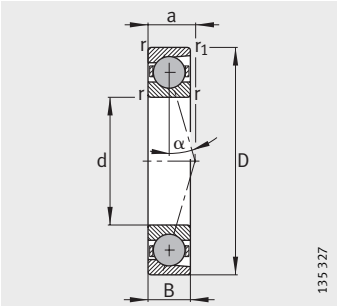


Mounting dimensions

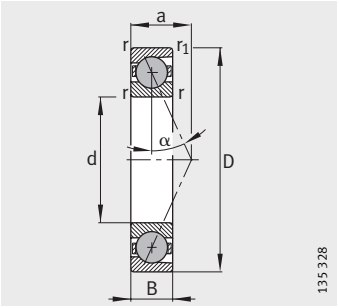
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
234	286	1	1	216 000	285 000	12 900	3 600	5 300
234	286	1	1	204 000	270 000	12 200	3 200	4 800
239	321	2,5	1	325 000	440 000	19 000	3 200	4 800
239	321	2,5	1	310 000	415 000	18 000	3 000	4 500
264	356	3	3	400 000	560 000	23 200	2 800	4 300
264	356	3	3	380 000	540 000	22 100	2 600	4 000
254	307	1	1	224 000	310 000	13 500	3 200	4 800
254	307	1	1	212 000	285 000	12 800	3 000	4 500
260	341	2,5	1	335 000	465 000	19 500	3 000	4 500
260	341	2,5	1	315 000	440 000	18 500	2 800	4 300

Spindle bearings

With ceramic balls



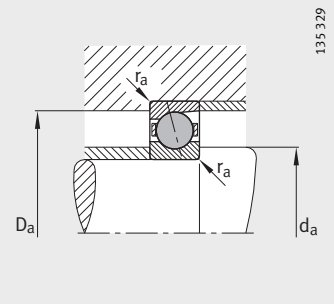
HCB719..-C, HCB70..-C,
HCB72..-C
$\alpha = 15°$



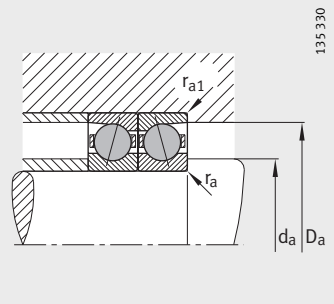
HCB719..-E, HCB70..-E,
HCB72..-E
$\alpha = 25°$

Dimension table · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
HCB71900-C-T-P4S	0,01	**10**	22	6	0,3	0,3	5
HCB71900-E-T-P4S	0,01	**10**	22	6	0,3	0,3	7
HCB7000-C-T-P4S	0,02	**10**	26	8	0,3	0,3	6
HCB7000-E-T-P4S	0,02	**10**	26	8	0,3	0,3	8
HCB7200-C-T-P4S	0,03	**10**	30	9	0,6	0,6	7
HCB7200-E-T-P4S	0,03	**10**	30	9	0,6	0,6	9
HCB71901-C-T-P4S	0,02	**12**	24	6	0,3	0,3	5
HCB71901-E-T-P4S	0,02	**12**	24	6	0,3	0,3	7
HCB7001-C-T-P4S	0,02	**12**	28	8	0,3	0,3	7
HCB7001-E-T-P4S	0,02	**12**	28	8	0,3	0,3	9
HCB7201-C-T-P4S	0,03	**12**	32	10	0,6	0,6	8
HCB7201-E-T-P4S	0,03	**12**	32	10	0,6	0,6	10
HCB71902-C-T-P4S	0,02	**15**	28	7	0,3	0,3	6
HCB71902-E-T-P4S	0,02	**15**	28	7	0,3	0,3	9
HCB7002-C-T-P4S	0,03	**15**	32	9	0,3	0,3	8
HCB7002-E-T-P4S	0,03	**15**	32	9	0,3	0,3	10
HCB7202-C-T-P4S	0,04	**15**	35	11	0,6	0,6	9
HCB7202-E-T-P4S	0,04	**15**	35	11	0,6	0,6	11
HCB71903-C-T-P4S	0,02	**17**	30	7	0,3	0,3	7
HCB71903-E-T-P4S	0,02	**17**	30	7	0,3	0,3	9
HCB7003-C-T-P4S	0,04	**17**	35	10	0,3	0,3	9
HCB7003-E-T-P4S	0,04	**17**	35	10	0,3	0,3	11
HCB7203-C-T-P4S	0,06	**17**	40	12	0,6	0,6	10
HCB7203-E-T-P4S	0,06	**17**	40	12	0,6	0,6	13
HCB71904-C-T-P4S	0,03	**20**	37	9	0,3	0,3	8
HCB71904-E-T-P4S	0,03	**20**	37	9	0,3	0,3	11
HCB7004-C-T-P4S	0,07	**20**	42	12	0,6	0,6	10
HCB7004-E-T-P4S	0,07	**20**	42	12	0,6	0,6	13
HCB7204-C-T-P4S	0,1	**20**	47	14	1	1	12
HCB7204-E-T-P4S	0,1	**20**	47	14	1	1	15
HCB71905-C-T-P4S	0,04	**25**	42	9	0,3	0,3	9
HCB71905-E-T-P4S	0,04	**25**	42	9	0,3	0,3	12
HCB7005-C-T-P4S	0,07	**25**	47	12	0,6	0,6	11
HCB7005-E-T-P4S	0,07	**25**	47	12	0,6	0,6	14
HCB7205-C-T-P4S	0,12	**25**	52	15	1	1	13
HCB7205-E-T-P4S	0,12	**25**	52	15	1	1	17



Mounting dimensions

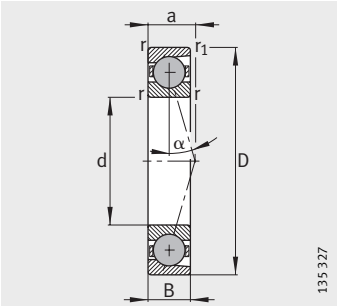


Mounting dimensions

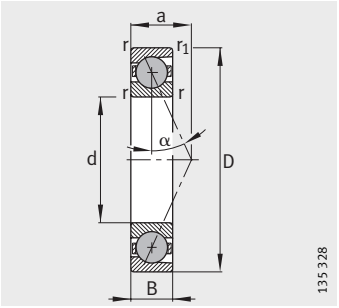
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
13	19,5	0,3	0,3	2 080	1 060	78	90 000	150 000
13	19,5	0,3	0,3	2 000	1 000	75	75 000	120 000
14	22	0,3	0,1	2 900	1 430	107	80 000	130 000
14	22	0,3	0,1	2 800	1 400	102	67 000	100 000
14,5	25,5	0,6	0,6	4 000	2 040	217	70 000	110 000
14,5	25,5	0,6	0,6	3 900	1 960	208	60 000	90 000
15	21,5	0,3	0,3	2 320	1 290	95	80 000	130 000
15	21,5	0,3	0,3	2 200	1 220	91	67 000	100 000
16,5	24,5	0,3	0,1	3 250	1 800	133	70 000	110 000
16,5	24,5	0,3	0,1	3 150	1 730	128	60 000	90 000
16,5	27,5	0,6	0,6	5 300	2 700	285	63 000	95 000
16,5	27,5	0,6	0,6	5 100	2 600	275	56 000	85 000
18	25,5	0,3	0,3	3 450	2 000	148	67 000	100 000
18	25,5	0,3	0,3	3 350	1 930	141	56 000	85 000
19	29	0,3	0,1	4 300	2 360	176	60 000	90 000
19	29	0,3	0,1	4 150	2 240	168	50 000	75 000
19,5	30,5	0,6	0,6	6 700	3 450	370	56 000	85 000
19,5	30,5	0,6	0,6	6 400	3 350	360	48 000	70 000
20	27,5	0,3	0,3	3 650	2 200	162	60 000	90 000
20	27,5	0,3	0,3	3 450	2 080	155	50 000	75 000
21	32	0,3	0,1	6 000	3 450	255	53 000	80 000
21	32	0,3	0,1	5 700	3 250	246	45 000	67 000
22,5	34,5	0,6	0,6	7 500	4 050	425	50 000	75 000
22,5	34,5	0,6	0,6	7 200	3 900	410	43 000	63 000
24	33,5	0,3	0,3	5 000	3 200	234	50 000	75 000
24	33,5	0,3	0,3	4 800	3 050	223	43 000	63 000
25	37	0,6	0,3	7 200	4 150	310	45 000	67 000
25	37	0,6	0,3	6 950	4 000	295	38 000	56 000
26,5	40,5	1	1	10 000	5 600	580	43 000	63 000
26,5	40,5	1	1	9 650	5 400	560	36 000	53 000
29	38,5	0,3	0,3	5 600	4 000	280	43 000	63 000
29	38,5	0,3	0,3	5 300	3 800	260	36 000	53 000
30	42	0,6	0,3	10 000	6 300	470	38 000	56 000
30	42	0,6	0,3	9 500	6 000	450	34 000	50 000
31,5	45,5	1	1	10 800	6 550	670	36 000	53 000
31,5	45,5	1	1	10 400	6 200	640	32 000	48 000

Spindle bearings

With ceramic balls



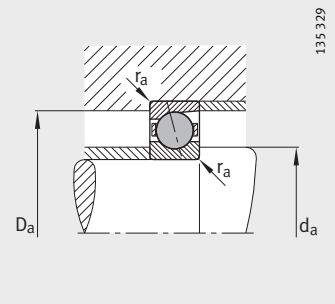
HCB719..-C, HCB70..-C,
HCB72..-C
$\alpha = 15°$



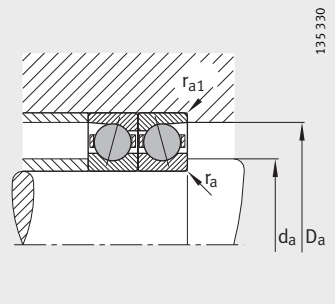
HCB719..-E, HCB70..-E,
HCB72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
HCB71906-C-T-P4S	0,05	**30**	47	9	0,3	0,3	10
HCB71906-E-T-P4S	0,05	**30**	47	9	0,3	0,3	14
HCB7006-C-T-P4S	0,11	**30**	55	13	1	1	12
HCB7006-E-T-P4S	0,11	**30**	55	13	1	1	16
HCB7206-C-T-P4S	0,19	**30**	62	16	1	1	14
HCB7206-E-T-P4S	0,19	**30**	62	16	1	1	19
HCB71907-C-T-P4S	0,08	**35**	55	10	0,6	0,6	11
HCB71907-E-T-P4S	0,08	**35**	55	10	0,6	0,6	16
HCB7007-C-T-P4S	0,15	**35**	62	14	1	1	14
HCB7007-E-T-P4S	0,15	**35**	62	14	1	1	18
HCB7207-C-T-P4S	0,28	**35**	72	17	1,1	1,1	16
HCB7207-E-T-P4S	0,28	**35**	72	17	1,1	1,1	21
HCB71908-C-T-P4S	0,11	**40**	62	12	0,6	0,6	13
HCB71908-E-T-P4S	0,11	**40**	62	12	0,6	0,6	18
HCB7008-C-T-P4S	0,19	**40**	68	15	1	1	–
HCB7008-E-T-P4S	0,19	**40**	68	15	1	1	–
HCB7208-C-T-P4S	0,37	**40**	80	18	1,1	1,1	17
HCB7208-E-T-P4S	0,37	**40**	80	18	1,1	1,1	23
HCB71909-C-T-P4S	0,13	**45**	68	12	0,6	0,6	14
HCB71909-E-T-P4S	0,13	**45**	68	12	0,6	0,6	19
HCB7009-C-T-P4S	0,23	**45**	75	16	1	1	16
HCB7009-E-T-P4S	0,23	**45**	75	16	1	1	22
HCB7209-C-T-P4S	0,41	**45**	85	19	1,1	1,1	18
HCB7209-E-T-P4S	0,41	**45**	85	19	1,1	1,1	25
HCB71910-C-T-P4S	0,13	**50**	72	12	0,6	0,6	14
HCB71910-E-T-P4S	0,13	**50**	72	12	0,6	0,6	20
HCB7010-C-T-P4S	0,25	**50**	80	16	1	1	17
HCB7010-E-T-P4S	0,25	**50**	80	16	1	1	23
HCB7210-C-T-P4S	0,46	**50**	90	20	1,1	1,1	19
HCB7210-E-T-P4S	0,46	**50**	90	20	1,1	1,1	26
HCB71911-C-T-P4S	0,18	**55**	80	13	1	1	16
HCB71911-E-T-P4S	0,18	**55**	80	13	1	1	22
HCB7011-C-T-P4S	0,37	**55**	90	18	1,1	1,1	19
HCB7011-E-T-P4S	0,37	**55**	90	18	1,1	1,1	26
HCB7211-C-T-P4S	0,61	**55**	100	21	1,5	1,5	21
HCB7211-E-T-P4S	0,61	**55**	100	21	1,5	1,5	29



Mounting dimensions

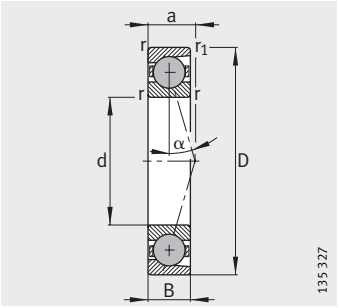


Mounting dimensions

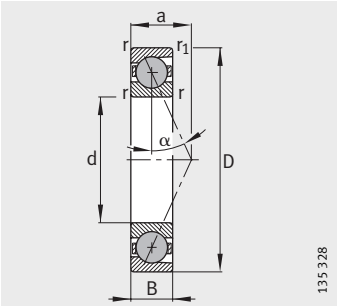
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
34	43,5	0,3	0,3	6 000	4 650	340	36 000	53 000
34	43,5	0,3	0,3	5 600	4 400	320	32 000	48 000
36	49	1	0,3	10 400	7 200	530	32 000	48 000
36	49	1	0,3	10 000	6 800	510	28 000	43 000
37,5	54,5	1	1	16 000	10 200	1 090	30 000	45 000
37,5	54,5	1	1	15 300	9 800	1 040	26 000	40 000
40	51,5	0,6	0,6	8 150	6 550	495	32 000	48 000
40	51,5	0,6	0,6	7 650	6 300	470	26 000	40 000
41	56	1	0,3	13 200	9 500	700	28 000	43 000
41	56	1	0,3	12 500	9 000	670	24 000	38 000
44	63	1	1	17 600	8 800	1 330	26 000	40 000
44	63	1	1	16 600	8 500	1 270	22 000	36 000
45	58,5	0,6	0,6	12 200	9 650	720	28 000	43 000
45	58,5	0,6	0,6	11 400	9 150	680	24 000	38 000
46	62	1	0,3	14 300	11 000	820	26 000	40 000
46	62	1	0,3	13 400	10 600	780	22 000	36 000
48	72	1	1	22 000	15 600	1 170	24 000	38 000
48	72	1	1	21 200	15 000	1 120	20 000	34 000
50	63,5	0,6	0,6	12 900	10 800	820	24 000	38 000
50	63,5	0,6	0,6	12 200	10 400	770	22 000	36 000
51	69	1	0,3	19 000	14 600	1 090	24 000	38 000
51	69	1	0,3	18 000	14 000	1 030	20 000	34 000
52,5	78	1	1	23 200	12 200	1 290	22 000	36 000
52,5	78	1	1	22 000	11 600	1 230	18 000	30 000
55	67,5	0,6	0,6	13 200	11 600	870	22 000	36 000
55	67,5	0,6	0,6	12 200	11 000	820	20 000	34 000
56	74	1	0,3	19 600	16 000	1 170	22 000	36 000
56	74	1	0,3	18 600	15 300	1 120	18 000	30 000
57	83	1	1	30 000	22 000	1 630	20 000	34 000
57	83	1	1	28 000	21 200	1 560	17 000	28 000
60	75,5	0,6	0,6	16 000	14 300	1 050	20 000	34 000
60	75,5	0,6	0,6	15 000	13 400	1 000	18 000	30 000
62	83	1	0,6	26 000	21 600	1 610	19 000	32 000
62	83	1	0,6	25 000	20 400	1 530	17 000	28 000
63	92	1,5	1,5	32 000	18 300	1 910	18 000	30 000
63	92	1,5	1,5	30 500	17 600	1 820	15 000	24 000

Spindle bearings

With ceramic balls



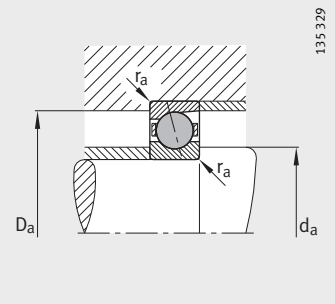
HCB719..-C, HCB70..-C,
HCB72..-C
$\alpha = 15°$



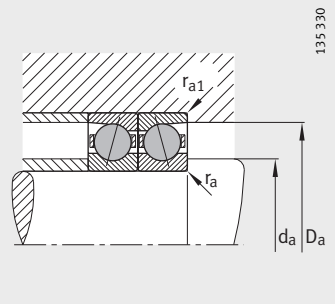
HCB719..-E, HCB70..-E,
HCB72..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
HCB71912-C-T-P4S	0,19	**60**	85	13	1	1	16
HCB71912-E-T-P4S	0,19	**60**	85	13	1	1	23
HCB7012-C-T-P4S	0,4	**60**	95	18	1,1	1,1	19
HCB7012-E-T-P4S	0,4	**60**	95	18	1,1	1,1	27
HCB7212-C-T-P4S	0,8	**60**	110	22	1,5	1,5	23
HCB7212-E-T-P4S	0,8	**60**	110	22	1,5	1,5	31
HCB71913-C-T-P4S	0,2	**65**	90	13	1	1	17
HCB71913-E-T-P4S	0,2	**65**	90	13	1	1	25
HCB7013-C-T-P4S	0,42	**65**	100	18	1,1	1,1	20
HCB7013-E-T-P4S	0,42	**65**	100	18	1,1	1,1	28
HCB7213-C-T-P4S	1,02	**65**	120	23	1,5	1,5	24
HCB7213-E-T-P4S	1,02	**65**	120	23	1,5	1,5	33
HCB71914-C-T-P4S	0,33	**70**	100	16	1	1	19
HCB71914-E-T-P4S	0,33	**70**	100	16	1	1	28
HCB7014-C-T-P4S	0,59	**70**	110	20	1,1	1,1	22
HCB7014-E-T-P4S	0,59	**70**	110	20	1,1	1,1	31
HCB7214-C-T-P4S	1,12	**70**	125	24	1,5	1,5	25
HCB7214-E-T-P4S	1,12	**70**	125	24	1,5	1,5	35
HCB71915-C-T-P4S	0,35	**75**	105	16	1	1	20
HCB71915-E-T-P4S	0,35	**75**	105	16	1	1	29
HCB7015-C-T-P4S	0,62	**75**	115	20	1,1	1,1	23
HCB7015-E-T-P4S	0,62	**75**	115	20	1,1	1,1	32
HCB7215-C-T-P4S	1,21	**75**	130	25	1,5	1,5	26
HCB7215-E-T-P4S	1,21	**75**	130	25	1,5	1,5	36
HCB71916-C-T-P4S	0,37	**80**	110	16	1	1	21
HCB71916-E-T-P4S	0,37	**80**	110	16	1	1	30
HCB7016-C-T-P4S	0,84	**80**	125	22	1,1	1,1	25
HCB7016-E-T-P4S	0,84	**80**	125	22	1,1	1,1	35
HCB71917-C-T-P4S	0,53	**85**	120	18	1,1	1,1	23
HCB71917-E-T-P4S	0,53	**85**	120	18	1,1	1,1	33
HCB7017-C-T-P4S	0,88	**85**	130	22	1,1	1,1	25
HCB7017-E-T-P4S	0,88	**85**	130	22	1,1	1,1	36
HCB71918-C-T-P4S	0,55	**90**	125	18	1,1	1,1	23
HCB71918-E-T-P4S	0,55	**90**	125	18	1,1	1,1	34
HCB7018-C-T-P4S	1,15	**90**	140	24	1,5	1,5	27
HCB7018-E-T-P4S	1,15	**90**	140	24	1,5	1,5	39



Mounting dimensions

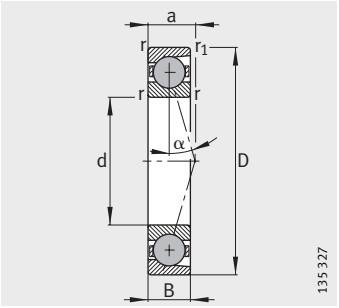


Mounting dimensions

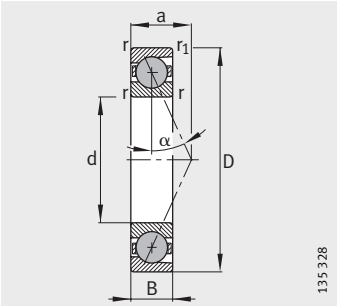
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
65	80,5	0,6	0,6	16 600	16 000	1 170	19 000	32 000
65	80,5	0,6	0,6	15 600	15 000	1 100	17 000	28 000
67	88	1	0,6	27 000	23 200	1 730	18 000	30 000
67	88	1	0,6	25 500	22 000	1 650	15 000	24 000
69,5	101,5	1,5	1,5	38 000	30 500	2 260	16 000	26 000
69,5	101,5	1,5	1,5	36 000	29 000	2 150	14 000	22 000
70	85,5	0,6	0,6	17 000	16 600	1 230	18 000	30 000
70	85,5	0,6	0,6	16 000	16 000	1 160	15 000	24 000
72	93	1	0,6	27 500	24 500	1 850	17 000	28 000
72	93	1	0,6	26 000	23 600	1 760	15 000	24 000
75,5	109,5	1,5	1,5	46 500	37 500	2 800	15 000	24 000
75,5	109,5	1,5	1,5	44 000	36 000	2 650	13 000	20 000
76	94,5	0,6	0,6	23 200	22 800	1 670	16 000	26 000
76	94,5	0,6	0,6	22 000	21 600	1 580	14 000	22 000
77	102	1	0,6	34 000	30 000	2 230	16 000	26 000
77	102	1	0,6	32 500	29 000	2 120	13 000	20 000
80	115	1,5	1,5	48 000	40 500	3 000	14 000	22 000
80	115	1,5	1,5	45 500	39 000	2 900	12 000	19 000
81	99,5	0,6	0,6	23 600	24 000	1 760	16 000	26 000
81	99,5	0,6	0,6	22 000	22 800	1 670	13 000	20 000
82	107	1	0,6	35 500	32 500	2 380	15 000	24 000
82	107	1	0,6	33 500	30 500	2 260	13 000	20 000
85	120	1,5	1,5	50 000	44 000	3 200	14 000	22 000
85	120	1,5	1,5	47 500	41 500	3 050	12 000	19 000
86	104	0,6	0,6	24 000	25 000	1 850	15 000	24 000
86	104	0,6	0,6	22 400	23 600	1 750	13 000	20 000
88	117	1	0,6	44 000	40 500	2 950	14 000	22 000
88	117	1	0,6	41 500	39 000	2 800	12 000	19 000
92	114	0,6	0,6	31 000	32 500	2 400	13 000	20 000
92	114	0,6	0,6	29 000	30 500	2 270	12 000	19 000
93	122	1	0,6	45 000	43 000	3 050	13 000	20 000
93	122	1	0,6	42 500	40 500	2 900	11 000	18 000
97	119	0,6	0,6	31 500	34 000	2 460	13 000	20 000
97	119	0,6	0,6	30 000	32 000	2 330	11 000	18 000
100	131	1,5	0,6	53 000	50 000	3 450	12 000	19 000
100	131	1,5	0,6	50 000	47 500	3 300	10 000	17 000

Spindle bearings

With ceramic balls



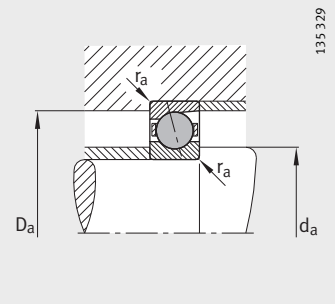
HCB719..-C, HCB70..-C,
$\alpha = 15°$



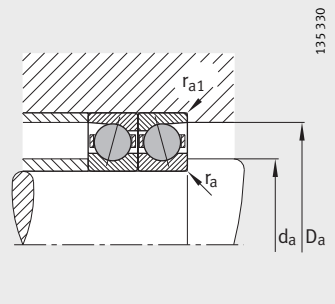
HCB719..-E, HCB70..-E,
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
HCB71919-C-T-P4S	0,58	**95**	130	18	1,1	1,1	24
HCB71919-E-T-P4S	0,58	**95**	130	18	1,1	1,1	35
HCB7019-C-T-P4S	1,2	**95**	145	24	1,5	1,5	28
HCB7019-E-T-P4S	1,2	**95**	145	24	1,5	1,5	40
HCB71920-C-T-P4S	0,79	**100**	140	20	1,1	1,1	26
HCB71920-E-T-P4S	0,79	**100**	140	20	1,1	1,1	38
HCB7020-C-T-P4S	1,25	**100**	150	24	1,5	1,5	29
HCB7020-E-T-P4S	1,25	**100**	150	24	1,5	1,5	41
HCB71921-C-T-P4S	0,82	**105**	145	20	1,1	1,1	27
HCB71921-E-T-P4S	0,82	**105**	145	20	1,1	1,1	39
HCB7021-C-T-P4S	1,49	**105**	160	26	2	2	31
HCB7021-E-T-P4S	1,49	**105**	160	26	2	2	44
HCB71922-C-T-P4S	0,85	**110**	150	20	1,1	1,1	27
HCB71922-E-T-P4S	0,85	**110**	150	20	1,1	1,1	40
HCB7022-C-T-P4S	1,95	**110**	170	28	2	2	33
HCB7022-E-T-P4S	1,95	**110**	170	28	2	2	47
HCB71924-C-T-P4S	1,12	**120**	165	22	1,1	1,1	30
HCB71924-E-T-P4S	1,12	**120**	165	22	1,1	1,1	44
HCB7024-C-T-P4S	2,12	**120**	180	28	2	2	34
HCB7024-E-T-P4S	2,12	**120**	180	28	2	2	49
HCB71926-C-T-P4S	1,49	**130**	180	24	1,5	1,5	33
HCB71926-E-T-P4S	1,49	**130**	180	24	1,5	1,5	48
HCB7026-C-T-P4S	3,21	**130**	200	33	2	2	39
HCB7026-E-T-P4S	3,21	**130**	200	33	2	2	55
HCB71928-C-T-P4S	1,65	**140**	190	24	1,5	1,5	34
HCB71928-E-T-P4S	1,65	**140**	190	24	1,5	1,5	50
HCB7028-C-T-P4S	3,34	**140**	210	33	2	2	40
HCB7028-E-T-P4S	3,34	**140**	210	33	2	2	57



Mounting dimensions

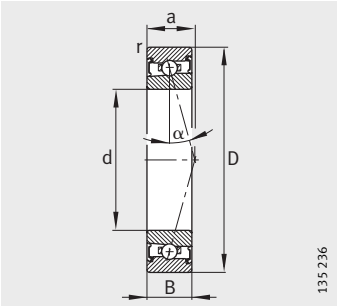


Mounting dimensions

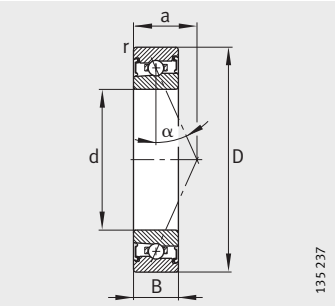
Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	
d_a h12	D_a H12	r_a max.	r_{a1} max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}	n_G oil min^{-1}
102	124	0,6	0,6	32 000	35 500	2 500	12 000	19 000
102	124	0,6	0,6	30 500	33 500	2 380	10 000	17 000
105	136	1,5	0,6	54 000	53 000	3 600	11 000	18 000
105	136	1,5	0,6	51 000	51 000	3 450	9 500	16 000
107	133	0,6	0,6	40 500	44 000	2 950	11 000	18 000
107	133	0,6	0,6	38 000	42 500	2 800	9 500	16 000
110	141	1,5	0,6	56 000	56 000	3 750	11 000	18 000
110	141	1,5	0,6	53 000	53 000	3 550	9 000	15 000
112	138	0,6	0,6	40 000	45 000	2 950	11 000	18 000
112	138	0,6	0,6	38 000	42 500	2 800	9 000	15 000
116	150	2	1	57 000	60 000	3 850	10 000	17 000
116	150	2	1	54 000	57 000	3 650	8 500	14 000
117	143	0,6	0,6	40 500	46 500	3 000	10 000	17 000
117	143	0,6	0,6	39 000	44 000	2 850	9 000	15 000
121	159	2	1	75 000	76 500	4 750	9 500	16 000
121	159	2	1	72 000	72 000	4 500	8 000	13 000
128	157	0,6	0,6	51 000	58 500	3 600	9 000	15 000
128	157	0,6	0,6	48 000	55 000	3 450	8 000	13 000
131	169	2	1	78 000	81 500	4 900	8 500	14 000
131	169	2	1	73 500	76 500	4 650	7 500	12 000
139	171	0,6	0,6	60 000	69 500	4 100	8 500	14 000
139	171	0,6	0,6	45 500	53 000	3 200	7 000	11 000
142	189	2	1	100 000	104 000	6 100	7 500	12 000
142	189	2	1	95 000	98 000	5 800	6 700	10 000
149	181	0,6	0,6	62 000	76 500	4 350	7 500	12 000
149	181	0,6	0,6	47 500	57 000	3 350	6 700	10 000
152	199	2	1	102 000	110 000	6 300	7 000	11 000
152	199	2	1	96 500	104 000	5 900	6 300	9 500

High speed spindle bearings

With steel balls
Sealed



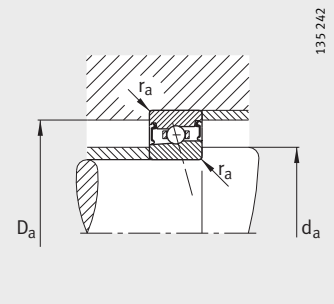
HSS719..-C, HSS70..-C
$\alpha = 15°$



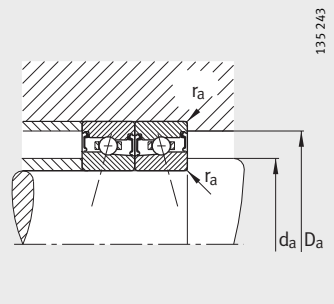
HSS719..-E, HSS70..-E
$\alpha = 25°$

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HSS71900-C-T-P4S	0,01	**10**	22	6	0,3	5
HSS71900-E-T-P4S	0,01	**10**	22	6	0,3	7
HSS7000-C-T-P4S	0,02	**10**	26	8	0,3	6
HSS7000-E-T-P4S	0,02	**10**	26	8	0,3	8
HSS71901-C-T-P4S	0,01	**12**	24	6	0,3	5
HSS71901-E-T-P4S	0,01	**12**	24	6	0,3	7
HSS7001-C-T-P4S	0,022	**12**	28	8	0,3	7
HSS7001-E-T-P4S	0,022	**12**	28	8	0,3	9
HSS71902-C-T-P4S	0,015	**15**	28	7	0,3	6
HSS71902-E-T-P4S	0,015	**15**	28	7	0,3	9
HSS7002-C-T-P4S	0,033	**15**	32	9	0,3	8
HSS7002-E-T-P4S	0,033	**15**	32	9	0,3	10
HSS71903-C-T-P4S	0,017	**17**	30	7	0,3	7
HSS71903-E-T-P4S	0,017	**17**	30	7	0,3	9
HSS7003-C-T-P4S	0,044	**17**	35	10	0,3	9
HSS7003-E-T-P4S	0,044	**17**	35	10	0,3	11
HSS71904-C-T-P4S	0,041	**20**	37	9	0,3	8
HSS71904-E-T-P4S	0,041	**20**	37	9	0,3	11
HSS7004-C-T-P4S	0,074	**20**	42	12	0,6	10
HSS7004-E-T-P4S	0,074	**20**	42	12	0,6	13
HSS71905-C-T-P4S	0,047	**25**	42	9	0,3	9
HSS71905-E-T-P4S	0,047	**25**	42	9	0,3	12
HSS7005-C-T-P4S	0,085	**25**	47	12	0,6	11
HSS7005-E-T-P4S	0,085	**25**	47	12	0,6	14
HSS71906-C-T-P4S	0,047	**30**	47	9	0,3	10
HSS71906-E-T-P4S	0,047	**30**	47	9	0,3	14
HSS7006-C-T-P4S	0,121	**30**	55	13	1	12
HSS7006-E-T-P4S	0,121	**30**	55	13	1	16
HSS71907-C-T-P4S	0,076	**35**	55	10	0,6	11
HSS71907-E-T-P4S	0,076	**35**	55	10	0,6	16
HSS7007-C-T-P4S	0,166	**35**	62	14	1	14
HSS7007-E-T-P4S	0,166	**35**	62	14	1	18
HSS71908-C-T-P4S	0,122	**40**	62	12	0,6	13
HSS71908-E-T-P4S	0,122	**40**	62	12	0,6	18
HSS7008-C-T-P4S	0,208	**40**	68	15	1	15
HSS7008-E-T-P4S	0,208	**40**	68	15	1	20



Mounting dimensions

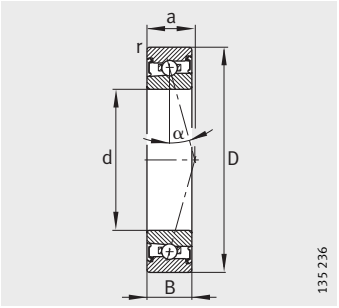


Mounting dimensions

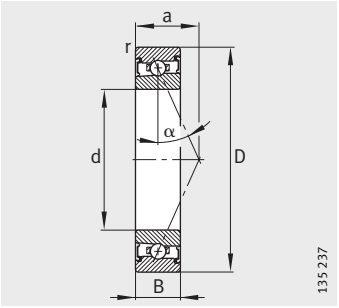
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
13	19,5	0,3	1 960	1 100	67	90 000
13	19,5	0,3	1 860	1 040	64	75 000
14	22	0,3	2 750	1 600	97	80 000
14	22	0,3	2 600	1 500	92	67 000
15	21,5	0,3	2 040	1 200	74	80 000
15	21,5	0,3	1 930	1 140	71	67 000
16,5	24,5	0,3	2 700	1 630	99	70 000
16,5	24,5	0,3	2 550	1 530	94	60 000
18	25,5	0,3	2 800	1 760	107	67 000
18	25,5	0,3	2 650	1 660	102	56 000
19	29	0,3	3 750	2 450	152	60 000
19	29	0,3	3 550	2 320	145	50 000
20	27,5	0,3	2 900	1 900	116	60 000
20	27,5	0,3	2 700	1 800	110	50 000
21	32	0,3	3 800	2 650	165	53 000
21	32	0,3	3 650	2 500	157	45 000
24	33,5	0,3	3 900	2 850	178	50 000
24	33,5	0,3	3 750	2 700	168	43 000
25	37	0,6	6 200	4 550	280	45 000
25	37	0,6	5 850	4 300	265	38 000
29	38,5	0,3	4 250	3 350	212	43 000
29	38,5	0,3	4 000	3 150	201	36 000
30	42	0,6	6 300	4 900	305	38 000
30	42	0,6	6 000	4 650	285	34 000
34	43,5	0,3	6 400	5 200	320	36 000
34	43,5	0,3	6 000	4 900	305	32 000
36	49	1	8 800	7 100	435	32 000
36	49	1	8 300	6 700	415	28 000
40	51,5	0,6	6 950	6 200	390	32 000
40	51,5	0,6	6 550	5 850	370	26 000
41	56	1	9 300	8 300	510	28 000
41	56	1	8 800	7 800	485	24 000
45	58,5	0,6	7 200	6 950	445	28 000
45	58,5	0,6	6 800	6 400	420	24 000
46	62	1	10 000	9 300	590	26 000
46	62	1	9 300	8 650	560	22 000

High speed spindle bearings

With steel balls
Sealed



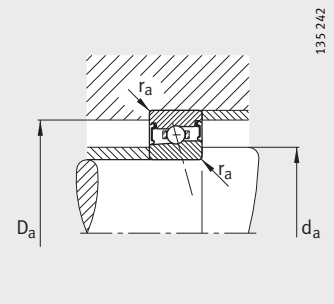
HSS719..-C, HSS70..-C
$\alpha = 15°$



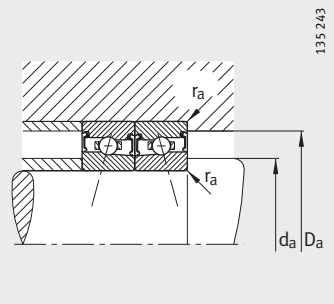
HSS719..-E, HSS70..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HSS71909-C-T-P4S	0,132	**45**	68	12	0,6	14
HSS71909-E-T-P4S	0,132	**45**	68	12	0,6	19
HSS7009-C-T-P4S	0,273	**45**	75	16	1	16
HSS7009-E-T-P4S	0,272	**45**	75	16	1	22
HSS71910-C-T-P4S	0,133	**50**	72	12	0,6	14
HSS71910-E-T-P4S	0,133	**50**	72	12	0,6	20
HSS7010-C-T-P4S	0,296	**50**	80	16	1	17
HSS7010-E-T-P4S	0,295	**50**	80	16	1	23
HSS71911-C-T-P4S	0,198	**55**	80	13	1	16
HSS71911-E-T-P4S	0,198	**55**	80	13	1	22
HSS7011-C-T-P4S	0,411	**55**	90	18	1,1	19
HSS7011-E-T-P4S	0,41	**55**	90	18	1,1	26
HSS71912-C-T-P4S	0,22	**60**	85	13	1	16
HSS71912-E-T-P4S	0,22	**60**	85	13	1	23
HSS7012-C-T-P4S	0,453	**60**	95	18	1,1	19
HSS7012-E-T-P4S	0,453	**60**	95	18	1,1	27
HSS71913-C-T-P4S	0,226	**65**	90	13	1	17
HSS71913-E-T-P4S	0,226	**65**	90	13	1	25
HSS7013-C-T-P4S	0,468	**65**	100	18	1,1	20
HSS7013-E-T-P4S	0,468	**65**	100	18	1,1	28
HSS71914-C-T-P4S	0,354	**70**	100	16	1	19
HSS71914-E-T-P4S	0,353	**70**	100	16	1	28
HSS7014-C-T-P4S	0,644	**70**	110	20	1,1	22
HSS7014-E-T-P4S	0,643	**70**	110	20	1,1	31
HSS71915-C-T-P4S	0,38	**75**	105	16	1	20
HSS71915-E-T-P4S	0,379	**75**	105	16	1	29
HSS7015-C-T-P4S	0,68	**75**	115	20	1,1	23
HSS7015-E-T-P4S	0,679	**75**	115	20	1,1	32
HSS71916-C-T-P4S	0,385	**80**	110	16	1	21
HSS71916-E-T-P4S	0,385	**80**	110	16	1	30
HSS7016-C-T-P4S	0,931	**80**	125	22	1,1	25
HSS7016-E-T-P4S	0,929	**80**	125	22	1,1	35
HSS71917-C-T-P4S	0,58	**85**	120	18	1,1	23
HSS71917-E-T-P4S	0,579	**85**	120	18	1,1	33
HSS7017-C-T-P4S	0,975	**85**	130	22	1,1	25
HSS7017-E-T-P4S	0,974	**85**	130	22	1,1	36



Mounting dimensions

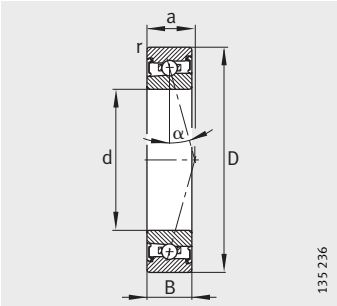


Mounting dimensions

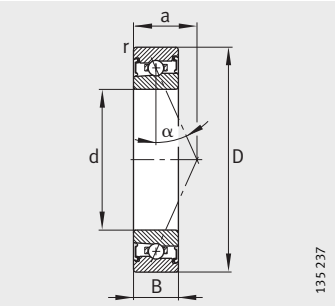
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
50	63,5	0,6	10 000	9 650	610	24 000
50	63,5	0,6	9 500	9 000	580	22 000
51	69	1	12 900	12 200	770	24 000
51	69	1	12 200	11 400	730	20 000
55	67,5	0,6	10 400	10 200	670	22 000
55	67,5	0,6	9 800	9 650	630	20 000
56	74	1	13 400	13 200	840	22 000
56	74	1	12 500	12 200	790	18 000
60	75,5	0,6	13 400	13 700	870	20 000
60	75,5	0,6	12 700	12 700	830	18 000
62	83	1	18 600	19 000	1 180	19 000
62	83	1	17 600	17 600	1 120	17 000
65	80,5	0,6	14 000	14 600	940	19 000
65	80,5	0,6	13 200	13 400	890	17 000
67	88	1	19 300	20 000	1 280	18 000
67	88	1	18 300	19 000	1 210	15 000
70	85,5	0,6	14 300	15 300	1 010	18 000
70	85,5	0,6	13 400	14 300	960	15 000
72	93	1	20 000	21 600	1 380	17 000
72	93	1	19 000	20 000	1 310	15 000
76	94,5	0,6	18 300	20 000	1 330	16 000
76	94,5	0,6	17 300	18 600	1 250	14 000
77	102	1	26 000	28 000	1 770	16 000
77	102	1	24 500	26 000	1 670	13 000
81	99,5	0,6	19 000	21 200	1 420	16 000
81	99,5	0,6	17 600	20 000	1 340	13 000
82	107	1	26 500	29 000	1 850	15 000
82	107	1	25 000	27 000	1 740	13 000
86	104	0,6	21 200	24 000	1 590	15 000
86	104	0,6	19 600	22 400	1 500	13 000
88	117	1	31 500	34 500	2 220	14 000
88	117	1	30 000	32 500	2 100	12 000
92	114	0,6	22 000	26 000	1 720	14 000
92	114	0,6	20 400	24 500	1 630	12 000
93	122	1	32 000	36 000	2 250	13 000
93	122	1	30 000	33 500	2 130	11 000

High speed spindle bearings

With steel balls
Sealed



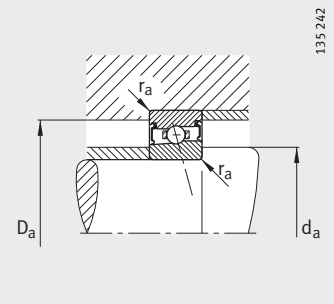
HSS719..-C, HSS70..-C
$\alpha = 15°$



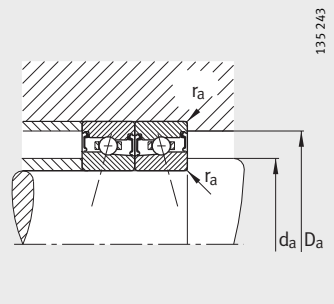
HSS719..-E, HSS70..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HSS71918-C-T-P4S	0,589	**90**	125	18	1,1	23
HSS71918-E-T-P4S	0,588	**90**	125	18	1,1	34
HSS7018-C-T-P4S	1,28	**90**	140	24	1,5	27
HSS7018-E-T-P4S	1,27	**90**	140	24	1,5	39
HSS71919-C-T-P4S	0,615	**95**	130	18	1,1	24
HSS71919-E-T-P4S	0,614	**95**	130	18	1,1	35
HSS7019-C-T-P4S	1,33	**95**	145	24	1,5	28
HSS7019-E-T-P4S	1,33	**95**	145	24	1,5	40
HSS71920-C-T-P4S	0,861	**100**	140	20	1,1	26
HSS71920-E-T-P4S	0,859	**100**	140	20	1,1	38
HSS7020-C-T-P4S	1,39	**100**	150	24	1,5	29
HSS7020-E-T-P4S	1,38	**100**	150	24	1,5	41
HSS71921-C-T-P4S	0,897	**105**	145	20	1,1	27
HSS71921-E-T-P4S	0,87	**105**	145	20	1,1	39
HSS7021-C-T-P4S	1,71	**105**	160	26	2	31
HSS7021-E-T-P4S	1,71	**105**	160	26	2	44
HSS71922-C-T-P4S	0,933	**110**	150	20	1,1	27
HSS71922-E-T-P4S	0,932	**110**	150	20	1,1	40
HSS7022-C-T-P4S	2,17	**110**	170	28	2	33
HSS7022-E-T-P4S	2,17	**110**	170	28	2	47
HSS71924-C-T-P4S	1,3	**120**	165	22	1,1	30
HSS71924-E-T-P4S	1,3	**120**	165	22	1,1	44
HSS7024-C-T-P4S	2,33	**120**	180	28	2	34
HSS7024-E-T-P4S	2,33	**120**	180	28	2	49
HSS71926-C-T-P4S	1,71	**130**	180	24	1,5	33
HSS71926-E-T-P4S	1,71	**130**	180	24	1,5	48
HSS7026-C-T-P4S	3,52	**130**	200	33	2	39
HSS7026-E-T-P4S	3,51	**130**	200	33	2	55



Mounting dimensions

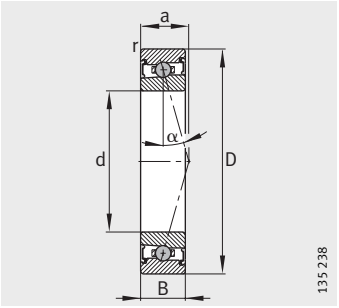


Mounting dimensions

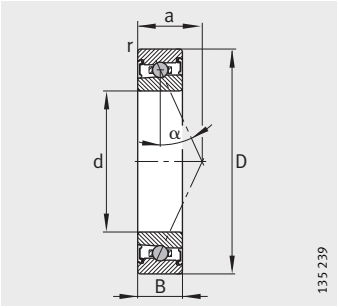
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
97	119	0,6	23 600	28 500	1 860	13 000
97	119	0,6	22 400	26 500	1 750	11 000
100	131	1,5	37 500	43 000	2 550	12 000
100	131	1,5	35 500	40 000	2 410	10 000
102	124	0,6	24 500	30 000	1 930	12 000
102	124	0,6	22 800	28 000	1 820	10 000
105	136	1,5	38 000	44 000	2 600	11 000
105	136	1,5	35 500	41 500	2 450	9 500
107	133	0,6	29 000	36 000	2 200	11 000
107	133	0,6	27 500	33 500	2 080	9 500
110	141	1,5	38 000	45 500	2 650	11 000
110	141	1,5	36 000	42 500	2 490	9 000
112	138	0,6	30 000	38 000	2 280	11 000
112	138	0,6	28 000	35 500	2 150	9 000
116	150	2	49 000	58 500	3 250	10 000
116	150	2	46 500	54 000	3 050	8 500
117	143	0,6	34 500	44 000	2 550	10 000
117	143	0,6	32 500	40 500	2 430	9 000
121	159	2	50 000	60 000	3 300	9 500
121	159	2	46 500	56 000	3 100	8 000
128	157	0,6	36 500	48 000	2 750	9 000
128	157	0,6	34 000	45 000	2 600	8 000
131	169	2	51 000	63 000	3 400	8 500
131	169	2	48 000	58 500	3 200	7 500
139	171	0,6	41 500	56 000	3 000	8 500
139	171	0,6	39 000	52 000	2 850	7 000
142	189	2	65 500	83 000	4 250	7 500
142	189	2	62 000	78 000	4 000	6 700

High speed spindle bearings

With ceramic balls
Sealed



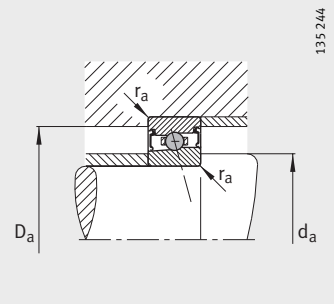
HCS719..-C, HCS70..-C
$\alpha = 15°$



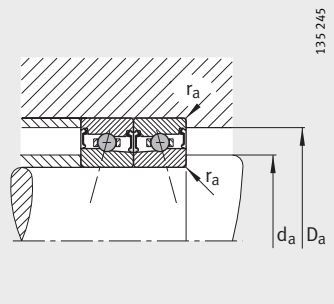
HCS719..-E, HCS70..-E
$\alpha = 25°$

Dimension table · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HCS71900-C-T-P4S	0,01	**10**	22	6	0,3	5
HCS71900-E-T-P4S	0,009	**10**	22	6	0,3	7
HCS7000-C-T-P4S	0,02	**10**	26	8	0,3	6
HCS7000-E-T-P4S	0,02	**10**	26	8	0,3	8
HCS71901-C-T-P4S	0,01	**12**	24	6	0,3	5
HCS71901-E-T-P4S	0,01	**12**	24	6	0,3	7
HCS7001-C-T-P4S	0,022	**12**	28	8	0,3	7
HCS7001-E-T-P4S	0,022	**12**	28	8	0,3	9
HCS71902-C-T-P4S	0,015	**15**	28	7	0,3	6
HCS71902-E-T-P4S	0,015	**15**	28	7	0,3	9
HCS7002-C-T-P4S	0,033	**15**	32	9	0,3	8
HCS7002-E-T-P4S	0,033	**15**	32	9	0,3	10
HCS71903-C-T-P4S	0,017	**17**	30	7	0,3	7
HCS71903-E-T-P4S	0,017	**17**	30	7	0,3	9
HCS7003-C-T-P4S	0,044	**17**	35	10	0,3	9
HCS7003-E-T-P4S	0,044	**17**	35	10	0,3	11
HCS71904-C-T-P4S	0,041	**20**	37	9	0,3	8
HCS71904-E-T-P4S	0,041	**20**	37	9	0,3	11
HCS7004-C-T-P4S	0,074	**20**	42	12	0,6	10
HCS7004-E-T-P4S	0,074	**20**	42	12	0,6	13
HCS71905-C-T-P4S	0,047	**25**	42	9	0,3	9
HCS71905-E-T-P4S	0,047	**25**	42	9	0,3	12
HCS7005-C-T-P4S	0,085	**25**	47	12	0,6	11
HCS7005-E-T-P4S	0,085	**25**	47	12	0,6	14
HCS71906-C-T-P4S	0,047	**30**	47	9	0,3	10
HCS71906-E-T-P4S	0,047	**30**	47	9	0,3	14
HCS7006-C-T-P4S	0,123	**30**	55	13	1	12
HCS7006-E-T-P4S	0,123	**30**	55	13	1	16
HCS71907-C-T-P4S	0,076	**35**	55	10	0,6	11
HCS71907-E-T-P4S	0,076	**35**	55	10	0,6	16
HCS7007-C-T-P4S	0,168	**35**	62	14	1	14
HCS7007-E-T-P4S	0,168	**35**	62	14	1	18
HCS71908-C-T-P4S	0,122	**40**	62	12	0,6	13
HCS71908-E-T-P4S	0,122	**40**	62	12	0,6	18
HCS7008-C-T-P4S	0,211	**40**	68	15	1	15
HCS7008-E-T-P4S	0,211	**40**	68	15	1	20



Mounting dimensions

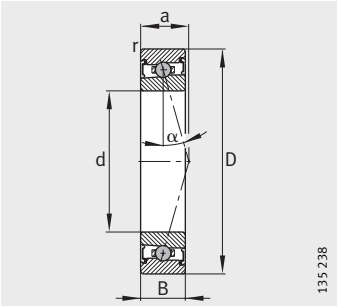


Mounting dimensions

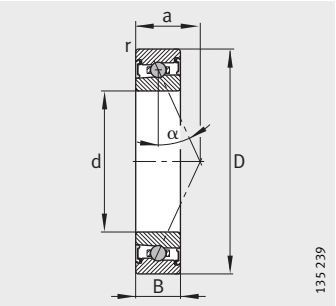
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
13	19,5	0,3	1 370	765	47,5	100 000
13	19,5	0,3	1 290	720	45,5	85 000
14	22	0,3	1 900	1 100	68	90 000
14	22	0,3	1 800	1 060	65	75 000
15	21,5	0,3	1 400	830	53	90 000
15	21,5	0,3	1 340	800	50	75 000
16,5	24,5	0,3	1 860	1 120	70	80 000
16,5	24,5	0,3	1 760	1 080	67	70 000
18	25,5	0,3	1 930	1 220	76	75 000
18	25,5	0,3	1 830	1 160	72	63 000
19	29	0,3	2 600	1 700	108	70 000
19	29	0,3	2 450	1 600	103	60 000
20	27,5	0,3	2 000	1 340	82	70 000
20	27,5	0,3	1 900	1 270	78	60 000
21	32	0,3	2 650	1 830	117	63 000
21	32	0,3	2 500	1 730	111	53 000
24	33,5	0,3	2 700	1 960	126	56 000
24	33,5	0,3	2 550	1 860	119	48 000
25	37	0,6	4 300	3 200	198	53 000
25	37	0,6	4 050	3 000	188	45 000
29	38,5	0,3	2 900	2 360	150	48 000
29	38,5	0,3	2 750	2 200	142	40 000
30	42	0,6	4 300	3 450	214	45 000
30	42	0,6	4 050	3 250	203	38 000
34	43,5	0,3	4 400	3 650	227	43 000
34	43,5	0,3	4 150	3 450	215	36 000
36	49	1	6 000	4 900	310	38 000
36	49	1	5 700	4 650	295	32 000
40	51,5	0,6	4 800	4 400	275	36 000
40	51,5	0,6	4 500	4 050	260	30 000
41	56	1	6 400	5 850	365	34 000
41	56	1	6 100	5 400	345	28 000
45	58,5	0,6	5 000	4 800	315	32 000
45	58,5	0,6	4 750	4 500	295	28 000
46	62	1	6 800	6 550	415	30 000
46	62	1	6 400	6 100	395	26 000

High speed spindle bearings

With ceramic balls
Sealed



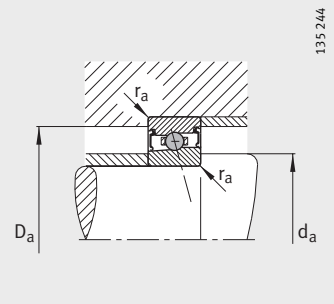
HCS719..-C, HCS70..-C
$\alpha = 15°$



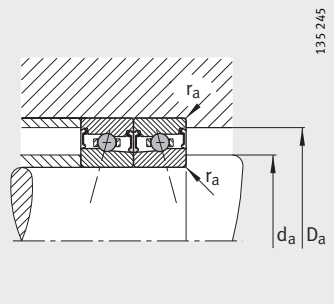
HCS719..-E, HCS70..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HCS71909-C-T-P4S	0,135	**45**	68	12	0,6	14
HCS71909-E-T-P4S	0,135	**45**	68	12	0,6	19
HCS7009-C-T-P4S	0,248	**45**	75	16	1	16
HCS7009-E-T-P4S	0,247	**45**	75	16	1	22
HCS71910-C-T-P4S	0,136	**50**	72	12	0,6	14
HCS71910-E-T-P4S	0,136	**50**	72	12	0,6	20
HCS7010-C-T-P4S	0,269	**50**	80	16	1	17
HCS7010-E-T-P4S	0,268	**50**	80	16	1	23
HCS71911-C-T-P4S	0,17	**55**	80	13	1	16
HCS71911-E-T-P4S	0,17	**55**	80	13	1	22
HCS7011-C-T-P4S	0,348	**55**	90	18	1,1	19
HCS7011-E-T-P4S	0,347	**55**	90	18	1,1	26
HCS71912-C-T-P4S	0,19	**60**	85	13	1	16
HCS71912-E-T-P4S	0,19	**60**	85	13	1	23
HCS7012-C-T-P4S	0,388	**60**	95	18	1,1	19
HCS7012-E-T-P4S	0,388	**60**	95	18	1,1	27
HCS71913-C-T-P4S	0,194	**65**	90	13	1	17
HCS71913-E-T-P4S	0,194	**65**	90	13	1	25
HCS7013-C-T-P4S	0,402	**65**	100	18	1,1	20
HCS7013-E-T-P4S	0,402	**65**	100	18	1,1	28
HCS71914-C-T-P4S	0,322	**70**	100	16	1	19
HCS71914-E-T-P4S	0,321	**70**	100	16	1	28
HCS7014-C-T-P4S	0,611	**70**	110	20	1,1	22
HCS7014-E-T-P4S	0,61	**70**	110	20	1,1	31
HCS71915-C-T-P4S	0,347	**75**	105	16	1	20
HCS71915-E-T-P4S	0,346	**75**	105	16	1	29
HCS7015-C-T-P4S	0,645	**75**	115	20	1,1	23
HCS7015-E-T-P4S	0,644	**75**	115	20	1,1	32
HCS71916-C-T-P4S	0,317	**80**	110	16	1	21
HCS71916-E-T-P4S	0,317	**80**	110	16	1	30
HCS7016-C-T-P4S	0,873	**80**	125	22	1,1	25
HCS7016-E-T-P4S	0,871	**80**	125	22	1,1	35
HCS71917-C-T-P4S	0,512	**85**	120	18	1,1	23
HCS71917-E-T-P4S	0,511	**85**	120	18	1,1	33
HCS7017-C-T-P4S	0,916	**85**	130	22	1,1	25
HCS7017-E-T-P4S	0,915	**85**	130	22	1,1	36



Mounting dimensions

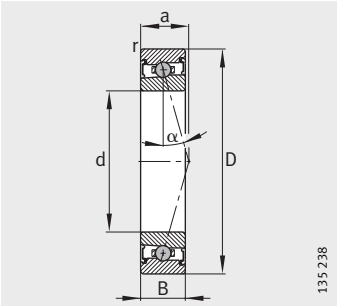


Mounting dimensions

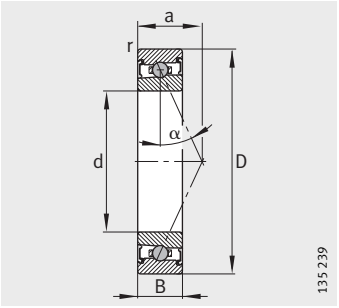
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
50	63,5	0,6	6 950	6 700	435	28 000
50	63,5	0,6	6 550	6 300	410	24 000
51	69	1	8 800	8 500	550	26 000
51	69	1	8 300	8 000	520	24 000
55	67,5	0,6	7 100	7 200	470	26 000
55	67,5	0,6	6 700	6 700	445	22 000
56	74	1	9 150	9 150	590	24 000
56	74	1	8 650	8 500	560	22 000
60	75,5	0,6	9 300	9 500	620	24 000
60	75,5	0,6	8 800	8 800	590	20 000
62	83	1	12 900	13 200	840	22 000
62	83	1	12 200	12 200	790	19 000
65	80,5	0,6	9 650	10 000	670	22 000
65	80,5	0,6	9 000	9 500	630	19 000
67	88	1	13 400	14 000	910	20 000
67	88	1	12 700	13 200	860	18 000
70	85,5	0,6	9 800	10 800	720	20 000
70	85,5	0,6	9 300	10 000	680	18 000
72	93	1	13 700	15 000	980	20 000
72	93	1	12 900	14 000	930	17 000
76	94,5	0,6	12 700	14 000	940	19 000
76	94,5	0,6	12 000	13 200	890	16 000
77	102	1	18 000	19 600	1 250	18 000
77	102	1	17 000	18 300	1 190	15 000
81	99,5	0,6	12 900	15 000	1 010	18 000
81	99,5	0,6	12 200	13 700	950	15 000
82	107	1	18 300	20 000	1 310	17 000
82	107	1	17 300	18 600	1 240	15 000
86	104	0,6	14 600	16 600	1 130	17 000
86	104	0,6	13 700	15 600	1 060	15 000
88	117	1	21 600	24 500	1 570	16 000
88	117	1	20 400	22 800	1 480	13 000
92	114	0,6	15 000	18 000	1 220	16 000
92	114	0,6	14 300	17 000	1 150	13 000
93	122	1	22 000	25 000	1 590	15 000
93	122	1	20 800	23 200	1 510	13 000

High speed spindle bearings

With ceramic balls
Sealed



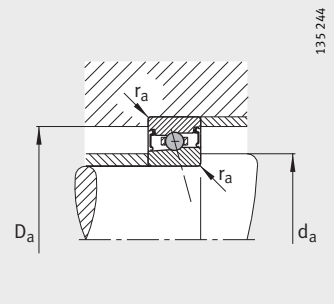
HCS719..-C, HCS70..-C
$\alpha = 15°$



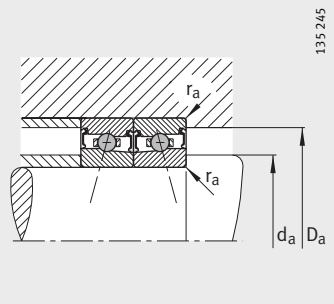
HCS719..-E, HCS70..-E
$\alpha = 25°$

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions				
	m	d	D	B	r	a
	≈kg				min.	≈
HCS71918-C-T-P4S	0,588	**90**	125	18	1,1	23
HCS71918-E-T-P4S	0,587	**90**	125	18	1,1	34
HCS7018-C-T-P4S	1,19	**90**	140	24	1,5	27
HCS7018-E-T-P4S	1,18	**90**	140	24	1,5	39
HCS71919-C-T-P4S	0,615	**95**	130	18	1,1	24
HCS71919-E-T-P4S	0,614	**95**	130	18	1,1	35
HCS7019-C-T-P4S	1,24	**95**	145	24	1,5	28
HCS7019-E-T-P4S	1,24	**95**	145	24	1,5	40
HCS71920-C-T-P4S	0,818	**100**	140	20	1,1	26
HCS71920-E-T-P4S	0,816	**100**	140	20	1,1	38
HCS7020-C-T-P4S	1,29	**100**	150	24	1,5	29
HCS7020-E-T-P4S	1,29	**100**	150	24	1,5	41
HCS71921-C-T-P4S	0,851	**105**	145	20	1,1	27
HCS71921-E-T-P4S	0,85	**105**	145	20	1,1	39
HCS7021-C-T-P4S	1,59	**105**	160	26	2	31
HCS7021-E-T-P4S	1,59	**105**	160	26	2	44
HCS71922-C-T-P4S	0,859	**110**	150	20	1,1	27
HCS71922-E-T-P4S	0,858	**110**	150	20	1,1	40
HCS7022-C-T-P4S	2,05	**110**	170	28	2	33
HCS7022-E-T-P4S	2,05	**110**	170	28	2	47
HCS71924-C-T-P4S	1,22	**120**	165	22	1,1	30
HCS71924-E-T-P4S	1,22	**120**	165	22	1,1	44
HCS7024-C-T-P4S	2,2	**120**	180	28	2	34
HCS7024-E-T-P4S	2,2	**120**	180	28	2	49
HCS71926-C-T-P4S	1,59	**130**	180	24	1,5	33
HCS71926-E-T-P4S	1,59	**130**	180	24	1,5	48
HCS7026-C-T-P4S	3,52	**130**	200	33	2	39
HCS7026-E-T-P4S	3,51	**130**	200	33	2	55



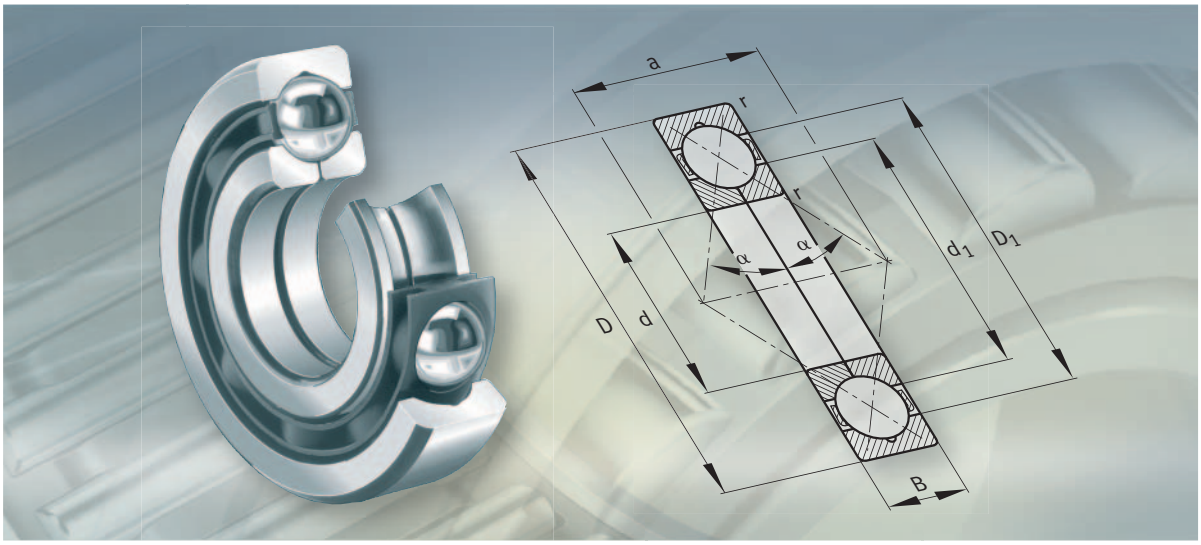
Mounting dimensions



Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a h12	D_a H12	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}
97	119	0,6	16 300	19 600	1 320	15 000
97	119	0,6	15 600	18 600	1 240	13 000
100	131	1,5	26 000	30 000	1 810	14 000
100	131	1,5	24 500	28 000	1 710	12 000
102	124	0,6	17 000	20 800	1 360	14 000
102	124	0,6	16 000	19 300	1 290	12 000
105	136	1,5	26 000	31 000	1 840	13 000
105	136	1,5	24 500	28 500	1 730	11 000
107	133	0,6	20 400	25 000	1 560	13 000
107	133	0,6	19 000	23 600	1 470	11 000
110	141	1,5	26 500	31 500	1 860	12 000
110	141	1,5	25 000	30 000	1 760	11 000
112	138	0,6	20 800	26 500	1 620	12 000
112	138	0,6	19 600	24 500	1 530	11 000
116	150	2	34 000	40 500	2 300	12 000
116	150	2	32 000	38 000	2 180	10 000
117	143	0,6	24 000	30 500	1 820	12 000
117	143	0,6	22 800	28 500	1 720	10 000
121	159	2	34 500	41 500	2 330	11 000
121	159	2	32 500	39 000	2 200	9 000
128	157	0,6	25 000	33 500	1 950	11 000
128	157	0,6	23 600	31 000	1 830	9 000
131	169	2	35 500	44 000	2 410	10 000
131	169	2	33 500	41 500	2 280	8 500
139	171	0,6	29 000	39 000	2 140	9 500
139	171	0,6	27 000	36 500	2 010	8 000
142	189	2	45 500	58 500	3 000	9 000
142	189	2	42 500	54 000	2 850	7 500

FAG



Four point contact bearings

Four point contact bearings

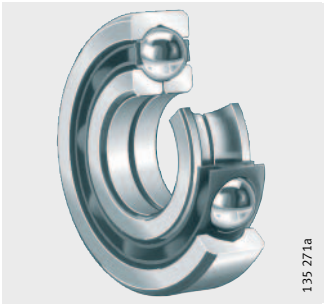


		Page
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Features	Axial load capacity in both directions	317
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Product overview Four point contact bearings

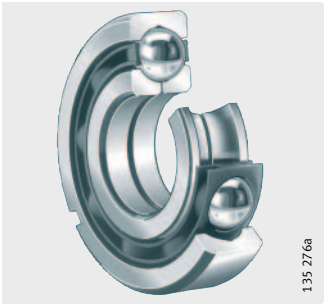
Without retaining slots

QJ2, QJ3



With retaining slots

QJ2..-N2, QJ3..-N2



Four point contact bearings

Features

Four point contact bearings are single row angular contact ball bearings and therefore require significantly less space in an axial direction than double row designs.

The bearings comprise solid outer rings, split inner rings and ball and cage assemblies with brass or polyamide cages. The two-piece inner rings allow a large complement of balls to be accommodated. The inner ring halves are matched to the particular bearing and must not be interchanged with those of other bearings of the same size. The outer ring with the ball and cage assembly can be mounted separately from the two inner ring halves.



Axial load capacity in both directions

Due to the design of the rolling element raceways with their high raceway shoulders, the contact angle of 35° and the large number of rolling elements, four point contact bearings have a high load carrying capacity. They can support high axial forces in both directions as well as small radial loads.

With or without retaining slots in the outer ring

Single row four point contact bearings capable of supporting axial loads in both directions are often combined with a radial bearing and used as an axial bearing with radial clearance in a housing. For quick and secure location, larger four point contact bearings therefore have two retaining slots in the outer ring offset by 180°. These bearings have the suffix N2.

Compensation of angular misalignments

The possible skewing of the inner rings in relation to the outer ring depends on the bearing load, the operating clearance and the bearing size and is very small. Four point contact bearings are not therefore suitable for the compensation of angular misalignments in housing bores or due to shaft deflections.

Skewing of the bearing rings increases the running noise, places increased strain on the cages and has a harmful influence on the operating life of the bearings.

Sealing/lubrication

Four point contact bearings are not sealed and not greased. They can be lubricated using oil or grease.

Operating temperature

Bearings with solid brass cages can be used at operating temperatures from –30 °C to +150 °C.

Bearings with an outside diameter of more than 240 mm are dimensionally stable up to +200 °C.

Caution! Bearings with cages made from glass fibre reinforced polyamide are suitable for operating temperatures up to +120 °C.

Cages

The standard cages for four point contact bearings are shown in the table Cage/bore code, page 318.

Four point contact bearings with brass cages have the suffix MPA. These window cages are guided on the outer ring.

Cages made from glass fibre reinforced polyamide are indicated by the suffix TVP.

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

Four point contact bearings

Cage/bore code

Series	Solid brass cage[1]	Window cage made from polyamide[1]
	Bore code	
QJ2	up to 07, 10, 13, from 16	08, 09, 11, 12, 14, 15
QJ3	04, from 10	05 to 09

1) Other cage designs available by agreement. In such cages, suitability for high speeds and temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffixes	Description	Design
C3	Axial internal clearance larger than normal	Special design[1]
MPA	Solid cage made from brass	Standard
TVP	Window cage made from glass fibre reinforced polyamide 66	Standard
N2	Two retaining slots in outer ring	Standard for larger bearings

1) Available by agreement.

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq 0{,}95$	$P = F_r + 0{,}66 \cdot F_a$
$\frac{F_a}{F_r} > 0{,}95$	$P = 0{,}6 \cdot F_r + 1{,}07 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r} + 0{,}58 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load.

Minimum axial load

In order to ensure low friction in the bearing, especially at high speeds, a minimum axial load is required. In order to prevent an excessive increase in friction, the axial force should be sufficiently high that the rolling bearings are in contact with the inner and outer ring raceway at only one point. This is ensured if $F_a \geqq 1{,}2 \cdot F_r$.

Application as axial bearings only

If four point contact bearings are to be used as axial bearings only, the outer ring must have a large radial clearance in the housing. As a result, the bearings are not subjected to radial load.



Speeds

High speeds can be achieved if four point contact ball bearings are subjected to purely axial load.

ISO 15 312 does not give thermal reference speeds for these bearings.

Caution! The dimension tables therefore only state limiting speeds n_G. These values are for oil lubrication and must not be exceeded. If higher speeds are required, please contact us.

Mounting dimensions

The shoulders on the adjacent construction (shaft/housing) must be sufficiently high that adequate abutment surfaces are ensured even with very large chamfer dimensions.

The maximum values for the radii r_a and the diameters of the abutment surfaces d_a, D_a are indicated in the dimension tables.

Accuracy

The main dimensions of the bearings conform to DIN 628-4.

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620-2.

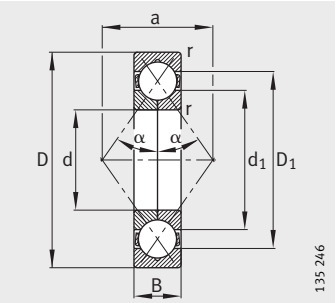
Axial internal clearance

The axial internal clearance corresponds to internal clearance group CN.

Axial internal clearance to DIN 628-4

Bore d mm		Axial internal clearance					
		C2 µm		CN µm		C3 µm	
over	incl.	min.	max.	min.	max.	min.	max.
18	40	30	70	60	110	100	150
40	60	40	90	80	130	120	170
60	80	50	100	90	140	130	180
80	100	60	120	100	160	140	200
100	140	70	140	120	180	160	220
140	180	80	160	140	200	180	240
180	220	100	180	160	220	200	260
220	260	120	200	180	240	220	300

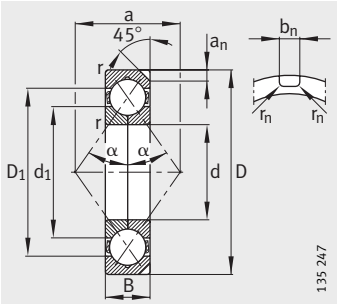
Four point contact bearings



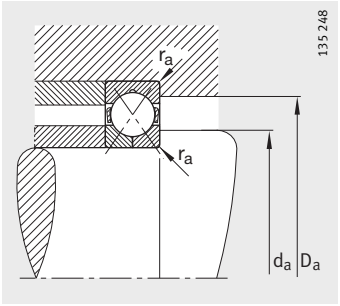
Without retaining slots
$\alpha = 35°$

Dimension table · Dimensions in mm

Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	d_1	a	a_n
	≈kg				min.	≈	≈	≈	
QJ304-MPA	0,184	**20**	52	15	1,1	41,4	30,6	26	–
QJ205-MPA	0,171	**25**	52	15	1	43,1	34,2	27	–
QJ305-TVP	0,256	**25**	62	17	1,1	49,5	37,5	31	–
QJ206-MPA	0,254	**30**	62	16	1	50,7	40,3	32	–
QJ306-TVP	0,379	**30**	72	19	1,1	58	43,9	36	–
QJ207-MPA	0,359	**35**	72	17	1,1	59,1	47,9	38	–
QJ307-TVP	0,516	**35**	80	21	1,5	64,8	50,7	41	–
QJ208-TVP	0,399	**40**	80	18	1,1	66,8	53,6	42	–
QJ308-TVP	0,695	**40**	90	23	1,5	73,4	56,6	46	–
QJ209-TVP	0,467	**45**	85	19	1,1	72	58,4	45	–
QJ309-TVP	0,934	**45**	100	25	1,5	81,7	63,6	51	–
QJ210-MPA	0,609	**50**	90	20	1,1	76,4	63,6	49	–
QJ310-MPA	1,39	**50**	110	27	2	89,6	70,8	56	–
QJ211-TVP	0,697	**55**	100	21	1,5	84,7	70,6	54	–
QJ311-MPA	1,76	**55**	120	29	2	97,8	77,5	61	–
QJ212-TVP	0,889	**60**	110	22	1,5	93	77,3	60	–
QJ312-MPA	2,2	**60**	130	31	2,1	106,9	84,2	67	–
QJ213-MPA	1,27	**65**	120	23	1,5	101,5	84,1	65	–
QJ313-MPA	2,71	**65**	140	33	2,1	114,4	90,9	72	–
QJ214-TVP	1,22	**70**	125	24	1,5	106,3	89	68	–
QJ314-MPA	3,29	**70**	150	35	2,1	123,6	97,6	77	–
QJ215-TVP	1,34	**75**	130	25	1,5	111,5	94	72	–
QJ315-N2-MPA	3,95	**75**	160	37	2,1	131	104,3	82	10,1
QJ216-MPA	1,84	**80**	140	26	2	119,6	100,9	77	–
QJ316-N2-MPA	4,65	**80**	170	39	2,1	140,8	110,6	88	10,1
QJ217-MPA	2,3	**85**	150	28	2	128,6	107,5	82	–
QJ317-N2-MPA	5,54	**85**	180	41	3	148,6	117,8	93	11,7
QJ218-N2-MPA	2,8	**90**	160	30	2	136,1	114,2	88	8,1
QJ318-N2-MPA	6,44	**90**	190	43	3	157,1	124,5	98	11,7
QJ219-N2-MPA	3,41	**95**	170	32	2,1	144,4	121	93	8,1
QJ319-N2-MPA	7,45	**95**	200	45	3	165,4	131,2	103	11,7
QJ220-N2-MPA	4,1	**100**	180	34	2,1	153,6	127,7	98	10,1
QJ320-N2-MPA	9,04	**100**	215	47	3	176,6	138,9	110	11,7
QJ221-N2-MPA	4,81	**105**	190	36	2,1	161,6	134,7	103	10,1



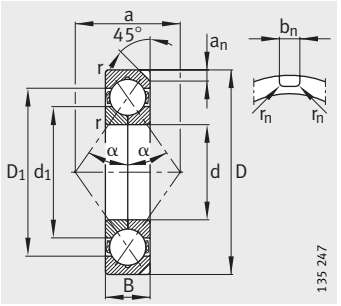
N2, two retaining slots
α = 35°



Mounting dimensions

		Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
b_n	r_n	d_a min.	D_a max.	r_a max.	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}
–	–	27	45	1	30 000	19 600	990	28 000
–	–	31	46	1	25 500	18 600	950	26 000
–	–	32	55	1	44 000	31 500	1 590	14 000
–	–	36	56	1	36 500	27 500	1 410	20 000
–	–	37	65	1	58 500	43 000	2 170	11 000
–	–	42	65	1	44 000	35 500	1 800	18 000
–	–	44	71	1,5	62 000	51 000	2 550	9 500
–	–	47	73	1	56 000	46 500	2 380	9 500
–	–	49	81	1,5	86 500	68 000	3 500	8 500
–	–	52	78	1	64 000	57 000	2 900	8 500
–	–	54	91	1,5	102 000	83 000	4 550	7 500
–	–	57	83	1	61 000	56 000	2 900	13 000
–	–	61	99	2	110 000	91 500	4 950	11 000
–	–	64	91	1,5	80 000	76 500	3 900	7 000
–	–	66	109	2	127 000	108 000	5 900	10 000
–	–	69	101	1,5	96 500	93 000	4 800	6 300
–	–	72	118	2,1	146 000	127 000	6 700	9 000
–	–	74	111	1,5	104 000	104 000	3 950	9 500
–	–	77	128	2,1	163 000	146 000	7 900	8 500
–	–	79	116	1,5	118 000	122 000	6 800	5 600
–	–	82	138	2,1	183 000	166 000	8 600	8 000
–	–	84	121	1,5	125 000	129 000	6 800	5 300
8,5	2	87	148	2,1	212 000	204 000	10 500	7 000
–	–	91	129	2	132 000	137 000	7 100	8 000
8,5	2	92	158	2,1	224 000	220 000	10 800	7 000
–	–	96	139	2	153 000	160 000	8 100	7 000
10,5	2	99	166	2,5	245 000	255 000	11 700	6 300
6,5	1	101	149	2	176 000	186 000	8 800	7 000
10,5	2	104	176	2,5	265 000	285 000	12 900	6 000
6,5	1	107	158	2,1	200 000	212 000	10 100	6 300
10,5	2	109	186	2,5	285 000	310 000	14 100	6 000
8,5	2	112	168	2,1	224 000	240 000	11 200	6 000
10,5	2	114	201	2,5	325 000	365 000	16 300	5 600
8,5	2	117	178	2,1	232 000	260 000	11 600	6 000

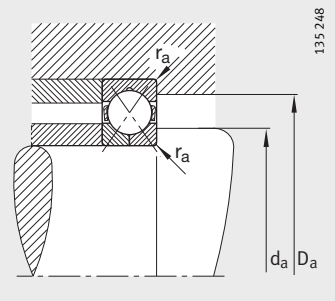
Four point contact bearings



N2, two retaining slots
$\alpha = 35°$

Dimension table (continued) · Dimensions in mm

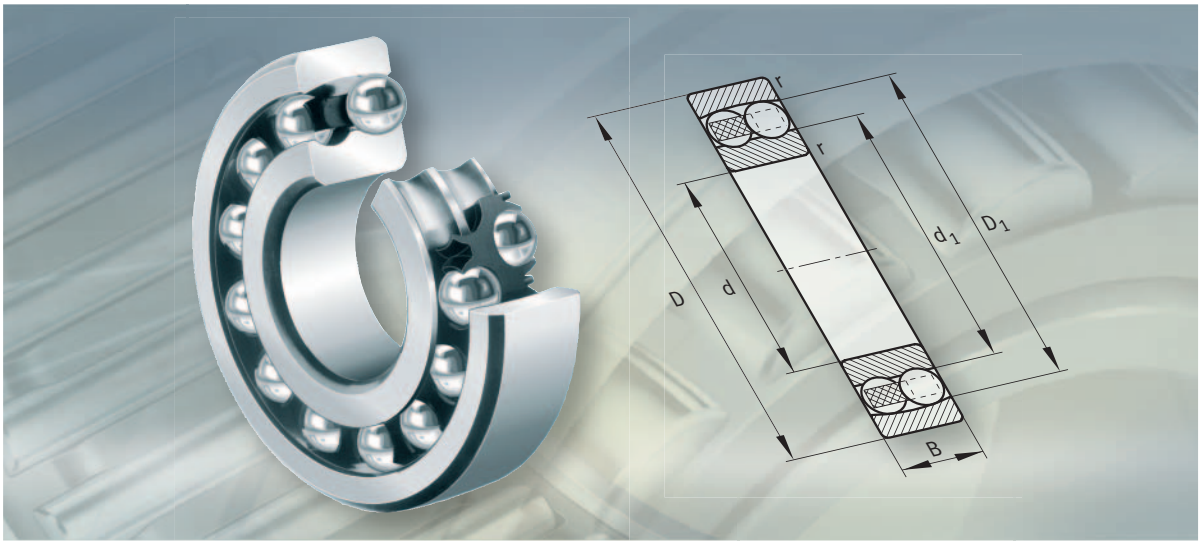
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	d_1	a	a_n
	≈kg				min.	≈	≈	≈	
QJ222-N2-MPA	5,66	**110**	200	38	2,1	169,8	141,6	109	10,1
QJ322-N2-MPA	12,2	**110**	240	50	3	195,5	156,4	123	11,7
QJ224-N2-MPA	6,74	**120**	215	40	2,1	183,6	152,8	117	11,7
QJ324-N2-MPA	15,6	**120**	260	55	3	210,6	169,8	133	11,7
QJ226-N2-MPA	7,66	**130**	230	40	3	195	165,4	127	11,7
QJ326-N2-MPA	19,2	**130**	280	58	4	228	184	144	12,7
QJ228-N2-MPA	9,69	**140**	250	42	3	210,5	180	137	11,7
QJ328-N2-MPA	23,2	**140**	300	62	4	243	197	154	12,7
QJ230-N2-MPA	12,2	**150**	270	45	3	226,7	193,7	147	11,7
QJ330-N2-MPA	28	**150**	320	65	4	261	211,3	165	12,7
QJ232-N2-MPA	15,3	**160**	290	48	3	240	210	158	12,7
QJ332-N2-MPA	32,8	**160**	340	68	4	279,9	222,7	175	12,7
QJ234-N2-MPA	18,9	**170**	310	52	4	260,5	221,4	168	12,7
QJ334-N2-MPA	38,4	**170**	360	72	4	292	238	186	12,7
QJ236-N2-MPA	19,6	**180**	320	52	4	269	231	175	12,7
QJ336-N2-MPA	44,9	**180**	380	75	4	311	249,1	196	12,7
QJ238-N2-MPA	23,8	**190**	340	55	4	286,3	245,8	186	12,7
QJ338-N2-MPA	52,1	**190**	400	78	5	327	262,5	207	12,7
QJ240-N2-MPA	28	**200**	360	58	4	302	258,6	196	12,7
QJ244-N2-MPA	38,6	**220**	400	65	4	336	284,6	217	12,7
QJ344-N2-MPA	77,1	**220**	460	88	5	378	302	238	15
QJ248-N2-MPA	53,1	**240**	440	72	4	367	312,5	238	15
QJ348-N2-MPA	98,2	**240**	500	95	5	410	330,7	259	15



Mounting dimensions

		Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
b_n	r_n	d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
		min.	max.	max.	N	N	N	min^{-1}
8,5	2	122	188	2,1	250 000	285 000	12 300	5 600
10,5	2	124	226	2,5	345 000	415 000	17 400	5 300
10,5	2	132	203	2,1	280 000	340 000	13 800	5 300
10,5	2	134	246	2,5	380 000	480 000	19 300	5 000
10,5	2	144	216	2,5	290 000	365 000	14 500	5 000
10,5	2	147	263	3	425 000	570 000	21 600	4 800
10,5	2	154	236	2,5	315 000	415 000	16 500	4 800
10,5	2	157	283	3	475 000	655 000	19 700	4 300
10,5	2	164	256	2,5	345 000	480 000	18 400	4 500
10,5	2	167	303	3	510 000	735 000	25 500	3 800
10,5	2	174	276	2,5	375 000	530 000	16 800	4 300
10,5	2	177	323	3	585 000	865 000	29 500	3 600
10,5	2	187	293	3	425 000	630 000	22 800	3 800
10,5	2	187	343	3	585 000	915 000	24 900	3 200
10,5	2	197	303	3	430 000	670 000	18 900	3 600
10,5	2	197	363	3	680 000	1 080 000	33 000	3 000
10,5	2	207	323	3	455 000	735 000	24 400	3 200
10,5	2	210	380	4	735 000	1 250 000	37 000	2 800
10,5	2	217	343	3	510 000	850 000	22 600	3 000
10,5	2	237	383	3	630 000	1 120 000	31 000	2 800
12,5	2,5	240	440	4	900 000	1 660 000	44 500	2 800
12,5	2,5	257	423	3	680 000	1 270 000	30 500	2 800
12,5	2,5	260	480	4	1 020 000	1 960 000	52 000	2 600

FAG



Self-aligning ball bearings

Self-aligning ball bearings

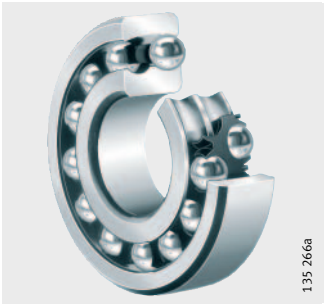
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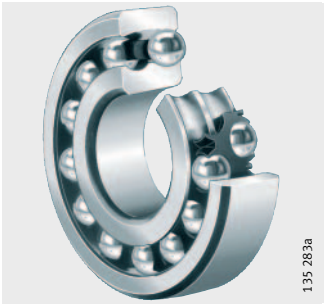
Product overview Self-aligning ball bearings

With cylindrical or tapered bore

10, 12, 13, 22, 23



12..-K, 13..-K, 22..-K, 23..-K



Lip seals

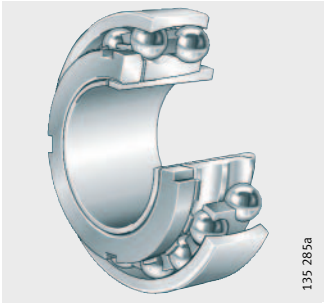
22..-2RS, 22..-K-2RS, 23..-2RS



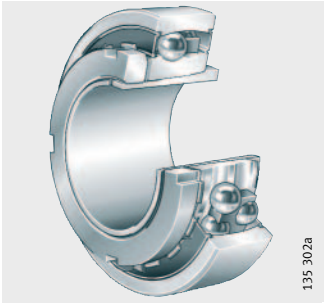
With adapter sleeve

Without or with lip seals

12..-K + H, 13..K + H 22..-K + H, 23..-K + H

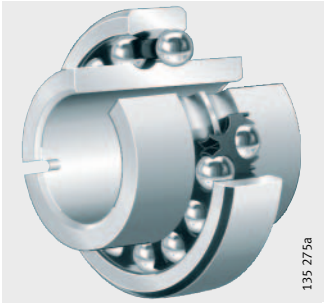


22..-K-2RS + H



With extended inner ring

112



Self-aligning ball bearings

Features

Self-aligning ball bearings are double row, self-retaining units comprising outer rings with a concave raceway, inner rings with a cylindrical or tapered bore and ball and cage assemblies.
The bearings are available in open and sealed designs.

Radial and axial load capacity

Self-aligning ball bearings can support axial forces in both directions as well as radial forces.

With cylindrical/tapered bore

Bearings of series 12, 13, 22 and 23 are available with a cylindrical or tapered bore.

Bearings with a tapered bore have a bore taper of 1:12 and the suffix K.

With adapter sleeve

Self-aligning ball bearings with a tapered bore are also available with an adapter sleeve, locknut and tab washer.
Adapter sleeves must be ordered in addition to the bearing.



With extended inner ring

Bearings of series 112 have an extended inner ring, a location slot on one side of the inner ring and are located by means of dowel pins.

These bearings are intended for simple bearing arrangements with conventional shafts. Due to the bearing bore tolerance (J7), they are very easy to fit.

Sealing/lubrication

Self-aligning ball bearings of series 12, 13, 22 and 23 are also available in sealed designs. Sealed bearings have contact seals on both sides and the suffix 2RS.

They are greased with a high quality grease and are maintenance-free.

Compensation of angular misalignments

Under normal operating conditions and with a rotating inner ring, self-aligning ball bearings can swivel approx. 4° about their central position; sealed bearings can swivel by max. 1,5°. As a result, they permit skewing between the inner and outer ring and can thus compensate misalignments, shaft deflections and housing deformations.

If the outer ring rotates or the inner ring undergoes tumbling motion, the angular adjustment facility is smaller. In this case, please contact us.

Operating temperature

Open bearings with brass cages can be used at operating temperatures from –30 °C to +150 °C.

Caution!

Bearings with cages made from glass fibre reinforced polyamide are suitable for operating temperatures up to +120 °C.

Sealed self-aligning ball bearings are suitable for operating temperatures from –30 °C to +100 °C, restricted by the grease and seal material.

Self-aligning ball bearings

Cages

The standard cages for self-aligning ball bearings are shown in the table Cage/bore code.

Self-aligning ball bearings with cages made from glass fibre reinforced polyamide 66 have the suffix TVH.

Ball-guided solid brass cages are indicated by the suffix M.

Caution!

Check the chemical resistance of polyamide to synthetic greases and oils and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

Cage/bore code

Series	Solid polyamide cage[1)] Bore code	Solid brass cage[1)]
10	8	–
12	up to 18	from 19
13	up to 13	from 14
22	up to 13, 15, 16, 18	14, 17, from 19
23	up to 13	from 14
112	04 to 12	–

1) Other cage designs available by agreement. In such cages, suitability for high speeds and temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
C3	Radial internal clearance larger than normal	Standard for tapered bore
K	Tapered bore	Standard
M	Solid brass cage	Standard
TVH	Solid cage made from glass fibre reinforced polyamide 66	Standard
2RS	Contact seals on both sides	Standard

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r + Y_1 \cdot F_a$
$\frac{F_a}{F_r} > e$	$P = 0{,}65 \cdot F_r + Y_2 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load
e, Y_1, Y_2 –
Factors from dimension tables.



Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r} + Y_0 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load
Y_0 –
Factors from dimension tables.

Minimum load

In order to ensure slippage-free operation, the bearings must be subjected to sufficient load. If insufficient load is applied – for example at high speeds during a test run – slippage can occur that may lead under conditions of inadequate lubrication to bearing damage.

The minimum load should be $P/C_r = 0{,}01$.

Speeds

Caution!

If the reference speed n_B in the dimension tables is higher than the limiting speed n_G, the higher value cannot be used.

In bearings with contact seals (suffix 2RS), the speed is limited by the permissible sliding speed of the sealing lips, so only the limiting speed n_G is given in the tables.

Mounting dimensions

The dimension tables give the maximum radius dimension r_a and the diameters of the abutment shoulders.

When fitting self-aligning ball bearings with adapter sleeves, attention must be paid to the dimensions of the support ring.

Projecting balls in bearings with brass cage

In some bearings with a brass cage, the balls project to a certain extent at the sides. The projection C_1 must be taken into consideration when designing the adjacent construction.

The projection is larger in the following bearings according to the table, *Figure 1*:

Ball projection

Bearing	Projection C_1 mm
1224-M	1,8
1226-M	0,6
1228-M	2,7
1230-M	3,8
1319-M	1,6
1320-M	2,4
1321-M	2,5
1322-M	2,7

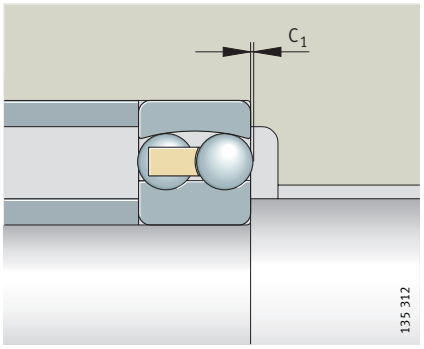


Figure 1
Ball projection C_1

Location

Series 112

These bearings are axially located by means of dowel pins that engage in the slot in the inner ring, *Figure 2*. These also prevent the inner rings creeping on the shaft.

If a shaft is to be supported by two bearings, the locating slots must be arranged on the sides of the bearing facing towards or away from each other, *Figure 2*.

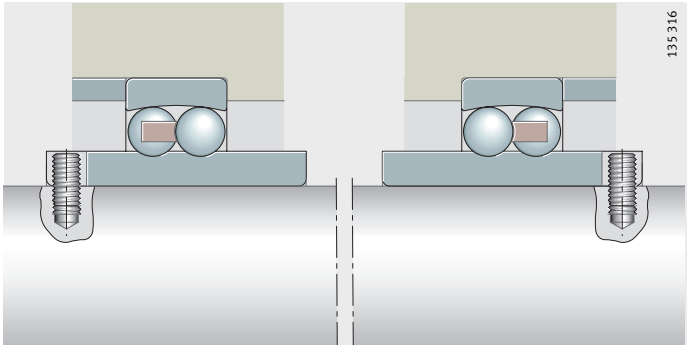


Figure 2
Location and arrangement of bearings

Bearings with tapered bore

Bearings with a tapered inner ring bore are:

- located either directly on tapered shaft seats or
- located on a cylindrical shaft seat using an adapter sleeve, locknut and tab washer.

If high axial forces are present, a support ring can be used.
For fitting, attention must be paid to the dimensions on the support ring according to the dimension tables.

Accuracy

The main dimensions of the bearings conform to DIN 630.

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620-2.

In series 112, the bearing bore tolerance is J7.

Radial internal clearance of bearings with cylindrical bore

The radial internal clearance is CN.



Radial internal clearance to DIN 620-4

Bore d mm		Radial internal clearance			
		CN µm		C3 µm	
over	incl.	min.	max.	min.	max.
–	6	5	15	10	20
6	10	6	17	12	25
10	14	6	19	13	26
14	18	8	21	15	28
18	24	10	23	17	30
24	30	11	24	19	35
30	40	13	29	23	40
40	50	14	31	25	44
50	65	16	36	30	50
65	80	18	40	35	60
80	100	22	48	42	70
100	120	25	56	50	83
120	140	30	68	60	100
140	160	35	80	70	120

Radial internal clearance of bearings with tapered bore

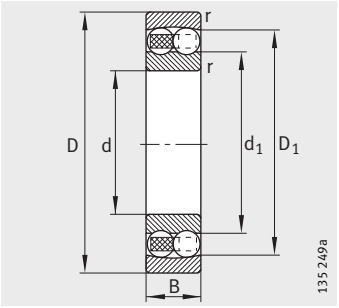
Bearings with a tapered bore have the internal clearance group C3.

Radial internal clearance to DIN 620-4

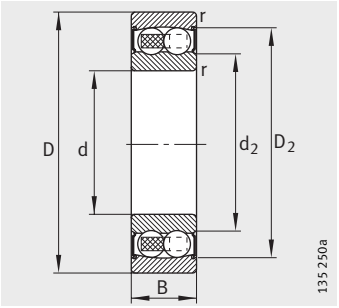
Bore d mm		Radial internal clearance			
		CN µm		C3 µm	
over	incl.	min.	max.	min.	max.
18	24	13	26	20	33
24	30	15	28	33	39
30	40	19	35	29	46
40	50	22	39	33	52
50	65	27	47	41	61
65	80	35	57	50	75
80	100	42	68	62	90
100	120	50	81	75	108
120	140	60	98	90	130
140	160	65	110	100	150

Self-aligning ball bearings

With cylindrical bore
Open or sealed



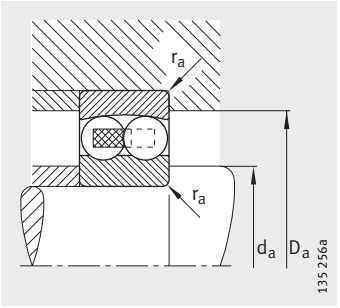
Cylindrical bore



Cylindrical bore
2RS seals

Dimension table · Dimensions in mm

Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	d_2
	≈kg				min.	≈	≈	≈	≈
135-TVH	0,01	**5**	19	6	0,3	14,5	–	10,1	–
126-TVH	0,009	**6**	19	6	0,3	14,5	–	10,1	–
127-TVH	0,014	**7**	22	7	0,3	16,8	–	12,4	–
108-TVH	0,014	**8**	22	7	0,3	16,8	–	12,4	–
129-TVH	0,022	**9**	26	8	0,6	20	–	14,5	–
1200-TVH	0,034	**10**	30	9	0,6	23,5	–	16,3	–
2200-2RS-TVH	0,053	**10**	30	14	0,6	–	25,9	–	14,1
2200-TVH	0,045	**10**	30	14	0,6	24,2	–	15,1	–
1201-TVH	0,041	**12**	32	10	0,6	25,4	–	18,2	–
2201-2RS-TVH	0,058	**12**	32	14	0,6	–	27,9	–	16,2
2201-TVH	0,05	**12**	32	14	0,6	26,2	–	17,1	–
1202-TVH	0,048	**15**	35	11	0,6	29,2	–	20,2	–
2202-2RS-TVH	0,061	**15**	35	14	0,6	–	31	–	19
2202-TVH	0,057	**15**	35	14	0,6	29,5	–	20,3	–
2302-TVH	0,111	**15**	42	17	1	34,8	–	22,5	–
1203-TVH	0,073	**17**	40	12	0,6	32,3	–	23,7	–
2203-2RS-TVH	0,098	**17**	40	16	0,6	–	34,3	–	21,7
2203-TVH	0,054	**17**	40	16	0,6	34,1	–	23,9	–
1303-TVH	0,065	**17**	47	14	1	37,3	–	26,7	–
2303-2RS-TVH	0,175	**17**	47	19	1	–	40,3	–	23,9
2303-TVH	0,155	**17**	47	19	1	37,3	–	26,2	–

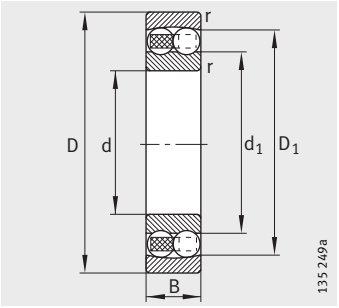


Mounting dimensions

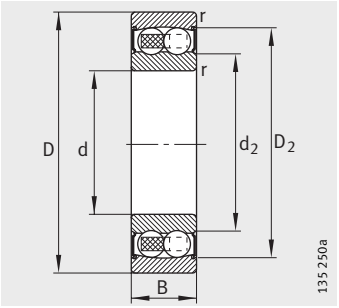
Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
7,4	16,6	0,3	2 600	475	0,35	1,82	2,82	1,91	29,5	36 000	35 000
8,4	16,6	0,3	2 600	475	0,35	1,82	2,82	1,91	29,5	36 000	39 500
9,4	19,6	0,3	2 750	560	0,33	1,92	2,97	2,01	34,5	36 000	36 500
10,6	19,4	0,3	2 750	560	0,33	1,92	2,97	2,01	34,5	36 000	–
13,2	21,8	0,6	3 950	800	0,32	1,95	3,01	2,04	50	32 000	31 500
14,2	25,8	0,6	5 700	1 180	0,32	1,95	3,02	2,05	73	30 000	28 500
14,2	25,8	0,6	5 700	1 180	0,32	1,95	3,02	2,05	73	18 000	–
14,2	25,8	0,6	8 800	1 730	0,58	1,09	1,69	1,14	107	28 000	27 500
16,2	27,8	0,6	5 700	1 260	0,37	1,69	2,62	1,77	78	30 000	27 500
16,2	27,8	0,6	5 700	1 260	0,37	1,69	2,62	1,77	78	17 000	–
16,2	27,8	0,6	9 400	1 920	0,53	1,2	1,85	1,25	120	26 000	24 600
19,2	30,8	0,6	7 700	1 730	0,34	1,86	2,88	1,95	108	26 000	24 800
19,2	30,8	0,6	7 700	1 730	0,34	1,86	2,88	1,95	108	15 000	–
19,2	30,8	0,6	9 600	2 080	0,46	1,37	2,13	1,44	130	24 000	21 100
20,6	36,4	1	17 000	3 700	0,51	1,23	1,91	1,29	232	18 000	18 200
21,2	35,8	0,6	8 100	2 000	0,33	1,93	2,99	2,03	124	22 000	22 300
21,2	35,8	0,6	8 100	2 000	0,33	1,93	2,99	2,03	124	14 000	–
21,2	35,8	0,6	11 800	2 750	0,46	1,37	2,12	1,43	171	19 000	19 600
22,6	41,4	1	12 900	3 150	0,32	1,94	3	2,03	197	18 000	17 900
22,6	41,4	1	12 900	3 150	0,32	1,94	3	2,03	197	11 000	–
22,6	41,4	1	13 900	3 150	0,53	1,19	1,85	1,25	197	17 000	16 900

Self-aligning ball bearings

With cylindrical or tapered bore
Open or sealed



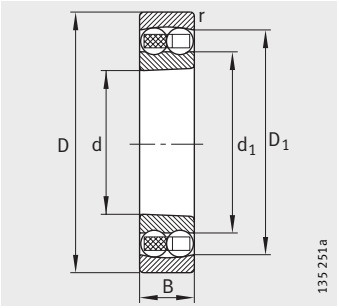
Cylindrical bore



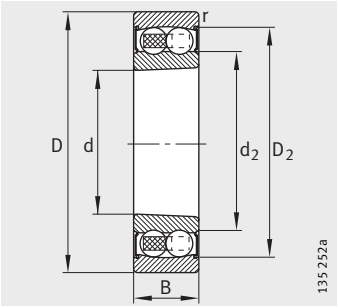
Cylindrical bore
2RS seals

Dimension table (continued) · Dimensions in mm

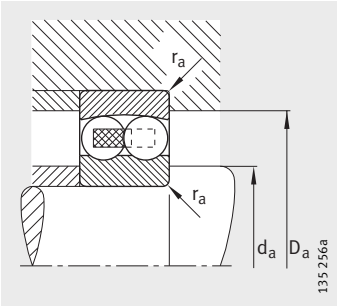
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	d_2
	≈kg				min.	≈	≈	≈	≈
1204-K-TVH-C3	0,116	**20**	47	14	1	38,1	–	29,2	–
1204-TVH	0,118	**20**	47	14	1	38,1	–	29,2	–
2204-2RS-TVH	0,151	**20**	47	18	1	–	41,7	–	25,9
2204-TVH	0,134	**20**	47	18	1	39,5	–	28	–
1304-TVH	0,163	**20**	52	15	1,1	41,9	–	31,6	–
2304-2RS-TVH	0,23	**20**	52	21	1,1	–	45,2	–	27,2
2304-TVH	0,206	**20**	52	21	1,1	41,5	–	29,1	–
1205-K-TVH-C3	0,135	**25**	52	15	1	43,9	–	33,3	–
1205-TVH	0,138	**25**	52	15	1	43,9	–	33,3	–
2205-2RS-TVH	0,161	**25**	52	18	1	–	46,3	–	30,7
2205-K-2RS-TVH-C3	0,157	**25**	52	18	1	–	46,3	–	30,7
2205-K-TVH-C3	0,152	**25**	52	18	1	44,7	–	32,3	–
2205-TVH	0,156	**25**	52	18	1	44,7	–	32,3	–
1305-K-TVH-C3	0,254	**25**	62	17	1,1	50,8	–	38,1	–
1305-TVH	0,258	**25**	62	17	1,1	50,8	–	38,1	–
2305-2RS-TVH	0,367	**25**	62	24	1,1	–	53,2	–	33,5
2305-K-TVH-C3	0,328	**25**	62	24	1,1	50,1	–	35,5	–
2305-TVH	0,335	**25**	62	24	1,1	50,1	–	35,5	–
1206-K-TVH-C3	0,217	**30**	62	16	1	51,9	–	40,1	–
1206-TVH	0,221	**30**	62	16	1	51,9	–	40,1	–
2206-2RS-TVH	0,274	**30**	62	20	1	–	54,3	–	37,3
2206-K-2RS-TVH-C3	0,268	**30**	62	20	1	–	54,3	–	37,3
2206-K-TVH-C3	0,246	**30**	62	20	1	54	–	38,5	–
2206-TVH	0,252	**30**	62	20	1	54	–	38,5	–
1306-K-TVH-C3	0,379	**30**	72	19	1,1	59,4	–	45	–
1306-TVH	0,384	**30**	72	19	1,1	59,4	–	45	–
2306-2RS-TVH	0,554	**30**	72	27	1,1	–	63	–	40,6
2306-K-TVH-C3	0,476	**30**	72	27	1,1	59,3	–	41,5	–
2306-TVH	0,488	**30**	72	27	1,1	59,3	–	41,5	–



Tapered bore
K = taper 1:12



Tapered bore
K = taper 1:12
2RS seals

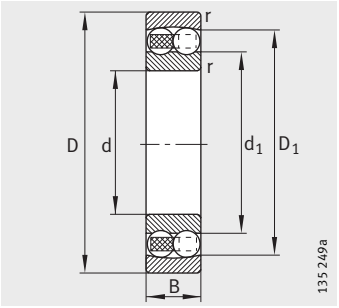


Mounting dimensions

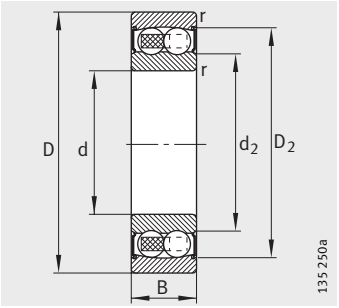
Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
25,6	41,4	1	10 100	2 600	0,28	2,24	3,46	2,34	161	18 000	20 200
25,6	41,4	1	10 100	2 600	0,28	2,24	3,46	2,34	161	18 000	20 200
25,6	41,4	1	10 100	2 600	0,28	2,24	3,46	2,34	161	11 000	–
25,6	41,4	1	14 700	3 500	0,44	1,45	2,24	1,51	219	17 000	17 300
27	45	1	12 700	3 300	0,29	2,17	3,35	2,27	206	16 000	16 200
27	45	1	12 700	3 300	0,29	2,17	3,35	2,27	206	10 000	–
27	45	1	17 600	4 250	0,51	1,23	1,9	1,29	265	16 000	15 600
30,6	46,4	1	12 300	3 250	0,27	2,37	3,66	2,48	203	16 000	17 800
30,6	46,4	1	12 300	3 250	0,27	2,37	3,66	2,48	203	16 000	17 800
30,6	46,4	1	12 300	3 250	0,27	2,37	3,66	2,48	203	9 500	–
30,6	46,4	1	12 300	3 250	0,27	2,37	3,66	2,48	203	9 500	–
30,6	46,4	1	17 300	4 400	0,35	1,78	2,75	1,86	275	15 000	14 600
30,6	46,4	1	17 300	4 400	0,35	1,78	2,75	1,86	275	15 000	14 600
32	55	1	18 300	4 950	0,28	2,29	3,54	2,4	310	14 000	13 900
32	55	1	18 300	4 950	0,28	2,29	3,54	2,4	310	14 000	13 900
32	55	1	18 300	4 950	0,28	2,29	3,54	2,4	310	8 000	–
32	55	1	25 000	6 500	0,48	1,32	2,04	1,38	405	13 000	13 500
32	55	1	25 000	6 500	0,48	1,32	2,04	1,38	405	13 000	13 500
35,6	56,4	1	15 900	4 600	0,25	2,53	3,91	2,65	285	14 000	14 900
35,6	56,4	1	15 900	4 600	0,25	2,53	3,91	2,65	285	14 000	14 900
35,6	56,4	1	15 900	4 600	0,25	2,53	3,91	2,65	285	8 000	–
35,6	56,4	1	15 900	4 600	0,25	2,53	3,91	2,65	285	8 000	–
35,6	56,4	1	26 000	6 900	0,3	2,13	3,29	2,23	430	12 000	12 600
35,6	56,4	1	26 000	6 900	0,3	2,13	3,29	2,23	430	12 000	12 600
37	65	1	21 700	6 300	0,26	2,39	3,71	2,51	390	11 000	12 300
37	65	1	21 700	6 300	0,26	2,39	3,71	2,51	390	11 000	12 300
37	65	1	21 700	6 300	0,26	2,39	3,71	2,51	390	6 700	–
37	65	1	32 500	8 700	0,45	1,4	2,17	1,47	540	10 000	11 900
37	65	1	32 500	8 700	0,45	1,4	2,17	1,47	540	10 000	11 900

Self-aligning ball bearings

With cylindrical or tapered bore
Open or sealed



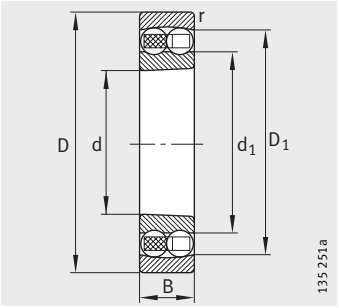
Cylindrical bore



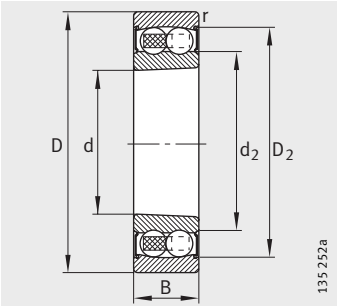
Cylindrical bore
2RS seals

Dimension table (continued) · Dimensions in mm

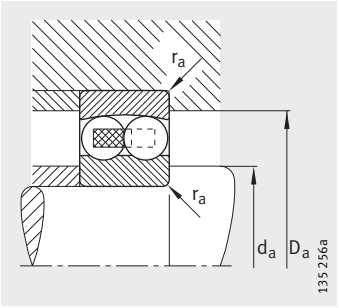
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	d_2
	≈kg				min.	≈	≈	≈	≈
1207-K-TVH-C3	0,319	**35**	72	17	1,1	59,6	–	47,7	–
1207-TVH	0,324	**35**	72	17	1,1	59,6	–	47,7	–
2207-2RS-TVH	0,442	**35**	72	23	1,1	–	64,3	–	43,5
2207-K-2RS-TVH-C3	0,432	**35**	72	23	1,1	–	64,3	–	43,5
2207-K-TVH-C3	0,38	**35**	72	23	1,1	62,9	–	45,7	–
2207-TVH	0,389	**35**	72	23	1,1	62,9	–	45,7	–
1307-K-TVH-C3	0,5	**35**	80	21	1,5	67,5	–	51,3	–
1307-TVH	0,507	**35**	80	21	1,5	67,5	–	51,3	–
2307-2RS-TVH	0,744	**35**	80	31	1,5	–	69,1	–	44,9
2307-K-TVH-C3	0,96	**35**	80	31	1,5	66,8	–	46,9	–
2307-TVH	0,975	**35**	80	31	1,5	66,8	–	46,9	–
1208-K-TVH-C3	0,408	**40**	80	18	1,1	67,8	–	54	–
1208-TVH	0,414	**40**	80	18	1,1	67,8	–	54	–
2208-2RS-TVH	0,528	**40**	80	23	1,1	–	71,1	–	49,2
2208-K-2RS-TVH-C3	0,517	**40**	80	23	1,1	–	71,1	–	49,2
2208-K-TVH-C3	0,465	**40**	80	23	1,1	70,7	–	52,5	–
2208-TVH	0,476	**40**	80	23	1,1	70,7	–	52,5	–
1308-K-TVH-C3	0,698	**40**	90	23	1,5	75,3	–	57,8	–
1308-TVH	0,708	**40**	90	23	1,5	75,3	–	57,8	–
2308-2RS-TVH	1,01	**40**	90	33	1,5	–	78	–	51
2308-K-TVH-C3	0,899	**40**	90	33	1,5	75	–	53,7	–
2308-TVH	0,922	**40**	90	33	1,5	75	–	53,7	–
1209-K-TVH-C3	0,454	**45**	85	19	1,1	72,7	–	57,7	–
1209-TVH	0,462	**45**	85	19	1,1	72,7	–	57,7	–
2209-2RS-TVH	0,548	**45**	85	23	1,1	–	75,4	–	53,8
2209-K-2RS-TVH-C3	0,535	**45**	85	23	1,1	–	75,4	–	53,8
2209-K-TVH-C3	0,505	**45**	85	23	1,1	75,9	–	59	–
2209-TVH	0,517	**45**	85	23	1,1	75,9	–	59	–
1309-K-TVH-C3	0,939	**45**	100	25	1,5	84,1	–	64,1	–
1309-TVH	0,953	**45**	100	25	1,5	84,1	–	64,1	–
2309-2RS-TVH	1,34	**45**	100	36	1,5	–	86,6	–	57,5
2309-K-TVH-C3	1,19	**45**	100	36	1,5	84,2	–	60,1	–
2309-TVH	1,22	**45**	100	36	1,5	84,2	–	60,1	–



Tapered bore
K = taper 1:12



Tapered bore
K = taper 1:12
2RS seals

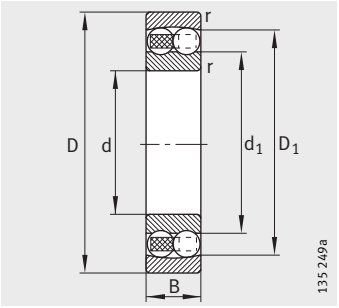


Mounting dimensions

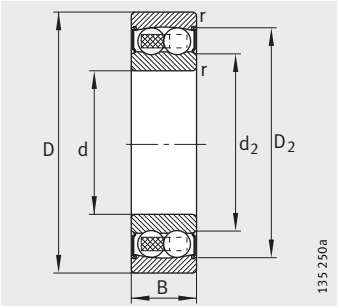
Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
42	65	1	16 000	5 100	0,22	2,8	4,34	2,94	315	12 000	12 900
42	65	1	16 000	5 100	0,22	2,8	4,34	2,94	315	12 000	12 900
42	65	1	16 000	5 100	0,22	2,8	4,34	2,94	315	7 000	–
42	65	1	16 000	5 100	0,22	2,8	4,34	2,94	315	7 000	–
42	65	1	33 000	8 900	0,3	2,13	3,29	2,23	560	9 500	11 400
42	65	1	33 000	8 900	0,3	2,13	3,29	2,23	560	9 500	11 400
44	71	1,5	25 500	7 800	0,26	2,47	3,82	2,59	485	9 500	11 300
44	71	1,5	25 500	7 800	0,26	2,47	3,82	2,59	485	9 500	11 300
44	71	1,5	25 500	7 800	0,26	2,47	3,82	2,59	485	6 000	–
44	71	1,5	40 500	11 100	0,47	1,35	2,1	1,42	690	9 000	11 200
44	71	1,5	40 500	11 100	0,47	1,35	2,1	1,42	690	9 000	11 200
47	73	1	19 400	6 500	0,22	2,9	4,49	3,04	400	10 000	11 600
47	73	1	19 400	6 500	0,22	2,9	4,49	3,04	400	10 000	11 600
47	73	1	19 400	6 500	0,22	2,9	4,49	3,04	400	6 300	–
47	73	1	19 400	6 500	0,22	2,9	4,49	3,04	400	6 300	–
47	73	1	32 500	9 400	0,26	2,43	3,76	2,54	580	9 000	9 900
47	73	1	32 500	9 400	0,26	2,43	3,76	2,54	580	9 000	9 900
49	81	1,5	30 000	9 600	0,25	2,52	3,9	2,64	600	8 500	10 300
49	81	1,5	30 000	9 600	0,25	2,52	3,9	2,64	600	8 500	10 300
49	81	1,5	30 000	9 600	0,25	2,52	3,9	2,64	600	5 300	–
49	81	1,5	46 000	13 400	0,43	1,45	2,25	1,52	830	8 000	10 000
49	81	1,5	46 000	13 400	0,43	1,45	2,25	1,52	830	8 000	10 000
52	78	1	22 000	7 300	0,21	3,04	4,7	3,18	455	9 000	10 900
52	78	1	22 000	7 300	0,21	3,04	4,7	3,18	455	9 000	10 900
52	78	1	22 000	7 300	0,21	3,04	4,7	3,18	455	5 600	–
52	78	1	22 000	7 300	0,21	3,04	4,7	3,18	455	5 600	–
52	78	1	28 500	8 900	0,26	2,43	3,76	2,54	550	8 500	9 000
52	78	1	28 500	8 900	0,26	2,43	3,76	2,54	550	8 500	9 000
54	91	1,5	38 500	12 600	0,25	2,5	3,87	2,62	780	7 500	9 500
54	91	1,5	38 500	12 600	0,25	2,5	3,87	2,62	780	7 500	9 500
54	91	1,5	38 500	12 600	0,25	2,5	3,87	2,62	780	4 800	–
54	91	1,5	55 000	16 500	0,43	1,48	2,29	1,55	1030	7 000	9 300
54	91	1,5	55 000	16 500	0,43	1,48	2,29	1,55	1030	7 000	9 300

Self-aligning ball bearings

With cylindrical or tapered bore
Open or sealed



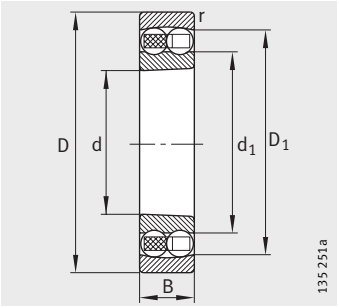
Cylindrical bore



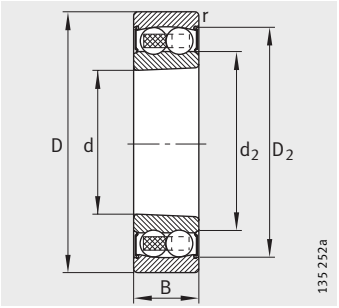
Cylindrical bore
2RS seals

Dimension table (continued) · Dimensions in mm

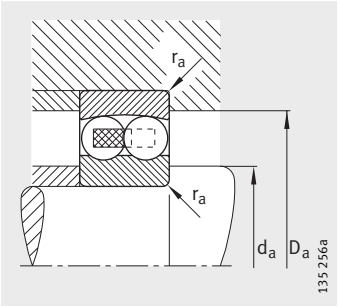
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	d_2
	≈kg				min.	≈	≈	≈	≈
1210-K-TVH-C3	0,516	**50**	90	20	1,1	77,6	–	62,7	–
1210-TVH	0,526	**50**	90	20	1,1	77,6	–	62,7	–
2210-2RS-TVH	0,606	**50**	90	23	1,1	–	80	–	60,6
2210-K-2RS-TVH-C3	0,593	**50**	90	23	1,1	–	80	–	60,6
2210-K-TVH-C3	0,543	**50**	90	23	1,1	81	–	64	–
2210-TVH	0,556	**50**	90	23	1,1	81	–	64	–
1310-K-TVH-C3	1,52	**50**	110	27	2	91,9	–	71,2	–
1310-TVH	1,54	**50**	110	27	2	91,9	–	71,2	–
2310-2RS-TVH	1,82	**50**	110	40	2	–	96	–	65,9
2310-TVH	1,64	**50**	110	40	2	92	–	66,9	–
1211-K-TVH-C3	0,682	**55**	100	21	1,5	86,9	–	69,5	–
1211-TVH	0,693	**55**	100	21	1,5	86,9	–	69,5	–
2211-2RS-TVH	0,825	**55**	100	25	1,5	–	88,9	–	68
2211-K-2RS-TVH-C3	0,808	**55**	100	25	1,5	–	88,9	–	68
2211-K-TVH-C3	0,73	**55**	100	25	1,5	90	–	69,6	–
2211-TVH	0,746	**55**	100	25	1,5	90	–	69,6	–
1311-K-TVH-C3	1,55	**55**	120	29	2	101,6	–	78	–
1311-TVH	1,57	**55**	120	29	2	101,6	–	78	–
2311-2RS-TVH	2,28	**55**	120	43	2	–	107	–	70,5
2311-K-TVH-C3	2,02	**55**	120	43	2	100,7	–	71,7	–
2311-TVH	2,07	**55**	120	43	2	100,7	–	71,7	–



Tapered bore
K = taper 1:12



Tapered bore
K = taper 1:12
2RS seals

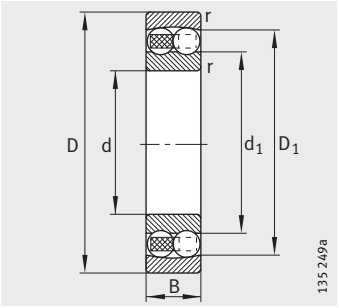


Mounting dimensions

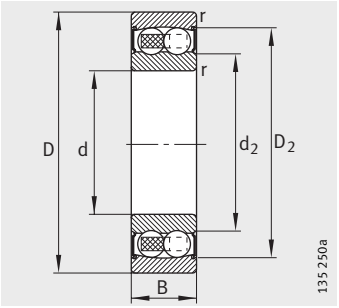
Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
57	83	1	22 900	8 000	0,2	3,17	4,9	3,32	500	8 500	10 300
57	83	1	22 900	8 000	0,2	3,17	4,9	3,32	500	8 500	10 300
57	83	1	22 900	8 000	0,2	3,17	4,9	3,32	500	5 300	–
57	83	1	22 900	8 000	0,2	3,17	4,9	3,32	500	5 300	–
57	83	1	28 500	9 400	0,24	2,61	4,05	2,74	580	8 000	8 300
57	83	1	28 500	9 400	0,24	2,61	4,05	2,74	580	8 000	8 300
61	99	2	42 000	14 100	0,24	2,6	4,03	2,73	880	6 700	8 800
61	99	2	42 000	14 100	0,24	2,6	4,03	2,73	880	6 700	8 800
61	99	2	42 000	14 100	0,24	2,6	4,03	2,73	880	4 300	–
61	99	2	66 000	19 900	0,43	1,47	2,27	1,54	1 240	6 300	8 800
64	91	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	7 500	9 400
64	91	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	7 500	9 400
64	91	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	4 800	–
64	91	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	4 800	–
64	91	1,5	39 000	12 400	0,22	2,92	4,52	3,06	770	6 700	7 700
64	91	1,5	39 000	12 400	0,22	2,92	4,52	3,06	770	6 700	7 700
66	109	2	52 000	17 700	0,24	2,66	4,12	2,79	1 100	6 000	8 300
66	109	2	52 000	17 700	0,24	2,66	4,12	2,79	1 100	6 000	8 300
66	109	2	52 000	17 700	0,24	2,66	4,12	2,79	1 100	3 800	–
66	109	2	77 000	23 800	0,42	1,51	2,33	1,58	1 480	5 600	8 200
66	109	2	77 000	23 800	0,42	1,51	2,33	1,58	1 480	5 600	8 200

Self-aligning ball bearings

With cylindrical or tapered bore
Open or sealed



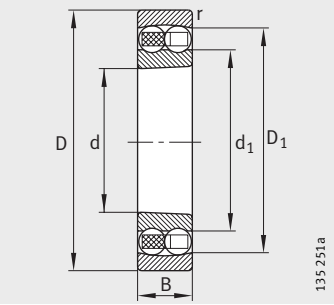
Cylindrical bore



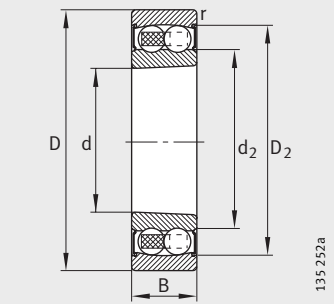
Cylindrical bore
2RS seals

Dimension table (continued) · Dimensions in mm

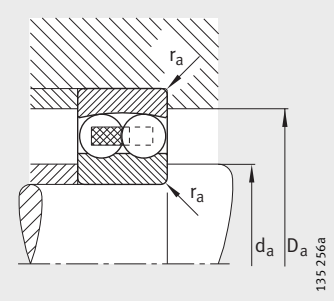
Designation	Mass	Dimensions							
	m	d	D	B	r	D_1	D_2	d_1	d_2
	≈kg				min.	≈	≈	≈	≈
1212-K-TVH-C3	0,88	**60**	110	22	1,5	95,8	–	78	–
1212-TVH	0,894	**60**	110	22	1,5	95,8	–	78	–
2212-2RS-TVH	1,13	**60**	110	28	1,5	–	98,5	–	70,4
2212-K-2RS-TVH-C3	1,13	**60**	110	28	1,5	–	98,5	–	70,4
2212-K-TVH-C3	1,03	**60**	110	28	1,5	98,8	–	76,6	–
2212-TVH	1,06	**60**	110	28	1,5	98,8	–	76,6	–
1312-K-TVH-C3	1,94	**60**	130	31	2,1	112,2	–	87	–
1312-TVH	1,97	**60**	130	31	2,1	112,2	–	87	–
2312-K-TVH-C3	2,52	**60**	130	46	2,1	109,1	–	77	–
2312-TVH	2,58	**60**	130	46	2,1	109,1	–	77	–
1213-K-TVH-C3	1,13	**65**	120	23	1,5	103,2	–	85,2	–
1213-TVH	1,14	**65**	120	23	1,5	103,2	–	85,2	–
2213-2RS-TVH	1,53	**65**	120	31	1,5	–	106,6	–	78
2213-K-2RS-TVH-C3	1,5	**65**	120	31	1,5	–	106,6	–	78
2213-K-TVH-C3	1,33	**65**	120	31	1,5	107,5	–	82,4	–
2213-TVH	1,36	**65**	120	31	1,5	107,5	–	82,4	–
1313-K-TVH-C3	2,41	**65**	140	33	2,1	118,8	–	92,7	–
1313-TVH	2,44	**65**	140	33	2,1	118,8	–	92,7	–
2313-K-TVH-C3	3,16	**65**	140	48	2,1	118,9	–	85,6	–
2313-TVH	3,23	**65**	140	48	2,1	118,9	–	85,6	–
1214-K-TVH-C3	1,23	**70**	125	24	1,5	106,6	–	87,7	–
1214-TVH	1,25	**70**	125	24	1,5	106,6	–	87,7	–
2214-2RS-TVH	1,59	**70**	125	31	1,5	–	111,4	–	84,7
2214-M	1,69	**70**	125	31	1,5	108,9	–	87,6	–
1314-M	3,22	**70**	150	35	2,1	126,4	–	97,7	–
2314-M	4,38	**70**	150	51	2,1	127,2	–	91,5	–
1215-K-TVH-C3	1,32	**75**	130	25	1,5	114,1	–	93,7	–
1215-TVH	1,34	**75**	130	25	1,5	114,1	–	93,7	–
2215-K-TVH-C3	1,6	**75**	130	31	1,5	114,3	–	93,3	–
2215-TVH	1,6	**75**	130	31	1,5	114,3	–	93,3	–
1315-K-M-C3	3,81	**75**	160	37	2,1	134,8	–	104,4	–
1315-M	3,86	**75**	160	37	2,1	134,8	–	104,4	–
2315-K-M-C3	5,21	**75**	160	55	2,1	146,7	–	100,5	–
2315-M	5,33	**75**	160	55	2,1	146,7	–	100,5	–



Tapered bore
K = taper 1:12



Tapered bore
K = taper 1:12
2RS seals

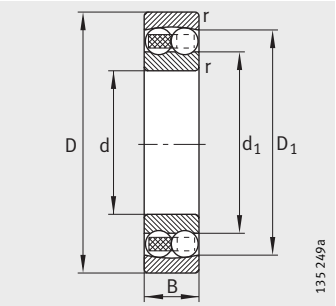


Mounting dimensions

Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
69	101	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	6 700	8 600
69	101	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	6 700	8 600
69	101	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	4 300	–
69	101	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	4 300	–
69	101	1,5	48 000	16 300	0,23	2,69	4,16	2,82	1 020	6 300	7 400
69	101	1,5	48 000	16 300	0,23	2,69	4,16	2,82	1 020	6 300	7 400
72	118	2,1	58 000	20 600	0,23	2,77	4,28	2,9	1 280	5 300	7 800
72	118	2,1	58 000	20 600	0,23	2,77	4,28	2,9	1 280	5 300	7 800
72	118	2,1	89 000	28 000	0,41	1,55	2,4	1,62	1 740	5 000	7 800
72	118	2,1	89 000	28 000	0,41	1,55	2,4	1,62	1 740	5 000	7 800
74	111	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	6 300	8 000
74	111	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	6 300	8 000
74	111	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	4 000	–
74	111	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	4 000	–
74	111	1,5	58 000	19 000	0,23	2,78	4,31	2,92	1 190	5 300	7 100
74	111	1,5	58 000	19 000	0,23	2,78	4,31	2,92	1 190	5 300	7 100
77	128	2,1	63 000	22 700	0,23	2,75	4,26	2,88	1 380	5 000	7 400
77	128	2,1	63 000	22 700	0,23	2,75	4,26	2,88	1 380	5 000	7 400
77	128	2,1	98 000	32 000	0,39	1,62	2,51	1,7	1 980	4 800	7 300
77	128	2,1	98 000	32 000	0,39	1,62	2,51	1,7	1 980	4 800	7 300
79	116	1,5	35 000	13 700	0,19	3,36	5,21	3,52	850	6 000	7 700
79	116	1,5	35 000	13 700	0,19	3,36	5,21	3,52	850	6 000	7 700
79	116	1,5	35 000	13 700	0,19	3,36	5,21	3,52	850	3 800	–
79	116	1,5	44 000	16 900	0,27	2,34	3,62	2,45	1 050	8 500	6 600
82	138	2,1	75 000	27 500	0,23	2,79	4,32	2,93	1 620	7 000	7 000
82	138	2,1	112 000	37 000	0,38	1,65	2,55	1,73	2 210	6 300	6 900
84	121	1,5	39 000	15 500	0,19	3,32	5,15	3,48	950	5 600	7 500
84	121	1,5	39 000	15 500	0,19	3,32	5,15	3,48	950	5 600	7 500
84	121	1,5	44 500	17 600	0,26	2,47	3,82	2,59	1 080	5 300	6 300
84	121	1,5	44 500	17 600	0,26	2,47	3,82	2,59	1 080	5 300	6 300
87	148	2,1	80 000	29 500	0,23	2,77	4,29	2,9	1 690	6 300	6 700
87	148	2,1	80 000	29 500	0,23	2,77	4,29	2,9	1 690	6 300	6 700
87	148	2,1	124 000	42 000	0,38	1,64	2,54	1,72	2 420	6 000	6 700
87	148	2,1	124 000	42 000	0,38	1,64	2,54	1,72	2 420	6 000	6 700

Self-aligning ball bearings

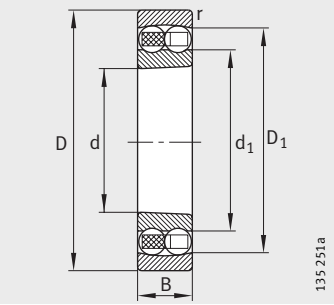
With cylindrical or tapered bore



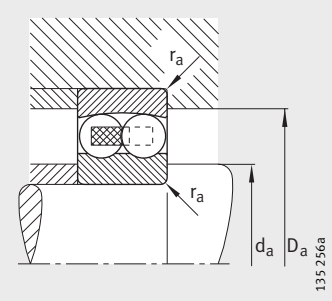
Cylindrical bore

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
1216-K-TVH-C3	1,62	**80**	140	26	2	122,1	102
1216-TVH	1,65	**80**	140	26	2	122,1	102
2216-K-TVH-C3	1,97	**80**	140	33	2	120,8	99,5
2216-TVH	2,01	**80**	140	33	2	120,8	99,5
1316-K-M-C3	4,5	**80**	170	39	2,1	144,3	110,2
1316-M	4,56	**80**	170	39	2,1	144,3	110,2
2316-K-M-C3	6,18	**80**	170	58	2,1	144,5	107,6
2316-M	6,31	**80**	170	58	2,1	144,5	107,6
1217-K-TVH-C3	2,03	**85**	150	28	2	130,4	107,5
1217-TVH	2,07	**85**	150	28	2	130,4	107,5
2217-K-M-C3	2,73	**85**	150	36	2	130	105,2
2217-M	2,79	**85**	150	36	2	130	105,2
1317-K-M-C3	5,32	**85**	180	41	3	152	117,2
1317-M	5,39	**85**	180	41	3	152	117,2
2317-K-M-C3	7,36	**85**	180	60	3	153,3	114
2317-M	7,35	**85**	180	60	3	153,3	114
1218-K-TVH-C3	2,48	**90**	160	30	2	138,7	112,7
1218-TVH	2,52	**90**	160	30	2	138,7	112,7
2218-K-TVH-C3	3,18	**90**	160	40	2	139,4	111,5
2218-TVH	3,18	**90**	160	40	2	139,4	111,5
1318-K-M-C3	6,27	**90**	190	43	3	159,9	124,4
1318-M	6,35	**90**	190	43	3	159,9	124,4
2318-K-M-C3	8,6	**90**	190	64	3	161	115,7
2318-M	8,78	**90**	190	64	3	161	115,7
1219-K-M-C3	3,28	**95**	170	32	2,1	148,2	120,5
1219-M	3,32	**95**	170	32	2,1	148,2	120,5
2219-K-M-C3	4,24	**95**	170	43	2,1	148,6	118,9
2219-M	4,33	**95**	170	43	2,1	148,6	118,9
1319-K-M-C3	7,2	**95**	200	45	3	170,5	127,7
1319-M	7,29	**95**	200	45	3	170,5	127,6
2319-K-M-C3	9,97	**95**	200	67	3	168,5	121,6
2319-M	10,2	**95**	200	67	3	168,5	121,6



Tapered bore
K = taper 1:12

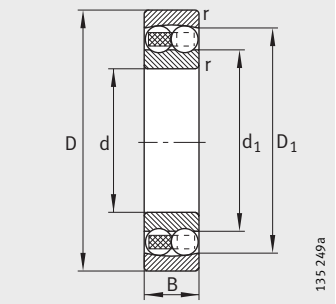


Mounting dimensions

Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
91	129	2	40 000	16 800	0,16	3,9	6,03	4,08	990	5 000	7 000
91	129	2	40 000	16 800	0,16	3,9	6,03	4,08	990	5 000	7 000
91	129	2	49 500	19 800	0,25	2,48	3,84	2,6	1 180	5 000	6 000
91	129	2	49 500	19 800	0,25	2,48	3,84	2,6	1 180	5 000	6 000
92	158	2,1	89 000	33 000	0,22	2,87	4,44	3	1 810	6 000	6 400
92	158	2,1	89 000	33 000	0,22	2,87	4,44	3	1 810	6 000	6 400
92	158	2,1	139 000	48 500	0,37	1,7	2,62	1,78	2 700	5 600	6 400
92	158	2,1	139 000	48 500	0,37	1,7	2,62	1,78	2 700	5 600	6 400
96	139	2	49 500	20 600	0,17	3,73	5,78	3,91	1 180	4 800	6 800
96	139	2	49 500	20 600	0,17	3,73	5,78	3,91	1 180	4 800	6 800
96	139	2	59 000	23 400	0,26	2,46	3,81	2,58	1 340	7 000	5 800
96	139	2	59 000	23 400	0,26	2,46	3,81	2,58	1 340	7 000	5 800
99	166	2,5	99 000	37 500	0,22	2,88	4,46	3,02	2 010	5 600	6 200
99	166	2,5	99 000	37 500	0,22	2,88	4,46	3,02	2 010	5 600	6 200
99	166	2,5	143 000	51 000	0,37	1,68	2,61	1,76	2 750	5 300	6 100
99	166	2,5	143 000	51 000	0,37	1,68	2,61	1,76	2 750	5 300	6 100
101	149	2	57 000	23 300	0,17	3,74	5,79	3,92	1 300	4 500	6 500
101	149	2	57 000	23 300	0,17	3,74	5,79	3,92	1 300	4 500	6 500
101	149	2	71 000	28 500	0,27	2,33	3,61	2,44	1 580	4 300	5 700
101	149	2	71 000	28 500	0,27	2,33	3,61	2,44	1 580	4 300	5 700
104	176	2,5	109 000	42 500	0,22	2,83	4,38	2,97	2 230	5 300	5 900
104	176	2,5	109 000	42 500	0,22	2,83	4,38	2,97	2 230	5 300	5 900
104	176	2,5	156 000	57 000	0,39	1,63	2,53	1,71	3 000	5 000	5 800
104	176	2,5	156 000	57 000	0,39	1,63	2,53	1,71	3 000	5 000	5 800
107	158	2,1	64 000	27 000	0,17	3,73	5,78	3,91	1 450	6 000	6 300
107	158	2,1	64 000	27 000	0,17	3,73	5,78	3,91	1 450	6 000	6 300
107	158	2,1	84 000	34 000	0,27	2,32	3,59	2,43	1 840	6 000	5 600
107	158	2,1	84 000	34 000	0,27	2,32	3,59	2,43	1 840	6 000	5 600
109	186	2,5	134 000	50 000	0,23	2,73	4,23	2,86	2 550	5 000	5 700
109	186	2,5	134 000	50 000	0,23	2,73	4,23	2,86	2 550	5 000	5 700
109	186	2,5	167 000	63 000	0,38	1,66	2,57	1,74	3 250	4 800	5 500
109	186	2,5	167 000	63 000	0,38	1,66	2,57	1,74	3 250	4 800	5 500

Self-aligning ball bearings

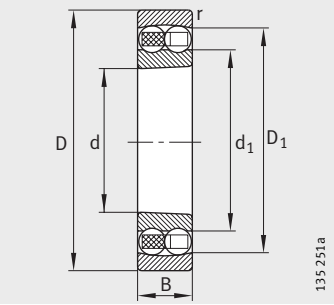
With cylindrical or tapered bore



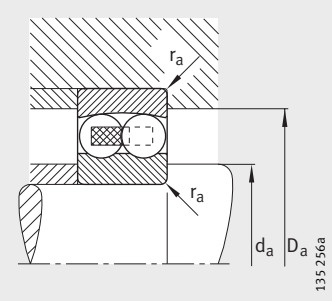
Cylindrical bore

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
1220-K-M-C3	3,94	**100**	180	34	2,1	155,2	127,7
1220-M	3,99	**100**	180	34	2,1	155,2	127,7
2220-K-M-C3	5,1	**100**	180	46	2,1	156,9	124,4
2220-M	5,21	**100**	180	46	2,1	156,9	124,4
1320-K-M-C3	8,95	**100**	215	47	3	182,6	135,5
1320-M	9,06	**100**	215	47	3	182,6	135,5
2320-K-M-C3	12,7	**100**	215	73	3	183	130,8
2320-M	12,9	**100**	215	73	3	183	130,8
1221-M	4,75	**105**	190	36	2,1	164,4	133,9
1321-M	10,3	**105**	225	49	3	191,3	143,2
1222-K-M-C3	5,49	**110**	200	38	2,1	173,9	140,7
1222-M	5,57	**110**	200	38	2,1	173,9	140,7
2222-K-M-C3	7,27	**110**	200	53	2,1	174,1	136,9
2222-M	7,45	**110**	200	53	2,1	174,1	136,9
1322-K-M-C3	12,2	**110**	240	50	3	203,2	154,7
1322-M	12,3	**110**	240	50	3	203,2	154,5
2322-K-M-C3	17,5	**110**	240	80	3	203	145,5
2322-M	18,1	**110**	240	80	3	203	145,5
1224-M	7,13	**120**	215	42	2,1	187,3	149
1226-M	8,67	**130**	230	46	3	200,1	161,5
1228-M	11,2	**140**	250	50	3	221,2	175
1230-M	14,6	**150**	270	54	3	237,9	186,7



Tapered bore
K = taper 1:12

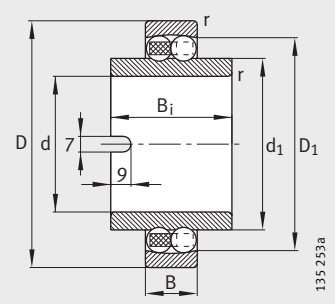


Mounting dimensions

Mounting dimensions			Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	N	N					N	min^{-1}	min^{-1}
112	168	2,1	70 000	29 500	0,18	3,58	5,53	3,75	1 550	5 600	6 200
112	168	2,1	70 000	29 500	0,18	3,58	5,53	3,75	1 550	5 600	6 200
112	168	2,1	98 000	40 000	0,27	2,33	3,61	2,44	2 120	5 600	5 600
112	168	2,1	98 000	40 000	0,27	2,33	3,61	2,44	2 120	5 600	5 600
114	201	2,5	145 000	57 000	0,24	2,68	4,15	2,81	2 800	4 800	5 400
114	201	2,5	145 000	57 000	0,24	2,68	4,15	2,81	2 800	4 800	5 400
114	201	2,5	196 000	78 000	0,38	1,67	2,58	1,75	3 900	4 500	5 200
114	201	2,5	196 000	78 000	0,38	1,67	2,58	1,75	3 900	4 500	5 200
117	178	2,1	75 000	32 000	0,18	3,54	5,48	3,71	1 640	5 300	6 600
119	211	2,5	158 000	64 000	0,23	2,75	4,25	2,88	3 100	4 500	5 200
122	188	2,1	89 000	38 000	0,17	3,61	5,59	3,78	1 900	5 000	5 800
122	188	2,1	89 000	38 000	0,17	3,61	5,59	3,78	1 900	5 000	5 800
122	188	2,1	126 000	51 000	0,28	2,23	3,45	2,33	2 550	5 000	5 300
122	188	2,1	126 000	51 000	0,28	2,23	3,45	2,33	2 550	5 000	5 300
124	226	2,5	165 000	71 000	0,23	2,79	4,32	2,92	3 300	4 500	4 850
124	226	2,5	165 000	71 000	0,23	2,79	4,32	2,92	3 300	4 500	4 850
124	226	2,5	221 000	94 000	0,37	1,69	2,62	1,77	4 400	4 300	4 600
124	226	2,5	221 000	94 000	0,37	1,69	2,62	1,77	4 400	4 300	4 500
132	203	2,1	121 000	52 000	0,2	3,11	4,81	3,25	2 500	4 800	5 600
144	216	2,5	125 000	55 000	0,19	3,24	5,02	3,4	2 550	4 500	5 400
154	236	2,5	163 000	74 000	0,21	3,05	4,71	3,19	3 600	4 300	4 950
164	256	2,5	180 000	86 000	0,22	2,9	4,49	3,04	3 700	3 800	4 600

Self-aligning ball bearings

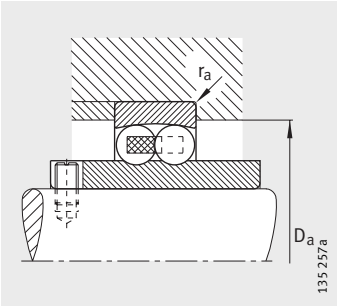
With extended inner ring



Extended inner ring

Dimension table · Dimensions in mm

Designation	Mass	Dimensions							Mounting dimensions	
	m	d	D	B	r	B_i	D_1	d_1	D_a	r_a
	≈kg				min.		≈	≈	max.	max.
11204-TVH	0,085	**20**	47	14	1	40	38,1	29,2	41,4	1
11205-TVH	0,226	**25**	52	15	1	44	43,9	33,3	46,4	1
11206-TVH	0,364	**30**	62	16	1	48	51,9	40,1	56,4	1
11207-TVH	0,554	**35**	72	17	1,1	52	59,6	47,7	65	1
11208-TVH	0,722	**40**	80	18	1,1	56	67,8	54	73	1
11209-TVH	0,78	**45**	85	19	1,1	58	72,7	57,7	78	1
11210-TVH	0,866	**50**	90	20	1,1	58	77,6	62,7	83	1
11211-TVH	1,13	**55**	100	21	1,5	60	86,9	69,5	91	1,5
11212-TVH	1,51	**60**	110	22	1,5	62	95,8	78	101	1,5

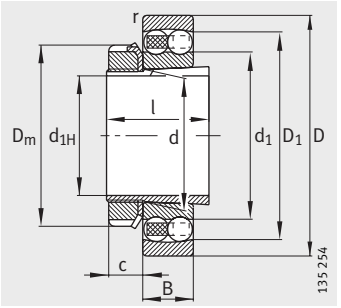


Mounting dimensions

Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed
dyn. C_r N	stat. C_{0r} N	e	Y_1	Y_2	Y_0	C_{ur} N	n_G min^{-1}
10 100	2 600	0,28	2,24	3,46	2,34	161	13 000
12 300	3 250	0,27	2,37	3,66	2,48	203	10 000
15 900	4 600	0,25	2,53	3,91	2,65	285	8 500
16 000	5 100	0,22	2,8	4,34	2,94	315	7 500
19 400	6 500	0,22	2,9	4,49	3,04	400	6 700
22 000	7 300	0,21	3,04	4,7	3,18	455	6 000
22 900	8 000	0,2	3,17	4,9	3,32	500	5 600
27 000	9 900	0,19	3,31	5,12	3,47	620	5 000
30 500	11 400	0,18	3,47	5,37	3,64	710	4 500

Self-aligning ball bearings

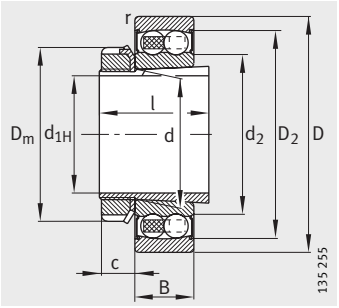
With adapter sleeve
Open or sealed



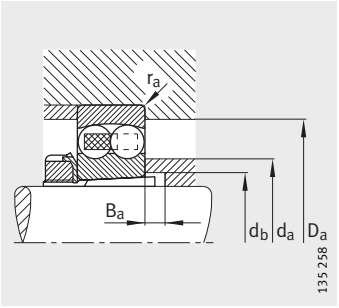
Open

Dimension table · Dimensions in mm

Designation		Mass m		Dimensions									
Bearing	Adapter sleeve	Bearing ≈kg	Adapter sleeve ≈kg	d_{1H}	d	D	B	r min.	D_1 ≈	D_2 ≈	d_1 ≈	d_2 ≈	D_m
1204-K-TVH-C3	**H204**	0,116	0,041	**17**	20	47	14	1	38,1	–	29,2	–	32
1205-K-TVH-C3	**H205**	0,135	0,069	**20**	25	52	15	1	43,9	–	33,3	–	38
2205-K-2RS-TVH-C3	**H305**	0,157	0,075	**20**	25	52	18	1	–	46,3	–	30,7	38
2205-K-TVH-C3	**H305**	0,152	0,075	**20**	25	52	18	1	44,7	–	32,3	–	38
1305-K-TVH-C3	**H305**	0,254	0,075	**20**	25	62	17	1,1	50,8	–	38,1	–	38
2305-K-TVH-C3	**H2305**	0,328	0,085	**20**	25	62	24	1,1	50,1	–	35,5	–	38
1206-K-TVH-C3	**H206**	0,217	0,091	**25**	30	62	16	1	51,9	–	40,1	–	45
2206-K-2RS-TVH-C3	**H306**	0,268	0,099	**25**	30	62	20	1	–	54,3	–	37,3	45
2206-K-TVH-C3	**H306**	0,246	0,099	**25**	30	62	20	1	54	–	38,5	–	45
1306-K-TVH-C3	**H306**	0,379	0,099	**25**	30	72	19	1,1	59,4	–	45	–	45
2306-K-TVH-C3	**H2306**	0,476	0,116	**25**	30	72	27	1,1	59,3	–	41,5	–	45
1207-K-TVH-C3	**H207**	0,319	0,129	**30**	35	72	17	1,1	59,6	–	47,7	–	57
2207-K-2RS-TVH-C3	**H307**	0,432	0,147	**30**	35	72	23	1,1	–	64,3	–	43,5	57
2207-K-TVH-C3	**H307**	0,38	0,147	**30**	35	72	23	1,1	62,9	–	45,7	–	57
1307-K-TVH-C3	**H307**	0,5	0,147	**30**	35	80	21	1,5	67,5	–	51,3	–	57
2307-K-TVH-C3	**H2307**	0,96	0,171	**30**	35	80	31	1,5	66,8	–	46,9	–	52
1208-K-TVH-C3	**H208**	0,408	0,17	**35**	40	80	18	1,1	67,8	–	54	–	58
2208-K-2RS-TVH-C3	**H308**	0,517	0,185	**35**	40	80	23	1,1	–	71,1	–	49,2	58
2208-K-TVH-C3	**H308**	0,465	0,185	**35**	40	80	23	1,1	70,7	–	52,5	–	58
1308-K-TVH-C3	**H308**	0,698	0,185	**35**	40	90	23	1,5	75,3	–	57,8	–	58
2308-K-TVH-C3	**H2308**	0,899	0,222	**35**	40	90	33	1,5	75	–	53,7	–	58
1209-K-TVH-C3	**H209**	0,454	0,216	**40**	45	85	19	1,1	72,7	–	57,7	–	65
2209-K-2RS-TVH-C3	**H309**	0,535	0,246	**40**	45	85	23	1,1	–	75,4	–	53,8	65
2209-K-TVH-C3	**H309**	0,505	0,246	**40**	45	85	23	1,1	75,9	–	59	–	65
1309-K-TVH-C3	**H309**	0,939	0,246	**40**	45	100	25	1,5	84,1	–	64,1	–	65
2309-K-TVH-C3	**H2309**	1,19	0,283	**40**	45	100	36	1,5	84,2	–	60,1	–	65



2RS seals

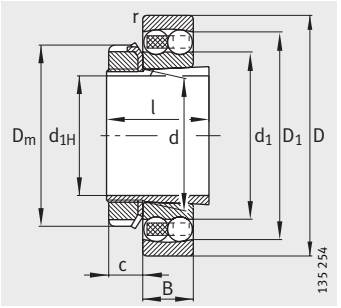


Mounting dimensions

		Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
l	c	d_a	D_a	d_b	B_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
	≈	max.	max.	min.	min.	max.	N	N					N	min^{-1}	min^{-1}
24	7	27	41,4	23	5	1	10 100	2 600	0,28	2,24	3,46	2,34	161	18 000	20 200
26	9	32	46,4	28	5	1	12 300	3 250	0,27	2,37	3,66	2,48	203	16 000	17 800
29	9	32	46,4	28	5	1	12 300	3 250	0,27	2,37	3,66	2,48	203	9 500	–
29	9	32	46,4	28	5	1	17 300	4 400	0,35	1,78	2,75	1,86	275	15 000	14 600
29	9	35	55	28	6	1	18 300	4 950	0,28	2,29	3,54	2,4	310	14 000	13 900
35	9	34	55	30	5	1	25 000	6 500	0,48	1,32	2,04	1,38	405	13 000	13 500
27	9	38	56,4	33	5	1	15 900	4 600	0,25	2,53	3,91	2,65	285	14 000	14 900
31	9	38	56,4	33	5	1	15 900	4 600	0,25	2,53	3,91	2,65	285	8 000	–
31	9	38	56,4	33	5	1	26 000	6 900	0,3	2,13	3,29	2,23	430	12 000	12 600
31	9	42	65	33	6	1	21 700	6 300	0,26	2,39	3,71	2,51	390	11 000	12 300
38	9	40	65	35	5	1	32 500	8 700	0,45	1,4	2,17	1,47	540	10 000	11 900
29	10	45	65	38	5	1	16 000	5 100	0,22	2,8	4,34	2,94	315	12 000	12 900
35	10	45	65	38	5	1	16 000	5 100	0,22	2,8	4,34	2,94	315	7 000	–
35	10	44	65	39	5	1	33 000	8 900	0,3	2,13	3,29	2,23	560	9 500	11 400
35	10	49	71	39	8	1,5	25 500	7 800	0,26	2,47	3,82	2,59	485	9 500	11 300
43	10	45	71	40	5	1,5	40 500	11 100	0,47	1,35	2,1	1,42	690	9 000	11 200
31	11	52	73	43	5	1	19 400	6 500	0,22	2,9	4,49	3,04	400	10 000	11 600
36	11	52	73	43	5	1	19 400	6 500	0,22	2,9	4,49	3,04	400	6 300	–
36	11	50	73	44	5	1	32 500	9 400	0,26	2,43	3,76	2,54	580	9 000	9 900
36	11	55	81	44	5	1,5	30 000	9 600	0,25	2,52	3,9	2,64	600	8 500	10 300
46	11	51	81	45	5	1,5	46 000	13 400	0,43	1,45	2,25	1,52	830	8 000	10 000
33	12	57	78	48	5	1	22 000	7 300	0,21	3,04	4,7	3,18	455	9 000	10 900
39	12	57	78	48	5	1	22 000	7 300	0,21	3,04	4,7	3,18	455	5 600	–
39	12	56	78	50	8	1	28 500	8 900	0,26	2,43	3,76	2,54	550	8 500	9 000
39	12	61	91	50	5	1,5	38 500	12 600	0,25	2,5	3,87	2,62	780	7 500	9 500
50	12	57	91	50	5	1,5	55 000	16 500	0,43	1,48	2,29	1,55	1 030	7 000	9 300

Self-aligning ball bearings

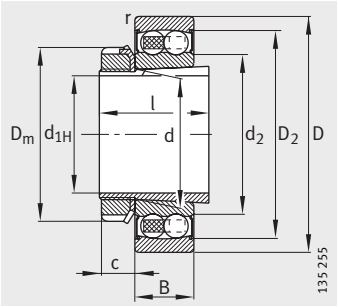
With adapter sleeve
Open or sealed



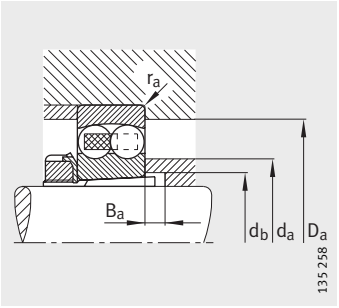
Open

Dimension table (continued) · Dimensions in mm

Designation		Mass m		Dimensions									
Bearing	Adapter sleeve	Bearing ≈kg	Adapter sleeve ≈kg	d_{1H}	d	D	B	r min.	D_1 ≈	D_2 ≈	d_1 ≈	d_2 ≈	D_m
1210-K-TVH-C3	**H210**	0,516	0,264	**45**	50	90	20	1,1	77,6	–	62,7	–	70
2210-K-2RS-TVH-C3	**H310**	0,593	0,301	**45**	50	90	23	1,1	–	80	–	60,6	70
2210-K-TVH-C3	**H310**	0,543	0,301	**45**	50	90	23	1,1	81	–	64	–	70
1310-K-TVH-C3	**H310**	1,52	0,301	**45**	50	110	27	2	91,9	–	71,2	–	70
1211-K-TVH-C3	**H211**	0,682	0,292	**50**	55	100	21	1,5	86,9	–	69,5	–	75
2211-K-2RS-TVH-C3	**H311**	0,808	0,35	**50**	55	100	25	1,5	–	88,9	–	68	75
2211-K-TVH-C3	**H311**	0,73	0,35	**50**	55	100	25	1,5	90	–	69,6	–	75
1311-K-TVH-C3	**H311**	1,55	0,35	**50**	55	120	29	2	101,6	–	78	–	75
2311-K-TVH-C3	**H2311**	2,02	0,426	**50**	55	120	43	2	100,7	–	71,7	–	75
1212-K-TVH-C3	**H212**	0,88	0,325	**55**	60	110	22	1,5	95,8	–	78	–	80
2212-K-2RS-TVH-C3	**H312**	1,13	0,373	**55**	60	110	28	1,5	–	98,5	–	70,4	80
2212-K-TVH-C3	**H312**	1,03	0,373	**55**	60	110	28	1,5	98,8	–	76,6	–	80
1312-K-TVH-C3	**H312**	1,94	0,373	**55**	60	130	31	2,1	112,2	–	87	–	80
2312-K-TVH-C3	**H2312**	2,52	0,464	**55**	60	130	46	2,1	109,1	–	77	–	80
1213-K-TVH-C3	**H213**	1,13	0,393	**60**	65	120	23	1,5	103,2	–	85,2	–	92
2213-K-2RS-TVH-C3	**H313**	1,5	0,452	**60**	65	120	31	1,5	–	106,6	–	78	92
2213-K-TVH-C3	**H313**	1,33	0,452	**60**	65	120	31	1,5	107,5	–	82,4	–	92
1313-K-TVH-C3	**H313**	2,41	0,452	**60**	65	140	33	2,1	118,8	–	92,7	–	92
2313-K-TVH-C3	**H2313**	3,16	0,553	**60**	65	140	48	2,1	118,9	–	85,6	–	92
1214-K-TVH-C3	**H214**	1,23	0,603	**60**	70	125	24	1,5	106,6	–	87,7	–	98
1215-K-TVH-C3	**H215**	1,32	0,693	**65**	75	130	25	1,5	114,1	–	93,7	–	98
2215-K-TVH-C3	**H315**	1,6	0,826	**65**	75	130	31	1,5	114,3	–	93,3	–	104
1315-K-M-C3	**H315**	3,81	0,826	**65**	75	160	37	2,1	134,8	–	104,4	–	104
2315-K-M-C3	**H2315**	5,21	1,05	**65**	75	160	55	2,1	146,7	–	100,5	–	98
1216-K-TVH-C3	**H216**	1,62	0,876	**70**	80	140	26	2	122,1	–	102	–	105
2216-K-TVH-C3	**H316**	1,97	1,01	**70**	80	140	33	2	120,8	–	99,5	–	105
1316-K-M-C3	**H316**	4,5	1,01	**70**	80	170	39	2,1	144,3	–	110,2	–	105
2316-K-M-C3	**H2316**	6,18	1,27	**70**	80	170	58	2,1	144,5	–	107,6	–	105
1217-K-TVH-C3	**H217**	2,03	0,995	**75**	85	150	28	2	130,4	–	107,5	–	110
2217-K-M-C3	**H317**	2,73	1,16	**75**	85	150	36	2	130	–	105,2	–	110
1317-K-M-C3	**H317**	5,32	1,16	**75**	85	180	41	3	152	–	117,2	–	110
2317-K-M-C3	**H2317**	7,36	1,44	**75**	85	180	60	3	153,3	–	114	–	110



2RS seals

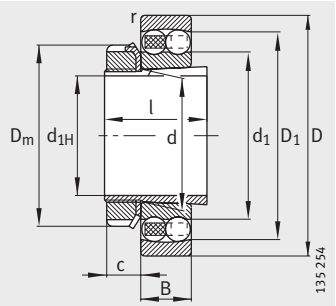


Mounting dimensions

		Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
l	c	d_a	D_a	d_b	B_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
	≈	max.	max.	min.	min.	max.	N	N					N	min^{-1}	min^{-1}
35	13	62	83	53	5	1	22 900	8 000	0,2	3,17	4,9	3,32	500	8 500	10 300
42	13	62	83	53	5	1	22 900	8 000	0,2	3,17	4,9	3,32	500	5 300	–
42	13	61	83	55	10	1	28 500	9 400	0,24	2,61	4,05	2,74	580	8 000	8 300
42	13	68	99	55	5	2	42 000	14 100	0,24	2,6	4,03	2,73	880	6 700	8 800
37	13	69	91	60	6	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	7 500	9 400
45	13	69	91	60	6	1,5	27 000	9 900	0,19	3,31	5,12	3,47	620	4 800	–
45	13	68	91	60	10	1,5	39 000	12 400	0,22	2,92	4,52	3,06	770	6 700	7 700
45	13	74	109	60	6	2	52 000	17 700	0,24	2,66	4,12	2,79	1 100	6 000	8 300
59	13	69	109	61	6	2	77 000	23 800	0,42	1,51	2,33	1,58	1 480	5 600	8 200
38	13	75	101	64	5	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	6 700	8 600
47	13	75	101	64	5	1,5	30 500	11 400	0,18	3,47	5,37	3,64	710	4 300	–
47	13	73	101	65	8	1,5	48 000	16 300	0,23	2,69	4,16	2,82	1 020	6 300	7 400
47	13	83	118	65	5	2,1	58 000	20 600	0,23	2,77	4,28	2,9	1 280	5 300	7 800
62	13	74	118	66	5	2,1	89 000	28 000	0,41	1,55	2,4	1,62	1 740	5 000	7 800
40	14	83	111	70	5	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	6 300	8 000
50	14	83	111	70	5	1,5	31 000	12 400	0,18	3,57	5,52	3,74	770	4 000	–
50	14	79	111	70	8	1,5	58 000	19 000	0,23	2,78	4,31	2,92	1 190	5 300	7 100
50	14	89	128	70	5	2,1	63 000	22 700	0,23	2,75	4,26	2,88	1 380	5 000	7 400
65	14	82	128	72	5	2,1	98000	32 000	0,39	1,62	2,51	1,7	1 980	4 800	7 300
41	14	86	116	75	5	1,5	35 000	13 700	0,19	3,36	5,21	3,52	850	6 000	7 700
43	15	92	121	80	5	1,5	39 000	15 500	0,19	3,32	5,15	3,48	950	5 600	7 500
55	15	90	121	80	12	1,5	44 500	17 600	0,26	2,47	3,82	2,59	1080	5 300	6 300
55	15	100	148	80	5	2,1	80 000	29 500	0,23	2,77	4,29	2,9	1 690	6 300	6 700
73	15	94	148	82	5	2,1	124 000	42 000	0,38	1,64	2,54	1,72	2 420	6 000	6 700
46	17	99	129	85	5	2	40 000	16 800	0,16	3,9	6,03	4,08	990	5 000	7 000
59	17	96	129	85	12	2	49 500	19 800	0,25	2,48	3,84	2,6	1 180	5 000	6 000
59	17	107	158	85	5	2,1	89 000	33 000	0,22	2,87	4,44	3	1 810	6 000	6 400
78	17	100	158	88	5	2,1	139 000	48 500	0,37	1,7	2,62	1,78	2 700	5 600	6 400
50	18	105	139	90	6	2	49 500	20 600	0,17	3,73	5,78	3,91	1 180	4 800	6 800
63	18	102	139	91	12	2	59 000	23 400	0,26	2,46	3,81	2,58	1 340	7 000	5 800
63	18	114	166	91	6	2,5	99 000	37 500	0,22	2,88	4,46	3,02	2 010	5 600	6 200
82	18	106	166	94	6	2,5	143 000	51 000	0,37	1,68	2,61	1,76	2 750	5 300	6 100

Self-aligning ball bearings

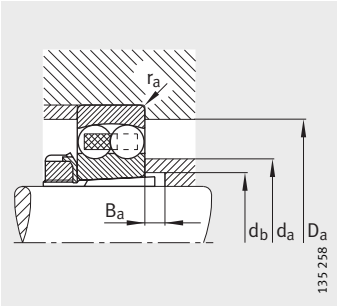
With adapter sleeve



Open

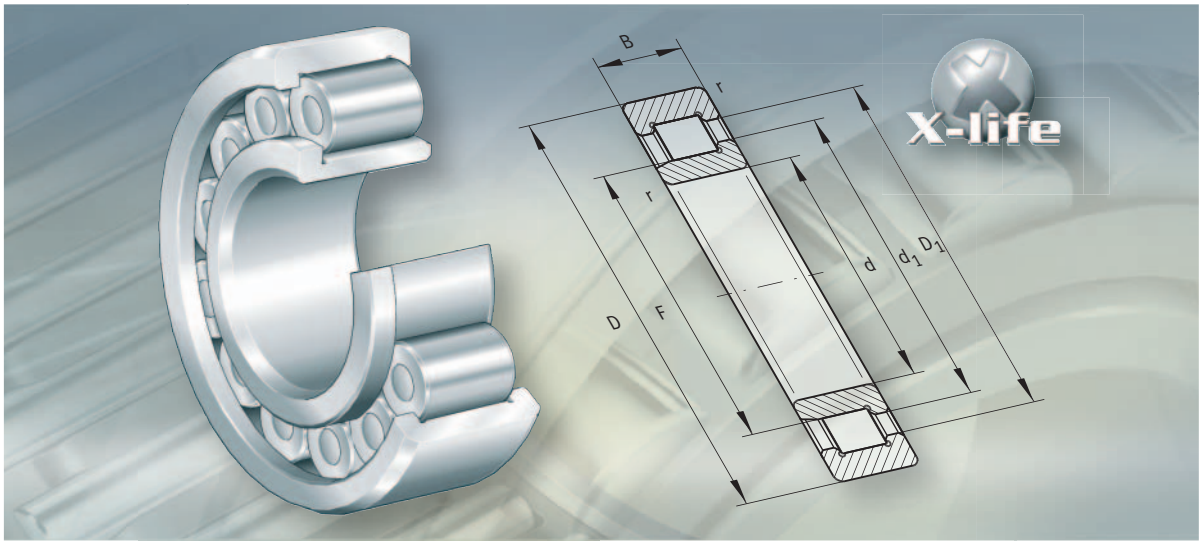
Dimension table (continued) · Dimensions in mm

Designation		Mass m		Dimensions							
Bearing	Adapter sleeve	Bearing ≈kg	Adapter sleeve ≈kg	d_{1H}	d	D	B	r min.	D_1 ≈	d_1 ≈	D_m
1218-K-TVH-C3	**H218**	2,48	1,17	**80**	90	160	30	2	138,7	112,7	126
2218-K-TVH-C3	**H318**	3,18	1,36	**80**	90	160	40	2	139,4	111,5	126
1318-K-M-C3	**H318**	6,27	1,36	**80**	90	190	43	3	159,9	124,4	126
2318-K-M-C3	**H2318**	8,6	1,68	**80**	90	190	64	3	161	115,7	126
1219-K-M-C3	**H219**	3,28	1,32	**85**	95	170	32	2,1	148,2	120,5	125
2219-K-M-C3	**H319**	4,24	1,51	**85**	95	170	43	2,1	148,6	118,9	125
1319-K-M-C3	**H319**	7,2	1,51	**85**	95	200	45	3	170,5	127,7	125
2319-K-M-C3	**H2319**	9,97	1,89	**85**	95	200	67	3	168,5	121,6	133
1220-K-M-C3	**H220**	3,94	1,48	**90**	100	180	34	2,1	155,2	127,7	130
2220-K-M-C3	**H320**	5,1	1,69	**90**	100	180	46	2,1	156,9	124,4	130
1320-K-M-C3	**H320**	8,95	1,69	**90**	100	215	47	3	182,6	135,5	130
2320-K-M-C3	**H2320**	12,7	2,17	**90**	100	215	73	3	183	130,8	142
1222-K-M-C3	**H222**	5,49	1,9	**100**	110	200	38	2,1	173,9	140,7	145
2222-K-M-C3	**H322**	7,27	2,15	**100**	110	200	53	2,1	174,1	136,9	154
1322-K-M-C3	**H322**	12,2	2,15	**100**	110	240	50	3	203,2	154,7	154
2322-K-M-C3	**H2322**	17,5	2,74	**100**	110	240	80	3	203	145,5	154



Mounting dimensions

		Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
l	c	d_a	D_a	d_b	B_a	r_a	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	n_G	n_B
	≈	max.	max.	min.	min.	max.	N	N					N	min^{-1}	min^{-1}
52	18	110	149	95	6	2	57 000	23 300	0,17	3,74	5,79	3,92	1 300	4 500	6 500
65	18	108	149	96	10	2	71 000	28 500	0,27	2,33	3,61	2,44	1 580	4 300	5 700
65	18	120	176	96	6	2,5	109 000	42 500	0,22	2,83	4,38	2,97	2 230	5 300	5 900
86	18	112	176	100	6	2,5	156 000	57 000	0,39	1,63	2,53	1,71	3 000	5 000	5 800
55	19	117	158	100	7	2,1	64 000	27 000	0,17	3,73	5,78	3,91	1 450	6 000	6 300
68	19	114	158	102	9	2,1	84 000	34 000	0,27	2,32	3,59	2,43	1 840	6 000	5 600
68	19	126	186	102	7	2,5	134 000	50 000	0,23	2,73	4,23	2,86	2 550	5 000	5 700
90	19	117	186	105	7	2,5	167 000	63 000	0,38	1,66	2,57	1,74	3 250	4 800	5 500
58	20	124	168	106	7	2,1	70 000	29 500	0,18	3,58	5,53	3,75	1 550	5 600	6 200
71	20	120	168	108	8	2,1	98 000	40 000	0,27	2,33	3,61	2,44	2 120	5 600	5 600
71	20	132	201	108	7	2,5	145 000	57 000	0,24	2,68	4,15	2,81	2 800	4 800	5 400
97	20	125	201	110	7	2,5	196 000	78 000	0,38	1,67	2,58	1,75	3 900	4 500	5 200
63	21	138	188	116	7	2,1	89 000	38 000	0,17	3,61	5,59	3,78	1 900	5 000	5 800
77	21	132	188	118	6	2,1	126 000	51 000	0,28	2,23	3,45	2,33	2 550	5 000	5 300
77	21	150	226	118	9	2,5	165 000	71 000	0,23	2,79	4,32	2,92	3 300	4 500	4 850
105	21	139	226	121	7	2,5	221 000	94 000	0,37	1,69	2,62	1,77	4 400	4 300	4 500





Cylindrical roller bearings

Cylindrical roller bearings with cage
Low friction cylindrical roller bearings
High precision cylindrical roller bearings
Full complement cylindrical roller bearings
Full complement cylindrical roller bearings with snap ring grooves

Cylindrical roller bearings

X-life
Cylindrical roller bearings with cage

358

Single row cylindrical roller bearings with cage have a very high radial load carrying capacity and are suitable for higher speeds compared to full complement designs. The rollers are guided between rigid ribs in one of the two bearing rings and form a unit with this ring due to the cage. Since a bearing ring of this type can be removed, the rings can be mounted separately. The bearings are available as non-locating, semi-locating and locating bearings.

X-life
Low friction cylindrical roller bearings

402

In the low friction cylindrical roller bearings, a brass disc cage or plastic spacers prevent the rolling elements from coming into contact with each other. They combined the advantages of full complement cylindrical roller bearings (high load carrying capacity) with those of cage type bearings (high limiting speeds).
The frictional torque is very low across the entire speed range.
As a result, the bearings have the highest limiting speeds of any cylindrical roller bearings.

High precision cylindrical roller bearings

414

Cylindrical roller bearings of this design are double row precision bearings (non-locating bearings) for machine tools and correspond to tolerance class SP. They are used to give radial support for main spindles. The bearings are separable and are therefore easier to fit and dismantle. The inner ring has a tapered bore for optimum setting of the radial internal clearance.

X-life
Full complement cylindrical roller bearings

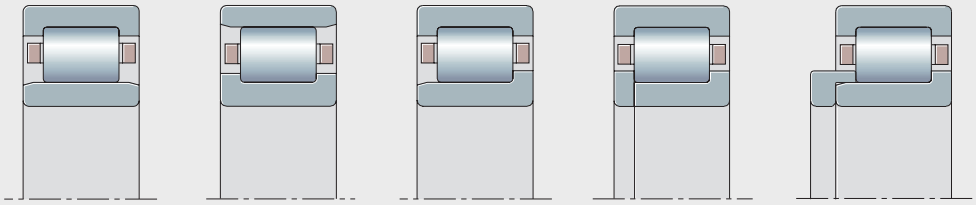
428

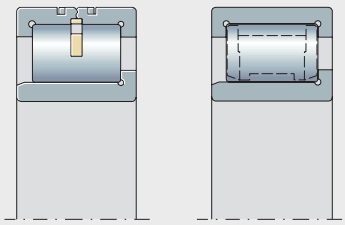
These single and double row bearings have full complement rolling element sets. The rolling elements are guided by ribs on the bearing rings. Since they have the maximum possible number of rollers, full complement bearings have extremely high load carrying capacity and high rigidity. Due to the kinematic conditions, however, they do not achieve the high speeds that are possible when using cylindrical roller bearings with cage. The bearings are available as non-locating, semi-locating and locating bearings.

Full complement cylindrical roller bearings with snap ring grooves

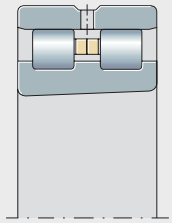
452

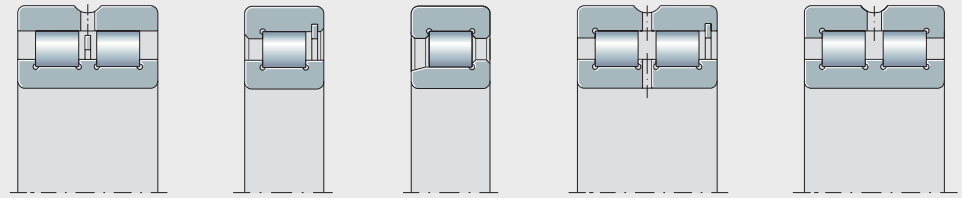
Due to the grooves in the outer rings, the bearing rings can be axially located using retaining rings. The bearings are therefore highly suitable for cable sheave bearing arrangements. Sealing rings on both sides of the bearings protect the running system reliably against contamination and moisture. Since it has the maximum possible number of rollers, the full complement design has extremely high load carrying capacity and high rigidity and is suitable for particularly compact designs.

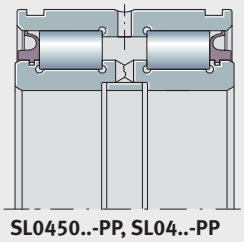

NU
N
NJ
NUP
NJ+HJ
113 478


LSL1923
ZSL1923
113 479

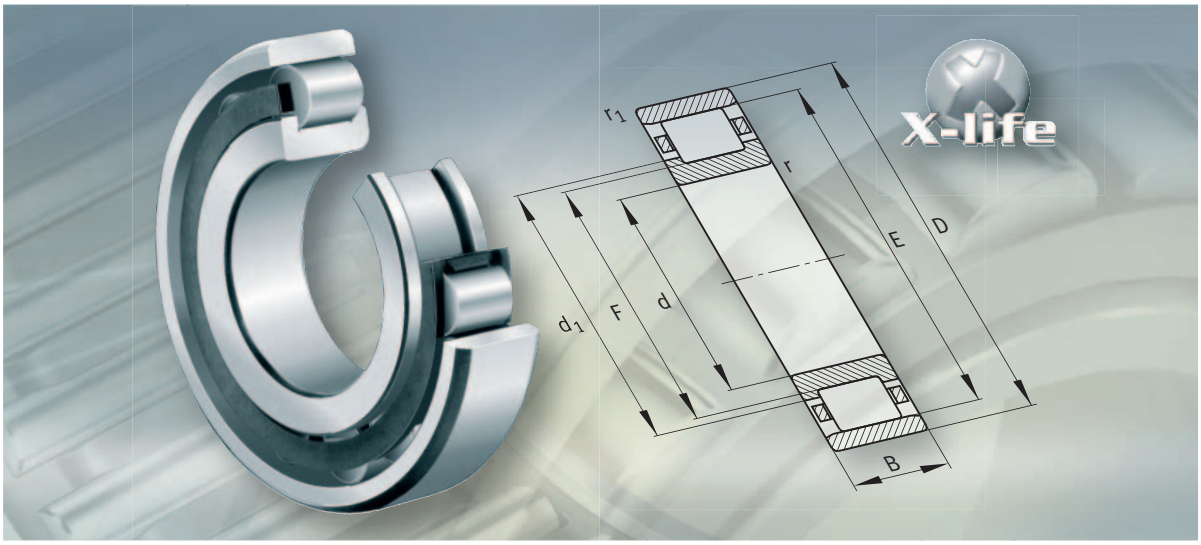



NN30..-AS-K-M-SP
113 480


SL0248, SL0249
SL1818, SL1829,
SL1830, SL1822
SL1923
SL1850
SL0148, SL0149
113 481


SL0450..-PP, SL04..-PP
113 482

FAG



Cylindrical roller bearings with cage

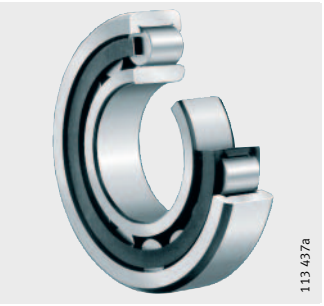
Cylindrical roller bearings with cage

		Page
Product overview	Cylindrical roller bearings with cage	360
Features	X-life	361
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	Semi-locating bearings	361
	Locating bearings	362
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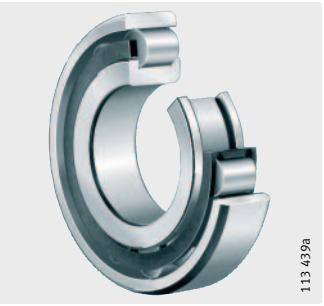


Non-locating bearings

NU10, NU19, NU2..-E, NU3..-E, NU22..-E, NU23..-E

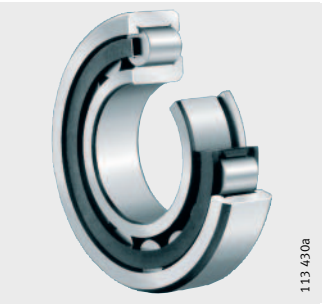


N2..-E, N3..-E



Semi-locating bearings

NJ2..-E, NJ3..-E, NJ22..-E, NJ23..-E



Locating bearings

With rib washer

NUP2..-E, NUP3..-E, NUP22..-E, NUP23..-E



With L-section ring

NJ2..-E + HJ, NJ3..-E + HJ, NJ22..-E + HJ, NJ23..-E + HJ



Cylindrical roller bearings with cage

Features

Single row cylindrical roller bearings with cage are units comprising solid inner and outer rings and cylindrical roller and cage assemblies. The outer rings have rigid ribs on both sides or no ribs, the inner rings have one or two rigid ribs or are designed without ribs. The cage prevents the cylindrical rollers from coming into contact with each other during rolling.

The cylindrical roller bearings have high rigidity, high radial load carrying capacity and, due to the cage, are suitable for higher speeds compared to full complement designs. Bearings with the suffix E have a higher capacity roller set and are thus designed for very high load carrying capacity.

The bearings are separable and are therefore easier to fit and dismantle. Both bearing rings can be given a tight fit by this process.

Single row cylindrical roller bearings with cage are available as non-locating, semi-locating and locating bearings.

Sealing/lubricant

The bearings are supplied without seals. They can be lubricated from the end faces.

X-life

Numerous sizes are supplied in the X-life grade.
These bearings are indicated in the dimension tables.

Bearings of X-life quality have lower roughness R_a and higher geometrical accuracy of the raceways than comparable designs that are not X-life. As a result, these bearings have higher load carrying capacity and longer life for the same dimensioning. In certain applications, this means that a smaller bearing arrangement can be designed.



Non-locating bearings

Cylindrical roller bearings NU and N are non-locating bearings and can support radial forces only.

In series NU, the outer ring has two ribs, while the inner ring has no ribs. Bearings of series N have two ribs on the inner ring and an outer ring without ribs.

Axial displacement

The outer and inner ring can be axially displaced relative to each other from the central position by the values “s” stated in the dimension tables.

Semi-locating bearings

Cylindrical roller bearings NJ are semi-locating bearings. Semi-locating bearings can support not only high radial forces but also axial forces in one direction and can therefore guide shafts axially in one direction. They act as non-locating bearings in the opposite direction.

The bearings have two ribs on the outer ring and one rib on the inner ring.

Non-locating bearings with L-section ring

Non-locating bearings NU can be combined with an L-section ring HJ to form a semi-locating bearing unit.

Caution!

Bearings NU must not be installed with two L-section rings – there is a risk of jamming.

Axial displacement

The outer and inner ring can be axially displaced relative to each other in one direction only by the dimension “s” stated in the dimension table.

Cylindrical roller bearings with cage

Locating bearings

Cylindrical roller bearings NUP and NJ with HJ are locating bearings. Locating bearings can support not only high radial forces but also axial forces in both directions and can therefore guide shafts axially in both directions.

Bearings with rib washer

Type NUP has two ribs on the outer ring and one rigid rib on the inner ring. A loose rib washer is fitted on the opposite side.

Bearings with L-section ring

Type NJ with HJ has two ribs on the outer ring, one rib on the inner ring and an L-section ring for the ribless side of the inner ring. The L-section rings suitable for the bearings are indicated in the dimension tables. The bearing and L-section ring must be ordered separately.

L-section rings

L-section rings are advantageous where, under high loads, the seating surface of the inner ring in NUP bearings with a loose rib washer is too small to provide a sufficiently high bearing seat. In some applications, they make it easier to fit and dismantle the bearings.

Operating temperature

Single row cylindrical roller bearings with cage can be used at operating temperatures from –30 °C to +150 °C.
For continuous operating temperatures above +120 °C, please contact us.

Caution! Bearings with a plastic cage (suffix TVP2) are suitable up to +120 °C; the operating life is heavily dependent on the lubricant used.

Cages

Suffix M1 indicates bearings with brass cages guided by rollers.

Higher strength cylindrical roller bearings with the suffix TVP2 have a cage made from glass fibre reinforced polyamide PA66.

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

The cages used in the bearings are shown in the table Bearing series and cage material, page 363.

Other cage designs

Other cage designs available by agreement. In such cages, suitability for high speeds and temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Bearing series and cage material

Series	Solid polyamide PA66 cage TVP2 Bore code	Solid brass cage M1
NU10	–	from 05
NU19	–	from 92
NU2..-E	up to 26	from 28
NU3..-E	up to 28	from 30
NU22..-E	up to 26	from 28
NU23..-E	up to 22	from 24
N2..-E	up to 20, 22 to 26	21, from 28
N3..-E	up to 16	from 17
NJ2..-E	up to 26	from 28
NJ3..-E	up to 28	from 30
NJ22..-E	up to 26	from 28
NJ23..-E	up to 22	from 24
NUP2..-E	up to 26	from 28
NUP3..-E	up to 28	from 30
NUP22..-E	up to 26	from 28
NUP23..-E	up to 22	from 24



Suffixes

Suffixes for available designs: see table.

Available designs

Suffixes	Description	Design
C3	Radial internal clearance larger than normal	Special design[1)]
C4	Radial internal clearance larger than C3	Special design[1)]
E	Increased capacity design	Standard
JP3	Sheet steel window cage, single-piece, roller-guided	Special design[1)]
MP1A	Solid brass cage, single-piece, rib-guided on outer ring	Special design[1)]
MP1B	Solid brass cage, single-piece, rib-guided on inner ring	Special design[1)]
M1	Solid brass cage, roller-guided	Standard
TVP2	Solid window cage made from glass fibre reinforced polyamide PA66	Standard
EX	Increased capacity design, design modified in accordance with standard (parts from these bearings must not be interchanged with parts from bearings of the same size of the previous design E)	Standard

1) Available by agreement.

Design and safety guidelines

Permissible skewing

The permissible skewing of the inner ring relative to the outer ring is dependent on the load ratio C_r/P and is restricted to a few angular minutes.

Caution! At a ratio $C_r/P \geqq 5$ ($P/C_r \leqq 0{,}2$), the adjustment angle must be no than 4 angular minutes (approx. 1,2 mrad).

Axial load carrying capacity

The axial load carrying capacity is dependent on:

- the size of the sliding surfaces between the ribs and the end faces of the rolling elements,
- the sliding velocity at the ribs,
- the lubrication on the contact surfaces.

Caution! Ribs subjected to load must be supported across their entire height. If severe shaft flexing is present, reversed bending loads may occur as a result of this support. Special analysis is required in this case.

The axial limiting load $F_{a\,max}$ must not be exceeded, in order to avoid impermissible pressure at the contact surfaces.

The ratio F_a/F_r should not exceed 0,4. Continuous axial loading without simultaneous radial loading is not permissible.

Permissible and maximum axial load

$$F_{a\,per} = k_S \cdot k_B \cdot d_M^{1,5} \cdot n^{-0,6} \leqq F_{a\,max}$$

$$F_{a\,max} = 0,075 \cdot k_B \cdot d_M^{2,1}$$

$F_{a\,per}$ N
Permissible axial load

$F_{a\,max}$ N
Axial limiting load

k_S –
Factor dependent on the lubrication method, see table

k_B –
Factor dependent on the bearing series, see table

d_M mm
Mean bearing diameter (d + D)/2 according to dimension table

n min^{-1}
Operating speed.

Factor k_S for lubrication method

Lubrication method[1)]	Factor k_S
Minimal heat dissipation, drip feed oil lubrication, oil mist lubrication, low operating viscosity ($\nu < 0,5 \cdot \nu_1$)	7,5 to 10
Poor heat dissipation, oil sump lubrication, oil spray lubrication, low oil flow	10 to 15
Good heat dissipation, recirculating oil lubrication (pressurised oil lubrication)	12 to 18
Very good heat dissipation, recirculating oil lubrication with oil cooling, high operating viscosity ($\nu > 2 \cdot \nu_1$)	16 to 24

1) Doped lubricating oils should be used, e.g. CLP (DIN 51517) and HLP (DIN 51524) of ISO VG classes 32 to 460 and ATF oils (DIN 51502) and gearbox oils (DIN 51512) of SAE viscosity classes 75 W to 140 W.

Bearing factor k_B

Series	Bearing factor k_B
NJ2..-E, NJ22..-E, NUP2..-E, NUP22..-E	18
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	23

Minimum radial load

In continuous operation, a minimum radial load of the order of $C_{0r}/P < 60$ is necessary.

Caution! If $C_{0r}/P > 60$, please contact us.

Equivalent dynamic bearing load

Non-locating bearings

For bearings under dynamic loading, the following applies:

$$P = F_r$$

Semi-locating and locating bearings

If an axial force F_a is present in addition to the radial force F_r, the effect on the life must be calculated using our calculation program BEARINX®.

Equivalent static bearing load

Non-locating bearings

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

Semi-locating and locating bearings

If an axial force F_{0a} is present in addition to the radial force F_{0r}, the effect on the static load safety factor must be calculated using our calculation program BEARINX®.



Accuracy

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

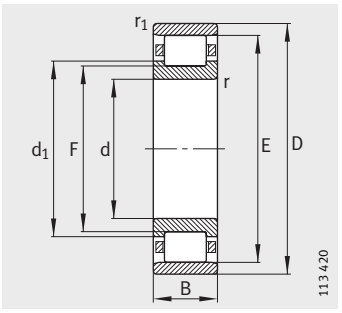
The radial internal clearance corresponds to internal clearance group CN.

Radial internal clearance to DIN 620-4

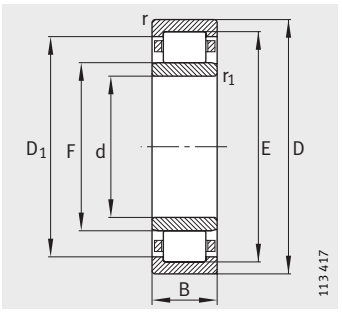
Bore d mm		Radial internal clearance					
		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.
–	24	20	45	35	60	50	75
24	30	20	45	35	60	50	75
30	40	25	50	45	70	60	85
40	50	30	60	50	80	70	100
50	65	40	70	60	90	80	110
65	80	40	75	65	100	90	125
80	100	50	85	75	110	105	140
100	120	50	90	85	125	125	165
120	140	60	105	100	145	145	190
140	160	70	120	115	165	165	215
160	180	75	125	120	170	170	220
180	200	90	145	140	195	195	250
200	225	105	165	160	220	220	280
225	250	110	175	170	235	235	300
250	280	125	195	190	260	260	330
280	315	130	205	200	275	275	350
315	355	145	225	225	305	305	385
355	400	190	280	280	370	370	460
400	450	210	310	310	410	410	510
450	500	220	330	330	440	440	550
500	560	240	360	360	480	480	600
560	630	260	380	380	500	500	620
630	710	285	425	425	565	565	705

Cylindrical roller bearings with cage

Non-locating bearings



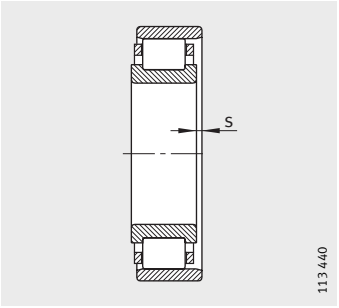
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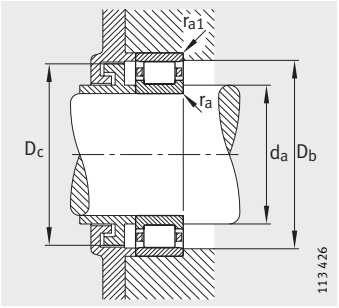
NU

Dimension table · Dimensions in mm

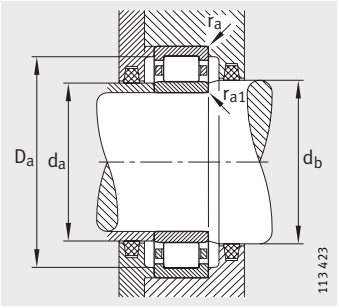
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
N202-E-TVP2	**XL**	0,047	**15**	35	11	0,6	0,3	0,5	30,3	19,3	–	21,6
NU202-E-TVP2	**XL**	0,048	**15**	35	11	0,6	0,3	1,6	30,3	19,3	28	–
N203-E-TVP2	**XL**	0,068	**17**	40	12	0,6	0,3	1,2	35,1	22,1	–	24,9
NU203-E-TVP2	**XL**	0,069	**17**	40	12	0,6	0,3	1,2	35,1	22,1	32,5	–
NU2203-E-TVP2	**XL**	0,051	**17**	40	16	0,6	0,3	1,7	35,1	22,1	32,5	–
NU303-E-TVP2	**XL**	0,121	**17**	47	14	1	0,6	1,2	40,2	24,2	37,1	–
N204-E-TVP2	**XL**	0,112	**20**	47	14	1	0,6	0,8	41,5	26,5	–	29,7
NU204-E-TVP2	**XL**	0,114	**20**	47	14	1	0,6	0,8	41,5	26,5	38,8	–
NU2204-E-TVP2	**XL**	0,146	**20**	47	18	1	0,6	1,8	41,5	26,5	38,8	–
NU304-E-TVP2	**XL**	0,153	**20**	52	15	1,1	0,6	1	45,5	27,5	42,4	–
NU2304-E-TVP2	**XL**	0,215	**20**	52	21	1,1	0,6	1,9	45,5	27,5	42,4	–
NU1005-M1	**XL**	0,092	**25**	47	12	0,6	0,3	2,4	41,5	30,5	39,3	–
N205-E-TVP2	**XL**	0,135	**25**	52	15	1	0,6	1,3	46,5	31,5	–	34,7
NU205-E-TVP2	**XL**	0,137	**25**	52	15	1	0,6	1,2	46,5	31,5	43,8	–
NU2205-E-TVP2	**XL**	0,165	**25**	52	18	1	0,6	1,7	46,5	31,5	43,8	–
N305-E-TVP2	**XL**	0,242	**25**	62	17	1,1	1,1	1,4	54	34	–	38,1
NU305-E-TVP2	**XL**	0,245	**25**	62	17	1,1	1,1	1,5	54	34	50,7	–
NU2305-E-TVP2	**XL**	0,349	**25**	62	24	1,1	1,1	1,9	54	34	50,7	–
NU1006-M1	**XL**	0,134	**30**	55	13	1	0,6	2,4	48,5	36,5	46,1	–
N206-E-TVP2	**XL**	0,205	**30**	62	16	1	0,6	1,4	55,5	37,5	–	41,1
NU206-E-TVP2	**XL**	0,207	**30**	62	16	1	0,6	1,5	55,5	37,5	52,5	–
NU2206-E-TVP2	**XL**	0,255	**30**	62	20	1	0,6	1,6	55,5	37,5	52,5	–
N306-E-TVP2	**XL**	0,366	**30**	72	19	1,1	1,1	0,6	62,5	40,5	–	45
NU306-E-TVP2	**XL**	0,368	**30**	72	19	1,1	1,1	1,2	62,5	40,5	59,2	–
NU2306-E-TVP2	**XL**	0,529	**30**	72	27	1,1	1,1	2,2	62,5	40,5	59,2	–
NU1007-M1	**XL**	0,177	**35**	62	14	1	0,6	2,6	55	42	52,4	–
N207-E-TVP2	**XL**	0,301	**35**	72	17	1,1	0,6	0,7	64	44	–	48
NU207-E-TVP2	**XL**	0,303	**35**	72	17	1,1	0,6	0,7	64	44	61	–
NU2207-E-TVP2	**XL**	0,406	**35**	72	23	1,1	0,6	2,2	64	44	61	–
N307-E-TVP2	**XL**	0,486	**35**	80	21	1,5	1,1	0,6	70,2	46,2	–	51
NU307-E-TVP2	**XL**	0,486	**35**	80	21	1,5	1,1	0,6	70,2	46,2	66,6	–
NU2307-E-TVP2	**XL**	0,723	**35**	80	31	1,5	1,1	3	70,2	46,2	66,6	–
NU1008-M1	**XL**	0,216	**40**	68	15	1	0,6	2	61	47	58,2	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

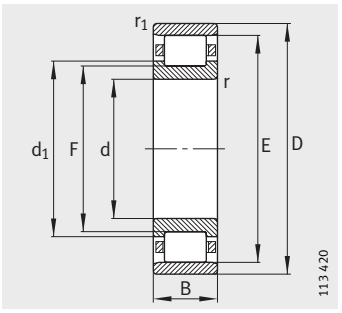


Mounting dimensions for NU

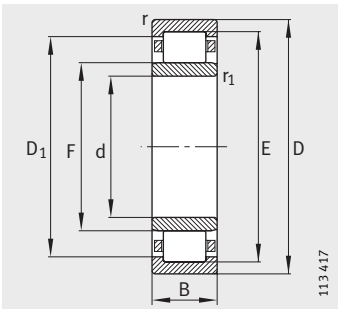
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
17,4	–	–	32,6	31	29	0,6	0,3	15 100	10 400	1 470	22 000	17 600
17,4	18,5	20	32,6	–	–	0,6	0,3	15 100	10 400	1 290	22 000	17 600
21	–	–	36	36	34	0,6	0,3	20 800	14 600	2 110	18 000	15 400
21	21,5	23	36	–	–	0,6	0,3	20 800	14 600	1 820	18 000	15 400
21	21,5	23	36	–	–	0,6	0,3	28 500	21 900	3 500	18 000	13 300
21,2	23,5	25	42,8	–	–	1	0,6	30 000	21 200	2 650	16 000	13 700
24	–	–	41	43	40	1	0,6	32 500	24 700	3 850	16 000	13 100
24	26	29	41	–	–	1	0,6	32 500	24 700	3 100	16 000	13 100
24	26	29	41	–	–	1	0,6	38 500	31 000	5 000	16 000	11 400
24	27	30	45	–	–	1	0,6	36 500	26 000	3 250	14 000	12 100
24	27	30	45	–	–	1	0,6	48 500	38 000	6 300	14 000	9 900
27	30	32	44	–	–	0,6	0,3	16 700	12 900	1 520	28 000	13 100
29	–	–	46	48	45	1	0,6	34 500	27 500	4 350	15 000	11 800
29	31	34	46	–	–	1	0,6	34 500	27 500	3 500	15 000	11 800
29	31	34	46	–	–	1	0,5	41 500	34 500	5700	15 000	9 800
32	–	–	55	55	53	1	1	48 000	36 500	5 800	12 000	10 200
32	33	37	55	–	–	1	1	48 000	36 500	4 700	12 000	10 200
32	33	37	55	–	–	1	1	66 000	55 000	9 400	12 000	8 400
33	35	38	50	–	–	1	0,6	22 900	19 300	2 400	24 000	11 000
34	–	–	56	57	54	1	0,6	45 000	36 000	5 700	12 000	9 800
34	37	40	56	–	–	1	0,6	45 000	36 000	4 650	12 000	9 800
34	37	40	56	–	–	1	0,6	57 000	48 500	8 100	12 000	8 200
37	–	–	65	64	61	1	1	61 000	48 000	8 000	10 000	9 000
37	40	44	65	–	–	1	1	61 000	48 000	6 400	10 000	9 000
37	40	44	65	–	–	1	1	86 000	75 000	13 200	10 000	7 300
38	41	44	57	–	–	1	0,6	29 000	26 000	3 150	20 000	9 700
39	–	–	65	65	63	1	0,6	58 000	48 500	7 900	10 000	8 300
39	43	46	65	–	–	1	0,6	58 000	48 500	6 400	10 000	8 300
39	43	46	65	–	–	1	0,6	72 000	64 000	10 800	10 000	7 300
42	–	–	71	71	69	1,5	1	76 000	63 000	10 700	9 000	8 100
42	45	48	71	–	–	1,5	1	76 000	63 000	8 600	9 000	8 100
42	45	48	71	–	–	1,5	1	108 000	98 000	17 400	9 000	6 700
43	46	49	63	–	–	1	0,6	33 500	30 500	3 350	19 000	8 900

Cylindrical roller bearings with cage

Non-locating bearings



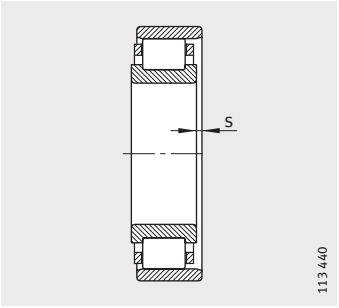
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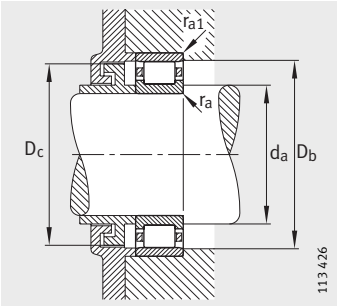
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Dimension table (continued) · Dimensions in mm

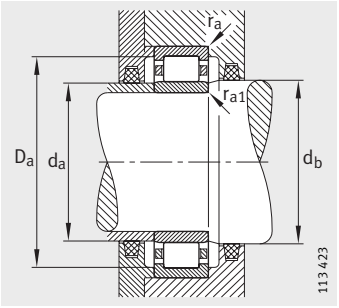
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
N208-E-TVP2	**XL**	0,358	**40**	80	18	1,1	1,1	1	71,5	49,5	–	54
NU208-E-TVP2	**XL**	0,379	**40**	80	18	1,1	1,1	1	71,5	49,5	68,3	–
NU2208-E-TVP2	**XL**	0,492	**40**	80	23	1,1	1,1	1,5	71,5	49,5	68,3	–
N308-E-TVP2	**XL**	0,656	**40**	90	23	1,5	1,5	1,2	80	52	–	57,6
NU308-E-TVP2	**XL**	0,659	**40**	90	23	1,5	1,5	1,3	80	52	75,9	–
NU2308-E-TVP2	**XL**	0,958	**40**	90	33	1,5	1,5	2,7	80	52	75,9	–
NU1009-M1	**XL**	0,277	**45**	75	16	1	0,6	2,5	67,5	52,5	64,5	–
N209-E-TVP2	**XL**	0,434	**45**	85	19	1,1	1,1	1	76,5	54,5	–	59
NU209-E-TVP2	**XL**	0,434	**45**	85	19	1,1	1,1	1	76,5	54,5	73,3	–
NU2209-E-TVP2	**XL**	0,532	**45**	85	23	1,1	1,1	1,5	76,5	54,5	73,3	–
N309-E-TVP2	**XL**	0,891	**45**	100	25	1,5	1,5	1	88,5	58,5	–	64,4
NU309-E-TVP2	**XL**	0,893	**45**	100	25	1,5	1,5	1	88,5	58,5	84,1	–
NU2309-E-TVP2	**XL**	1,3	**45**	100	36	1,5	1,5	2,5	88,5	58,5	84,1	–
NU1010-M1	**XL**	0,305	**50**	80	16	1	0,6	2,1	72,5	57,5	69,5	–
N210-E-TVP2	**XL**	0,488	**50**	90	20	1,1	1,1	1,3	81,5	59,5	–	64
NU210-E-TVP2	**XL**	0,49	**50**	90	20	1,1	1,1	1,3	81,5	59,5	78,3	–
NU2210-E-TVP2	**XL**	0,573	**50**	90	23	1,1	1,1	1,3	81,5	59,5	78,3	–
N310-E-TVP2	**XL**	1,16	**50**	110	27	2	2	1,7	97	65	–	71,3
NU310-E-TVP2	**XL**	1,16	**50**	110	27	2	2	1,7	97	65	92,5	–
NU2310-E-TVP2	**XL**	1,75	**50**	110	40	2	2	3,2	97	65	92,5	–
NU1011-E-M1	**XL**	0,451	**55**	90	18	1,1	1	2,1	82	64	79,2	–
N211-E-TVP2	**XL**	0,668	**55**	100	21	1,5	1,1	0,8	90	66	–	70,8
NU211-E-TVP2	**XL**	0,665	**55**	100	21	1,5	1,1	0,8	90	66	86,6	–
NU2211-E-TVP2	**XL**	0,796	**55**	100	25	1,5	1,1	1,3	90	66	86,6	–
N311-E-TVP2	**XL**	1,48	**55**	120	29	2	2	1,8	106,5	70,5	–	77,5
NU311-E-TVP2	**XL**	1,48	**55**	120	29	2	2	1,8	106,5	70,5	101,4	–
NU2311-E-TVP2	**XL**	2,23	**55**	120	43	2	2	3,3	106,5	70,5	101,4	–
NU1012-M1	**XL**	0,48	**60**	95	18	1,1	1	3,3	85,5	69,5	82,3	–
N212-E-TVP2	**XL**	0,827	**60**	110	22	1,5	1,5	1,6	100	72	–	77,6
NU212-E-TVP2	**XL**	0,824	**60**	110	22	1,5	1,5	1,6	100	72	96,1	–
NU2212-E-TVP2	**XL**	1,08	**60**	110	28	1,5	1,5	1,6	100	72	96,1	–
N312-E-TVP2	**XL**	1,84	**60**	130	31	2,1	2,1	1,9	115	77	–	84,4
NU312-E-TVP2	**XL**	1,85	**60**	130	31	2,1	2,1	1,8	115	77	109,6	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

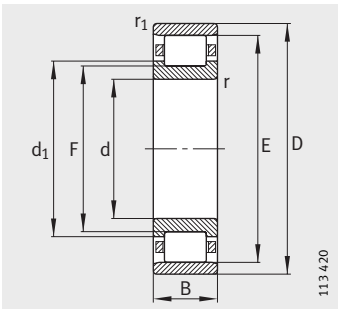


Mounting dimensions for NU

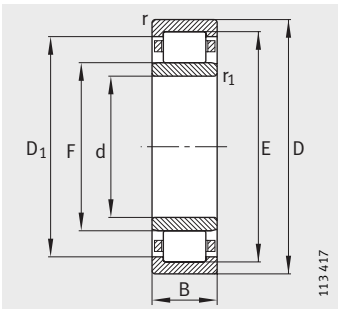
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
47	–	–	73	73	70	1	1	63 000	53 000	8 700	9 000	7 600
47	49	52	73	–	–	1	1	63 000	53 000	7 000	9 000	7 600
47	49	52	73	–	–	1	1	83 000	75 000	12 900	9 000	6 400
49	–	–	81	81	79	1,5	1,5	95 000	78 000	12 900	7 500	7 300
49	51	55	81	–	–	1,5	1,5	95 000	78 000	10 400	7 500	7 300
49	51	55	81	–	–	1,5	1,5	132 000	119 000	20 700	7 500	6 000
48	52	54	70	–	–	1	0,6	40 000	37 500	4 800	16 000	8 100
52	–	–	78	78	75	1	1	72 000	63 000	10 600	8 500	7 100
52	54	57	78	–	–	1	1	72 000	63 000	8 600	8 500	7 100
52	54	57	78	–	–	1	1	87 000	82 000	14 100	8 500	5 800
54	–	–	91	90	87	1,5	1,5	115 000	98 000	16 400	6 700	6 500
54	57	60	91	–	–	1,5	1,5	115 000	98 000	13 300	6 700	6 500
54	57	60	91	–	–	1,5	1,5	162 000	153 000	27 000	6 700	5 400
53	57	59	75	–	–	1	0,6	42 500	41 500	5 300	15 000	7 400
57	–	–	83	83	80	1	1	75 000	69 000	11 500	8 000	6 700
57	58	62	83	–	–	1	1	75 000	69 000	9 300	8 000	6 700
57	58	62	83	–	–	1	1	92 000	88 000	15 300	8 000	5 400
61	–	–	99	98	96	2	2	130 000	113 000	19 100	6 300	6 100
61	63	67	99	–	–	2	2	130 000	113 000	15 500	6 300	6 100
61	63	67	99	–	–	2	2	192 000	187 000	33 000	6 300	5 000
60	63	65	84	–	–	1,1	1	53 000	62 000	6 600	13 000	6 900
62	–	–	91	91	89	1,5	1	99 000	95 000	16 300	7 000	5 800
62	65	68	91	–	–	1,5	1	99 000	95 000	13 200	7 000	5 800
62	65	68	91	–	–	1,5	1	117 000	118 000	20 700	7 000	4 750
66	–	–	109	108	105	2	2	159 000	139 000	23 600	5 600	5 600
66	69	72	109	–	–	2	2	159 000	139 000	19 100	5 600	5 600
66	69	72	109	–	–	2	2	235 000	230 000	41 000	5 600	4 600
65	68	71	89	–	–	1,1	1	52 000	55 000	7 100	13 000	6 400
69	–	–	101	101	99	1,5	1,5	111 000	102 000	16 800	6 300	5 400
69	71	75	101	–	–	1,5	1,5	111 000	102 000	13 900	6 300	5 400
69	71	75	101	–	–	1,5	1,5	151 000	152 000	26 500	6 300	4 400
72	–	–	118	116	114	2,1	2,1	177 000	157 000	26 500	5 000	5 300
72	75	79	118	–	–	2,1	2,1	177 000	157 000	21 700	5 000	5 300

Cylindrical roller bearings with cage

Non-locating bearings



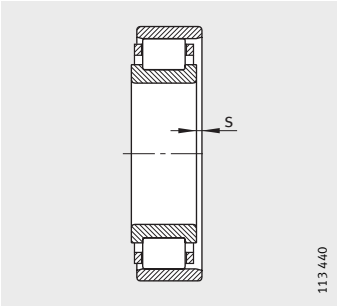
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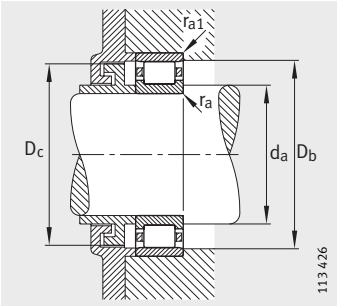
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Dimension table (continued) · Dimensions in mm

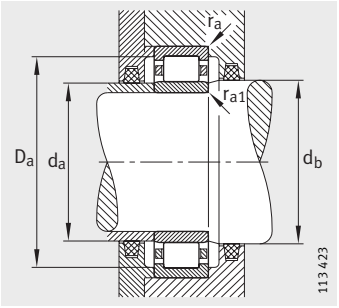
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NU2312-E-TVP2	**XL**	2,78	**60**	130	46	2,1	2,1	3,5	115	77	109,6	–
NU1013-M1	**XL**	0,507	**65**	100	18	1,1	1	3,3	90,5	74,5	87,3	–
N213-E-TVP2	**XL**	1,05	**65**	120	23	1,5	1,5	1,4	108,5	78,5	–	84,4
NU213-E-TVP2	**XL**	1,04	**65**	120	23	1,5	1,5	1,4	108,5	78,5	104,3	–
NU2213-E-TVP2	**XL**	1,43	**65**	120	31	1,5	1,5	1,9	108,5	78,5	104,3	–
N313-E-TVP2	**XL**	2,28	**65**	140	33	2,1	2,1	1,4	124,5	82,5	–	90,5
NU313-E-TVP2	**XL**	2,28	**65**	140	33	2,1	2,1	1,5	124,5	82,5	118,6	–
NU2313-E-TVP2	**XL**	3,32	**65**	140	48	2,1	2,1	4	124,5	82,5	118,6	–
NU1014-M1	**XL**	0,706	**70**	110	20	1,1	1	2,5	100	80	96	–
N214-E-TVP2	**XL**	1,16	**70**	125	24	1,5	1,5	1,6	113,5	83,5	–	89,4
NU214-E-TVP2	**XL**	1,15	**70**	125	24	1,5	1,5	1,6	113,5	83,5	109,4	–
NU2214-E-TVP2	**XL**	1,52	**70**	125	31	1,5	1,5	1,6	113,5	83,5	109,4	–
N314-E-TVP2	**XL**	2,79	**70**	150	35	2,1	2,1	1,6	133	89	–	97,4
NU314-E-TVP2	**XL**	2,79	**70**	150	35	2,1	2,1	1,7	133	89	126,8	–
NU2314-E-TVP2	**XL**	4,02	**70**	150	51	2,1	2,1	4,7	133	89	126,8	–
NU1015-M1	**XL**	0,737	**75**	115	20	1,1	1	2,5	105	85	101,7	–
N215-E-TVP2	**XL**	1,29	**75**	130	25	1,5	1,5	1,1	118,5	88,5	–	94,4
NU215-E-TVP2	**XL**	1,27	**75**	130	25	1,5	1,5	1,2	118,5	88,5	114,4	–
NU2215-E-TVP2	**XL**	1,6	**75**	130	31	1,5	1,5	1,6	118,5	88,5	114,4	–
N315-E-TVP2	**XL**	3,34	**75**	160	37	2,1	2,1	1,1	143	95	–	104,1
NU315-E-TVP2	**XL**	3,33	**75**	160	37	2,1	2,1	1,2	143	95	136,2	–
NU2315-E-TVP2	**XL**	4,95	**75**	160	55	2,1	2,1	4,2	143	95	136,2	–
NU1016-M1	**XL**	0,99	**80**	125	22	1,1	1	2,7	113,5	91,5	109,8	–
N216-E-TVP2	**XL**	1,55	**80**	140	26	2	2	1,2	127,3	95,3	–	101,5
NU216-E-TVP2	**XL**	1,55	**80**	140	26	2	2	1,3	127,3	95,3	122,9	–
NU2216-E-TVP2	**XL**	2,01	**80**	140	33	2	2	1,3	127,3	95,3	122,9	–
N316-E-TVP2	**XL**	4,12	**80**	170	39	2,1	2,1	0,6	151	101	–	110,4
NU316-E-TVP2	**XL**	3,96	**80**	170	39	2,1	2,1	0,7	151	101	143,9	–
NU2316-E-TVP2	**XL**	5,89	**80**	170	58	2,1	2,1	3,7	151	101	143,9	–
NU1017-M1	**XL**	1,04	**85**	130	22	1,1	1	4	118,5	96,5	114,8	–
N217-E-TVP2	**XL**	1,92	**85**	150	28	2	2	0,7	136,5	100,5	–	107,5
NU217-E-TVP2	**XL**	1,91	**85**	150	28	2	2	0,8	136,5	100,5	131,5	–
NU2217-E-TVP2	**XL**	2,5	**85**	150	36	2	2	1,3	136,5	100,5	131,5	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

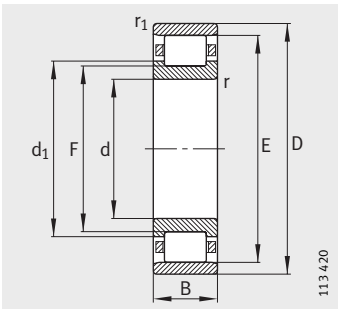


Mounting dimensions for NU

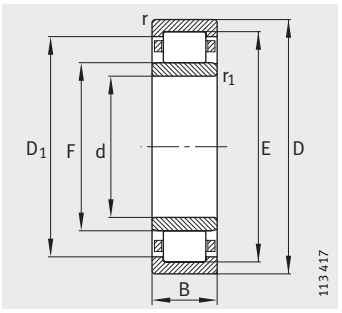
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
72	75	79	118	–	–	2,1	2,1	265 000	260 000	47 000	5 000	4 300
70	73	76	94	–	–	1,1	1	53 000	58 000	7 500	12 000	5 900
74	–	–	111	110	107	1,5	1,5	127 000	119 000	19 800	6 000	5 000
74	77	81	111	–	–	1,5	1,5	127 000	119 000	16 300	6 000	5 000
74	77	81	111	–	–	1,5	1,5	176 000	181 000	32 000	5 600	4 150
77	–	–	128	126	123	2,1	2,1	214 000	191 000	32 000	4 800	4 900
77	81	85	128	–	–	2,1	2,1	214 000	191 000	26 000	4 800	4 900
77	81	85	128	–	–	2,1	2,1	295 000	285 000	50 000	4 800	4 050
75	78	82	104	–	–	1	1	75 000	78 000	10 600	11 000	5 500
79	–	–	116	115	112	1,5	1,5	140 000	137 000	23 100	5 300	4 750
79	82	86	116	–	–	1,5	1,5	140 000	137 000	19 000	5 300	4 750
79	82	86	116	–	–	1,5	1,5	184 000	194 000	34 000	5 300	3 900
82	–	–	138	135	131	2,1	2,1	242 000	222 000	37 000	4 500	4 550
82	87	92	138	–	–	2,1	2,1	242 000	222 000	30 000	4 500	4 550
82	87	92	138	–	–	2,1	2,1	325 000	325 000	56 000	4 500	3 850
80	83	87	109	–	–	1,1	1	76 000	82 000	11 100	10 000	5 200
84	–	–	121	120	117	1,5	1,5	154 000	156 000	26 500	5 300	4 500
84	87	90	121	–	–	1,5	1,5	154 000	156 000	21 700	5 300	4 500
84	87	90	121	–	–	1,5	1,5	191 000	207 000	36 000	5 300	3 700
87	–	–	148	145	141	2,1	2,1	285 000	265 000	43 000	4 000	4 200
87	93	97	148	–	–	2,1	2,1	285 000	265 000	34 500	4 000	4 200
87	93	97	148	–	–	2,1	2,1	390 000	395 000	67 000	4 000	3 600
85	90	94	119	–	–	1	1	91 000	99 000	13 600	9 500	5 000
91	–	–	129	129	126	2	2	165 000	167 000	27 500	4 800	4 250
91	94	97	129	–	–	2	2	165 000	167 000	22 600	4 800	4 250
91	94	97	129	–	–	2	2	220 000	243 000	42 000	4 800	3 450
92	–	–	158	153	149	2,1	2,1	300 000	275 000	46 000	3 800	4 150
92	99	105	158	–	–	2,1	2,1	300 000	275 000	37 000	3 800	4 150
92	99	105	158	–	–	2,1	2,1	420 000	425 000	73 000	3 800	3 500
90	95	99	124	–	–	1	1	93 000	103 000	14 000	9 000	4 750
96	–	–	139	138	135	2	2	194 000	194 000	31 500	4 500	4 100
96	99	104	139	–	–	2	2	194 000	194 000	26 000	4 500	4 100
96	99	104	139	–	–	2	2	255 000	275 000	46 500	4 500	3 350

Cylindrical roller bearings with cage

Non-locating bearings



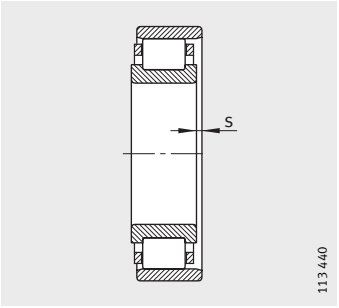
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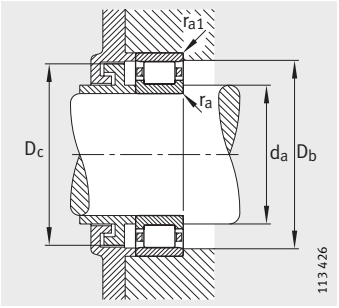
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Dimension table (continued) · Dimensions in mm

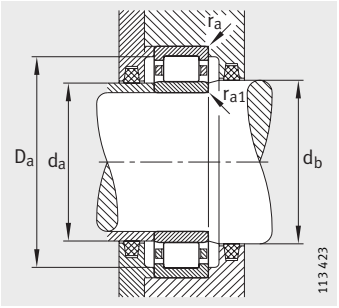
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
N317-E-M1	**XL**	5,3	**85**	180	41	3	3	1,1	160	108	–	117,8
NU317-E-TVP2	**XL**	4,62	**85**	180	41	3	3	1,3	160	108	152,7	–
NU2317-E-TVP2	**XL**	6,72	**85**	180	60	3	3	4,7	160	108	152,7	–
NU1018-M1	**XL**	1,31	**90**	140	24	1,5	1,1	3	127	103	122,9	–
N218-E-TVP2	**XL**	2,37	**90**	160	30	2	2	1,4	145	107	–	114,3
NU218-E-TVP2	**XL**	2,36	**90**	160	30	2	2	1,5	145	107	139,7	–
NU2218-E-TVP2	**XL**	3,17	**90**	160	40	2	2	2,5	145	107	139,7	–
N318-E-M1	**XL**	6,19	**90**	190	43	3	3	1,3	169,5	113,5	–	124
NU318-E-TVP2	**XL**	5,39	**90**	190	43	3	3	1,5	169,5	113,5	161,6	–
NU2318-E-TVP2	**XL**	8,04	**90**	190	64	3	3	5	169,5	113,5	161,6	–
NU1019-M1	**XL**	1,41	**95**	145	24	1,5	1,1	4,1	132	108	127,9	–
N219-E-TVP2	**XL**	2,89	**95**	170	32	2,1	2,1	0,6	154,5	112,5	–	120,5
NU219-E-TVP2	**XL**	2,88	**95**	170	32	2,1	2,1	0,7	154,5	112,5	148,6	–
NU2219-E-TVP2	**XL**	3,9	**95**	170	43	2,1	2,1	2,2	154,5	112,5	148,6	–
N319-E-M1	**XL**	7,05	**95**	200	45	3	3	1,4	177,5	121,5	–	132
NU319-E-TVP2	**XL**	6,32	**95**	200	45	3	3	1,4	177,5	121,5	169,6	–
NU2319-E-TVP2	**XL**	9,4	**95**	200	67	3	3	5,6	177,5	121,5	169,6	–
NU1020-M1	**XL**	1,46	**100**	150	24	1,5	1,1	4,3	137	113	132,9	–
N220-E-TVP2	**XL**	3,5	**100**	180	34	2,1	2,1	1,4	163	119	–	127,3
NU220-E-TVP2	**XL**	3,49	**100**	180	34	2,1	2,1	1,5	163	119	156,9	–
NU2220-E-TVP2	**XL**	4,77	**100**	180	46	2,1	2,1	2,5	163	119	156,9	–
N320-E-M1	**XL**	8,75	**100**	215	47	3	3	1,2	191,5	127,5	–	139,4
NU320-E-TVP2	**XL**	7,67	**100**	215	47	3	3	1,2	191,5	127,5	182	–
NU2320-E-TVP2	**XL**	12,1	**100**	215	73	3	3	4,2	191,5	127,5	182	–
NU1021-M1	**XL**	1,84	**105**	160	26	2	1,1	4,5	145,5	119,5	141	–
N221-E-M1	**XL**	4,63	**105**	190	36	2,1	2,1	1,2	171,5	125,5	–	134,5
NU221-E-TVP2	**XL**	4,08	**105**	190	36	2,1	2,1	1,3	171,5	125,5	165,1	–
NU1022-M1	**XL**	2,31	**110**	170	28	2	1,1	3,2	155	125	149,7	–
N222-E-TVP2	**XL**	4,85	**110**	200	38	2,1	2,1	1,4	180,5	132,5	–	141,6
NU222-E-TVP2	**XL**	4,84	**110**	200	38	2,1	2,1	1,5	180,5	132,5	173,8	–
NU2222-E-TVP2	**XL**	6,76	**110**	200	53	2,1	2,1	4	180,5	132,5	173,8	–
N322-E-M1	**XL**	11,7	**110**	240	50	3	3	1,3	211	143	–	155,6
NU322-E-TVP2	**XL**	10,3	**110**	240	50	3	3	1,3	211	143	200,9	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

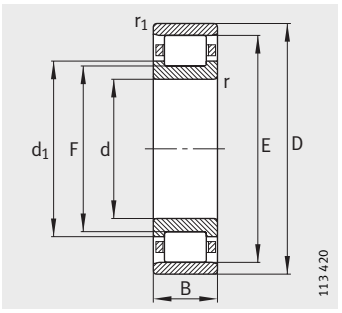


Mounting dimensions for NU

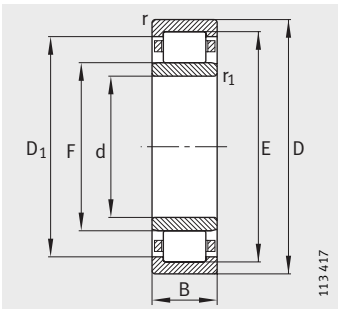
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
99	–	–	166	162	158	2,5	2,5	340 000	325 000	53 000	5 600	3 850
99	106	110	166	–	–	2,5	2,5	320 000	300 000	40 000	3 600	4 000
99	106	110	166	–	–	2,5	2,5	435 000	445 000	75 000	3 600	3 350
96	101	106	133	–	–	1,5	1	111 000	124 000	16 800	8 500	4 550
101	–	–	149	147	143	2	2	215 000	217 000	35 000	4 300	3 950
101	105	109	149	–	–	2	2	215 000	217 000	28 500	4 300	3 950
101	105	109	149	–	–	2	2	285 000	315 000	52 000	4 300	3 300
104	–	–	176	171	168	2,5	2,5	370 000	350 000	55 000	5 300	3 750
104	111	117	176	–	–	2,5	2,5	370 000	350 000	44 000	3 400	3 750
104	111	117	176	–	–	2,5	2,5	510 000	530 000	86 000	3 400	3 050
101	106	111	138	–	–	1,5	1	113 000	130 000	17 300	8 000	4 350
107	–	–	158	156	153	2,1	2,1	260 000	265 000	41 500	3 800	3 700
107	111	116	158	–	–	2,1	2,1	260 000	265 000	34 000	3 800	3 700
107	111	116	158	–	–	2,1	2,1	340 000	370 000	60 000	3 800	3 100
109	–	–	186	179	176	2,5	2,5	390 000	380 000	59 000	5 300	3 600
109	119	124	186	–	–	2,5	2,5	390 000	380 000	48 000	3 400	3 600
109	119	124	186	–	–	2,5	2,5	540 000	580 000	93 000	3 400	2 850
106	111	116	143	–	–	1,5	1	116 000	135 000	17 900	7 500	4 150
112	–	–	168	165	161	2,1	2,1	295 000	305 000	47 500	3 800	3 500
112	117	122	168	–	–	2,1	2,1	295 000	305 000	38 500	3 800	3 500
112	117	122	168	–	–	2,1	2,1	395 000	445 000	72 000	3 800	2 900
114	–	–	201	193	190	2,5	2,5	450 000	425 000	65 000	5 000	3 400
114	125	132	201	–	–	2,5	2,5	450 000	425 000	53 000	3 200	3 400
114	125	132	201	–	–	2,5	2,5	680 000	720 000	114 000	3 200	2 550
111	118	122	151	–	–	2	1	131 000	153 000	19 400	7 000	4 050
117	–	–	178	173	170	2,1	2,1	310 000	320 000	49 000	5 600	3 450
117	123	128	178	–	–	2,1	2,1	310 000	320 000	40 000	3 600	3 450
116	124	128	161	–	–	2	1	166 000	190 000	24 200	7 000	3 850
122	–	–	188	182	179	2	2	345 000	365 000	56 000	3 400	3 300
122	130	135	188	–	–	2,1	2,1	345 000	365 000	56 000	3 400	3 300
122	130	135	188	–	–	2,1	2,1	455 000	520 000	81 000	3 400	2 800
124	–	–	226	213	209	2,5	2,5	520 000	510 000	78 000	4 800	3 000
124	140	145	226	–	–	2,5	2,5	495 000	475 000	59 000	3 000	3 100

Cylindrical roller bearings with cage

Non-locating bearings



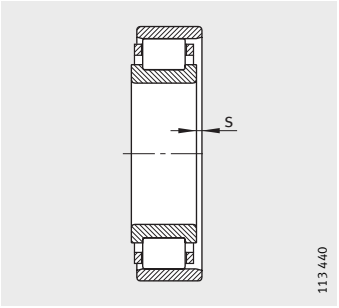
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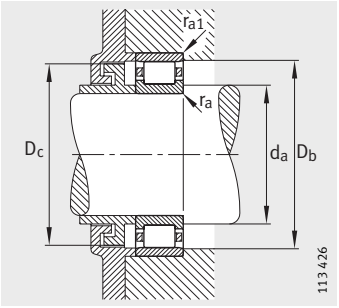
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Dimension table (continued) · Dimensions in mm

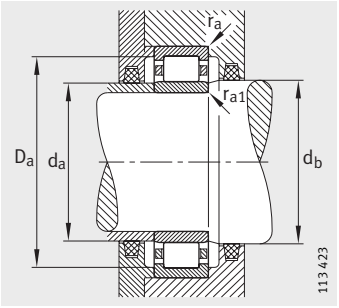
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NU2322-E-TVP2	**XL**	16,6	**110**	240	80	3	3	5,8	211	143	200,9	–
NU1024-M1	**XL**	2,47	**120**	180	28	2	1,1	3,2	165	135	159,7	–
N224-E-TVP2	**XL**	5,67	**120**	215	40	2,1	2,1	1,4	195,5	143,5	–	153,2
NU224-E-TVP2	**XL**	5,8	**120**	215	40	2,1	2,1	1,4	195,5	143,5	187,8	–
NU2224-E-TVP2	**XL**	8,38	**120**	215	58	2,1	2,1	4,5	195,5	143,5	187,8	–
N324-E-M1	**XL**	15,1	**120**	260	55	3	3	3,5	230	154	–	168,7
NU324-E-TVP2	**XL**	13,3	**120**	260	55	3	3	3,5	230	154	218,7	–
NU2324-E-M1	**XL**	23,2	**120**	260	86	3	3	7,2	230	154	218,7	–
NU1026-M1	**XL**	3,81	**130**	200	33	2	1,1	3,9	182	148	175,9	–
N226-E-TVP2	**XL**	6,51	**130**	230	40	3	3	1,2	209,5	153,5	–	164
NU226-E-TVP2	**XL**	6,5	**130**	230	40	3	3	1,2	209,5	153,5	201,2	–
NU2226-E-TVP2	**XL**	10,4	**130**	230	64	3	3	5,2	209,5	153,5	201,2	–
N326-E-M1	**XL**	18,4	**130**	280	58	4	4	3,5	247	167	–	181,7
NU326-E-TVP2	**XL**	16,2	**130**	280	58	4	4	3,5	247	167	235,2	–
NU2326-E-M1	**XL**	28,8	**130**	280	93	4	4	8,1	247	167	235,2	–
NU1028-M1	**XL**	3,94	**140**	210	33	2	1,1	3,8	192	158	185,9	–
N228-E-M1	**XL**	9,3	**140**	250	42	3	3	2	225	169	–	179,4
NU228-E-M1	**XL**	9,31	**140**	250	42	3	3	2	225	169	216,7	–
NU2228-E-M1	**XL**	14,5	**140**	250	68	3	3	7	225	169	216,7	–
N328-E-M1	**XL**	22,5	**140**	300	62	4	4	5,2	264	180	–	195,4
NU328-E-TVP2	**XL**	20,1	**140**	300	62	4	4	5,2	264	180	251,7	–
NU2328-E-M1	**XL**	36	**140**	300	102	4	4	9,2	264	180	251,7	–
NU1030-M1	**XL**	4,93	**150**	225	35	2,1	1,5	4,2	205,5	169,5	199	–
N230-E-M1	**XL**	11,7	**150**	270	45	3	3	4	242	182	–	193,1
NU230-E-M1	**XL**	11,8	**150**	270	45	3	3	4	242	182	233,2	–
NU2230-E-M1	**XL**	18,4	**150**	270	73	3	3	7,5	242	182	233,2	–
N330-E-M1	**XL**	26,8	**150**	320	65	4	4	5,5	283	193	–	209,5
NU330-E-M1	**XL**	26,8	**150**	320	65	4	4	5,5	283	193	269,8	–
NU2330-E-M1	**XL**	43,2	**150**	320	108	4	4	9,7	283	193	269,8	–
NU1032-M1	**XL**	5,92	**160**	240	38	2,1	1,5	4,3	220	180	212,9	–
N232-E-M1	**XL**	14,6	**160**	290	48	3	3	4,1	259	195	–	206,8
NU232-E-M1	**XL**	14,6	**160**	290	48	3	3	4,1	259	195	249,6	–
NU2232-E-M1	**XL**	23,5	**160**	290	80	3	3	7,2	261	193	251,1	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

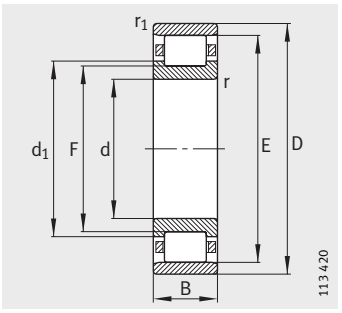


Mounting dimensions for NU

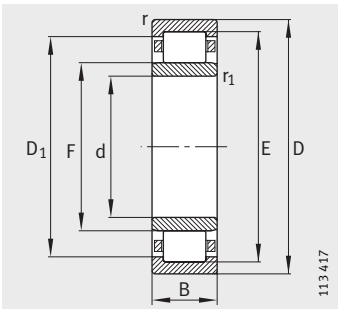
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
124	140	145	226	–	–	2,5	2,5	750 000	800 000	126 000	2 800	2 320
126	134	138	171	–	–	2	1	174 000	207 000	26 000	6 300	3 550
132	–	–	203	197	194	2,1	2,1	390 000	415 000	64 000	3 200	3 100
132	141	146	203	–	–	2,1	2,1	390 000	415 000	52 000	3 200	3 100
132	141	146	203	–	–	2,1	2,1	530 000	610 000	97 000	3 200	2 550
134	–	–	246	232	228	2,5	2,5	610 000	600 000	87 000	4 500	2 700
134	151	156	246	–	–	2,5	2,5	610 000	600 000	70 000	2 800	2 700
134	151	156	246	–	–	2,5	2,5	930 000	1 010 000	153 000	4 300	2 000
136	146	151	191	–	–	2	1	212 000	250 000	31 000	5 600	3 500
144	–	–	216	212	207	2,5	2,5	425 000	445 000	65 000	3 000	2 850
144	151	158	216	–	–	2,5	2,5	425 000	445 000	54 000	3 000	2 850
144	151	158	216	–	–	2,5	2,5	620 000	730 000	111 000	3 000	2 300
147	–	–	263	249	245	3	3	720 000	720 000	103 000	4 300	2 460
147	164	169	263	–	–	3	3	680 000	670 000	79 000	2 600	2 460
147	164	169	263	–	–	3	3	1 080 000	1 220 000	180 000	3 800	1 780
146	156	161	201	–	–	2	1	216 000	265 000	32 000	5 300	3 250
154	–	–	236	227	223	2,5	2,5	460 000	510 000	72 000	4 800	2 600
154	166	171	236	–	–	2,5	2,5	460 000	510 000	59 000	4 800	2 600
154	166	171	236	–	–	2,5	2,5	670 000	830 000	123 000	4 500	2 080
157	–	–	283	266	262	3	3	790 000	800 000	113 000	3 800	2 200
157	176	182	283	–	–	3	3	790 000	800 000	92 000	2 400	2 200
157	176	182	283	–	–	3	3	1 210 000	1390 000	202 000	3 600	1 640
158	167	173	215	–	–	2,1	1,5	248 000	310 000	37 000	5 000	3 100
164	–	–	256	244	240	2,5	2,5	520 000	590 000	82 000	4 500	2 390
164	179	184	256	–	–	2,5	2,5	520 000	590 000	68 000	4 500	2 390
164	179	184	256	–	–	2,5	2,5	780 000	970 000	142 000	4 300	1 860
167	–	–	303	285	281	3	3	900 000	930 000	126 000	3 600	1 970
167	190	195	303	–	–	3	3	900 000	930 000	103 000	3 600	1 970
167	190	195	303	–	–	3	3	1 380 000	1 600 000	226 000	3 200	1 480
168	178	184	230	–	–	2,1	1,5	290 000	355 000	42 500	4 800	3 000
174	–	–	276	261	257	2,5	2,5	590 000	670 000	93 000	4 300	2 190
174	192	197	276	–	–	2,5	2,5	590 000	670 000	76 000	4 300	2 190
174	192	197	276	–	–	2,5	2,5	940 000	1 170 000	172 000	3 800	1 670

Cylindrical roller bearings with cage

Non-locating bearings



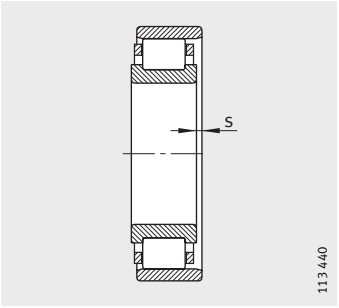
N



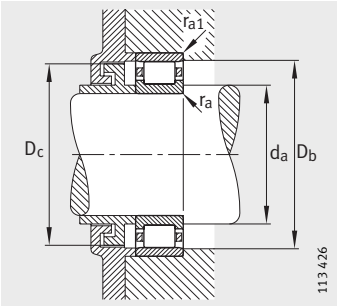
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Dimension table (continued) · Dimensions in mm

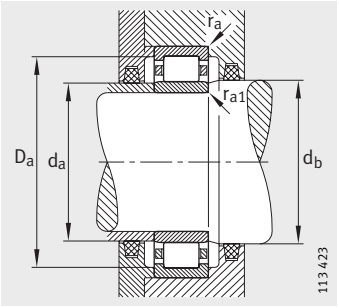
Designation		Mass	Dimensions									
	X-life	m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
N332-E-M1	–	32,6	**160**	340	68	4	4	5,5	300	204	–	221,6
NU332-E-M1	–	31,8	**160**	340	68	4	4	5,6	300	204	286	–
NU2332-E-M1	–	51,5	**160**	340	114	4	4	9,9	300	204	286	–
NU1034-M1	**XL**	8,03	**170**	260	42	2,1	2,1	4,8	237	193	229,1	–
N234-E-M1	**XL**	18	**170**	310	52	4	4	4,3	279	207	–	218,4
NU234-E-M1	**XL**	18,1	**170**	310	52	4	4	4,3	279	207	268,5	–
NU2234-E-M1	**XL**	29,4	**170**	310	86	4	4	7,2	281	205	269,9	–
N334-E-M1	–	37,9	**170**	360	72	4	4	5,9	318	218	–	237
NU334-E-M1	–	38	**170**	360	72	4	4	6	318	218	301,6	–
NU2334-EX-M1	–	61,4	**170**	360	120	4	4	10,2	320	216	303	–
NU1036-M1	**XL**	10,5	**180**	280	46	2,1	2,1	5	255	205	245,9	–
NU236-E-M1	**XL**	18,9	**180**	320	52	4	4	4,7	289	217	278,6	–
NU2236-E-M1	**XL**	30,5	**180**	320	86	4	4	7,2	291	215	280	–
NU336-E-M1	–	43,9	**180**	380	75	4	4	6,1	335	231	319,8	–
NU2336-EX-M1	–	71,8	**180**	380	126	4	4	10,5	339	227	320,8	–
NU1038-M1	**XL**	10,9	**190**	290	46	2,1	2,1	5	265	215	255,9	–
N238-E-M1	–	22,8	**190**	340	55	4	4	4,7	306	230	–	244
NU238-E-M1	–	22,8	**190**	340	55	4	4	4,7	306	230	295	–
NU2238-E-M1	–	37,1	**190**	340	92	4	4	8	308	228	296,4	–
NU338-E-M1	–	50,6	**190**	400	78	5	5	6,3	353	245	336	–
NU2338-EX-M1	–	83,1	**190**	400	132	5	5	11	360	240	340,5	–
NU1040-M1	**XL**	14,1	**200**	310	51	2,1	2,1	8,3	281	229	271,5	–
N240-E-M1	–	27,2	**200**	360	58	4	4	4,8	323	243	–	257,6
NU240-E-M1	–	27,2	**200**	360	58	4	4	4,8	323	243	311,5	–
NU2240-E-M1	–	44,7	**200**	360	98	4	4	8,2	325	241	312,9	–
NU340-E-M1	–	57,3	**200**	420	80	5	5	6,3	370	258	351,8	–
NU2340-EX-M1	–	95,6	**200**	420	138	5	5	11,3	377	253	356,9	–
NU1044-M1	–	20,5	**220**	340	56	3	3	6,2	310	250	298,9	–
NU244-E-M1	–	38,5	**220**	400	65	4	4	5,5	358	268	344,9	–
NU2244-EX-M1	–	61,6	**220**	400	108	4	4	8,4	367	259	349,4	–
NU344-E-M1	–	75,5	**220**	460	88	5	5	7	406	282	386	–
NU2344-EX-M1	–	121	**220**	460	145	5	5	11,9	413	277	391,2	–
NU1048-M1	–	19,8	**240**	360	56	3	3	6,4	330	270	318,9	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

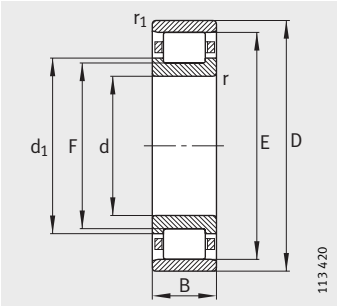


Mounting dimensions for NU

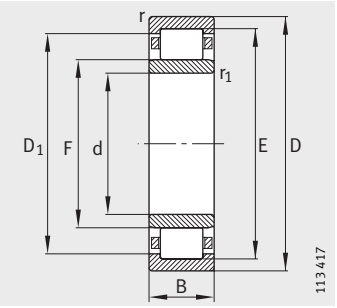
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
177	–	–	323	302	298	3	3	865 000	1 060 000	114 000	3 000	1 790
177	200	211	323	–	–	3	3	865 000	1 060 000	96 000	3 000	1 790
177	200	211	323	–	–	3	3	1 320 000	1 830 000	204 000	3 000	1 350
180	190	197	250	–	–	2,1	2,1	350 000	435 000	49 500	4 500	2 800
187	–	–	293	281	277	3	3	700 000	780 000	107 000	3 600	2 010
187	204	211	293	–	–	3	3	700 000	780 000	88 000	3 600	2 010
187	204	211	293	–	–	3	3	1 130 000	1 400 000	198 000	3 200	1 500
187	–	–	343	320	316	3	3	965 000	1 220 000	132 000	3 000	1 630
187	215	221	343	–	–	3	3	965 000	1 220 000	105 000	3 000	1 630
187	214	218	343	–	–	3	3	1 500 000	2 080 000	231 000	2 800	1 230
190	203	209	270	–	–	2,1	2,1	425 000	520 000	61 000	4 500	2 550
197	214	221	303	–	–	3	3	730 000	830 000	93 000	3 600	1 880
197	214	221	303	–	–	3	3	1 180 000	1 490 000	209 000	3 200	1 390
197	228	234	363	–	–	3	3	1 040 000	1 320 000	112 000	2 800	1 520
197	225	229	363	–	–	3	3	1 660 000	2 320 000	260 000	2 800	1 130
200	213	219	280	–	–	2,1	2,1	435 000	550 000	63 000	4 300	2 410
207	–	–	323	309	303	3	3	680 000	930 000	100 000	3 200	1 750
207	227	234	323	–	–	3	3	680 000	930 000	85 000	3 200	1 750
207	227	234	323	–	–	3	3	1 100 000	1 660 000	184 000	3 000	1 300
210	242	248	380	–	–	4	4	1 120 000	1 430 000	120 000	2 800	1 430
210	237,8	242,2	380	–	–	4	4	1 900 000	2 650 000	285 000	2 600	1 030
210	226	233	300	–	–	2,1	2,1	470 000	600 000	68 000	3 800	2 310
217	–	–	343	326	320	3	3	750 000	1 040 000	110 000	3 000	1 620
217	240	247	343	–	–	3	3	750 000	1 040 000	94 000	3 000	1 620
217	240	247	343	–	–	3	3	1 220 000	1 860 000	206 000	2 800	1 210
220	255	261	400	–	–	4	4	1 180 000	1 530 000	128 000	2 600	1 340
220	250,7	255,3	400	–	–	4	4	2 040 000	2 900 000	310 000	2 400	960
232	248	254	328	–	–	2,5	2,5	510 000	765 000	69 000	3 200	2 040
237	265	271	383	–	–	3	3	950 000	1 320 000	109 000	2 800	1 400
237	256,7	261,3	383	–	–	3	3	1 630 000	2 360 000	250 000	2 600	1 020
240	279	285	440	–	–	4	4	1 430 000	1 900 000	152 000	2 400	1 160
240	274,7	279,3	440	–	–	4	4	2 360 000	3 350 000	340 000	2 200	840
252	268	275	348	–	–	2,5	2,5	540 000	850 000	74 000	3 000	1 840

Cylindrical roller bearings with cage

Non-locating bearings



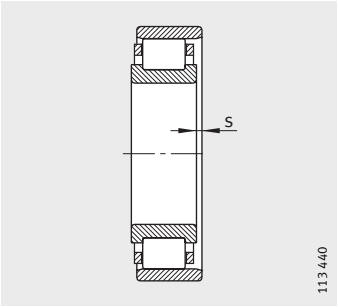
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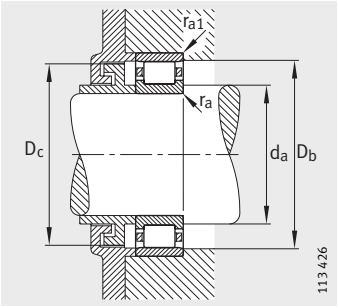
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Dimension table (continued) · Dimensions in mm

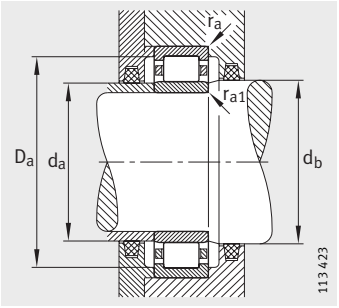
Designation	Mass	Dimensions									
	m	d	D	B	r	r_1	$s^{1)}$	E	F	D_1	d_1
	≈kg				min.	min.				≈	≈
N248-E-M1	51,5	**240**	440	72	4	4	6	393	293	–	312
NU248-E-M1	51,8	**240**	440	72	4	4	6	393	293	376,6	–
NU2248-EX-M1	82,8	**240**	440	120	4	4	10,2	399	287	380,7	–
NU348-E-M1	95,7	**240**	500	95	5	5	7,4	442	306	421,2	–
NU2348-EX-M1	151	**240**	500	155	5	5	13,3	447	303	424	–
NU1052-M1	29,7	**260**	400	65	4	4	7,2	364	296	351,3	–
NU252-E-M1	68,4	**260**	480	80	5	5	6,2	429	317	410,8	–
NU2252-E-M1	109	**260**	480	130	5	5	10,5	433	313	413,6	–
NU352-E-M1	121	**260**	540	102	6	6	10	477	337	454,6	–
NU2352-EX-M1	189	**260**	540	165	6	6	13,7	484	324	458,4	–
NU1056-M1	31,3	**280**	420	65	4	4	7,2	384	316	371,3	–
NU256-E-M1	72,1	**280**	500	80	5	5	6,3	449	337	430,8	–
NU2256-E-M1	114	**280**	500	130	5	5	10,5	453	333	436	–
NU356-E-M1	147	**280**	580	108	6	6	8,7	512	362	488	–
NU2356-EX-M1	234	**280**	580	175	6	6	13,8	521	351	493,8	–
NU1060-M1	44,6	**300**	460	74	4	4	7,9	420	340	405,2	–
NU260-E-M1	90,4	**300**	540	85	5	5	6,9	484	364	464,6	–
NU2260-EX-M1	143	**300**	540	140	5	5	12,2	495	355	472,6	–
NU1064-M1	46,9	**320**	480	74	4	4	11,5	440	360	425,1	–
NU264-EX-M1	113	**320**	580	92	5	5	7,5	520	392	499,4	–
NU2264-EX-M1	180	**320**	580	150	5	5	11,9	530	380	506	–
NU1068-M1	63,2	**340**	520	82	5	5	12,5	475	385	458,2	–
NU1072-M1	66	**360**	540	82	5	5	12,5	495	405	478,1	–
NU2272-E-M1	254	**360**	650	170	6	6	15	588	428	562	–
NU1076-M1	69,1	**380**	560	82	5	5	9	515	425	498,1	–
NU2276-E-M1	288	**380**	680	175	6	6	13,8	615	451	588,8	–
NU1080-M1	89,8	**400**	600	90	5	5	13,5	550	450	531,5	–
NU1084-M1	92,9	**420**	620	90	5	5	9,6	570	470	551,5	–
NU1088-M1	107	**440**	650	94	6	6	9,8	597	493	577,6	–
NU1992-M1	63,1	**460**	620	74	4	4	8,4	578	502	562,8	–
NU1092-M1	125	**460**	680	100	6	6	11,2	624	516	603,9	–
NU1996-M1	74,2	**480**	650	78	5	5	6,8	605	525	589	–
NU1096-M1	129	**480**	700	100	6	6	10,7	644	536	623,9	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N248-E-M1: $D_{b\ min}$ = 396 mm, $D_{c\ max}$ = 390 mm

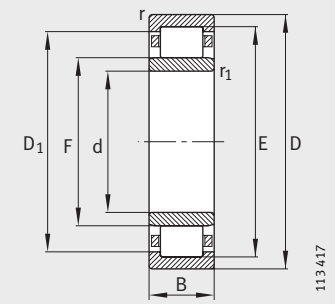


Mounting dimensions for NU

Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
257	–	–	423	3	3	1 140 000	1 600 000	163 000	2 600	1 240
257	290	296	423	3	3	1 140 000	1 600 000	132 000	2 600	1 240
257	284,5	289,5	423	3	3	1 830 000	2 800 000	295 000	2 400	910
260	303	309	480	4	4	1 730 000	2 280 000	176 000	2 200	1 010
260	300,5	305,5	480	4	4	2 600 000	3 750 000	375 000	2 000	770
275	292	300	385	3	3	655 000	1 020 000	90 000	2 800	1 690
280	314	320	460	4	4	1 340 000	1 900 000	154 000	2 400	1 120
280	310	316	460	4	4	2 160 000	3 350 000	345 000	2 200	790
286	334,3	339,7	514	5	5	1 900 000	2 600 000	198 000	2 000	920
286	321,3	326,7	514	5	5	3 100 000	4 500 000	435 000	1 800	670
295	312	321	405	3	3	680 000	1 100 000	96 000	2 800	1 550
300	334	340	480	4	4	1 400 000	2 000 000	163 000	2 200	1 040
300	330	336	480	4	4	2 280 000	3 600 000	360 000	2 000	730
306	359	366	554	5	5	2 160 000	3 050 000	224 000	1 900	810
306	348	354	554	5	5	3 550 000	5 200 000	495 000	1 600	600
315	336	345	445	3	3	900 000	1 430 000	120 000	2 400	1 390
320	359	367	520	4	4	1 600 000	2 320 000	182 000	2 000	930
320	352	358	520	4	4	2 700 000	4 150 000	395 000	1 900	660
335	356	365	465	3	3	915 000	1 500 000	124 000	2 400	1 300
340	388,5	395,5	560	4	4	1 800 000	2 700 000	204 000	1 900	850
340	376,5	383,5	560	4	4	3 150 000	4 900 000	460 000	1 600	580
357	381	390	503	4	4	1 120 000	1 830 000	147 000	2 200	1 190
377	400	410	523	4	4	1 140 000	1 900 000	151 000	2 200	1 120
386	424	432	624	5	5	3 600 000	5 700 000	520 000	1 400	520
397	420	430	543	4	4	1 180 000	2 000 000	156 000	2 000	1 050
406	446	456	654	5	5	4 050 000	6 700 000	610 000	1 400	455
417	445	455	583	4	4	1 370 000	2 320 000	177 000	1 900	980
437	465	475	603	4	4	1 400 000	2 450 000	183 000	1 800	920
463	488	498	627	5	5	1 560 000	2 750 000	203 000	1 600	860
475	498	506	605	3	3	1 020 000	1 960 000	152 000	1 800	–
483	510	522	657	5	5	1 660 000	3 000 000	218 000	1 600	820
497	521	529	633	4	4	1 140 000	2 240 000	172 000	1 800	–
503	530	542	677	5	5	1 700 000	3 100 000	225 000	1 500	780

Cylindrical roller bearings with cage

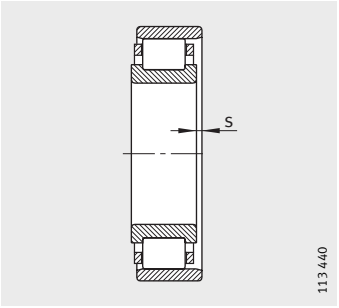
Non-locating bearings



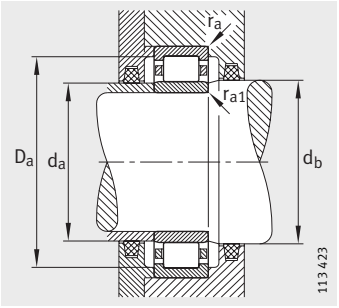
NU

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	$s^{1)}$	E	F	D_1
	≈kg				min.	min.				≈
NU10/500-M1	133	**500**	720	100	6	6	10,7	664	556	643,9
NU19/560-M1	105	**560**	750	85	5	5	9,6	700	610	682
NU10/560-M1	213	**560**	820	115	6	6	9,8	754	626	731
NU19/600-M1	125	**600**	800	90	5	5	9,9	748	652	730,7
NU19/670-M1	186	**670**	900	103	6	6	11,3	839	731	817
NU19/710-M1	213	**710**	950	106	6	6	9,3	886	774	867,7



[1] Axial displacement “s” for N and NU

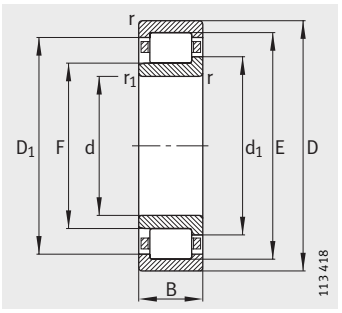


Mounting dimensions for NU

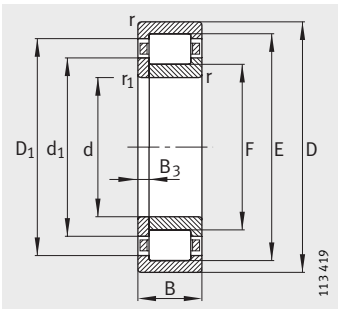
Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	max.	max.	N	N	N	min^{-1}	min^{-1}
523	550	562	697	5	5	1 760 000	3 200 000	232 000	1 500	750
577	606	614	733	4	4	1 460 000	3 000 000	215 000	1 400	–
583	620	632	797	5	5	2 700 000	5 100 000	355 000	1 200	590
617	647	657	783	4	4	1 700 000	3 450 000	249 000	1 400	–
693	726	736	877	5	5	2 040 000	4 250 000	300 000	1 200	–
733	769	779	927	5	5	2 240 000	4 750 000	335 000	1 100	–

Cylindrical roller bearings with cage

Semi-locating and locating bearings



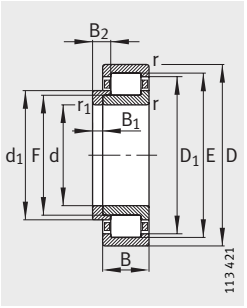
NJ
Semi-locating bearings



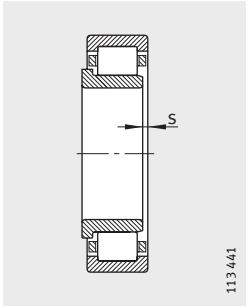
NUP
Locating bearings

Dimension table · Dimensions in mm

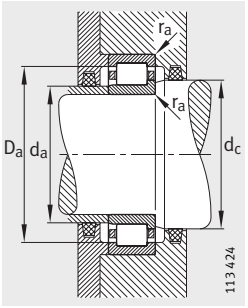
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NJ202-E-TVP2	**XL**	–	0,049	–	**15**	35	11	0,6	0,3	1,6	30,3	19,3	28	21,6
NJ202-E-TVP2	**XL**	**HJ202-E**	0,049	0,005	**15**	35	11	0,6	0,3	–	30,3	19,3	28	21,6
NJ203-E-TVP2	**XL**	–	0,07	–	**17**	40	12	0,6	0,3	1,2	35,1	22,1	32,5	24,7
NJ203-E-TVP2	**XL**	**HJ203-E**	0,07	0,008	**17**	40	12	0,6	0,3	–	35,1	22,1	32,5	24,7
NUP203-E-TVP2	**XL**	–	0,073	–	**17**	40	12	0,6	0,3	–	35,1	22,1	32,5	24,7
NJ2203-E-TVP2	**XL**	–	0,053	–	**17**	40	16	0,6	0,3	1,7	35,1	22,1	32,5	24,7
NJ2203-E-TVP2	**XL**	**HJ2203-E**	0,053	0,008	**17**	40	16	0,6	0,3	–	35,1	22,1	32,5	24,7
NUP2203-E-TVP2	**XL**	–	0,055	–	**17**	40	16	0,6	0,6	–	35,1	22,1	32,5	24,7
NJ303-E-TVP2	**XL**	–	0,124	–	**17**	47	14	1	0,6	1,2	40,2	24,2	37,1	27,6
NJ303-E-TVP2	**XL**	**HJ303-E**	0,124	0,014	**17**	47	14	1	0,6	–	40,2	24,2	37,1	27,6
NUP303-E-TVP2	**XL**	–	0,142	–	**17**	47	14	1	0,6	–	40,2	24,2	37,1	27,6
NJ204-E-TVP2	**XL**	–	0,117	–	**20**	47	14	1	0,6	1	41,5	26,5	38,8	29,7
NJ204-E-TVP2	**XL**	**HJ204-E**	0,117	0,011	**20**	47	14	1	0,6	–	41,5	26,5	38,8	29,7
NUP204-E-TVP2	**XL**	–	0,119	–	**20**	47	14	1	0,6	–	41,5	26,5	38,8	29,7
NJ2204-E-TVP2	**XL**	–	0,15	–	**20**	47	18	1	0,6	1,8	41,5	26,5	38,8	29,7
NJ2204-E-TVP2	**XL**	**HJ2204-E**	0,15	0,012	**20**	47	18	1	0,6	–	41,5	26,5	38,8	29,7
NUP2204-E-TVP2	**XL**	–	0,154	–	**20**	47	18	1	0,6	–	41,5	26,5	38,8	29,7
NJ304-E-TVP2	**XL**	–	0,156	–	**20**	52	15	1,1	0,6	1	45,5	27,5	42,4	31,3
NJ304-E-TVP2	**XL**	**HJ304-E**	0,156	0,017	**20**	52	15	1,1	0,6	–	45,5	27,5	42,4	31,3
NUP304-E-TVP2	**XL**	–	0,16	–	**20**	52	15	1,1	0,6	–	45,5	27,5	42,4	31,3
NJ2304-E-TVP2	**XL**	–	0,219	–	**20**	52	21	1,1	0,6	1,9	45,5	27,5	42,4	31,3
NJ2304-E-TVP2	**XL**	**HJ2304-E**	0,219	0,019	**20**	52	21	1,1	0,6	–	45,5	27,5	42,4	31,3
NUP2304-E-TVP2	**XL**	–	0,224	–	**20**	52	21	1,1	0,6	–	45,5	27,5	42,4	31,3
NJ205-E-TVP2	**XL**	–	0,14	–	**25**	52	15	1	0,6	1,2	46,5	31,5	43,8	34,7
NJ205-E-TVP2	**XL**	**HJ205-E**	0,14	0,014	**25**	52	15	1	0,6	–	46,5	31,5	43,8	34,7
NUP205-E-TVP2	**XL**	–	0,145	–	**25**	52	15	1	0,6	–	46,5	31,5	43,8	34,7
NJ2205-E-TVP2	**XL**	–	0,17	–	**25**	52	18	1	0,6	1,7	46,5	31,5	43,8	34,7
NJ2205-E-TVP2	**XL**	**HJ2205-E**	0,17	0,015	**25**	52	18	1	0,6	–	46,5	31,5	43,8	34,7
NUP2205-E-TVP2	**XL**	–	0,174	–	**25**	52	18	1	0,6	–	46,5	31,5	43,8	34,7
NJ305-E-TVP2	**XL**	–	0,25	–	**25**	62	17	1,1	1,1	1,5	54	34	50,7	38,1
NJ305-E-TVP2	**XL**	**HJ305-E**	0,25	0,025	**25**	62	17	1,1	1,1	–	54	34	50,7	38,1
NUP305-E-TVP2	**XL**	–	0,256	–	**25**	62	17	1,1	1,1	–	54	34	50,7	38,1
NJ2305-E-TVP2	**XL**	–	0,356	–	**25**	62	24	1,1	1,1	1,9	54	34	50,7	38,1
NJ2305-E-TVP2	**XL**	**HJ2305-E**	0,356	0,027	**25**	62	24	1,1	1,1	–	54	34	50,7	38,1
NUP2305-E-TVP2	**XL**	–	0,364	–	**25**	62	24	1,1	1,1	–	54	34	50,7	38,1



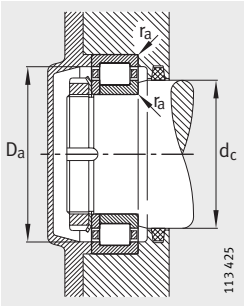
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

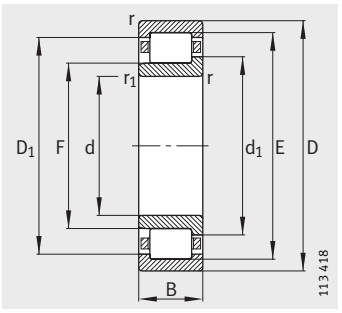


Mounting dimensions for NUP

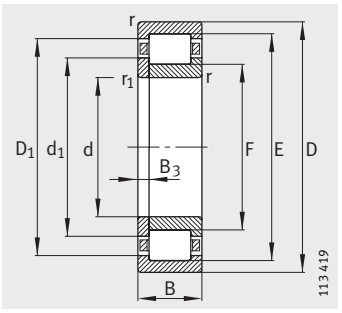
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	17,4	18,5	22	32,6	0,6	15 100	10 400	1 460	22 000	17 600
2,5	5	–	17,4	–	22	32,6	0,6	15 100	10 400	1 460	22 000	17 600
–	–	–	21	21,5	28	36	0,6	20 800	14 600	2 100	18 000	15 400
3	5,5	–	21	–	28	36	0,6	20 800	14 600	2 100	18 000	15 400
–	–	2,5	21	–	28	36	0,6	20 800	14 600	2 100	18 000	15 400
–	–	–	21	21,5	26	36	0,6	28 500	21 900	3 500	18 000	13 300
3	6	–	21	–	26	36	0,6	28 500	21 900	3 500	18 000	13 300
–	–	3	21	–	26	36	0,6	28 500	21 900	3 500	18 000	13 300
–	–	–	21,2	23,5	28	42,8	1	30 000	21 200	3 300	16 000	13 700
4	6,5	–	21,2	–	28	42,8	1	30 000	21 200	3 300	16 000	13 700
–	–	2,5	21,2	–	28	42,8	1	30 000	21 200	3 300	16 000	13 700
–	–	–	24	26	32	41	1	32 500	24 700	3 850	16 000	13 100
3	5,5	–	24	–	32	41	1	32 500	24 700	3 850	16 000	13 100
–	–	2,5	24	–	32	41	1	32 500	24 700	3 850	16 000	13 100
–	–	–	24	26	32	41	1	38 500	31 000	5 000	16 000	11 400
3	6,5	–	24	–	32	41	1	38 500	31 000	5 000	16 000	11 400
–	–	3,5	24	–	32	41	1	38 500	31 000	5 000	16 000	11 400
–	–	–	24	27	33	45	1	36 500	26 000	4 050	14 000	12 100
4	6,5	–	24	–	33	45	1	36 500	26 000	4 050	14 000	12 100
–	–	2,5	24	–	33	45	1	36 500	26 000	4 050	14 000	12 100
–	–	–	24	27	33	45	1	48 500	38 000	6 300	14 000	9 900
4	7,5	–	24	–	33	45	1	48 500	38 000	6 300	14 000	9 900
–	–	3,5	24	–	33	45	1	48 500	38 000	6 300	14 000	9 900
–	–	–	29	31	37	46	1	34 500	27 500	4 350	15 000	11 800
3	6	–	29	–	37	46	1	34 500	27 500	4 350	15 000	11 800
–	–	3	29	–	37	46	1	34 500	27 500	4 350	15 000	11 800
–	–	–	29	31	37	46	1	41 500	34 500	5 700	15 000	9 800
3	6,5	–	29	–	37	46	1	41 500	34 500	5 700	15 000	9 800
–	–	3,5	29	–	37	46	1	41 500	34 500	5 700	15 000	9 800
–	–	–	32	33	40	55	1	48 000	36 500	5 800	12 000	10 200
4	7	–	32	–	40	55	1	48 000	36 500	5 800	12 000	10 200
–	–	3	32	–	40	55	1	48 000	36 500	5 800	12 000	10 200
–	–	–	32	33	40	55	1	66 000	55 000	9 400	12 000	8 400
4	8	–	32	–	40	55	1	66 000	55 000	9 400	12 000	8 400
–	–	4	32	–	40	55	1	66 000	55 000	9 400	12 000	8 400

Cylindrical roller bearings with cage

Semi-locating and locating bearings



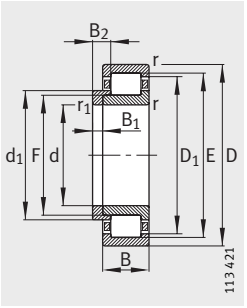
NJ
Semi-locating bearings



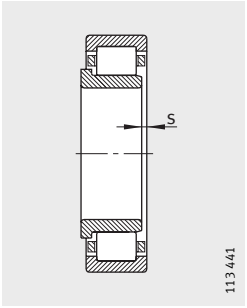
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

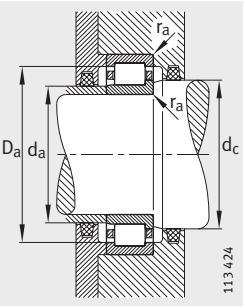
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[1)]	E	F	D_1 ≈	d_1 ≈
NJ206-E-TVP2	**XL**	–	0,213	–	**30**	62	16	1	0,6	1,5	55,5	37,5	52,5	41,1
NJ206-E-TVP2	**XL**	**HJ206-E**	0,213	0,024	**30**	62	16	1	0,6	–	55,5	37,5	52,5	41,1
NUP206-E-TVP2	**XL**	–	0,219	–	**30**	62	16	1	0,6	–	55,5	37,5	52,5	41,1
NJ2206-E-TVP2	**XL**	–	0,261	–	**30**	62	20	1	0,6	1,6	55,5	37,5	52,5	41,3
NJ2206-E-TVP2	**XL**	**HJ2206-E**	0,261	0,025	**30**	62	20	1	0,6	–	55,5	37,5	52,5	41,3
NUP2206-E-TVP2	**XL**	–	0,268	–	**30**	62	20	1	0,6	–	55,5	37,5	52,5	41,3
NJ306-E-TVP2	**XL**	–	0,376	–	**30**	72	19	1,1	1,1	1,2	62,5	40,5	59,2	45
NJ306-E-TVP2	**XL**	**HJ306-E**	0,376	0,042	**30**	72	19	1,1	1,1	–	62,5	40,5	59,2	45
NUP306-E-TVP2	**XL**	–	0,385	–	**30**	72	19	1,1	1,1	–	62,5	40,5	59,2	45
NJ2306-E-TVP2	**XL**	–	0,54	–	**30**	72	27	1,1	1,1	2,2	62,5	40,5	59,2	45
NJ2306-E-TVP2	**XL**	**HJ2306-E**	0,54	0,044	**30**	72	27	1,1	1,1	–	62,5	40,5	59,2	45
NUP2306-E-TVP2	**XL**	–	0,551	–	**30**	72	27	1,1	1,1	–	62,5	40,5	59,2	45
NJ207-E-TVP2	**XL**	–	0,309	–	**35**	72	17	1,1	0,6	0,7	64	44	61	48
NJ207-E-TVP2	**XL**	**HJ207-E**	0,309	0,032	**35**	72	17	1,1	0,6	–	64	44	61	48
NUP207-E-TVP2	**XL**	–	0,317	–	**35**	72	17	1,1	0,6	–	64	44	61	48
NJ2207-E-TVP2	**XL**	–	0,416	–	**35**	72	23	1,1	0,6	2,2	64	44	61	48
NJ2207-E-TVP2	**XL**	**HJ2207-E**	0,416	0,035	**35**	72	23	1,1	0,6	–	64	44	61	48
NUP2207-E-TVP2	**XL**	–	0,427	–	**35**	72	23	1,1	0,6	–	64	44	61	48
NJ307-E-TVP2	**XL**	–	0,496	–	**35**	80	21	1,5	1,1	0,6	70,2	46,2	66,6	51
NJ307-E-TVP2	**XL**	**HJ307-E**	0,496	0,06	**35**	80	21	1,5	1,1	–	70,2	46,2	66,6	51
NUP307-E-TVP2	**XL**	–	0,506	–	**35**	80	21	1,5	1,1	–	70,2	46,2	66,6	51
NJ2307-E-TVP2	**XL**	–	0,736	–	**35**	80	31	1,5	1,1	2,1	70,2	46,2	66,6	51
NJ2307-E-TVP2	**XL**	**HJ2307-E**	0,736	0,063	**35**	80	31	1,5	1,1	–	70,2	46,2	66,6	51
NUP2307-E-TVP2	**XL**	–	0,751	–	**35**	80	31	1,5	1,5	–	70,2	46,2	66,6	51
NJ208-E-TVP2	**XL**	–	0,389	–	**40**	80	18	1,1	1,1	1	71,5	49,5	68,3	54
NJ208-E-TVP2	**XL**	**HJ208-E**	0,389	0,049	**40**	80	18	1,1	1,1	–	71,5	49,5	68,3	54
NUP208-E-TVP2	**XL**	–	0,399	–	**40**	80	18	1,1	1,1	–	71,5	49,5	68,3	54
NJ2208-E-TVP2	**XL**	–	0,504	–	**40**	80	23	1,1	1,1	1,5	71,5	49,5	68,3	54
NJ2208-E-TVP2	**XL**	**HJ2208-E**	0,504	0,05	**40**	80	23	1,1	1,1	–	71,5	49,5	68,3	54
NUP2208-E-TVP2	**XL**	–	0,518	–	**40**	80	23	1,1	1,1	–	71,5	49,5	68,3	54
NJ308-E-TVP2	**XL**	–	0,674	–	**40**	90	23	1,5	1,5	1,3	80	52	75,9	57,6
NJ308-E-TVP2	**XL**	**HJ308-E**	0,674	0,087	**40**	90	23	1,5	1,5	–	80	52	75,9	57,6
NUP308-E-TVP2	**XL**	–	0,688	–	**40**	90	23	1,5	1,5	–	80	52	75,9	57,6
NJ2308-E-TVP2	**XL**	–	0,978	–	**40**	90	33	1,5	1,5	2,7	80	52	75,9	57,6
NJ2308-E-TVP2	**XL**	**HJ2308-E**	0,978	0,091	**40**	90	33	1,5	1,5	–	80	52	75,9	57,6
NUP2308-E-TVP2	**XL**	–	0,999	–	**40**	90	33	1,5	1,5	–	80	52	75,9	57,6



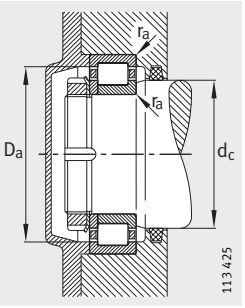
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

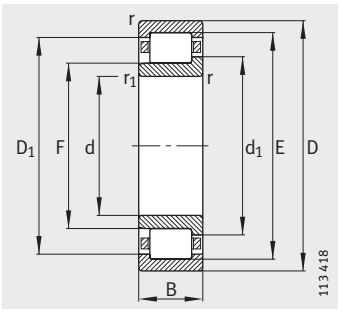


Mounting dimensions for NUP

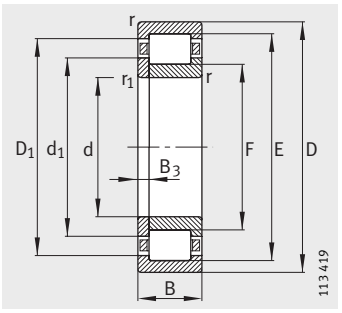
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	34	37	44	56	1	45 000	36 000	5 700	12 000	9 800
4	7	–	34	–	44	56	1	45 000	36 000	5 700	12 000	9 800
–	–	3	34	–	44	56	1	45 000	36 000	5 700	12 000	9 800
–	–	–	34	37	44	56	1	57 000	48 500	8 100	12 000	8 200
4	7,5	–	34	–	44	56	1	57 000	48 500	8 100	12 000	8 200
–	–	3,5	34	–	44	56	1	57 000	48 500	8 100	12 000	8 200
–	–	–	37	40	48	65	1	61 000	48 000	8 000	10 000	9 000
5	8,5	–	37	–	48	65	1	61 000	48 000	8 000	10 000	9 000
–	–	3,5	37	–	48	65	1	61 000	48 000	8 000	10 000	9 000
–	–	–	37	40	48	65	1	86 000	75 000	13 200	10 000	7 300
5	9,5	–	37	–	48	65	1	86 000	75 000	13 200	10 000	7 300
–	–	4,5	37	–	48	65	1	86 000	75 000	13 200	10 000	7 300
–	–	–	39	43	50	65	1	58 000	48 500	7 900	10 000	8 300
4	7	–	39	–	50	65	1	58 000	48 500	7 900	10 000	8 300
–	–	3	39	–	50	65	1	58 000	48 500	7 900	10 000	8 300
–	–	–	39	43	50	65	1	72 000	64 000	10 800	10 000	7 300
4	8,5	–	39	–	50	65	1	72 000	64 000	10 800	10 000	7 300
–	–	4,5	39	–	50	65	1	72 000	64 000	10 800	10 000	7 300
–	–	–	42	45	53	71	1,5	76 000	63 000	10 700	9 000	8 100
6	9,5	–	42	–	53	71	1,5	76 000	63 000	10 700	9 000	8 100
–	–	3,5	42	–	53	71	1,5	76 000	63 000	10 700	9 000	8 100
–	–	–	42	45	53	71	1,5	108 000	98 000	17 400	9 000	6 700
6	11	–	42	–	53	71	1,5	108 000	98 000	17 400	9 000	6 700
–	–	5	42	–	53	71	1,5	108 000	98 000	17 400	9 000	6 700
–	–	–	47	49	56	73	1	63 000	53 000	8 700	9 000	7 600
5	8,5	–	47	–	56	73	1	63 000	53 000	8 700	9 000	7 600
–	–	3,5	47	–	56	73	1	63 000	53 000	8 700	9 000	7 600
–	–	–	47	49	56	73	1	83 000	75 000	12 900	9 000	6 400
5	9	–	47	–	56	73	1	83 000	75 000	12 900	9 000	6 400
–	–	4	47	–	56	73	1	83 000	75 000	12 900	9 000	6 400
–	–	–	49	51	60	81	1,5	95 000	78 000	12 900	7 500	7 300
7	11	–	49	–	60	81	1,5	95 000	78 000	12 900	7 500	7 300
–	–	4	49	–	60	81	1,5	95 000	78 000	12 900	7 500	7 300
–	–	–	49	51	60	81	1,5	132 000	119 000	20 700	7 500	6 000
7	12,5	–	49	–	60	81	1,5	132 000	119 000	20 700	7 500	6 000
–	–	5,5	49	–	60	81	1,5	132 000	119 000	20 700	7 500	6 000

Cylindrical roller bearings with cage

Semi-locating and locating bearings



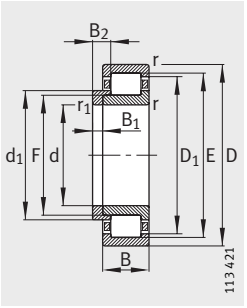
NJ
Semi-locating bearings



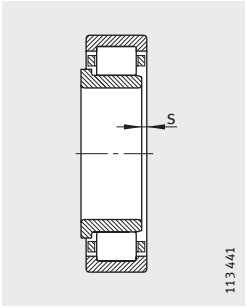
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

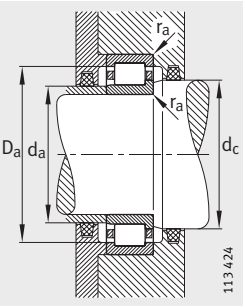
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NJ209-E-TVP2	**XL**	–	0,445	–	**45**	85	19	1,1	1,1	1,9	76,5	54,5	73,3	59
NJ209-E-TVP2	**XL**	**HJ209-E**	0,445	0,054	**45**	85	19	1,1	1,1	–	76,5	54,5	73,3	59
NUP209-E-TVP2	**XL**	–	0,457	–	**45**	85	19	1,1	1,1	–	76,5	54,5	73,3	59
NJ2209-E-TVP2	**XL**	–	0,544	–	**45**	85	23	1,1	1,1	1,5	76,5	54,5	73,3	59
NJ2209-E-TVP2	**XL**	**HJ2209-E**	0,544	0,055	**45**	85	23	1,1	1,1	–	76,5	54,5	73,3	59
NUP2209-E-TVP2	**XL**	–	0,559	–	**45**	85	23	1,1	1,1	–	76,5	54,5	73,3	59
NJ309-E-TVP2	**XL**	–	0,913	–	**45**	100	25	1,5	1,5	1	88,5	58,5	84,1	64,4
NJ309-E-TVP2	**XL**	**HJ309-E**	0,913	0,109	**45**	100	25	1,5	1,5	–	88,5	58,5	84,1	64,4
NUP309-E-TVP2	**XL**	–	0,937	–	**45**	100	25	1,5	1,5	–	88,5	58,5	84,1	64,4
NJ2309-E-TVP2	**XL**	–	1,33	–	**45**	100	36	1,5	1,5	2,5	88,5	58,5	84,1	64,4
NJ2309-E-TVP2	**XL**	**HJ2309-E**	1,33	0,115	**45**	100	36	1,5	1,5	–	88,5	58,5	84,1	64,4
NUP2309-E-TVP2	**XL**	–	1,36	–	**45**	100	36	1,5	1,5	–	88,5	58,5	84,1	64,4
NJ210-E-TVP2	**XL**	–	0,503	–	**50**	90	20	1,1	1,1	1,3	81,5	59,5	78,3	64
NJ210-E-TVP2	**XL**	**HJ210-E**	0,503	0,06	**50**	90	20	1,1	1,1	–	81,5	59,5	78,3	64
NUP210-E-TVP2	**XL**	–	0,517	–	**50**	90	20	1,1	1,1	–	81,5	59,5	78,3	64
NJ2210-E-TVP2	**XL**	–	0,586	–	**50**	90	23	1,1	1,1	1,3	81,5	59,5	78,3	64
NJ2210-E-TVP2	**XL**	**HJ210-E**	0,586	0,06	**50**	90	23	1,1	1,1	–	81,5	59,5	78,3	64
NUP2210-E-TVP2	**XL**	–	0,597	–	**50**	90	23	1,1	1,1	–	81,5	59,5	78,3	64
NJ310-E-TVP2	**XL**	–	1,19	–	**50**	110	27	2	2	1,7	97	65	92,5	71,3
NJ310-E-TVP2	**XL**	**HJ310-E**	1,19	0,149	**50**	110	27	2	2	–	97	65	92,5	71,3
NUP310-E-TVP2	**XL**	–	1,21	–	**50**	110	27	2	2	–	97	65	92,5	71,3
NJ2310-E-TVP2	**XL**	–	1,77	–	**50**	110	40	2	2	4,2	97	65	92,5	71,3
NJ2310-E-TVP2	**XL**	**HJ2310-E**	1,77	0,156	**50**	110	40	2	2	–	97	65	92,5	71,3
NUP2310-E-TVP2	**XL**	–	1,82	–	**50**	110	40	2	2	–	97	65	92,5	71,3
NJ211-E-TVP2	**XL**	–	0,679	–	**55**	100	21	1,5	1,1	0,8	90	66	86,6	70,8
NJ211-E-TVP2	**XL**	**HJ211-E**	0,679	0,087	**55**	100	21	1,5	1,1	–	90	66	86,6	70,8
NUP211-E-TVP2	**XL**	–	0,693	–	**55**	100	21	1,5	1,1	–	90	66	86,6	70,8
NJ2211-E-TVP2	**XL**	–	0,812	–	**55**	100	25	1,5	1,1	1,3	90	66	86,6	70,8
NJ2211-E-TVP2	**XL**	**HJ2211-E**	0,812	0,087	**55**	100	25	1,5	1,1	–	90	66	86,6	70,8
NUP2211-E-TVP2	**XL**	–	0,828	–	**55**	100	25	1,5	1,1	–	90	66	86,6	70,8
NJ311-E-TVP2	**XL**	–	1,51	–	**55**	120	29	2	2	1,8	106,5	70,5	101,4	77,5
NJ311-E-TVP2	**XL**	**HJ311-E**	1,51	0,192	**55**	120	29	2	2	–	106,5	70,5	101,4	77,5
NUP311-E-TVP2	**XL**	–	1,54	–	**55**	120	29	2	2	–	106,5	70,5	101,4	77,5
NJ2311-E-TVP2	**XL**	–	2,27	–	**55**	120	43	2	2	3,3	106,5	70,5	101,4	77,5
NJ2311-E-TVP2	**XL**	**HJ2311-E**	2,27	0,2	**55**	120	43	2	2	–	106,5	70,5	101,4	77,5
NUP2311-E-TVP2	**XL**	–	2,31	–	**55**	120	43	2	2	–	106,5	70,5	101,4	77,5



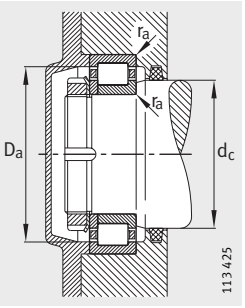
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

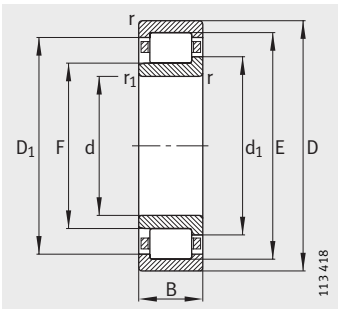


Mounting dimensions for NUP

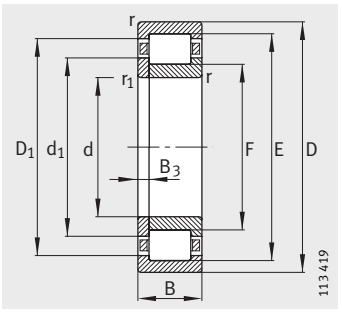
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	52	54	61	78	1	72 000	63 000	10 600	8 500	7 100
5	8,5	–	52	–	61	78	1	72 000	63 000	10 600	8 500	7 100
–	–	3,5	52	–	61	78	1	72 000	63 000	10 600	8 500	7 100
–	–	–	52	54	61	78	1	87 000	82 000	14 100	8 500	5 800
5	9	–	52	–	61	78	1	87 000	82 000	14 100	8 500	5 800
–	–	4	52	–	61	78	1	87 000	82 000	14 100	8 500	5 800
–	–	–	54	57	66	91	1,5	108 000	91 000	15 200	6 700	6 500
7	11,5	–	54	–	66	91	1,5	108 000	91 000	15 200	6 700	6 500
–	–	4,5	54	–	66	91	1,5	115 000	98 000	16 400	6 700	6 500
–	–	–	54	57	66	91	1,5	162 000	153 000	27 000	6 700	5 400
7	13	–	54	–	66	91	1,5	162 000	153 000	27 000	6 700	5 400
–	–	6	54	–	66	91	1,5	162 000	153 000	27 000	6 700	5 400
–	–	–	57	58	67	83	1	75 000	69 000	11 500	8 000	6 700
5	9	–	57	–	67	83	1	75 000	69 000	11 500	8 000	6 700
–	–	4	57	–	67	83	1	75 000	69 000	11 500	8 000	6 700
–	–	–	57	58	67	83	1	92 000	88 000	15 300	8 000	5 400
5	9	–	57	–	67	83	1	92 000	88 000	15 300	8 000	5 400
–	–	4	57	–	67	83	1	92 000	88 000	15 300	8 000	5 400
–	–	–	61	63	73	99	2	130 000	113 000	19 100	6 300	6 100
8	13	–	61	–	73	99	2	130 000	113 000	19 100	6 300	6 100
–	–	5	61	–	73	99	2	130 000	113 000	19 100	6 300	6 100
–	–	–	61	63	73	99	2	192 000	187 000	33 000	6 300	5 000
8	14,5	–	61	–	73	99	2	192 000	187 000	33 000	6 300	5 000
–	–	6,5	61	–	73	99	2	192 000	187 000	33 000	6 300	5 000
–	–	–	62	65	73	91	1,5	99 000	95 000	16 300	7 000	5 800
6	9,5	–	62	–	73	91	1,5	99 000	95 000	16 300	7 000	5 800
–	–	3,5	62	–	73	91	1,5	99 000	95 000	16 300	7 000	5 800
–	–	–	62	65	73	91	1,5	117 000	118 000	20 700	7 000	4 750
6	10	–	62	–	73	91	1,5	117 000	118 000	20 700	7 000	4 750
–	–	4	62	–	73	91	1,5	117 000	118 000	20 700	7 000	4 750
–	–	–	66	69	80	109	2	159 000	139 000	23 600	5 600	6 000
9	14	–	66	–	80	109	2	159 000	139 000	23 600	5 600	6 000
–	–	5	66	–	80	109	2	159 000	139 000	23 600	5 600	5 600
–	–	–	66	69	80	109	2	235 000	230 000	41 000	5 600	4 600
9	15,5	–	66	–	80	109	2	235 000	230 000	41 000	5 600	4 600
–	–	6,5	66	–	80	109	2	235 000	230 000	41 000	5 600	4 600

Cylindrical roller bearings with cage

Semi-locating and locating bearings



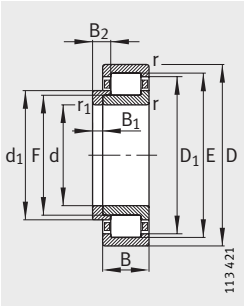
NJ
Semi-locating bearings



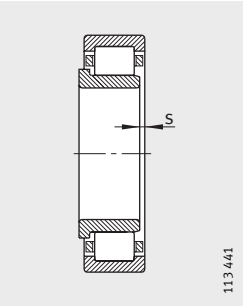
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

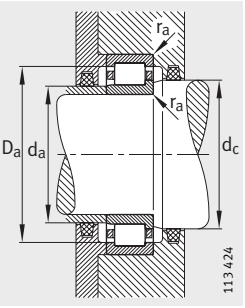
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[1]	E	F	D_1 ≈	d_1 ≈
NJ212-E-TVP2	**XL**	–	0,845	–	**60**	110	22	1,5	1,5	1,6	100	72	96,1	77,6
NJ212-E-TVP2	**XL**	**HJ212-E**	0,845	0,106	**60**	110	22	1,5	1,5	–	100	72	96,1	77,6
NUP212-E-TVP2	**XL**	–	0,865	–	**60**	110	22	1,5	1,5	–	100	72	96,1	77,6
NJ2212-E-TVP2	**XL**	–	1,1	–	**60**	110	28	1,5	1,5	1,6	100	72	96,1	77,6
NJ2212-E-TVP2	**XL**	**HJ212-E**	1,1	0,106	**60**	110	28	1,5	1,5	–	100	72	96,1	77,6
NUP2212-E-TVP2	**XL**	–	1,12	–	**60**	110	28	1,5	1,5	–	100	72	96,1	77,6
NJ312-E-TVP2	**XL**	–	1,89	–	**60**	130	31	2,1	2,1	1,8	115	77	109,6	84,4
NJ312-E-TVP2	**XL**	**HJ312-E**	1,89	0,229	**60**	130	31	2,1	2,1	–	115	77	109,6	84,4
NUP312-E-TVP2	**XL**	–	1,93	–	**60**	130	31	2,1	2,1	–	115	77	109,6	84,4
NJ2312-E-TVP2	**XL**	–	2,83	–	**60**	130	46	2,1	2,1	3,5	115	77	109,6	84,4
NJ2312-E-TVP2	**XL**	**HJ2312-E**	2,83	0,238	**60**	130	46	2,1	2,1	–	115	77	109,6	84,4
NUP2312-E-TVP2	**XL**	–	2,88	–	**60**	130	46	2,1	2,1	–	115	77	109,6	84,4
NJ213-E-TVP2	**XL**	–	1,06	–	**65**	120	23	1,5	1,5	1,4	108,5	78,5	104,3	84,4
NJ213-E-TVP2	**XL**	**HJ213-E**	1,06	0,127	**65**	120	23	1,5	1,5	–	108,5	78,5	104,3	84,4
NUP213-E-TVP2	**XL**	–	1,09	–	**65**	120	23	1,5	1,5	–	108,5	78,5	104,3	84,4
NJ2213-E-TVP2	**XL**	–	1,46	–	**65**	120	31	1,5	1,5	1,9	108,5	78,5	104,3	84,4
NJ2213-E-TVP2	**XL**	**HJ2213-E**	1,46	0,13	**65**	120	31	1,5	1,5	–	108,5	78,5	104,3	84,4
NUP2213-E-TVP2	**XL**	–	1,54	–	**65**	120	31	1,5	1,5	–	108,5	78,5	104,3	84,4
NJ313-E-TVP2	**XL**	–	2,32	–	**65**	140	33	2,1	2,1	1,5	124,5	82,5	118,6	90,5
NJ313-E-TVP2	**XL**	**HJ313-E**	2,32	0,285	**65**	140	33	2,1	2,1	–	124,5	82,5	118,6	90,5
NUP313-E-TVP2	**XL**	–	2,37	–	**65**	140	33	2,1	2,1	–	124,5	82,5	118,6	90,5
NJ2313-E-TVP2	**XL**	–	3,38	–	**65**	140	48	2,1	2,1	4	124,5	82,5	118,6	90,5
NJ2313-E-TVP2	**XL**	**HJ2313-E**	3,38	0,303	**65**	140	48	2,1	2,1	–	124,5	82,5	118,6	90,5
NUP2313-E-TVP2	**XL**	–	3,45	–	**65**	140	48	2,1	2,1	–	124,5	82,5	118,6	90,5
NJ214-E-TVP2	**XL**	–	1,18	–	**70**	125	24	1,5	1,5	1,6	113,5	83,5	109,4	89,4
NJ214-E-TVP2	**XL**	**HJ214-E**	1,18	0,155	**70**	125	24	1,5	1,5	–	113,5	83,5	109,4	89,4
NUP214-E-TVP2	**XL**	–	1,2	–	**70**	125	24	1,5	1,5	–	113,5	83,5	109,4	89,4
NJ2214-E-TVP2	**XL**	–	1,54	–	**70**	125	31	1,5	1,5	1,6	113,5	83,5	109,4	89,4
NJ2214-E-TVP2	**XL**	**HJ2214-E**	1,54	0,157	**70**	125	31	1,5	1,5	–	113,5	83,5	109,4	89,4
NUP2214-E-TVP2	**XL**	–	1,58	–	**70**	125	31	1,5	1,5	–	113,5	83,5	109,4	89,4
NJ314-E-TVP2	**XL**	–	2,84	–	**70**	150	35	2,1	2,1	1,7	133	89	126,8	97,4
NJ314-E-TVP2	**XL**	**HJ314-E**	2,84	0,328	**70**	150	35	2,1	2,1	–	133	89	126,8	97,4
NUP314-E-TVP2	**XL**	–	2,89	–	**70**	150	35	2,1	2,1	–	133	89	126,8	97,4
NJ2314-E-TVP2	**XL**	–	4,1	–	**70**	150	51	2,1	2,1	4,7	133	89	126,8	97,4
NJ2314-E-TVP2	**XL**	**HJ2314-E**	4,1	0,352	**70**	150	51	2,1	2,1	–	133	89	126,8	97,4
NUP2314-E-TVP2	**XL**	–	4,18	–	**70**	150	51	2,1	2,1	–	133	89	126,8	97,4



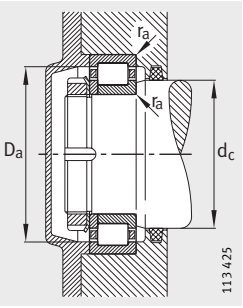
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

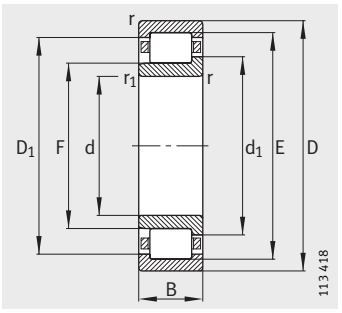


Mounting dimensions for NUP

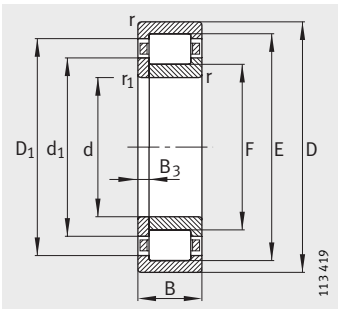
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	69	71	80	101	1,5	111 000	102 000	16 800	6 300	5 400
6	10	–	69	–	80	101	1,5	111 000	102 000	16 800	6 300	5 400
–	–	4	69	–	80	101	1,5	111 000	102 000	16 800	6 300	5 400
–	–	–	69	71	80	101	1,5	151 000	152 000	26 500	6 300	4 400
6	10	–	69	–	80	101	1,5	151 000	152 000	26 500	6 300	4 400
–	–	4	69	–	80	101	1,5	151 000	152 000	26 500	6 300	4 400
–	–	–	72	75	86	118	2,1	177 000	157 000	26 500	5 000	5 300
9	14,5	–	72	–	86	118	2,1	177 000	157 000	26 500	5 000	5 300
–	–	5,5	72	–	86	118	2,1	177 000	157 000	26 500	5 000	5 300
–	–	–	72	75	86	118	2,1	265 000	260 000	47 000	5 000	4 300
9	16	–	72	–	86	118	2,1	265 000	260 000	47 000	5 000	4 300
–	–	7	72	–	86	118	2,1	265 000	260 000	47 000	5 000	4 300
–	–	–	74	77	87	111	1,5	127 000	119 000	19 800	6 000	5 000
6	10	–	74	–	87	111	1,5	127 000	119 000	19 800	6 000	5 000
–	–	4	74	–	87	111	1,5	127 000	119 000	19 800	6 000	5 000
–	–	–	74	77	87	111	1,5	176 000	181 000	32 000	5 600	4 150
6	10,5	–	74	–	87	111	1,5	176 000	181 000	32 000	5 600	4 150
–	–	4,5	74	–	87	111	1,5	176 000	181 000	32 000	5 600	4 150
–	–	–	77	81	93	128	2,1	214 000	191 000	32 000	4 800	4 900
10	15,5	–	77	–	93	128	2,1	214 000	191 000	32 000	4 800	4 900
–	–	5,5	77	–	93	128	2,1	214 000	191 000	32 000	4 800	4 900
–	–	–	77	81	93	128	2,1	295 000	285 000	50 000	4 800	4 050
10	18	–	77	–	93	128	2,1	295 000	285 000	50 000	4 800	4 050
–	–	8	77	–	93	128	2,1	295 000	285 000	50 000	4 800	4 050
–	–	–	79	82	92	116	1,5	140 000	137 000	23 100	5 300	4 750
7	11	–	79	–	92	116	1,5	140 000	137 000	23 100	5 300	4 750
–	–	4	79	–	92	116	1,5	140 000	137 000	23 100	5 300	4 750
–	–	–	79	82	92	116	1,5	184 000	194 000	34 000	5 300	3 900
7	11,5	–	79	–	92	116	1,5	184 000	194 000	34 000	5 300	3 900
–	–	4,5	79	–	92	116	1,5	184 000	194 000	34 000	5 300	3 900
–	–	–	82	87	100	138	2,1	242 000	222 000	37 000	4 500	4 550
10	15,5	–	82	–	100	138	2,1	242 000	222 000	37 000	4 500	4 550
–	–	5,5	82	–	100	138	2,1	242 000	222 000	37 000	4 500	4 550
–	–	–	82	87	100	138	2,1	325 000	325 000	56 000	4 500	3 850
10	18,5	–	82	–	100	138	2,1	325 000	325 000	56 000	4 500	3 850
–	–	8,5	82	–	100	138	2,1	325 000	325 000	56 000	4 500	3 850

Cylindrical roller bearings with cage

Semi-locating and locating bearings



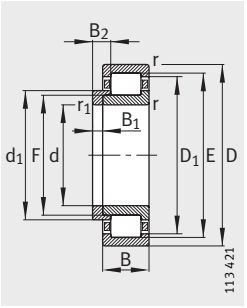
NJ
Semi-locating bearings



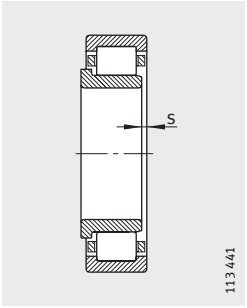
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

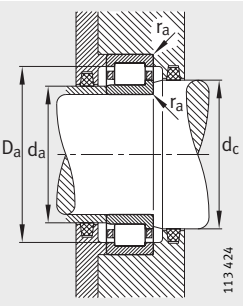
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NJ215-E-TVP2	**XL**	–	1,3	–	**75**	130	25	1,5	1,5	1,2	118,5	88,5	114,4	94,4
NJ215-E-TVP2	**XL**	**HJ215-E**	1,3	0,164	**75**	130	25	1,5	1,5	–	118,5	88,5	114,4	94,4
NUP215-E-TVP2	**XL**	–	1,33	–	**75**	130	25	1,5	1,5	–	118,5	88,5	114,4	94,4
NJ2215-E-TVP2	**XL**	–	1,64	–	**75**	130	31	1,5	1,5	1,6	118,5	88,5	114,4	94,4
NJ2215-E-TVP2	**XL**	**HJ2215-E**	1,64	0,165	**75**	130	31	1,5	1,5	–	118,5	88,5	114,4	94,4
NUP2215-E-TVP2	**XL**	–	1,67	–	**75**	130	31	1,5	1,5	–	118,5	88,5	114,4	94,4
NJ315-E-TVP2	**XL**	–	3,39	–	**75**	160	37	2,1	2,1	1,2	143	95	136,2	104,1
NJ315-E-TVP2	**XL**	**HJ315-E**	3,39	0,407	**75**	160	37	2,1	2,1	–	143	95	136,2	104,1
NUP315-E-TVP2	**XL**	–	3,45	–	**75**	160	37	2,1	2,1	–	143	95	136,2	104,1
NJ2315-E-TVP2	**XL**	–	5,04	–	**75**	160	55	2,1	2,1	4,2	143	95	136,2	104,1
NJ2315-E-TVP2	**XL**	**HJ2315-E**	5,04	0,436	**75**	160	55	2,1	2,1	–	143	95	136,2	104,1
NUP2315-E-TVP2	**XL**	–	5,14	–	**75**	160	55	2,1	2,1	–	143	95	136,2	104,1
NJ216-E-TVP2	**XL**	–	1,58	–	**80**	140	26	2	2	1,3	127,3	95,3	122,9	101,5
NJ216-E-TVP2	**XL**	**HJ216-E**	1,58	0,22	**80**	140	26	2	2	–	127,3	95,3	122,9	101,5
NUP216-E-TVP2	**XL**	–	1,62	–	**80**	140	26	2	2	–	127,3	95,3	122,9	101,5
NJ2216-E-TVP2	**XL**	–	2,04	–	**80**	140	33	2	2	1,3	127,3	95,3	122,9	101,5
NJ2216-E-TVP2	**XL**	**HJ216-E**	2,04	0,22	**80**	140	33	2	2	–	127,3	95,3	122,9	101,5
NUP2216-E-TVP2	**XL**	–	2,08	–	**80**	140	33	2	2	–	127,3	95,3	122,9	101,5
NJ316-E-TVP2	**XL**	–	4,03	–	**80**	170	39	2,1	2,1	0,7	151	101	143,9	110,4
NJ316-E-TVP2	**XL**	**HJ316-E**	4,03	0,456	**80**	170	39	2,1	2,1	–	151	101	143,9	110,4
NUP316-E-TVP2	**XL**	–	4,11	–	**80**	170	39	2,1	2,1	–	151	101	143,9	110,4
NJ2316-E-TVP2	**XL**	–	6	–	**80**	170	58	2,1	2,1	3,7	151	101	143,9	110,4
NJ2316-E-TVP2	**XL**	**HJ2316-E**	6	0,488	**80**	170	58	2,1	2,1	–	151	101	143,9	110,4
NUP2316-E-TVP2	**XL**	–	6,11	–	**80**	170	58	2,1	2,1	–	151	101	143,9	110,4
NJ217-E-TVP2	**XL**	–	1,95	–	**85**	150	28	2	2	0,8	136,5	100,5	131,5	107,5
NJ217-E-TVP2	**XL**	**HJ217-E**	1,95	0,247	**85**	150	28	2	2	–	136,5	100,5	131,5	107,5
NUP217-E-TVP2	**XL**	–	2,08	–	**85**	150	28	2	2	–	136,5	100,5	131,5	107,5
NJ2217-E-TVP2	**XL**	–	2,55	–	**85**	150	36	2	2	1,3	136,5	100,5	131,5	107,5
NJ2217-E-TVP2	**XL**	**HJ2217-E**	2,55	0,249	**85**	150	36	2	2	–	136,5	100,5	131,5	107,5
NUP2217-E-TVP2	**XL**	–	2,6	–	**85**	150	36	2	2	–	136,5	100,5	131,5	107,5
NJ317-E-TVP2	**XL**	–	4,71	–	**85**	180	41	3	3	1,3	160	108	152,7	117,8
NJ317-E-TVP2	**XL**	**HJ317-E**	4,71	0,566	**85**	180	41	3	3	–	160	108	152,7	117,8
NUP317-E-TVP2	**XL**	–	4,8	–	**85**	180	41	3	3	–	160	108	152,7	117,8
NJ2317-E-TVP2	**XL**	–	6,85	–	**85**	180	60	3	3	4,7	160	108	152,7	117,8
NJ2317-E-TVP2	**XL**	**HJ2317-E**	6,85	0,606	**85**	180	60	3	3	–	160	108	152,7	117,8
NUP2317-E-TVP2	**XL**	–	6,99	–	**85**	180	60	3	3	–	160	108	152,7	117,8



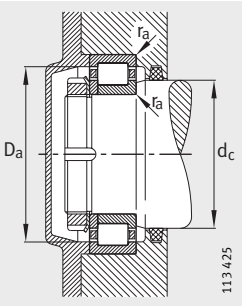
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

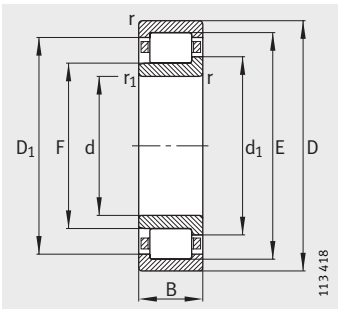


Mounting dimensions for NUP

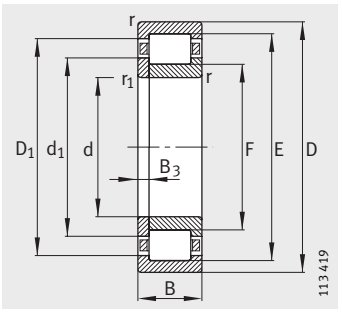
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	84	87	96	121	1,5	154 000	156 000	26 500	5 300	4 500
7	11	–	84	–	96	121	1,5	154 000	156 000	26 500	5 300	4 500
–	–	4	84	–	96	121	1,5	154 000	156 000	26 500	5 300	4 500
–	–	–	84	87	96	121	1,5	191 000	207 000	36 000	5 300	3 700
7	11,5	–	84	–	96	121	1,5	191 000	207 000	36 000	5 300	3 700
–	–	4,5	84	–	96	121	1,5	191 000	207 000	36 000	5 300	3 700
–	–	–	87	93	106	148	2,1	285 000	265 000	43 000	4 000	4 200
11	16,5	–	87	–	106	148	2,1	285 000	265 000	43 000	4 000	4 200
–	–	5,5	87	–	106	148	2,1	285 000	265 000	43 000	4 000	4 200
–	–	–	87	93	106	148	2,1	390 000	395 000	67 000	4 000	3 600
11	19,5	–	87	–	106	148	2,1	390 000	395 000	67 000	4 000	3 600
–	–	8,5	87	–	106	148	2,1	390 000	395 000	67 000	4 000	3 600
–	–	–	91	94	104	129	2	165 000	167 000	27 500	4 800	4 250
8	12,5	–	91	–	104	129	2	165 000	167 000	27 500	4 800	4 250
–	–	4,5	91	–	104	129	2	165 000	167 000	27 500	4 800	4 250
–	–	–	91	94	104	129	2	220 000	243 000	42 000	4 800	3 450
8	12,5	–	91	–	104	129	2	220 000	243 000	42 000	4 800	3 450
–	–	4,5	91	–	104	129	2	220 000	243 000	42 000	4 800	3 450
–	–	–	92	99	114	158	2,1	300 000	275 000	46 000	3 800	4 150
11	17	–	92	–	114	158	2,1	300 000	275 000	46 000	3 800	4 150
–	–	6	92	–	114	158	2,1	300 000	275 000	46 000	3 800	4 150
–	–	–	92	99	114	158	2,1	420 000	425 000	73 000	3 800	3 500
11	20	–	92	–	114	158	2,1	420 000	425 000	73 000	3 800	3 500
–	–	9	92	–	114	158	2,1	420 000	425 000	73 000	3 800	3 500
–	–	–	96	99	110	139	2	194 000	194 000	31 500	4 500	4 100
8	12,5	–	96	–	110	139	2	194 000	194 000	31 500	4 500	4 100
–	–	4,5	96	–	110	139	2	194 000	194 000	31 500	4 500	4 100
–	–	–	96	99	110	139	2	255 000	275 000	46 000	4 500	3 350
8	13	–	96	–	110	139	2	255 000	275 000	46 000	4 500	3 350
–	–	5	96	–	110	139	2	255 000	275 000	46 000	4 500	3 350
–	–	–	99	106	119	166	2,5	320 000	300 000	49 500	3 600	4 000
12	18,5	–	99	–	119	166	2,5	320 000	300 000	49 500	3 600	4 000
–	–	6,5	99	–	119	166	2,5	320 000	300 000	49 500	3 600	4 000
–	–	–	99	106	119	166	2,5	435 000	445 000	75 000	3 600	3 350
12	22	–	99	–	119	166	2,5	435 000	445 000	75 000	3 600	3 350
–	–	10	99	–	119	166	2,5	435 000	445 000	75 000	3 600	3 350

Cylindrical roller bearings with cage

Semi-locating and locating bearings



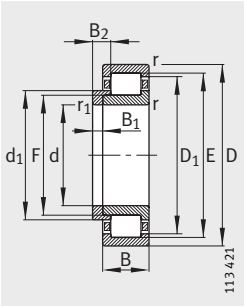
NJ
Semi-locating bearings



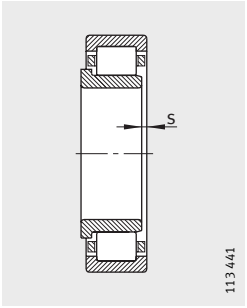
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

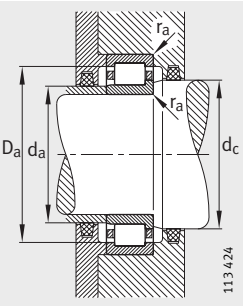
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[1)]	E	F	D_1 ≈	d_1 ≈
NJ218-E-TVP2	**XL**	–	2,41	–	**90**	160	30	2	2	1,5	145	107	139,7	114,3
NJ218-E-TVP2	**XL**	**HJ218-E**	2,41	0,317	**90**	160	30	2	2	–	145	107	139,7	114,3
NUP218-E-TVP2	**XL**	–	2,46	–	**90**	160	30	2	2	–	145	107	139,7	114,3
NJ2218-E-TVP2	**XL**	–	3,23	–	**90**	160	40	2	2	2,5	145	107	139,7	114,3
NJ2218-E-TVP2	**XL**	**HJ2218-E**	3,23	0,323	**90**	160	40	2	2	–	145	107	139,7	114,3
NUP2218-E-TVP2	**XL**	–	3,29	–	**90**	160	40	2	2	–	145	107	139,7	114,3
NJ318-E-TVP2	**XL**	–	5,49	–	**90**	190	43	3	3	1,5	169,5	113,5	161,6	124
NJ318-E-TVP2	**XL**	**HJ318-E**	5,49	0,623	**90**	190	43	3	3	–	169,5	113,5	161,6	124
NUP318-E-TVP2	**XL**	–	5,59	–	**90**	190	43	3	3	–	169,5	113,5	161,6	124
NJ2318-E-TVP2	**XL**	–	8,19	–	**90**	190	64	3	3	5	169,5	113,5	161,6	124
NJ2318-E-TVP2	**XL**	**HJ2318-E**	8,19	0,669	**90**	190	64	3	3	–	169,5	113,5	161,6	124
NUP2318-E-TVP2	**XL**	–	8,35	–	**90**	190	64	3	3	–	169,5	113,5	161,6	124
NJ219-E-TVP2	**XL**	–	2,94	–	**95**	170	32	2,1	2,1	0,7	154,5	112,5	148,6	120,5
NJ219-E-TVP2	**XL**	**HJ219-E**	2,94	0,352	**95**	170	32	2,1	2,1	–	154,5	112,5	148,6	120,5
NUP219-E-TVP2	**XL**	–	2,99	–	**95**	170	32	2,1	2,1	–	154,5	112,5	148,6	120,5
NJ2219-E-TVP2	**XL**	–	3,98	–	**95**	170	43	2,1	2,1	2,2	154,5	112,5	148,6	120,5
NJ2219-E-TVP2	**XL**	**HJ2219-E**	3,98	0,366	**95**	170	43	2,1	2,1	–	154,5	112,5	148,6	120,5
NUP2219-E-TVP2	**XL**	–	4,05	–	**95**	170	43	2,1	2,1	–	154,5	112,5	148,6	120,5
NJ319-E-TVP2	**XL**	–	6,44	–	**95**	200	45	3	3	1,4	177,5	121,5	169,6	132
NJ319-E-TVP2	**XL**	**HJ319-E**	6,44	0,777	**95**	200	45	3	3	–	177,5	121,5	169,6	132
NUP319-E-TVP2	**XL**	–	6,56	–	**95**	200	45	3	3	–	177,5	121,5	169,6	132
NJ2319-E-TVP2	**XL**	–	9,58	–	**95**	200	67	3	3	5,6	177,5	121,5	169,6	132
NJ2319-E-TVP2	**XL**	**HJ2319-E**	9,58	0,83	**95**	200	67	3	3	–	177,5	121,5	169,6	132
NUP2319-E-TVP2	**XL**	–	9,77	–	**95**	200	67	3	3	–	177,5	121,5	169,6	132
NJ220-E-TVP2	**XL**	–	3,55	–	**100**	180	34	2,1	2,1	1,5	163	119	156,9	127,3
NJ220-E-TVP2	**XL**	**HJ220-E**	3,55	0,436	**100**	180	34	2,1	2,1	–	163	119	156,9	127,3
NUP220-E-TVP2	**XL**	–	3,61	–	**100**	180	34	2,1	2,1	–	163	119	156,9	127,3
NJ2220-E-TVP2	**XL**	–	4,85	–	**100**	180	46	2,1	2,1	3	163	119	156,9	127,3
NJ2220-E-TVP2	**XL**	**HJ2220-E**	4,85	0,446	**100**	180	46	2,1	2,1	–	163	119	156,9	127,3
NUP2220-E-TVP2	**XL**	–	4,92	–	**100**	180	46	2,1	2,1	–	163	119	156,9	127,3
NJ320-E-TVP2	**XL**	–	7,82	–	**100**	215	47	3	3	1,2	191,5	127,5	182	139,4
NJ320-E-TVP2	**XL**	**HJ320-E**	7,82	0,883	**100**	215	47	3	3	–	191,5	127,5	182	139,4
NUP320-E-TVP2	**XL**	–	7,96	–	**100**	215	47	3	3	–	191,5	127,5	182	139,4
NJ2320-E-TVP2	**XL**	–	12,3	–	**100**	215	73	3	3	6,1	191,5	127,5	182	139,4
NJ2320-E-TVP2	**XL**	**HJ2320-E**	12,3	0,934	**100**	215	73	3	3	–	191,5	127,5	182	139,4
NUP2320-E-TVP2	**XL**	–	12,5	–	**100**	215	73	3	3	–	191,5	127,5	182	139,4



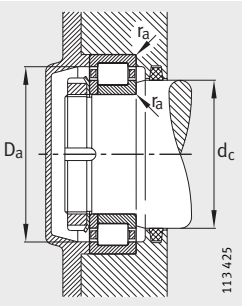
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

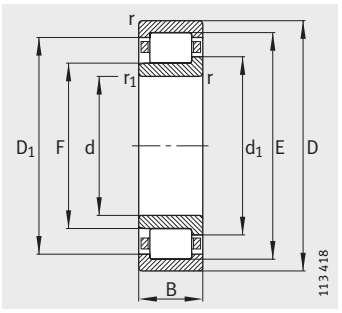


Mounting dimensions for NUP

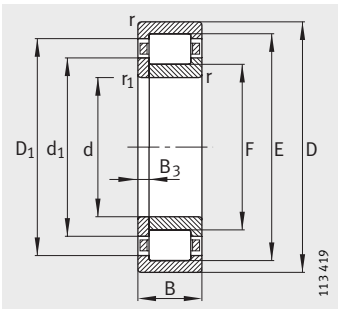
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	101	105	116	149	2	215 000	217 000	35 000	4 300	3 950
9	14	–	101	–	116	149	2	215 000	217 000	35 000	4 300	3 950
–	–	5	101	–	116	149	2	215 000	217 000	35 000	4 300	3 950
–	–	–	101	105	116	149	2	285 000	315 000	52 000	4 300	3 300
9	15	–	101	–	116	149	2	285 000	315 000	52 000	4 300	3 300
–	–	6	101	–	116	149	2	285 000	315 000	52 000	4 300	3 300
–	–	–	104	111	127	176	2,5	370 000	350 000	55 000	3 400	3 750
12	18,5	–	104	–	127	176	2,5	370 000	350 000	55 000	3 400	3 750
–	–	6,5	104	–	127	176	2,5	370 000	350 000	55 000	3 400	3 750
–	–	–	104	111	127	176	2,5	510 000	530 000	86 000	3 400	3 050
12	22	–	104	–	127	176	2,5	510 000	530 000	86 000	3 400	3 050
–	–	10	104	–	127	176	2,5	510 000	530 000	86 000	3 400	3 050
–	–	–	107	111	123	158	2,1	260 000	265 000	41 500	3 800	3 700
9	14	–	107	–	123	158	2,1	260 000	265 000	41 500	3 800	3 700
–	–	5	107	–	123	158	2,1	260 000	265 000	41 500	3 800	3 700
–	–	–	107	111	123	158	2,1	340 000	370 000	60 000	3 800	3 100
9	15,5	–	107	–	123	158	2,1	340 000	370 000	60 000	3 800	3 100
–	–	6,5	107	–	123	158	2,1	340 000	370 000	60 000	3 800	3 100
–	–	–	109	119	134	186	2,5	390 000	380 000	59 000	3 400	3 600
13	20,5	–	109	–	134	186	2,5	390 000	380 000	59 000	3 400	3 600
–	–	7,5	109	–	134	186	2,5	390 000	380 000	59 000	3 400	3 600
–	–	–	109	119	134	186	2,5	540 000	580 000	92 000	3 400	2 850
13	24,5	–	109	–	134	186	2,5	540 000	580 000	92 000	3 400	2 850
–	–	11,5	109	–	134	186	2,5	540 000	580 000	92 000	3 400	2 850
–	–	–	112	117	130	168	2,1	295 000	305 000	47 500	3 800	3 500
10	15	–	112	–	130	168	2,1	295 000	305 000	47 500	3 800	3 500
–	–	5	112	–	130	168	2,1	295 000	305 000	47 500	3 800	3 500
–	–	–	112	117	130	168	2,1	395 000	445 000	72 000	3 800	2 900
10	16	–	112	–	130	168	2,1	395 000	445 000	72 000	3 800	2 900
–	–	6	112	–	130	168	2,1	395 000	445 000	72 000	3 800	2 900
–	–	–	114	125	143	201	2,5	450 000	425 000	65 000	3 200	3 400
13	20,5	–	114	–	143	201	2,5	450 000	425 000	65 000	3 200	3 400
–	–	7,5	114	–	143	201	2,5	450 000	425 000	65 000	3 200	3 400
–	–	–	114	125	143	201	2,5	680 000	720 000	114 000	3 200	2 550
13	23,5	–	114	–	143	201	2,5	680 000	720 000	114 000	3 200	2 550
–	–	10,5	114	–	143	201	2,5	680 000	720 000	114 000	3 200	2 550

Cylindrical roller bearings with cage

Semi-locating and locating bearings



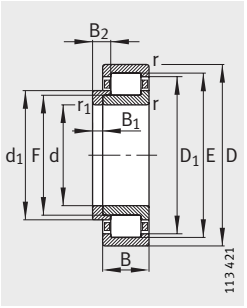
NJ
Semi-locating bearings



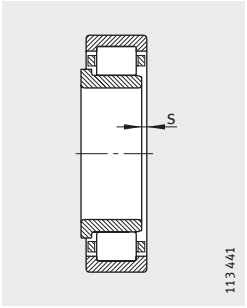
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

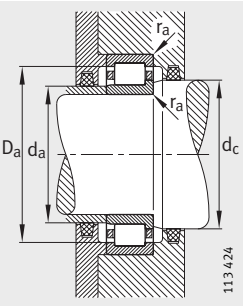
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[1]	E	F	D_1 ≈	d_1 ≈
NJ221-E-TVP2	**XL**	–	4,17	–	**105**	190	36	2,1	2,1	1,3	171,5	125,5	165,1	134,5
NJ221-E-TVP2	**XL**	**HJ221-E**	4,17	0,51	**105**	190	36	2,1	2,1	–	171,5	125,5	165,1	134,5
NUP221-E-TVP2	**XL**	–	4,26	–	**105**	190	36	2,1	2,1	–	171,5	125,5	165,1	134,5
NJ222-E-TVP2	**XL**	–	4,93	–	**110**	200	38	2,1	2,1	1,5	180,5	132,5	173,8	141,6
NJ222-E-TVP2	**XL**	**HJ222-E**	4,93	0,616	**110**	200	38	2,1	2,1	–	180,5	132,5	173,8	141,6
NUP222-E-TVP2	**XL**	–	5,02	–	**110**	200	38	2,1	2,1	–	180,5	132,5	173,8	141,6
NJ2222-E-TVP2	**XL**	–	6,89	–	**110**	200	53	2,1	2,1	4	180,5	132,5	173,8	141,6
NJ2222-E-TVP2	**XL**	**HJ2222-E**	6,89	0,647	**110**	200	53	2,1	2,1	–	180,5	132,5	173,8	141,6
NUP2222-E-TVP2	**XL**	–	7,02	–	**110**	200	53	2,1	2,1	–	180,5	132,5	173,8	141,6
NJ322-E-TVP2	**XL**	–	10,3	–	**110**	240	50	3	3	1,3	211	143	200,9	155,6
NJ322-E-TVP2	**XL**	**HJ322-E**	10,3	1,21	**110**	240	50	3	3	–	211	143	200,9	155,6
NUP322-E-TVP2	**XL**	–	10,7	–	**110**	240	50	3	3	–	211	143	200,9	155,6
NJ2322-E-TVP2	**XL**	–	16,9	–	**110**	240	80	3	3	5,8	211	143	200,9	155,6
NJ2322-E-TVP2	**XL**	**HJ2322-E**	16,9	1,3	**110**	240	80	3	3	–	211	143	200,9	155,6
NUP2322-E-TVP2	**XL**	–	17,2	–	**110**	240	80	3	3	–	211	143	200,9	155,6
NJ224-E-TVP2	**XL**	–	5,91	–	**120**	215	40	2,1	2,1	1,4	195,5	143,5	187,8	153,2
NJ224-E-TVP2	**XL**	**HJ224-E**	5,91	0,707	**120**	215	40	2,1	2,1	–	195,5	143,5	187,8	153,2
NUP224-E-TVP2	**XL**	–	6,02	–	**120**	215	40	2,1	2,1	–	195,5	143,5	187,8	153,2
NJ2224-E-TVP2	**XL**	–	8,54	–	**120**	215	58	2,1	2,1	4,5	195,5	143,5	187,8	153,2
NJ2224-E-TVP2	**XL**	**HJ2224-E**	8,54	0,75	**120**	215	58	2,1	2,1	–	195,5	143,5	187,8	153,2
NUP2224-E-TVP2	**XL**	–	8,7	–	**120**	215	58	2,1	2,1	–	195,5	143,5	187,8	153,2
NJ324-E-TVP2	**XL**	–	13,5	–	**120**	260	55	3	3	3,5	230	154	218,7	168,1
NJ324-E-TVP2	**XL**	**HJ324-E**	13,5	1,41	**120**	260	55	3	3	–	230	154	218,7	168,1
NUP324-E-TVP2	**XL**	–	13,8	–	**120**	260	55	3	3	–	230	154	218,7	168,1
NJ2324-E-M1	**XL**	–	23,5	–	**120**	260	86	3	3	7,2	230	154	218,7	168,1
NJ2324-E-M1	**XL**	**HJ2324-E**	23,5	1,49	**120**	260	86	3	3	–	230	154	218,7	168,1
NUP2324-E-M1	**XL**	–	23,8	–	**120**	260	86	3	3	–	230	154	218,7	168,1



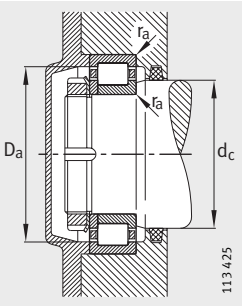
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

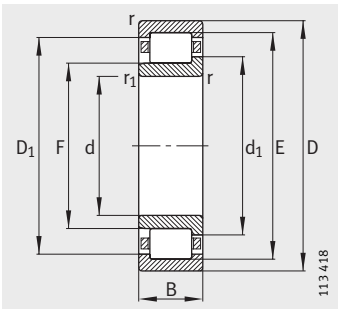


Mounting dimensions for NUP

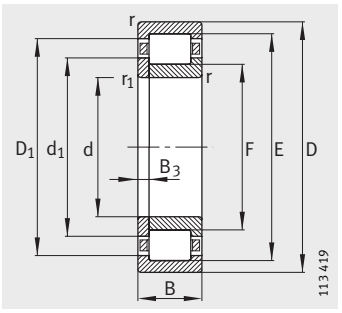
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	117	123	137	178	2,1	310 000	320 000	49 000	3 600	3 450
10	16	–	117	–	137	178	2,1	310 000	320 000	49 000	3 600	3 450
–	–	6	117	123	137	178	2,1	310 000	320 000	49 000	3 600	3 450
–	–	–	122	130	144	188	2,1	345 000	365 000	55 000	3 400	3 300
11	17	–	122	–	144	188	2,1	345 000	365 000	55 000	3 400	3 300
–	–	6	122	–	144	188	2,1	345 000	365 000	55 000	3 400	3 300
–	–	–	122	130	144	188	2,1	455 000	520 000	81 000	3 400	2 800
11	19,5	–	122	–	144	188	2,1	455 000	520 000	81 000	3 400	2 800
–	–	8,5	122	–	144	188	2,1	455 000	520 000	81 000	3 400	2 800
–	–	–	124	140	158	226	2,5	495 000	475 000	73 000	3 000	3 100
14	22	–	124	–	158	226	2,5	495 000	475 000	73 000	3 000	3 100
–	–	8	124	–	158	226	2,5	495 000	475 000	73 000	3 000	3 100
–	–	–	124	140	158	226	2,5	750 000	800 000	126 000	2 800	2 320
14	26,5	–	124	–	158	226	2,5	750 000	800 000	126 000	2 800	2 320
–	–	12,5	124	–	158	226	2,5	750 000	800 000	126 000	2 800	2 320
–	–	–	132	141	156	203	2,1	390 000	415 000	64 000	3 200	3 100
11	17	–	132	–	156	203	2,1	390 000	415 000	64 000	3 200	3 100
–	–	6	132	–	156	203	2,1	390 000	415 000	64 000	3 200	3 100
–	–	–	132	141	156	203	2,1	530 000	610 000	960 00	3 200	2 550
11	20	–	132	–	156	203	2,1	530 000	610 000	960 00	3 200	2 550
–	–	9	132	–	156	203	2,1	530 000	610 000	96 000	3 200	2 550
–	–	–	134	151	171	246	2,5	610000	600 000	87 000	2 800	2 700
14	22,5	–	134	–	171	246	2,5	610 000	600 000	87 000	2 800	2 700
–	–	8,5	134	–	171	246	2,5	610 000	600 000	87 000	2 800	2 700
–	–	–	134	151	171	246	2,5	930 000	1 010 000	153 000	4 300	2 000
14	26	–	134	–	171	246	2,5	930 000	1 010 000	153 000	4 300	2 000
–	–	12	134	–	171	246	2,5	930 000	1 010 000	153 000	4 300	2 000

Cylindrical roller bearings with cage

Semi-locating and locating bearings



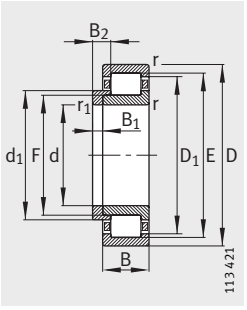
NJ
Semi-locating bearings



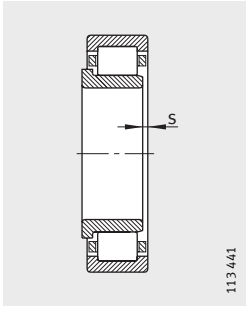
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

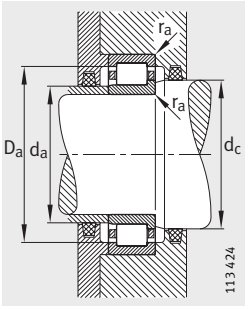
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[1)]	E	F	D_1 ≈	d_1 ≈
NJ226-E-TVP2	**XL**	–	6,63	–	**130**	230	40	3	3	1,2	209,5	153,5	201,2	164
NJ226-E-TVP2	**XL**	**HJ226-E**	6,63	0,78	**130**	230	40	3	3	–	209,5	153,5	201,2	164
NUP226-E-TVP2	**XL**	–	6,74	–	**130**	230	40	3	3	–	209,5	153,5	201,2	164
NJ2226-E-TVP2	**XL**	–	10,6	–	**130**	230	64	3	3	5,2	209,5	153,5	201,2	164
NJ2226-E-TVP2	**XL**	**HJ2226-E**	10,6	0,849	**130**	230	64	3	3	–	209,5	153,5	201,2	164
NUP2226-E-TVP2	**XL**	–	10,8	–	**130**	230	64	3	3	–	209,5	153,5	201,2	164
NJ326-E-TVP2	**XL**	–	16,5	–	**130**	280	58	4	4	3,5	247	167	235,2	181,7
NJ326-E-TVP2	**XL**	**HJ326-E**	16,5	1,64	**130**	280	58	4	4	–	247	167	235,2	181,7
NUP326-E-TVP2	**XL**	–	16,7	–	**130**	280	58	4	4	–	247	167	235,2	181,7
NJ2326-E-M1	**XL**	–	29,2	–	**130**	280	93	4	4	8,1	247	167	235,2	181,7
NJ2326-E-M1	**XL**	**HJ2326-E**	29,2	1,77	**130**	280	93	4	4	–	247	167	235,2	181,7
NUP2326-E-M1	**XL**	–	29,7	–	**130**	280	93	4	4	–	247	167	235,2	181,7
NJ228-E-M1	**XL**	–	9,46	–	**140**	250	42	3	3	2	225	169	216,7	179,4
NJ228-E-M1	**XL**	**HJ228-E**	9,46	0,986	**140**	250	42	3	3	–	225	169	216,7	179,4
NUP228-E-M1	**XL**	–	9,61	–	**140**	250	42	3	3	–	225	169	216,7	179,4
NJ2228-E-M1	**XL**	–	14,7	–	**140**	250	68	3	3	7	225	169	216,7	179,4
NJ2228-E-M1	**XL**	**HJ2228-E**	14,7	1,08	**140**	250	68	3	3	–	225	169	216,7	179,4
NUP2228-E-M1	**XL**	–	16,8	–	**140**	250	68	3	3	–	225	169	216,7	180
NJ328-E-TVP2	**XL**	–	20,5	–	**140**	300	62	4	4	5,2	264	180	251,7	195,4
NJ328-E-TVP2	**XL**	**HJ328-E**	20,5	2,03	**140**	300	62	4	4	–	264	180	251,7	195,4
NUP328-E-TVP2	**XL**	–	20,8	–	**140**	300	62	4	4	–	264	180	251,7	195,4
NJ2328-E-M1	**XL**	–	36,6	–	**140**	300	102	4	4	9,2	264	180	251,7	195,4
NJ2328-E-M1	**XL**	**HJ2328-E**	36,6	2,2	**140**	300	102	4	4	–	264	180	251,7	195,4
NUP2328-E-M1	**XL**	–	37,1	–	**140**	300	102	4	4	–	264	180	251,7	195,4
NJ230-E-M1	**XL**	–	11,9	–	**150**	270	45	3	3	4	242	182	233,2	193,1
NJ230-E-M1	**XL**	**HJ230-E**	11,9	1,26	**150**	270	45	3	3	–	242	182	233,2	193,1
NUP230-E-M1	**XL**	–	12,1	–	**150**	270	45	3	3	–	242	182	233,2	193,1
NJ2230-E-M1	**XL**	–	18,7	–	**150**	270	73	3	3	7,5	242	182	233,2	193,1
NJ2230-E-M1	**XL**	**HJ2230-E**	18,7	1,36	**150**	270	73	3	3	–	242	182	233,2	193,1
NUP2230-E-M1	**XL**	–	19,1	–	**150**	270	73	3	3	–	242	182	233,2	193,1
NJ330-E-M1	**XL**	–	27,2	–	**150**	320	65	4	4	5,5	283	193	269,8	209,5
NJ330-E-M1	**XL**	**HJ330-E**	27,2	2,33	**150**	320	65	4	4	–	283	193	269,8	209,5
NUP330-E-M1	**XL**	–	27,7	–	**150**	320	65	4	4	–	283	193	269,8	209,5
NJ2330-E-M1	**XL**	–	43,8	–	**150**	320	108	4	4	9,7	283	193	269,8	209,5
NJ2330-E-M1	**XL**	**HJ2330-E**	43,8	2,55	**150**	320	108	4	4	–	283	193	269,8	209,5
NUP2330-E-M1	**XL**	–	44,6	–	**150**	320	108	4	4	–	283	193	269,8	209,5



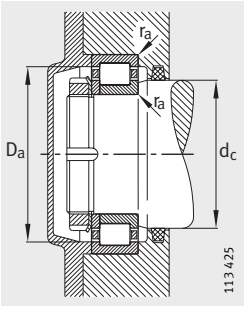
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

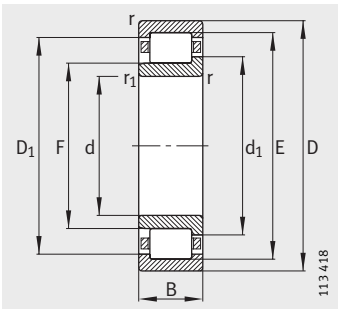


Mounting dimensions for NUP

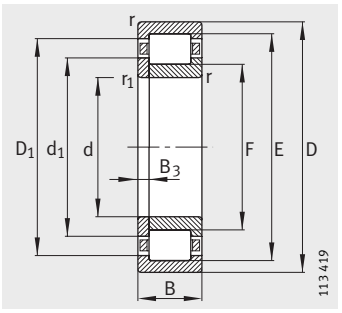
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	144	151	168	216	2,5	425 000	445 000	65 000	3 000	2 850
11	17	–	144	–	168	216	2,5	425 000	445 000	65 000	3 000	2 850
–	–	6	144	–	168	216	2,5	425 000	445 000	65 000	3 000	2 850
–	–	–	144	151	168	216	2,5	620 000	730 000	111 000	3 000	2 300
11	21	–	144	–	168	216	2,5	620 000	730 000	111 000	3 000	2 300
–	–	10	144	–	168	216	2,5	620 000	730 000	111 000	3 000	2 300
–	–	–	147	164	184	263	3	680 000	670 000	96 000	2 600	2 460
14	23	–	147	–	184	263	3	680 000	670 000	96 000	2 600	2 460
–	–	9	147	–	184	263	3	680 000	670 000	96 000	2 600	2 460
–	–	–	147	164	184	263	3	1 080 000	1 220 000	180 000	3 800	1 780
14	28	–	147	–	184	263	3	1 080 000	1 220 000	180 000	3 800	1 780
–	–	14	147	–	184	263	3	1 080 000	1 220 000	180 000	3 800	1 780
–	–	–	154	166	182	236	2,5	460 000	510 000	72 000	4 800	2 600
11	18	–	154	–	182	236	2,5	460 000	510 000	72 000	4 800	2 600
–	–	7	154	–	182	236	2,5	460 000	510 000	72 000	4 800	2 600
–	–	–	154	166	182	236	2,5	670 000	830 000	123 000	4 500	2 080
11	23	–	154	–	182	236	2,5	670 000	830 000	123 000	4 500	2 080
–	–	12	154	–	182	236	2,5	670 000	830 000	123 000	4 500	2 080
–	–	–	157	176	198	283	3	790 000	800 000	113 000	2 400	2 200
15	25	–	157	–	198	283	3	790 000	800 000	113 000	2 400	2 200
–	–	10	157	–	198	283	3	790 000	800 000	113 000	2 400	2 200
–	–	–	157	176	198	283	3	1 210 000	1 390 000	202 000	3 600	1 640
15	31	–	157	–	198	283	3	1 210 000	1 390 000	202 000	3 600	1 640
–	–	16	157	–	198	283	3	1 210 000	1 390 000	202 000	3 600	1 640
–	–	–	164	179	196	256	2,5	520 000	590 000	82 000	4 500	2 390
12	19,5	–	164	–	196	256	2,5	520 000	590 000	82 000	4 500	2 390
–	–	7,5	164	–	196	256	2,5	520 000	590 000	82 000	4 500	2 390
–	–	–	164	179	196	256	2,5	780 000	970 000	142 000	4 300	1 860
12	24,5	–	164	–	196	256	2,5	780 000	970 000	142 000	4 300	1 860
–	–	12,5	164	–	196	256	2,5	780 000	970 000	142 000	4 300	1 860
–	–	–	167	190	213	303	3	900 000	930 000	126 000	3 600	1 970
15	25	–	167	–	213	303	3	900 000	930 000	126 000	3 600	1 970
–	–	10	167	–	213	303	3	900 000	930 000	126 000	3 600	1 970
–	–	–	167	190	213	303	3	1 380 000	1 600 000	226 000	3 200	1 480
15	31,5	–	167	–	213	303	3	1 380 000	1 600 000	226 000	3 200	1 480
–	–	16,5	167	–	213	303	3	1 380 000	1 600 000	226 000	3 200	1 480

Cylindrical roller bearings with cage

Semi-locating and locating bearings



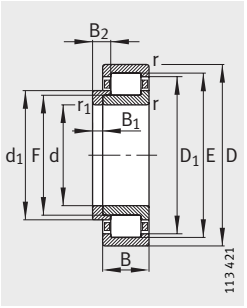
NJ
Semi-locating bearings



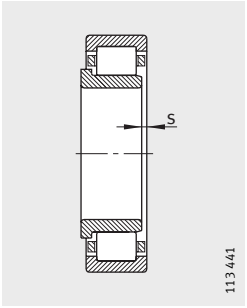
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

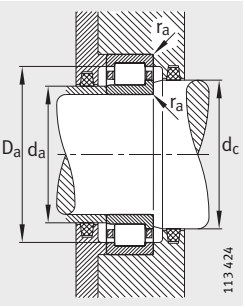
Designation			Mass m		Dimensions									
Bearing	X-life	L-section ring	Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NJ232-E-M1	**XL**	–	14,8	–	**160**	290	48	3	3	4,1	259	195	249,6	206,8
NJ232-E-M1	**XL**	**HJ232-E**	14,8	1,47	**160**	290	48	3	3	–	259	195	249,6	206,8
NUP232-E-M1	**XL**	–	15,1	–	**160**	290	48	3	3	–	259	195	249,6	206,8
NJ2232-E-M1	**XL**	–	23,9	–	**160**	290	80	3	3	7,2	261	193	251,1	205,5
NJ2232-E-M1	**XL**	**HJ2232-E**	23,9	1,56	**160**	290	80	3	3	–	261	193	251,1	205,5
NUP2232-E-M1	**XL**	–	24,3	–	**160**	290	80	3	3	–	261	193	251,1	205,5
NJ332-E-M1	–	–	32,3	–	**160**	340	68	4	4	5,6	300	204	286	221,6
NJ332-E-M1	–	**HJ332-E**	32,3	2,58	**160**	340	68	4	4	–	300	204	286	221,6
NJ2332-E-M1	–	–	52,3	–	**160**	340	114	4	4	9,9	300	204	286	221,6
NJ2332-E-M1	–	**HJ2332-E**	52,3	2,85	**160**	340	114	4	4	–	300	204	286	221,6
NJ234-E-M1	**XL**	–	18,4	–	**170**	310	52	4	4	4,3	279	207	268,5	218,4
NJ234-E-M1	**XL**	**HJ234-E**	18,4	1,58	**170**	310	52	4	4	–	279	207	268,5	218,4
NUP234-E-M1	**XL**	–	18,6	–	**170**	310	52	4	4	–	279	207	268,5	218,4
NJ2234-E-M1	**XL**	–	29,8	–	**170**	310	86	4	4	7,2	281	205	269,9	219
NJ2234-E-M1	**XL**	**HJ2234-E**	29,8	1,78	**170**	310	86	4	4	–	281	205	269,9	219
NUP2234-E-M1	**XL**	–	30,2	–	**170**	310	86	4	4	–	281	205	269,9	219
NJ334-E-M1	–	–	38,6	–	**170**	360	72	4	4	6	318	218	301,6	237
NJ334-E-M1	–	**HJ334-E**	38,6	3,21	**170**	360	72	4	4	–	318	218	301,6	237
NJ2334-EX-M1	–	–	62,3	–	**170**	360	120	4	4	10,2	320	216	303	235,7
NJ2334-EX-M1	–	**HJ2334-EX**	62,3	3,53	**170**	360	120	4	4	–	320	216	303	235,7
NJ236-E-M1	**XL**	–	19,2	–	**180**	320	52	4	4	4,7	289	217	278,6	230,2
NJ236-E-M1	**XL**	**HJ236-E**	19,2	1,76	**180**	320	52	4	4	–	289	217	278,6	230,2
NUP236-E-M1	**XL**	–	17,3	–	**180**	320	52	4	4	–	289	217	278,6	230,2
NJ2236-E-M1	**XL**	–	30,9	–	**180**	320	86	4	4	7,2	291	215	280	229
NJ2236-E-M1	**XL**	**HJ2236-E**	30,9	1,87	**180**	320	86	4	4	–	291	215	280	229
NUP2236-E-M1	**XL**	–	31,4	–	**180**	320	86	4	4	–	291	215	280	229
NJ336-E-M1	–	–	44,6	–	**180**	380	75	4	4	6,1	335	231	319,8	250,5
NJ336-E-M1	–	**HJ336E**	44,6	3,77	**180**	380	75	4	4	–	335	231	319,8	250,5
NJ2336-EX-M1	–	–	72,9	–	**180**	380	126	4	4	10,5	339	227	320,8	248
NJ2336-EX-M1	–	**HJ2336-EX**	72,9	4,05	**180**	380	126	4	4	–	339	227	320,8	248



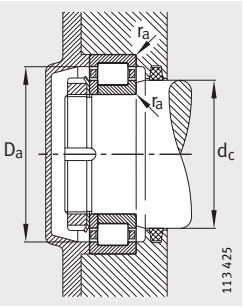
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ



Mounting dimensions for NJ

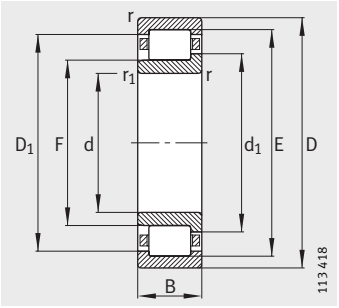


Mounting dimensions for NUP

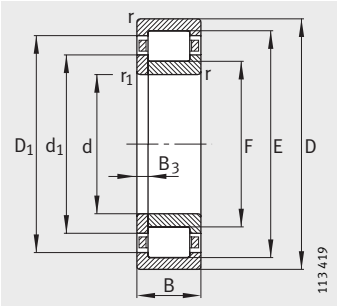
			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	174	192	210	276	2,5	590 000	670 000	93 000	4 300	2 190
12	20	–	174	–	210	276	2,5	590 000	670 000	93 000	4 300	2 190
–	–	8	174	–	210	276	2,5	590 000	670 000	93 000	4 300	2 190
–	–	–	174	192	210	276	2,5	940 000	1 170 000	171 000	3 800	1 670
12	24,5	–	174	–	210	276	2,5	940 000	1 170 000	171 000	3 800	1 670
–	–	12,5	174	–	210	276	2,5	940 000	1 170 000	171 000	3 800	1 670
–	–	–	177	200	228	323	3	865 000	1 060 000	114 000	3 000	1 790
15	25	–	177	–	228	323	3	865 000	1 060 000	114 000	3 000	1 790
–	–	–	177	200	228	323	3	1 320 000	1 830 000	204 000	3 000	1 350
15	32	–	177	–	228	323	3	1 320 000	1 830 000	204 000	3 000	1 350
–	–	–	187	204	223	293	3	700 000	780 000	107 000	3 600	2 010
12	20	–	187	–	223	293	3	700 000	780 000	107 000	3 600	2 010
–	–	8	187	–	223	293	3	700 000	780 000	107 000	3 600	2 010
–	–	–	187	204	223	293	3	1 130 000	1 400 000	198 000	3 200	1 500
12	24	–	187	–	223	293	3	1 130 000	1 400 000	198 000	3 200	1 500
–	–	12	187	–	223	293	3	1 130 000	1 400 000	198 000	3 200	1 500
–	–	–	187	215	240	343	3	965 000	1 220 000	132 000	3 000	1 630
16	27	–	187	–	240	343	3	965 000	1 220 000	132 000	3 000	1 630
–	–	–	187	214	238,3	343	3	1 500 000	2 080 000	230 000	2 800	1 230
16	33,5	–	187	–	238,3	343	3	1 500 000	2 080 000	230 000	2 800	1 230
–	–	–	197	214	233	303	3	730 000	830 000	112 000	3 600	1 880
12	20	–	197	–	233	303	3	730 000	830 000	112 000	3 600	1 880
–	–	8	197	–	233	303	3	730 000	830 000	112 000	3 600	1 880
–	–	–	197	214	233	303	3	1 180 000	1 490 000	208 000	3 200	1 390
12	24	–	197	–	233	303	3	1 180 000	1 490 000	208 000	3 200	1 390
–	–	12	197	–	233	303	3	1 180 000	1 490 000	208 000	3 200	1 390
–	–	–	197	228	254	363	3	1 040 000	1 320 000	141 000	2 800	1 520
17	28,5	–	197	–	254	363	3	1 040 000	1 320 000	141 000	2 800	1 520
–	–	–	197	225	250,6	363	3	1 660 000	2 320 000	260 000	2 800	1 130
17	35	–	197	–	250,6	363	3	1 660 000	2 320 000	260 000	2 800	1 130

Cylindrical roller bearings with cage

Semi-locating and locating bearings



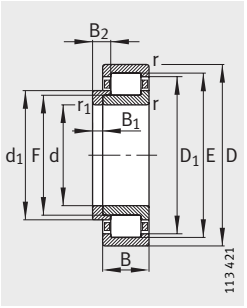
NJ
Semi-locating bearings



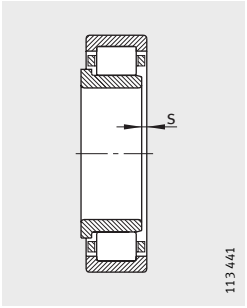
NUP
Locating bearings

Dimension table (continued) · Dimensions in mm

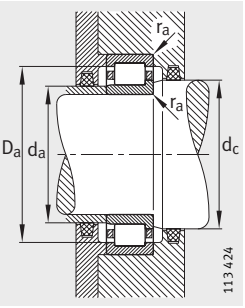
Designation		Mass m		Dimensions									
Bearing	L-section ring	Bearing ≈kg	L-section ring ≈g	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈
NJ238-E-M1	–	23,2	–	**190**	340	55	4	4	4,7	306	230	295	244
NJ238-E-M1	**HJ238-E**	23,2	2,17	**190**	340	55	4	4	–	306	230	295	244
NUP238-E-M1	–	23,5	–	**190**	340	55	4	4	–	306	230	295	244
NJ2238-E-M1	–	37,7	–	**190**	340	92	4	4	8	308	228	296,4	242,7
NJ2238-E-M1	**HJ2238-E**	37,7	2,31	**190**	340	92	4	4	–	308	228	296,4	242,7
NJ2338-EX-M1	–	84,4	–	**190**	400	132	5	5	11	360	240	340,5	262,5
NJ2338-EX-M1	**HJ2338-EX**	84,4	4,8	**190**	400	132	5	5	–	360	240	340,5	262,5
NJ240-E-M1	–	27,5	–	**200**	360	58	4	4	4,8	323	243	311,5	257,6
NJ240-E-M1	**HJ240-E**	27,5	2,62	**200**	360	58	4	4	–	323	243	311,5	257,6
NUP240-E-M1	–	28	–	**200**	360	58	4	4	–	323	243	311,5	257,6
NJ2240-E-M1	–	45,3	–	**200**	360	98	4	4	8,2	325	241	312,9	256,3
NJ2240-E-M1	**HJ2240-E**	45,3	2,78	**200**	360	98	4	4	–	325	241	312,9	256,3
NJ340-E-M1	–	58,1	–	**200**	420	80	5	5	6,3	370	258	351,8	279
NJ340-E-M1	**HJ340-E**	58,1	4,94	**200**	420	80	5	5	–	370	258	351,8	279
NJ2340-EX-M1	–	97,2	–	**200**	420	138	5	5	11,3	377	253	356,9	276,1
NJ2340-EX-M1	**HJ2340-EX**	97,2	5,28	**200**	420	138	5	5	–	377	253	356,9	276,1
NJ244-E-M1	–	38,7	–	**220**	400	65	4	4	5,5	358	268	344,9	285,2
NJ244-E-M1	**HJ244-E**	38,7	3,55	**220**	400	65	4	4	–	358	268	344,9	285,2
NUP244-E-M1	–	39,3	–	**220**	400	65	4	4	–	358	268	344,9	285,2
NUP2244-EX-M1	–	63,4	–	**220**	400	108	4	4	–	367	259	349,4	279,4
NUP2344-EX-M1	–	124	–	**220**	460	145	5	5	–	413	277	391,2	302,2
NJ248-E-M1	–	52,5	–	**240**	440	72	4	4	6	393	293	376,6	312
NJ248-E-M1	**HJ248-E**	52,5	4,6	**240**	440	72	4	4	–	393	293	376,6	312
NJ348-E-M1	–	97	–	**240**	500	95	5	5	7,4	442	306	421,2	331,3
NJ348-E-M1	**HJ348-E**	97	8,3	**240**	500	95	5	5	–	442	306	421,2	331,3
NJ252-E-M1	–	69,4	–	**260**	480	80	5	5	6,2	429	317	410,8	336,9
NJ252-E-M1	**HJ252-E**	69,4	5,92	**260**	480	80	5	5	–	429	317	410,8	336,9
NJ356-E-M1	–	149	–	**280**	580	108	6	6	8,7	512	362	488	389,8
NJ356-E-M1	**HJ356-E**	149	13,7	**280**	580	108	6	6	–	512	362	488	389,8



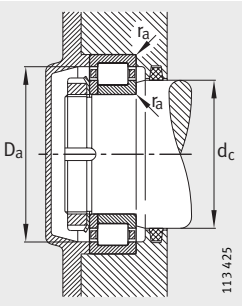
NJ and HJ
Locating bearings



1) Axial displacement “s” for NJ

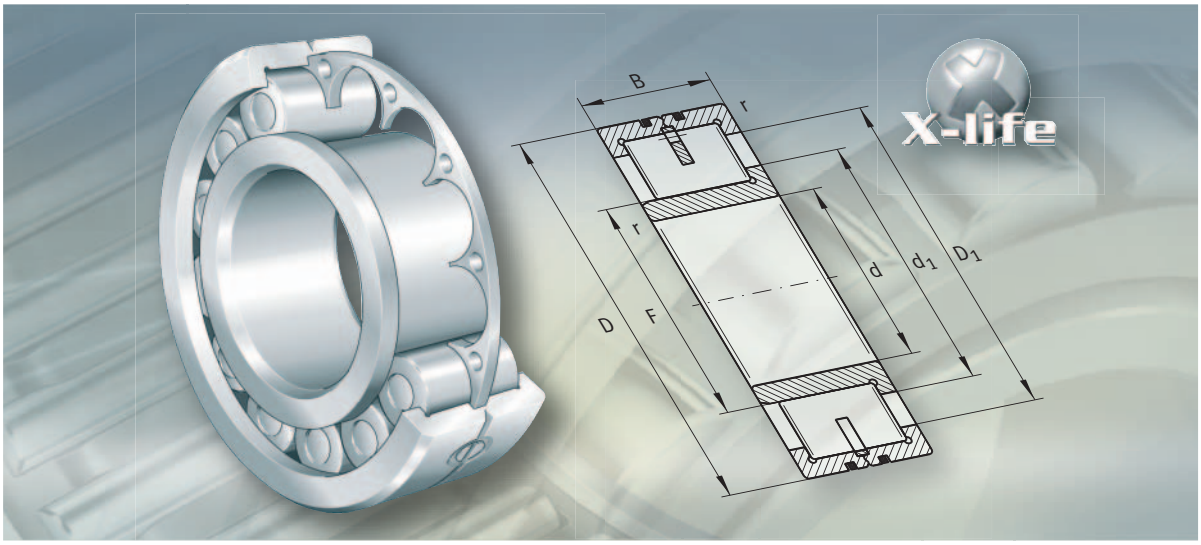


Mounting dimensions for NJ



Mounting dimensions for NUP

			Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.	max.	min.	max.	max.	N	N	N	min^{-1}	min^{-1}
–	–	–	207	227	247	323	3	680 000	930 000	100 000	3 200	1 750
13	21,5	–	207	–	247	323	3	680 000	930 000	100 000	3 200	1 750
–	–	8,5	207	–	247	323	3	680 000	930 000	100 000	3 200	1 750
–	–	–	207	227	247	323	3	1 100 000	1 660 000	184 000	3 000	1 300
13	26,5	–	207	–	247	323	3	1 100 000	1 660 000	184 000	3 000	1 300
–	–	–	210	237,8	265,3	380	4	1 900 000	2 650 000	285 000	2 600	1 030
18	36,5	–	210	–	265,3	380	4	1 900 000	2 650 000	285 000	2 600	1 030
–	–	–	217	240	261	343	3	750 000	1 040 000	110 000	3 000	1 620
14	23	–	217	–	261	343	3	750 000	1 040 000	110 000	3 000	1 620
–	–	9	217	–	261	343	3	750 000	1 040 000	110 000	3 000	1 620
–	–	–	217	240	261	343	3	1 220 000	1 860 000	206 000	2 800	1 210
14	28	–	217	–	261	343	3	1 220 000	1 860 000	206 000	2 800	1 210
–	–	–	220	255	282	400	4	1 180 000	1 530 000	161 000	2 600	1 340
18	30	–	220	–	282	400	4	1 180 000	1 530 000	161 000	2 600	1 340
–	–	–	220	250,7	279	400	4	2 040 000	2 900 000	310 000	2 400	960
18	37	–	220	–	279	400	4	2 040 000	2 900 000	310 000	2 400	960
–	–	–	237	265	288	383	3	950 000	1 320 000	134 000	2 800	1 400
15	25	–	237	–	288	383	3	950 000	1 320 000	134 000	2 800	1 400
–	–	10	237	–	288	383	3	950 000	1 320 000	134 000	2 800	1 400
–	–	14	237	–	282,3	383	3	1 630 000	2 360 000	250 000	2 600	1 020
–	–	20	240	–	305,1	440	4	2 360 000	3 350 000	340 000	2 200	840
–	–	–	257	290	315	423	3	1 140 000	1 600 000	163 000	2 600	1 240
16	27	–	257	–	315	423	3	1 140 000	1 600 000	163 000	2 600	1 240
–	–	–	260	303	335	480	4	1 730 000	2 280 000	221 000	2 200	1 010
22	35,5	–	260	–	335	480	4	1 730 000	2 280 000	221 000	2 200	1 010
–	–	–	280	314	341	460	4	1 340 000	1 900 000	191 000	2 400	1 120
18	30	–	280	–	341	460	4	1 340 000	1 900 000	191 000	2 400	1 120
–	–	–	306	359	393,4	554	5	2 160 000	3 050 000	285 000	1 900	810
26	42,5	–	306	–	393,4	554	5	2 160 000	3 050 000	285 000	1 900	810



Low friction cylindrical roller bearings

Low friction cylindrical roller bearings

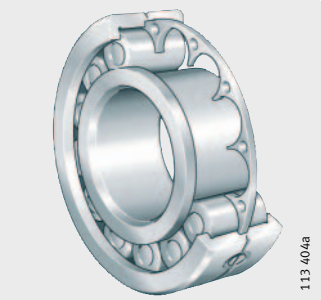
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Semi-locating bearings

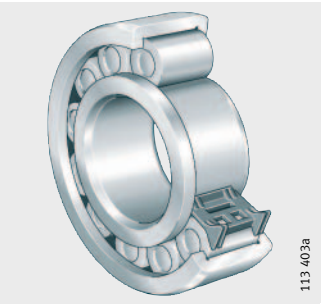
With disc cage

LSL1923



With spacers

ZSL1923



Low friction cylindrical roller bearings

Features

Low friction cylindrical roller bearings LSL and ZSL are of a single row, self-retaining design and correspond to dimension series 23. The bearings have solid outer rings with two ribs, the inner rings are designed with one rib. The inner ring is removable and thus allows easier mounting of the bearings. The disc cages or spacers prevent the cylindrical rollers from coming into contact with each other during rolling.

Cylindrical roller bearings NJ23..-E and spherical roller bearings 223..-E1 have the same design envelope as LSL1923 and ZSL1923.

X-life

Numerous sizes are supplied in the X-life grade. These bearings are indicated in the dimension tables.

Bearings of X-life quality have lower roughness R_a and higher geometrical accuracy of the raceways than comparable designs that are not X-life. As a result, these bearings have higher load carrying capacity and longer life for the same dimensioning. In certain applications, this means that a smaller bearing arrangement can be designed.



Semi-locating bearings

Cylindrical roller bearings LSL1923 and ZSL1923 are semi-locating bearings and can support not only high radial forces but also large axial forces in one direction. They act as non-locating bearings in the opposite direction.

Since they have a larger number of rolling elements and larger rolling elements, LSL and ZSL bearings have higher radial and axial load carrying capacity than all comparable cylindrical roller bearing designs with a solid cage. They can withstand high shock loads and vibrations, support large centrifugal forces and allow accelerations up to 500 m/s^2.

Due to the low frictional torque across the entire speed range and the low heat generation, the bearings have the highest limiting speeds of all cylindrical roller bearings. In addition, the optimum heat dissipation ensures thermally stable conditions in the bearing.

With disc cage

In cylindrical roller bearings LSL1923, an externally-guided flat brass disc cage prevents the cylindrical rollers from coming into contact with each other during rolling.

The cage has pockets to accommodate the rolling elements. The rolling elements are guided between the ribs on the outer ring. Due to its low mass, the cage is subjected to only minimal strain under acceleration. It therefore fulfils ideally its role as an element separating the rolling elements and supporting the inertia forces.

Lubricant is exchanged via axial through holes. Good oil flow through the axially open bearing is supported by the axial holes.

The outer ring is axially split and held together by fasteners.

Axial displacement

The outer and inner ring can be axially displaced relative to each other in one direction only by the dimension “s” stated in the dimension table.

Sealing/lubricant

The cylindrical roller bearings are open on both sides. They can be lubricated via the end faces.

Low friction cylindrical roller bearings

With spacers

In cylindrical roller bearings ZSL1923, plastic spacers prevent the cylindrical rollers from coming into contact with each other during rolling.

The spacers are designed such that the rolling element set is self-retaining, so the bearing and inner ring can be mounted separately.

The spacers are guided axially between the two outer ring ribs.

Axial displacement

The outer and inner ring can be axially displaced relative to each other in one direction only by the dimension “s” stated in the dimension table.

Sealing/lubricant

The cylindrical roller bearings are open on both sides. They can be lubricated via the end faces.

Special design for vibratory machinery

In addition to high basic dynamic load ratings and thus long life values, bearings in vibratory machinery must also be able to compensate or support considerable shaft tilting due to load or misalignment. The bearings LSL and ZSL are therefore also available by agreement in the BIR design. In these bearings, the inner ring raceway is ground slightly spherical.

Operating temperature

Cylindrical roller bearings with disc cage or spacers are suitable for operating temperatures from –30 °C to +120 °C.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
BIR	Inner ring raceway ground slightly spherical	Special design[1)]
BR	Black oxide coated	Special design[1)]
C3	Radial internal clearance larger than normal	Special design[1)]
C4	Radial internal clearance larger than C3	Special design[1)]
C5	Radial internal clearance larger than C4	Special design[1)]
RR	Corrosion-resistant design, with Corrotect® plating	Special design[1)]

[1)] Available by agreement.

Design and safety guidelines

Axial load carrying capacity

Radial cylindrical roller bearings of a semi-locating bearing design can support axial forces in one direction as well as radial forces.

The axial load carrying capacity is dependent on:

- the size of the sliding surfaces between the ribs and the end faces of the rolling elements
- the sliding velocity at the ribs
- the lubrication on the contact surfaces.

Caution!

Ribs subjected to load must be supported across their entire height. If severe shaft flexing is present, reversed bending loads may occur as a result of this support. Special analysis is required in this case.

The axial limiting load $F_{a\,max}$ according to the formula must not be exceeded, in order to avoid impermissible pressure at the contact surfaces.

The ratio F_a/F_r should not exceed 0,4.

Continuous axial loading without simultaneous radial loading is not permissible.



Permissible and maximum axial load

$$F_{a\,per} = k_S \cdot k_B \cdot d_M^{\,1,5} \cdot n^{-0,6} \leqq F_{a\,max}$$

$$F_{a\,max} = 0,075 \cdot k_B \cdot d_M^{\,2,1}$$

$F_{a\,per}$ N
Permissible axial load

$F_{a\,max}$ N
Axial limiting load

k_S –
Factor dependent on the lubrication method, see table

k_B –
Bearing factor, $k_B = 28$

d_M mm
Mean bearing diameter (d + D)/2 according to dimension table

n min^{-1}
Operating speed.

Factor k_S for lubrication method

Lubrication method[1)]	k_S
Minimal heat dissipation, drip feed oil lubrication, oil mist lubrication, low operating viscosity ($\nu < 0,5 \cdot \nu_1$)	7,5 to 10
Poor heat dissipation, oil sump lubrication, oil spray lubrication, low oil flow	10 to 15
Good heat dissipation, recirculating oil lubrication (pressurised oil lubrication)	12 to 18
Very good heat dissipation, recirculating oil lubrication with oil cooling, high operating viscosity ($\nu > 2 \cdot \nu_1$)	16 to 24

1) Doped lubricating oils should be used, e.g. CLP (DIN 51 517) and HLP (DIN 51 524) of ISO VG classes 32 to 460 and ATF oils (DIN 51 502) and gearbox oils (DIN 51 512) of SAE viscosity classes 75 W to 140 W.

Equivalent dynamic bearing load

Non-locating bearings

For bearings under dynamic loading, the following applies:

$$P = F_r$$

Semi-locating bearings

If an axial force F_a is present in addition to the radial force F_r, the effect on the life must be calculated using our calculation program BEARINX®.

Equivalent static bearing load

Non-locating bearings

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

Semi-locating bearings

If an axial force F_{0a} is present in addition to the radial force F_{0r}, the effect on the static load safety factor must be calculated using our calculation program BEARINX®.

Minimum radial load

In continuous operation, a minimum radial load of the order of $C_{0r}/P < 60$ is necessary.

Caution! If $C_{0r}/P > 60$, please contact us.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by force or physical locking means.

The abutting shoulders (shaft/housing) should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seating to the abutting shoulder must be designed with rounding to DIN 5 418 or an undercut to DIN 509. Note the minimum chamfer dimensions r as given in the dimension tables.

For semi-locating bearings, the bearings only require support on one side, on the rib supporting the axial load.

Caution! Full support must be provided for ribs transmitting forces in axially loaded bearings.

Accuracy

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

The radial internal clearance corresponds to internal clearance group CN.

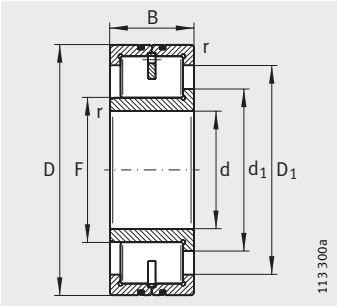
Radial internal clearance to DIN 620-4

Bore		Radial internal clearance							
d mm		CN µm		C3 µm		C4 µm		C5 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
–	24	20	45	35	60	50	75	65	90
24	30	20	45	35	60	50	75	70	95
30	40	25	50	45	70	60	85	80	105
40	50	30	60	50	80	70	100	95	125
50	65	40	70	60	90	80	110	110	140
65	80	40	75	65	100	90	125	130	165
80	100	50	85	75	110	105	140	155	190
100	120	50	90	85	125	125	165	180	220
120	140	60	105	100	145	145	190	200	245
140	160	70	120	115	165	165	215	225	275
160	180	75	125	120	170	170	220	250	300
180	200	90	145	140	195	195	250	275	330
200	225	105	165	160	220	220	280	305	365
225	250	110	175	170	235	235	300	330	395
250	280	125	195	190	260	260	330	370	440
280	315	130	205	200	275	275	350	410	485



Cylindrical roller bearings

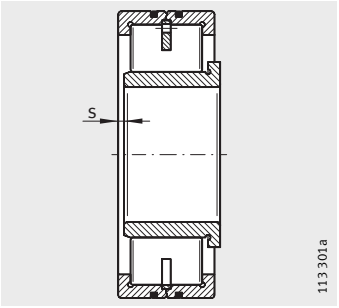
With disc cage
Semi-locating bearings



LSL1923

Dimension table · Dimensions in mm

Designation		Mass	Dimensions					Mounting dimensions		
	X-life	m ≈kg	d	D	B	r min.	s[1)]	F	d_1 ≈	D_1 ≈
LSL192316	**XL**	6,1	**80**	170	58	2,1	3,5	94	104,5	134,8
LSL192317	**XL**	7,3	**85**	180	60	3	4	100	111,3	143,9
LSL192318	**XL**	8,6	**90**	190	64	3	4	105,26	117,2	152,5
LSL192319	**XL**	10	**95**	200	67	3	4	114,66	126,6	161
LSL192320	**XL**	12,8	**100**	215	73	3	4	119,3	132,7	172
LSL192322	**XL**	17,3	**110**	240	80	3	5	135,5	150,7	193,1
LSL192324	**XL**	22	**120**	260	86	3	5	147,39	164,2	213,1
LSL192326	**XL**	27,2	**130**	280	93	4	5	157,9	176	227,9
LSL192328	**XL**	34	**140**	300	102	4	7	168,45	187,5	243,2
LSL192330	–	40,7	**150**	320	108	4	7	182,49	203,3	263,9
LSL192332	–	48,1	**160**	340	114	4	7	196,38	219	284,8
LSL192334	–	57,5	**170**	360	120	4	7	230,55	226,6	295,4
LSL192336	–	67,4	**180**	380	126	4	7	221,56	245	313,3
LSL192338	–	78,1	**190**	400	132	5	7	224,43	250	325,5
LSL192340	–	89,3	**200**	420	138	5	7	238,45	265,7	345,9
LSL192344	–	108	**220**	460	145	5	7	266,71	297	385,9
LSL192348	–	138,6	**240**	500	155	5	10	280,55	312,5	406,1
LSL192352	–	168	**260**	540	165	6	10	315,6	351,6	457,2
LSL192356	–	206,6	**280**	580	175	6	12	333,1	371	485
LSL192360	–	253	**300**	620	185	7,5	12	350,93	390,9	508,5

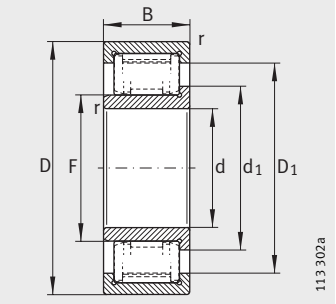


[1] Axial displacement “s”

Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
475 000	495 000	89 000	5 700	8 800
500 000	520 000	90 000	5 400	8 300
590 000	610 000	104 000	5 000	7 900
610 000	660 000	112 000	4 750	7 500
750 000	790 000	133 000	6 300	3 300
880 000	940 000	151 000	5 700	2 950
1 060 000	1 150 000	181 000	5 300	2 600
1 190 000	1 300 000	200 000	4 900	2 400
1 340 000	1 470 000	224 000	4 550	2 240
1 420 000	1 780 000	199 000	4 250	2 010
1 600 000	2 020 000	224 000	4 000	1 850
1 750 000	2 230 000	241 000	3 750	1 720
1 850 000	2 440 000	260 000	3 550	1 610
2 110 000	2 750 000	295 000	3 400	1 490
2 350 000	3 050 000	315 000	3 250	1 390
2 500 000	3 200 000	320 000	2 950	1 280
2 750 000	3 550 000	350 000	2 700	1 170
3 400 000	4 400 000	425 000	2 500	1 020
3 700 000	4 850 000	460 000	2 330	950
4 150 000	5 600 000	510 000	2 170	850

Cylindrical roller bearings

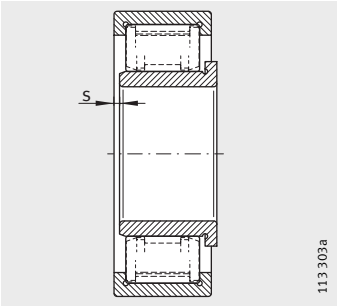
With spacers
Semi-locating bearings



ZSL1923

Dimension table · Dimensions in mm

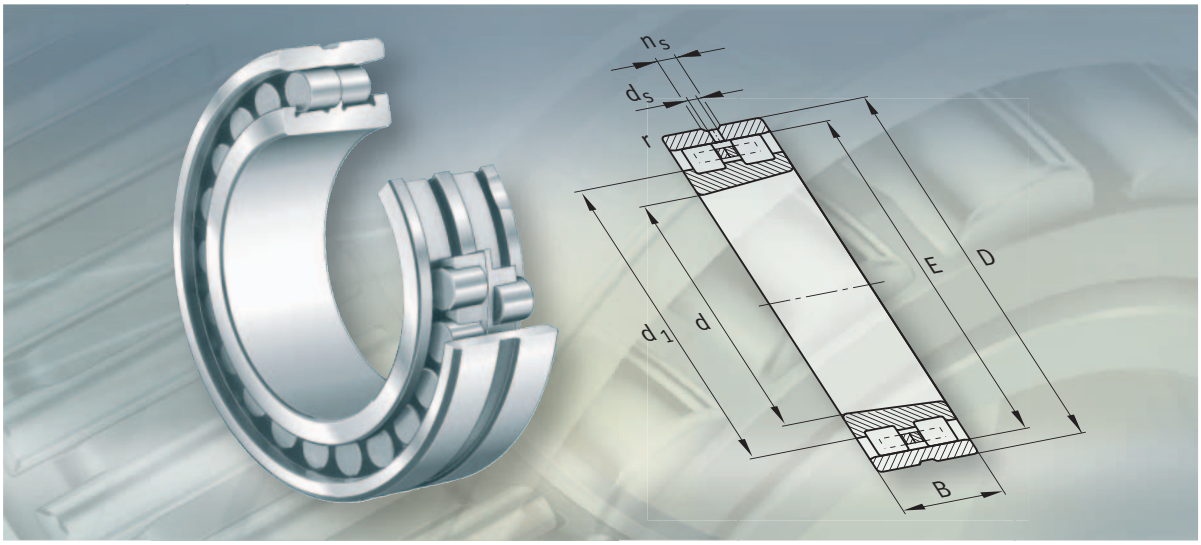
Designation		Mass	Dimensions					Mounting dimensions		
	X-life	m ≈kg	d	D	B	r min.	s[1)]	F	d_1 ≈	D_1 ≈
ZSL192305	–	0,36	**25**	62	24	1,1	2	31,72	36,7	47,5
ZSL192306	–	0,55	**30**	72	27	1,1	2	38,3	43,5	56
ZSL192307	–	0,72	**35**	80	31	1,5	2	44,68	50,7	65,8
ZSL192308	–	1	**40**	90	33	1,5	2	51,12	57,5	75,2
ZSL192309	–	1,34	**45**	100	36	1,5	3	56,1	62,5	80,3
ZSL192310	–	1,76	**50**	110	40	2	3	60,72	68,3	89,7
ZSL192311	–	2,22	**55**	120	43	2	3	67,11	75,5	99,3
ZSL192312	–	2,82	**60**	130	46	2,1	3	73,62	82	105,8
ZSL192313	–	3,44	**65**	140	48	2,1	3,5	80,69	90	116,5
ZSL192314	–	4,27	**70**	150	51	2,1	3,5	84,14	93,5	121,6
ZSL192315	–	5,2	**75**	160	55	2,1	3,5	91,22	101,6	131,9
ZSL192316	**XL**	6,2	**80**	170	58	2,1	3,5	98,24	109,5	142,1
ZSL192317	**XL**	7,23	**85**	180	60	3	4	107,01	118,2	150,9
ZSL192318	**XL**	8,7	**90**	190	64	3	4	105,26	117,5	152,5
ZSL192319	**XL**	10	**95**	200	67	3	4	114,65	126,6	161,9
ZSL192320	**XL**	12,7	**100**	215	73	3	4	119,3	132,7	172,8
ZSL192322	**XL**	16,5	**110**	240	80	3	5	134,27	151,1	199,9
ZSL192324	**XL**	21,9	**120**	260	86	3	5	147,39	164,2	213,1



[1] Axial displacement “s”

Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
68 000	55 000	8 700	16 100	9 600
94 000	81 000	13 400	13 700	8 300
118 000	104 000	17 500	12 200	7 700
160 000	144 000	25 000	10 800	6 600
171 000	160 000	27 500	9 700	6 200
219 000	202 000	35 500	8 800	5 800
255 000	236 000	42 000	8 000	5 400
270 000	260 000	46 500	7 400	5 100
335 000	330 000	59 000	6 800	4 650
365 000	365 000	64 000	6 400	4 450
435 000	440 000	78 000	6 000	4 200
510 000	520 000	90 000	5 600	3 900
540 000	570 000	96 000	5 300	3 700
590 000	610 000	104 000	5 000	3 550
620 000	670 000	112 000	4 750	3 300
750 000	800 000	133 000	4 450	3 050
890 000	910 000	144 000	4 000	2 700
1 060 000	1 150 000	181 000	3 700	2 380

FAG



High precision cylindrical roller bearings

Double row

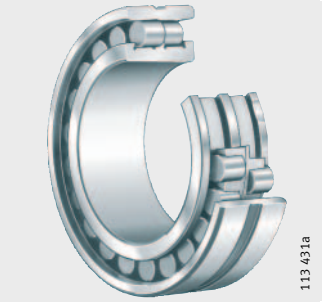
High precision cylindrical roller bearings

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Non-locating bearings

NN30..-AS-K-M-SP



High precision cylindrical roller bearings

Features

Cylindrical roller bearings of this design are double row precision bearings for machine tools. They allow radially rigid, high precision bearing arrangements and are principally used to give radial support for main spindles.

The bearings comprise solid outer rings without ribs, solid inner rings with three ribs and cylindrical roller and cage assemblies with solid brass cages. For optimum setting of the radial internal clearance, the inner ring has a tapered bore with a bore taper 1:12. The cylindrical roller bearings are separable and are therefore easier to fit and dismantle. Both bearing rings can be given a tight fit by this process.

For details of other high precision cylindrical roller bearings, see catalogue AC 41130, Super Precision Bearings.

Non-locating bearings

Cylindrical roller bearings NN30..-AS-K-M-SP are non-locating bearings and can support radial forces only. Axial forces are normally supported by double direction axial angular contact ball bearings.



Axial displacement

The outer and inner ring can be axially displaced relative to each other from the central position by the values “s” stated in the dimension tables.

Sealing/lubricant

The bearings are supplied without seals. They can be lubricated from the end faces as well as through a lubrication groove and lubrication holes in the outer ring.

Operating temperature

Cylindrical roller bearings with special precision (SP) can be used at operating temperatures from –30 °C to +150 °C.

Caution! For continuous operation above +120 °C, please contact us.

Cage

The cylindrical roller bearings have two roller-guided solid brass cages.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description
A	Modified internal construction
K	Tapered bore, taper 1:12
M	Solid brass cage, roller-guided
S	Lubrication groove and lubrication holes in outer ring
SP	Tolerance class SP

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading used as non-locating bearings, the following applies:

$$P = F_r$$

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

Static load safety factor

$$S_0 = \frac{C_{0r}}{P_0}$$

S_0 –
Static load safety factor

C_{0r} N
Basic static load rating according to dimension tables

P_0 N
Equivalent static bearing load.

Caution! In order to achieve sufficiently smooth running, the static load safety factor should be $S_0 > 3$.

Speeds

Caution! The achievable speed depends on the radial internal clearance while warm from operation. For calculation, the values from the dimension table are multiplied by the correction factor in the table.

Correction factors

Clearance or preload in operation µm	Correction factor
0 to 5 (clearance)	1 to 1,1
–5 to 0 (preload)	0,8 to 1

Caution! The limiting speeds n_G given in the dimension tables are valid for lubrication with grease or minimal quantity lubrication with oil and must not be exceeded.

Design of tapered shaft

Recommendations for machining of the tapered shaft: see table and *Figure 1*.

Tapered shaft

Shaft diameter				Round-ness	Flat-ness	Axial runout	Mean rough-ness
d mm		Deviation of small taper diameter µm		t_2 µm	t_3 µm	t_4 µm	R_a µm
over	incl.	max.	min.				
18	30	+73	+64	1	1	1,5	0,2
30	40	+91	+80	1	1	1,5	0,2
40	50	+108	+97	1	1	1,5	0,2
50	65	+135	+122	1,2	1,2	2	0,2
65	80	+159	+146	1,2	1,2	2	0,2
80	100	+193	+178	1,5	1,5	2,5	0,2
100	120	+225	+210	1,5	1,5	2,5	0,2
120	140	+266	+248	2	2	3,5	0,2
140	160	+298	+280	2	2	3,5	0,2
160	180	+328	+310	2	2	3,5	0,2
180	200	+370	+350	3	3	4,5	0,2
200	225	+405	+385	3	3	4,5	0,2
225	250	+445	+425	3	3	4,5	0,2
250	280	+498	+475	4	4	6	0,4
280	315	+548	+525	4	4	6	0,4
315	355	+615	+590	5	5	7	0,4
355	400	+685	+660	5	5	7	0,4
400	450	+767	+740	6	6	8	0,4
450	500	+847	+820	6	6	8	0,4

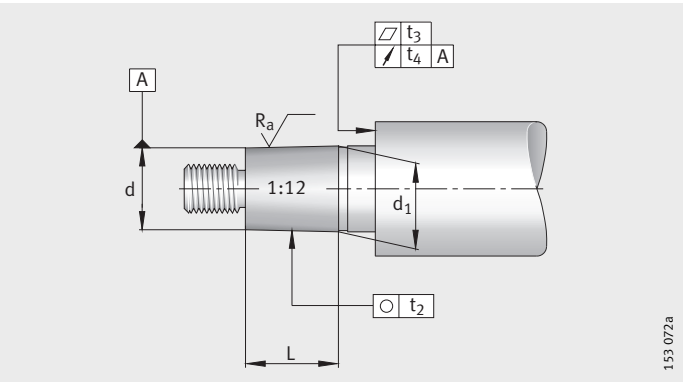


Figure 1
Design of shaft

The deviation of the taper angle of the shaft seat for bearings of tolerance class SP is shown in the table.

Deviation of taper angle

Taper length L mm		Taper angle tolerance AT_D µm			
L_U	L_O	AT_{DU}		AT_{DO}	
over	incl.	max.	min.	max.	min.
16	25	+2	0	+3,2	0
25	40	+2,5	0	+4	0
40	63	+3,2	0	+5	0
63	100	+4	0	+6,3	0
100	160	+5	0	+8	0
160	250	+6,3	0	+10	0

The taper angle tolerance AT_D applies vertical to the axis and is defined as the differential diameter.

If FAG taper gauges MGK132 are used, the AT_D values listed should be halved (inclination angle tolerance).

For taper lengths with nominal dimensions between the values listed in the table, the taper angle tolerance AT_D should be determined by means of interpolation.

Calculation example

Taper length of shaft seat 50 mm, tolerance class SP.

$$AT_D = AT_{DU} + \frac{AT_{DO} - AT_{DU}}{L_o - L_u} \cdot (L - L_u)$$

$$AT_D = 3{,}2 + \frac{5 - 3{,}2}{63 - 40} \cdot (50 - 40) = 3{,}98\,\mu m$$

Taper angle tolerance AT_D = +4 µm.

Design of housing

Caution! In order to allow assembly and dismantling of the bearings, the dimension $D_{b\ min}$ in the dimension tables must be observed.

Recommendations for machining of housings: see table and *Figure 2*.

Housing bore

Housing bore				Cylindricity	Flatness	Axial runout	Coaxiality	Mean roughness
D mm		Deviation µm		t_1 µm	t_3 µm	t_4 µm	t_5 µm	R_a µm
over	incl.	max.	min.					
30	50	+2	−9	1,5	1,5	2,5	4	0,4
50	80	+3	−10	2	2	3	5	0,4
80	120	+2	−13	2,5	2,5	4	6	0,8
120	180	+3	−15	3,5	3,5	5	8	0,8
180	250	+2	−18	4,5	4,5	7	10	0,8
250	315	+3	−20	6	6	8	12	1,6
315	400	+3	−22	7	7	9	13	1,6
400	500	+2	−25	8	8	10	15	1,6
500	630	0	−30	9	9	11	16	1,6
630	800	0	−35	10	10	12	18	1,6



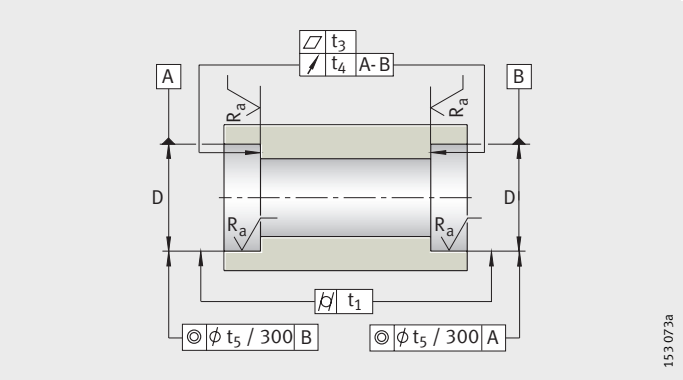


Figure 2
Design of housing

Accuracy

The bearings correspond to the improved tolerance class SP.
Bearings of tolerance class UP available by agreement.

Width tolerances

Bore d mm		Width deviation (in relation to bore) Δ_{Bs} µm		Width variation V_{Bs} µm
over	incl.	max.	min.	
18	30	0	−100	5
30	50	0	−120	5
50	80	0	−150	6
80	120	0	−200	7
120	180	0	−250	8
180	250	0	−300	10
250	315	0	−350	13
315	400	0	−400	15
400	500	0	−450	17

Inner ring tolerances

Bore d mm		Deviation Δ_{dmp} µm		$\Delta_{d1\,mp} - \Delta_{dmp}$ µm		Variation V_{dp} µm	Radial runout K_{ia} µm	Axial runout S_d µm	Axial runout S_{ia} µm
over	incl.								
18	30	10	0	4	0	3	3	8	8
30	50	12	0	6	0	4	4	8	8
50	80	15	0	6	0	5	4	8	8
80	120	20	0	8	0	5	5	9	9
120	180	25	0	8	0	7	6	10	10
180	250	30	0	10	0	8	8	11	13
250	315	35	0	12	0	9	8	13	15
315	400	40	0	12	0	12	10	15	20
400	500	45	0	14	0	14	10	17	23

Outer ring tolerances

Outside diameter D mm		Outside diameter deviation Δ_{Ds} µm		Variation V_{Dp} µm	Radial runout K_{ea} µm	Axial runout S_D µm	Axial runout S_{ea} µm
over	incl.						
30	50	0	−7	4	5	8	8
50	80	0	−9	5	5	8	10
80	120	0	−10	5	6	9	11
120	150	0	−11	6	7	10	13
150	180	0	−13	7	8	10	14
180	250	0	−15	8	10	11	15
250	315	0	−18	9	11	13	18
315	400	0	−20	10	13	13	20
400	500	0	−23	12	15	15	23
500	630	0	−28	14	17	18	25
630	800	0	−35	18	20	20	30

Radial internal clearance

The radial internal clearance smaller than normal internal clearance corresponds to internal clearance group C1NA.
The internal clearance is not stated in the designation.
The bearing rings are not interchangeable.

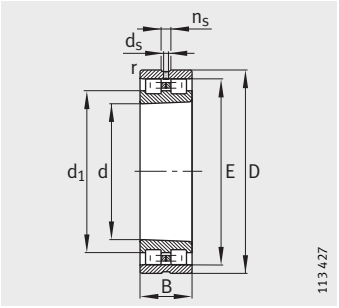
Radial internal clearance

Bore d mm		Radial internal clearance C1NA µm	
over	incl.	min.	max.
24	30	15	25
30	40	15	25
40	50	17	30
50	65	20	35
65	80	25	40
80	100	35	55
100	120	40	60
120	140	45	70
140	160	50	75
160	180	55	85
180	200	60	90
200	225	60	95
225	250	65	100
250	280	75	110
280	315	80	120
315	355	90	135
355	400	100	150
400	450	110	170
450	500	120	190



High precision cylindrical roller bearings

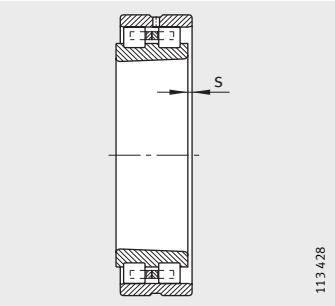
Double row
Non-locating bearings



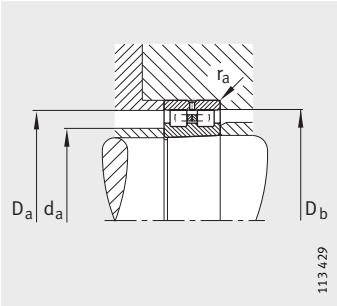
NN30..-AS-K-M-SP
Taper 1:12

Dimension table · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	s[1)]	E	d_1	d_s	n_s
	≈kg				min.			≈		
NN3006-AS-K-M-SP	0,191	**30**	55	19	1	1,4	48,5	39,7	3,2	4,8
NN3007-AS-K-M-SP	0,249	**35**	62	20	1	1,4	55	45,4	3,2	4,8
NN3008-AS-K-M-SP	0,303	**40**	68	21	1	1,4	61	50,6	3,2	4,8
NN3009-AS-K-M-SP	0,393	**45**	75	23	1	1,7	67,5	56,3	3,2	4,8
NN3010-AS-K-M-SP	0,426	**50**	80	23	1	1,7	72,5	61,3	3,2	4,8
NN3011-AS-K-M-SP	0,63	**55**	90	26	1,1	1,9	81	68,2	3,2	4,8
NN3012-AS-K-M-SP	0,674	**60**	95	26	1,1	1,9	86,1	73,3	3,2	4,8
NN3013-AS-K-M-SP	0,715	**65**	100	26	1,1	1,9	91	78,2	3,2	4,8
NN3014-AS-K-M-SP	1,04	**70**	110	30	1,1	2,3	100	85,6	3,2	6,5
NN3015-AS-K-M-SP	1,09	**75**	115	30	1,1	2,3	105	90,6	3,2	6,5
NN3016-AS-K-M-SP	1,51	**80**	125	34	1,1	2,5	113	97	3,2	6,5
NN3017-AS-K-M-SP	1,58	**85**	130	34	1,1	2,5	118	102	3,2	6,5
NN3018-AS-K-M-SP	2,05	**90**	140	37	1,5	2,5	127	109,4	3,2	6,5
NN3019-AS-K-M-SP	2,14	**95**	145	37	1,5	2,5	132	114,4	3,2	6,5
NN3020-AS-K-M-SP	2,23	**100**	150	37	1,5	2,5	137	119,4	3,2	6,5
NN3021-AS-K-M-SP	2,84	**105**	160	41	2	2,6	146	125,2	3,2	6,5
NN3022-AS-K-M-SP	3,61	**110**	170	45	2	2,9	155	132,6	3,2	6,5
NN3024-AS-K-M-SP	3,94	**120**	180	46	2	3,1	165	142,6	3,2	6,5
NN3026-AS-K-M-SP	5,79	**130**	200	52	2	3,4	182	156,4	4,8	9,5
NN3028-AS-K-M-SP	6,22	**140**	210	53	2	3,4	192	166,4	4,8	9,5
NN3030-AS-K-M-SP	7,58	**150**	225	56	2,1	3,7	206	178,8	4,8	9,5
NN3032-AS-K-M-SP	9,23	**160**	240	60	2,1	4,2	219	190,2	4,8	9,5
NN3034-AS-K-M-SP	12,5	**170**	260	67	2,1	4,5	236	204	4,8	9,5
NN3036-AS-K-M-SP	16,4	**180**	280	74	2,1	4,8	255	218,2	6,3	12,2
NN3038-AS-K-M-SP	17,3	**190**	290	75	2,1	4,8	265	228,2	6,3	12,2
NN3040-AS-K-M-SP	22,2	**200**	310	82	2,1	5,3	282	242	6,3	12,2
NN3044-AS-K-M-SP	29,1	**220**	340	90	3	4,5	310	265,2	8	15
NN3048-AS-K-M-SP	31,6	**240**	360	92	3	6	330	285,2	8	15
NN3052-AS-K-M-SP	46,2	**260**	400	104	4	6,5	364	312,8	8	15
NN3056-AS-K-M-SP	49,7	**280**	420	106	4	6,8	384	332,8	8	15
NN3060-AS-K-M-SP	68,8	**300**	460	118	4	7,5	418	360,4	9,5	17,7
NN3064-AS-K-M-SP	74,2	**320**	480	121	4	7,9	438	380,4	9,5	17,7
NN3068-AS-K-M-SP	99,3	**340**	520	133	5	8,7	473	409	9,5	17,7
NN3072-AS-K-M-SP	104	**360**	540	134	5	8,7	493	429	9,5	17,7



[1] Axial displacement “s”

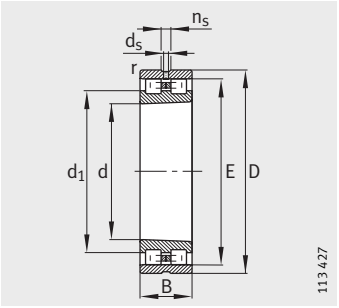


Mounting dimensions

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speeds	
d_a	D_a	D_b	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G grease	n_G oil
min.	max.	min.	max.	N	N	N	min^{-1}	min^{-1}
35	50	49	1	29 000	34 000	4 800	16 000	19 000
40	57	56	1	35 500	44 000	6 500	14 000	17 000
45	63	62	1	45 000	58 500	8 400	12 000	15 000
50	70	69	1	54 000	72 000	10 700	11 000	14 000
55	75	74	1	57 000	80 000	11 800	10 000	13 000
61	84	82	1	72 000	100 000	15 600	9 000	11 000
66	89	87	1	75 000	110 000	17 200	8 500	10 000
71	94	92	1	76 500	116 000	18 000	8 000	9 500
76	104	102	1	98 000	150 000	22 400	7 000	8 500
81	109	107	1	100 000	156 000	23 400	6 700	8 000
86	119	115	1	120 000	186 000	28 500	6 300	7 500
91	124	120	1	125 000	200 000	30 500	6 000	7 000
98	132	129	1,5	140 000	224 000	36 000	5 600	6 700
103	137	134	1,5	143 000	236 000	37 000	5 300	6 300
108	142	139	1,5	146 000	245 000	38 000	5 300	6 300
114	151	148	2	190 000	310 000	46 000	4 800	5 600
119	161	157	2	220 000	360 000	54 000	4 500	5 300
129	171	167	2	232 000	390 000	57 000	4 300	5 000
139	191	184	2	290 000	500 000	72 000	3 800	4 500
149	201	194	2	300 000	520 000	74 000	3 600	4 300
160	215	208	2,1	335 000	585 000	83 000	3 400	4 000
170	230	222	2,1	375 000	670 000	93 000	3 200	3 800
180	250	239	2,1	450 000	800 000	111 000	3 000	3 600
190	270	258	2,1	570 000	1 000 000	134 000	2 800	3 400
200	280	268	2,1	585 000	1 040 000	138 000	2 600	3 200
210	300	285	2,1	655 000	1 200 000	161 000	2 400	3 000
232	328	313	2,5	800 000	1 460 000	187 000	2 200	2 800
252	348	334	2,5	850 000	1 560 000	199 000	2 000	2 600
275	385	368	3	1 060 000	2 000 000	249 000	1 900	2 400
295	405	388	3	1 080 000	2 080 000	255 000	1 800	2 200
315	445	422	3	1 270 000	2 400 000	290 000	1 600	1 900
335	465	442	3	1 320 000	2 600 000	310 000	1 600	1 900
357	503	477	4	1 630 000	3 250 000	380 000	1 400	1 700
377	523	497	4	1 660 000	3 350 000	390 000	1 400	1 700

High precision cylindrical roller bearings

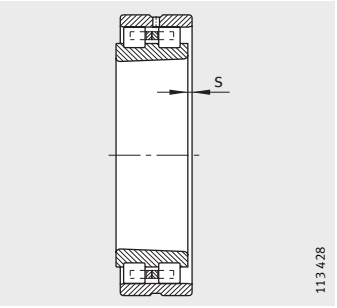
Double row
Non-locating bearings



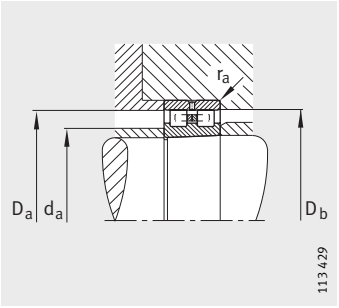
NN30..-AS-K-M-SP
Taper 1:12

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	s[1)]	E	d_1	d_s	n_s
	≈kg				min.			≈		
NN3076-AS-K-M-SP	110	**380**	560	135	5	9	513	449	9,5	17,7
NN3080-AS-K-M-SP	143	**400**	600	148	5	9,5	549	477	9,5	17,7
NN3084-AS-K-M-SP	150	**420**	620	150	5	10	569	497	9,5	17,7
NN3088-AS-K-M-SP	172	**440**	650	157	6	10,3	597	520,2	12,5	23,5
NN3092-AS-K-M-SP	197	**460**	680	163	6	10,5	624	544	12,5	23,5
NN3096-AS-K-M-SP	206	**480**	700	165	6	11	644	564	12,5	23,5
NN30/500-AS-K-M-SP	214	**500**	720	167	6	11,5	664	584	12,5	23,5

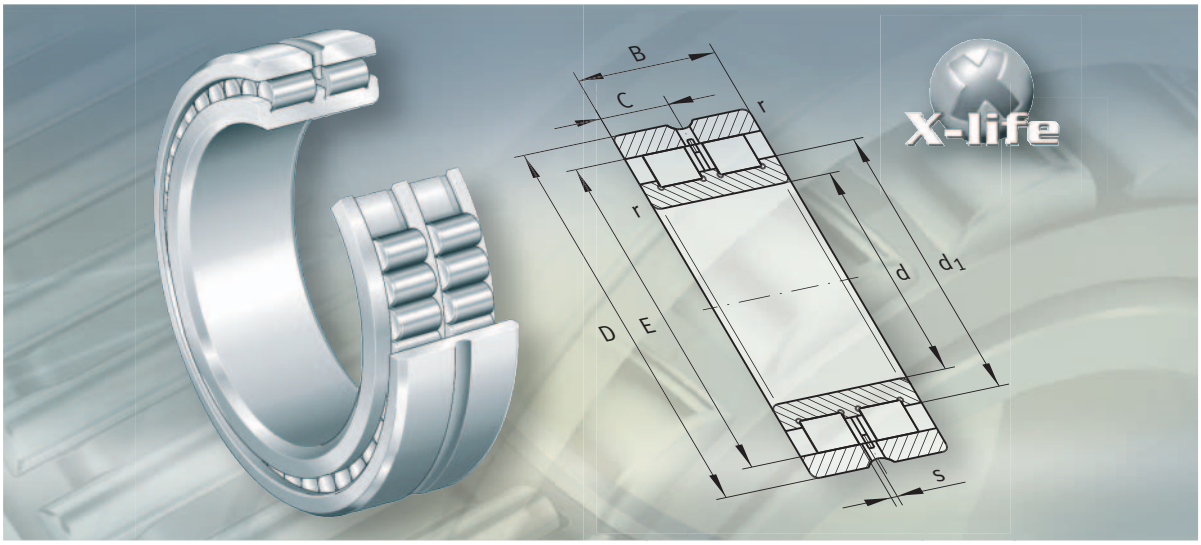


[1] Axial displacement “s”



Mounting dimensions

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speeds	
d_a	D_a	D_b	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G grease	n_G oil
min.	max.	min.	max.	N	N	N	min^{-1}	min^{-1}
397	543	517	4	1 700 000	3 450 000	400 000	1 300	1 600
417	583	553	4	2 160 000	4 500 000	490 000	1 200	1 500
437	603	573	4	2 120 000	4 500 000	490 000	1 200	1 500
463	627	601	5	2 450 000	5 100 000	550 000	1 100	1 400
483	657	628	5	2 600 000	5 400 000	590 000	1 100	1 400
503	677	648	5	2 700 000	5 850 000	630 000	1 000	1 300
523	697	668	5	2 650 000	5 850 000	620 000	1 000	1 300



Full complement cylindrical roller bearings

Full complement cylindrical roller bearings

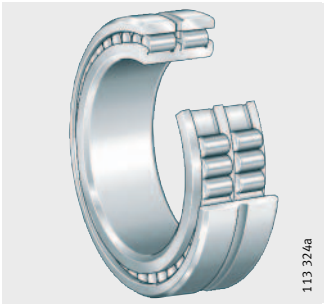
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Non-locating bearings

Double row

SL0248, SL0249



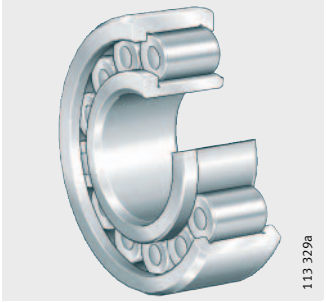
Semi-locating bearings

Single row

SL1818, SL1829, SL1830, SL1822

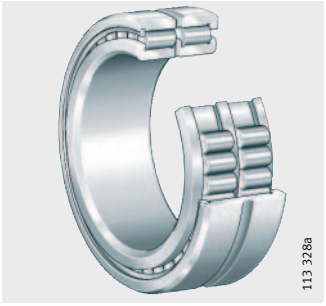


SL1923



Double row

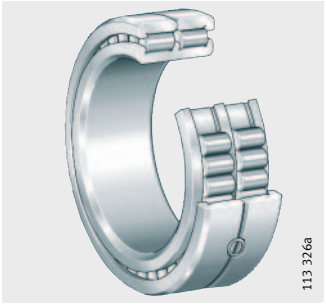
SL1850



Locating bearings

Double row

SL0148, SL0149



Full complement cylindrical roller bearings

Features

Full complement cylindrical roller bearings have solid outer and inner rings and rib-guided cylindrical rollers. Since they have the maximum possible number of rolling elements, these bearings have extremely high radial load carrying capacity and high rigidity and are suitable for particularly compact designs. Due to the kinematic conditions, however, they do not achieve the high speeds that are possible when using cylindrical roller bearings with cage.

Full complement cylindrical roller bearings are available as non-locating, semi-locating and locating bearings as well as in single and double row designs.

X-life

Numerous sizes are supplied in the X-life grade.
These bearings are indicated in the dimension tables.

Bearings of X-life quality have lower roughness R_a and higher geometrical accuracy of the raceways than comparable designs that are not X-life. As a result, they have higher load carrying capacity and longer life for the same dimensioning. In certain applications, this means that a smaller bearing arrangement can be designed.

Non-locating bearings



Bearings SL0248 (designation to DIN 5 412-9: NNCL 48..V) and bearings SL0249 (designation to DIN 5 412-9: NNCL 49..V) are double row non-locating bearings and can support radial forces only.

Axial displacement

The outer ring without ribs can be axially displaced in both directions in relation to the inner ring. The inner ring has ribs on both sides.

Caution!

The bearings are held together in handling and transport by a transport and mounting retaining device. This retaining device must not be subjected to axial load.

Sealing/lubricant

The cylindrical roller bearings are not sealed and not greased. They can be lubricated with oil or grease. For lubrication, they have a lubrication groove and lubrication holes in the outer ring.

Semi-locating bearings

Semi-locating bearings are available in single row design as SL1818 (dimension series 18), SL1829 (dimension series 29), SL1830 (dimension series 30), SL1822 (dimension series 22), SL1923 (dimension series 23)
and in double row design as SL1850 (dimension series 50).
They can support not only high radial forces but also axial forces in one direction and can therefore guide shafts axially in one direction. They act as non-locating bearings in the opposite direction.

Series SL1923 has only one rib on the inner ring. As a result, the inner ring can be removed from the bearing. This makes fitting and dismantling considerably easier.

Caution!

The bearings SL1818, SL1829, SL1830, SL1822 and SL1850 are held together in handling and transport by a transport and mounting retaining device.

This retaining device must not be subjected to axial load.

Axial displacement of inner ring

The inner ring can be axially displaced in one direction only by the dimension “s” stated in the dimension table.

Sealing/lubricant

The cylindrical roller bearings are not sealed and not greased. They can be lubricated with oil or grease. The semi-locating bearings can be lubricated via the end faces, while the double row designs can additionally be lubricated via a lubrication groove and lubrication holes in the outer ring.

Locating bearings

Cylindrical roller bearings SL0148 (designation to DIN 5 412-9: NNC 48..V) and SL0149 (designation to DIN 5 412-9: NNC 49..V) are double row locating bearings. These bearings can support axial forces from both directions as well as radial forces.

Caution! The outer ring has ribs on both sides, is axially split and held together by fasteners. The inner ring has an additional central rib.

The fasteners must not be subjected to axial load.

Sealing/lubricant

The cylindrical roller bearings are not sealed and not greased. They can be lubricated with oil or grease.

For lubrication, the outer ring has a lubrication groove and lubrication holes.

Operating temperature

Full complement cylindrical roller bearings are suitable for operating temperatures from –30 °C to +120 °C.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
BR	Black oxide coated	Special design[1)]
C3	Radial internal clearance larger than normal	Special design[1)]
C4	Radial internal clearance larger than C3	Special design[1)]
C5	Radial internal clearance larger than C4	Special design[1)]
E	Increased capacity design	Special design[1)]
RR	Corrosion-resistant design, with Corrotect® plating	Special design[1)]

1) Available by agreement.

Design and safety guidelines

Axial load carrying capacity

Radial cylindrical roller bearings used as semi-locating and locating bearings can support axial forces in one or both directions in addition to radial forces.

The axial load carrying capacity is dependent on:

- the size of the sliding surfaces between the ribs and the end faces of the rolling elements
- the sliding velocity at the ribs
- the lubrication on the contact surfaces.

Caution! Ribs subjected to load must be supported across their entire height. If severe shaft flexing is present, reversed bending stresses may occur as a result of this support. Special analysis is required in this case. The axial limiting load $F_{a\ max}$ according to the formula must not be exceeded, in order to avoid impermissible pressure at the contact surfaces.

The ratio F_a/F_r should not exceed 0,4. Continuous axial loading without simultaneous radial loading is not permissible.

Permissible and maximum axial load

$$F_{a\,per} = k_S \cdot k_B \cdot {d_M}^{1,5} \cdot n^{-0,6} \leqq F_{a\,max}$$

$$F_{a\,max} = 0,075 \cdot k_B \cdot {d_M}^{2,1}$$

$F_{a\,per}$ N
Permissible axial load

$F_{a\,max}$ N
Axial limiting load

k_S –
Factor dependent on the lubrication method, see table

k_B –
Bearing factor: see table

d_M mm
Mean bearing diameter (d + D)/2 according to dimension table

n min^{-1}
Operating speed.

Factor k_S for lubrication method

Lubrication method[1)]	k_S
Minimal heat dissipation, drip feed oil lubrication, oil mist lubrication, low operating viscosity ($\nu < 0,5 \cdot \nu_1$)	7,5 to 10
Poor heat dissipation, oil sump lubrication, oil spray lubrication, low oil flow	10 to 15
Good heat dissipation, recirculating oil lubrication (pressurised oil lubrication)	12 to 18
Very good heat dissipation, recirculating oil lubrication with oil cooling, high operating viscosity ($\nu > 2 \cdot \nu_1$)	16 to 24



1) Doped lubricating oils should be used, e.g. CLP (DIN 51 517) and HLP (DIN 51 524) of ISO VG classes 32 to 460 and ATF oils (DIN 51 502) and gearbox oils (DIN 51 512) of SAE viscosity classes 75 W to 140 W.

Bearing factor k_B

Series	k_B
SL1818, SL0148	4,5
SL1829, SL0149	11
SL1830, SL1850	17
SL1822	20
SL1923	30

Equivalent dynamic bearing load

Non-locating bearings

For bearings under dynamic loading, the following applies:

$$P = F_r$$

Semi-locating and locating bearings

If an axial force F_a is present in addition to the radial force F_r, the effect on the life must be calculated using our calculation program BEARINX®.

Equivalent static bearing load

Non-locating bearings

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

Semi-locating and locating bearings

If an axial force F_{0a} is present in addition to the radial force F_{0r}, the effect on the static load safety factor must be calculated using our calculation program BEARINX®.

Minimum radial load

In continuous operation, a minimum radial load of the order of $C_{0r}/P < 60$ is necessary.

Caution! If $C_{0r}/P > 60$, please contact us.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by force or physical locking means.

The abutting shoulders (shaft/housing) should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seating to the abutting shoulders must be designed with rounding to DIN 5 418 or an undercut to DIN 509. Note the minimum chamfer dimensions r as given in the dimension tables.

For semi-locating bearings, the bearings only require support on one side, on the rib supporting the axial load.

Caution! Full support must be provided for ribs transmitting forces in axially loaded bearings.

Accuracy

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

The radial internal clearance corresponds to internal clearance group CN.

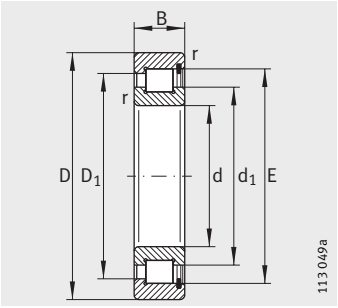
Radial internal clearance to DIN 620-4

Bore		Radial internal clearance							
d mm		CN µm		C3 µm		C4 µm		C5 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
–	24	20	45	35	60	50	75	65	90
24	30	20	45	35	60	50	75	70	95
30	40	25	50	45	70	60	85	80	105
40	50	30	60	50	80	70	100	95	125
50	65	40	70	60	90	80	110	110	140
65	80	40	75	65	100	90	125	130	165
80	100	50	85	75	110	105	140	155	190
100	120	50	90	85	125	125	165	180	220
120	140	60	105	100	145	145	190	200	245
140	160	70	120	115	165	165	215	225	275
160	180	75	125	120	170	170	220	250	300
180	200	90	145	140	195	195	250	275	330
200	225	105	165	160	220	220	280	305	365
225	250	110	175	170	235	235	300	330	395
250	280	125	195	190	260	260	330	370	440



Cylindrical roller bearings

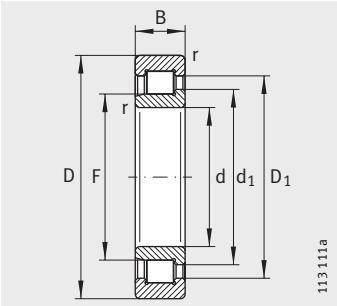
Full complement, single row
Semi-locating bearings



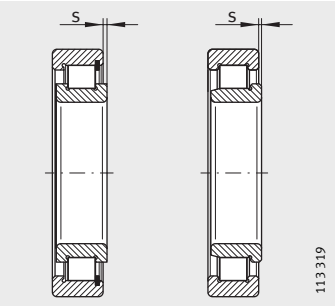
SL1829, SL1830, SL1822
Semi-locating bearings

Dimension table · Dimensions in mm

Designation		Mass	Dimensions					Mounting dimensions	
	X-life	m ≈kg	d	D	B	r min.	s[1)]	F	d_1 ≈
SL183004	**XL**	0,11	**20**	42	16	0,6	1,5	–	28,8
SL182204	**XL**	0,16	**20**	47	18	1	1	–	30,3
SL183005	**XL**	0,12	**25**	47	16	0,6	1,5	–	34,6
SL182205	**XL**	0,18	**25**	52	18	1	1	–	35,3
SL192305	–	0,37	**25**	62	24	1,1	2	31,72	36,7
SL183006	**XL**	0,2	**30**	55	19	1	2	–	40
SL182206	**XL**	0,3	**30**	62	20	1	1	–	42
SL192306	–	0,56	**30**	72	27	1,1	2	38,3	43,5
SL183007	**XL**	0,26	**35**	62	20	1	2	–	44,9
SL182207	**XL**	0,44	**35**	72	23	1,1	1	–	47
SL192307	–	0,74	**35**	80	31	1,5	2	44,68	50,7
SL183008	**XL**	0,31	**40**	68	21	1	2	–	50,5
SL182208	**XL**	0,55	**40**	80	23	1,1	1	–	54
SL192308	–	1,01	**40**	90	33	1,5	2	51,12	57,5
SL183009	**XL**	0,4	**45**	75	23	1	2	–	55,3
SL182209	**XL**	0,59	**45**	85	23	1,1	1	–	57,5
SL192309	–	1,37	**45**	100	36	1,5	3	56,1	62,5
SL183010	**XL**	0,43	**50**	80	23	1	2	–	59,1
SL182210	**XL**	0,64	**50**	90	23	1,1	1	–	64,4
SL192310	–	1,81	**50**	110	40	2	3	60,72	68,3
SL183011	**XL**	0,64	**55**	90	26	1,1	2	–	68,5
SL182211	**XL**	0,87	**55**	100	25	1,5	1	–	70
SL192311	–	2,28	**55**	120	43	2	3	67,11	75,5
SL182912	**XL**	0,29	**60**	85	16	1	1	–	69
SL183012	**XL**	0,69	**60**	95	26	1,1	2	–	71,7
SL182212	**XL**	1,18	**60**	110	28	1,5	1,5	–	76,8
SL192312	–	2,88	**60**	130	46	2,1	3	73,62	82
SL182913	**XL**	0,31	**65**	90	16	1	1	–	75,7
SL183013	**XL**	0,73	**65**	100	26	1,1	2	–	78,1
SL182213	**XL**	1,57	**65**	120	31	1,5	1,5	–	82,3
SL192313	–	3,52	**65**	140	48	2,1	3,5	80,69	90
SL182914	**XL**	0,49	**70**	100	19	1	1	–	81,2
SL183014	**XL**	1,02	**70**	110	30	1,1	3	–	81,5
SL182214	–	1,66	**70**	125	31	1,5	1,5	–	87
SL192314	–	4,33	**70**	150	51	2,1	3,5	84,14	93,5



SL1923
Semi-locating bearings

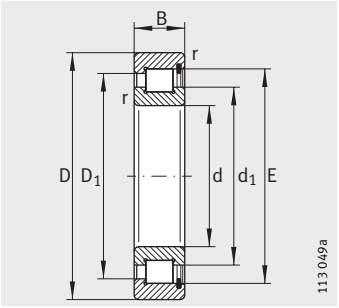


[1] Axial displacement “s”

		Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
D_1	E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈		N	N	N	min^{-1}	min^{-1}
32,8	36,81	30 500	26 500	4 450	10 500	7 400
36,9	41,47	45 500	37 500	6 100	9 700	6 500
38,5	42,51	35 000	32 500	5 500	9 000	6 200
41,9	46,52	51 000	45 000	7 400	8 400	5 500
47,5	–	73 000	60 000	9 400	7 400	4 650
45,4	49,6	45 000	43 000	7 500	7 600	5 600
50,6	55,19	70 000	65 000	10 200	7 000	4 550
56	–	100 000	88 000	14 500	6 400	3 950
51,3	55,52	55 000	55 000	9 400	6 700	4 850
59,3	63,97	88 000	79 000	12 700	6 100	4 200
65,8	–	126 000	112 000	19 000	5 600	3 700
57,1	61,74	66 000	68 000	11 200	6 000	4 300
66,3	70,94	97 000	93 000	14 900	5 400	3 600
75,2	–	170 000	156 000	27 000	5 000	3 150
62,2	66,85	70 000	76 000	12 500	5 400	4 050
69,8	74,43	101 000	99 000	16 000	5 000	3 300
80,3	–	181 000	169 000	30 000	4 450	3 000
67,7	72,33	88 000	96 000	15 100	5 000	3 550
76,7	81,4	109 000	113 000	18 100	4 650	3 000
89,7	–	232 000	219 000	38 500	4 050	2 750
78,8	83,54	120 000	136 000	22 600	4 450	3 150
84,1	88,81	140 000	150 000	25 000	4 200	2 650
99,3	–	270 000	255 000	45 500	3 700	2 550
74,4	78,55	63 000	78 000	13 700	4 450	2 800
82,1	86,74	123 000	145 000	23 700	4 200	2 950
93,9	99,17	169 000	180 000	31 000	3 800	2 550
105,8	–	285 000	280 000	50 000	3 400	2 450
81	85,24	67 000	86 000	15 100	4 200	2 600
88,4	93,09	130 000	159 000	26 000	3 950	2 700
100,7	106,25	198 000	214 000	37 000	3 500	2 410
116,5	–	350 000	355 000	63 000	3 150	3 200
87,8	92,31	88 000	114 000	18 800	3 800	2 490
95,6	100,28	153 000	176 000	29 500	3 600	2 700
105,2	111,45	184 000	227 000	32 000	3 300	2 270
121,6	–	385 000	390 000	69 000	2 950	2 110

Cylindrical roller bearings

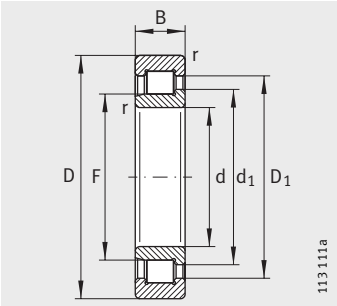
Full complement, single row
Semi-locating bearings



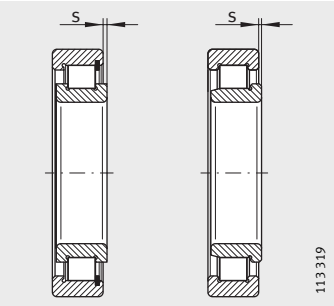
SL1829, SL1830, SL1822
Semi-locating bearings

Dimension table (continued) · Dimensions in mm

Designation		Mass	Dimensions					Mounting dimensions	
	X-life	m ≈kg	d	D	B	r min.	s[1)]	F	d_1 ≈
SL182915	**XL**	0,52	**75**	105	19	1	1	–	86,3
SL183015	**XL**	1,06	**75**	115	30	1,1	3	–	89
SL182215	–	1,75	**75**	130	31	1,5	1,5	–	91,8
SL192315	–	5,3	**75**	160	55	2,1	3,5	91,22	101,6
SL182916	**XL**	0,55	**80**	110	19	1	1	–	91,4
SL183016	–	1,43	**80**	125	34	1,1	4	–	95
SL182216	–	2,15	**80**	140	33	2	1,5	–	98,6
SL192316	–	6,32	**80**	170	58	2,1	3,5	98,24	109,5
SL182917	**XL**	0,81	**85**	120	22	1,1	1	–	96,4
SL183017	–	1,51	**85**	130	34	1,1	4	–	99,4
SL182217	–	2,74	**85**	150	36	2	1,5	–	104,4
SL192317	–	7,34	**85**	180	60	3	4	107,01	118,2
SL182918	**XL**	0,84	**90**	125	22	1,1	1	–	102
SL183018	–	1,97	**90**	140	37	1,5	4	–	106,1
SL182218	–	3,48	**90**	160	40	2	2,5	–	110,2
SL192318	–	8,83	**90**	190	64	3	4	105,26	117,5
SL182919	**XL**	0,86	**95**	130	22	1,1	1	–	106,7
SL182219	–	4,17	**95**	170	43	2,1	2,5	–	122
SL192319	–	10,2	**95**	200	67	3	4	114,65	126,6
SL182920	**XL**	1,14	**100**	140	24	1,1	1,5	–	113,4
SL183020	–	2,15	**100**	150	37	1,5	4	–	115,7
SL182220	–	5,13	**100**	180	46	2,1	2,5	–	127,5
SL192320	–	13	**100**	215	73	3	4	119,3	132,7
SL182922	**XL**	1,23	**110**	150	24	1,1	1,5	–	124
SL183022	–	3,5	**110**	170	45	2	5,5	–	127,3
SL182222	–	7,24	**110**	200	53	2,1	4	–	137
SL192322	–	17	**110**	240	80	3	5	134,27	151,1
SL182924	**XL**	1,73	**120**	165	27	1,1	1,5	–	134,8
SL183024	–	3,8	**120**	180	46	2	5,5	–	138,8
SL182224	–	9,08	**120**	215	58	2,1	4	–	150,7
SL192324	–	22,3	**120**	260	86	3	5	147,39	164,2
SL182926	**XL**	2,33	**130**	180	30	1,5	2	–	146
SL183026	–	5,65	**130**	200	52	2	5,5	–	148,6
SL182226	–	11,25	**130**	230	64	3	5	–	162,3



SL1923
Semi-locating bearings

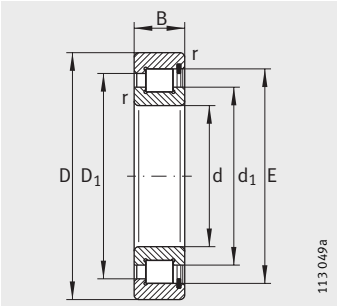


[1] Axial displacement “s”

		Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
D_1 ≈	E	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
92,8	97,41	91 000	121 000	20 100	3 600	2 340
103,2	107,9	162 000	194 000	32 500	3 400	2 500
110	116,2	190 000	241 000	33 500	3 150	2 140
131,5	–	460 000	465 000	83 000	2 750	1 980
98	102,51	94 000	129 000	21 400	3 400	2 190
111,7	117,4	173 000	225 000	31 000	3 150	2 470
119,3	126,3	226 000	285 000	38 500	2 950	2 000
142,1	–	540 000	560 000	96 000	2 600	1 840
105	109,58	118 000	162 000	25 500	3 150	2 130
116,1	121,95	178 000	237 000	32 000	3 000	2 330
126,3	133,75	255 000	325 000	44 500	2 750	1 930
150,9	–	570 000	620 000	103 000	2 450	1 740
110,7	115,75	122 000	172 000	26 500	3 000	2 010
124,5	130,65	208 000	280 000	38 000	2 800	2 220
133,3	141,15	290 000	370 000	51 000	2 600	1 900
152,5	–	620 000	660 000	112 000	2 310	1 660
117	122,25	132 000	179 000	27 500	2 900	1 910
147,3	155,95	340 000	435 000	58 000	2 450	1 800
161,9	–	650 000	720 000	120 000	2 200	1 560
125,7	130,95	152 000	206 000	31 500	2 700	1 850
134	140,2	219 000	310 000	40 500	2 600	2 010
154,3	163,35	395 000	520 000	70 000	2 310	1 700
172,8	–	790 000	860 000	143 000	2 060	1 420
136,2	141,5	155 000	220 000	34 000	2 490	1 690
149,3	156,7	285 000	395 000	52 000	2 310	1 950
168	177,6	455 000	590 000	78 000	2 090	1 660
199,9	–	950 000	980 000	156 000	1 850	1 280
149	154,3	199 000	295 000	45 500	2 270	1 550
160,7	168,15	300 000	435 000	56 000	2 160	1 820
183	192,9	540 000	730 000	95 000	1 930	1 470
213,1	–	1 130 000	1 240 000	195 000	1 710	1 110
161,1	167,15	238 000	355 000	54 000	2 090	1 470
175,5	184,4	435 000	620 000	79 000	1 960	1 590
197	207,75	630 000	860 000	110 000	1 800	1 350

Cylindrical roller bearings

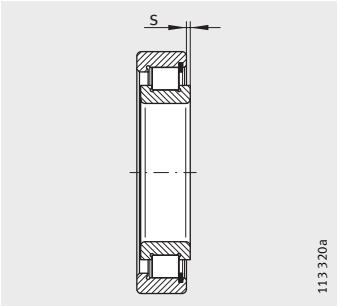
Full complement, single row
Semi-locating bearings



SL1818, SL1829, SL1830, SL1822
Semi-locating bearings

Dimension table (continued) · Dimensions in mm

Designation		Mass	Dimensions					Mounting dimensions	
	X-life	m ≈kg	d	D	B	r min.	s[1)]	d_1 ≈	D_1 ≈
SL182928	**XL**	2,42	**140**	190	30	1,5	2	157	174
SL183028	–	6,04	**140**	210	53	2	5,5	162,2	189,5
SL182228	–	14,47	**140**	250	68	3	5	173,9	211,1
SL182930	**XL**	3,77	**150**	210	36	2	2,5	169	189,6
SL183030	–	7,33	**150**	225	56	2,1	7	170	198
SL182230	–	18,43	**150**	270	73	3	6	185,5	225,2
SL182932	**XL**	4	**160**	220	36	2	2,5	179,7	200,5
SL183032	–	8,8	**160**	240	60	2,1	7	184,8	215,8
SL182232	–	23	**160**	290	80	3	6	208,7	253,4
SL182934	**XL**	4,3	**170**	230	36	2	2,5	190,6	211,3
SL183034	–	12,2	**170**	260	67	2,1	7	198,1	232,7
SL182234	–	28,65	**170**	310	86	4	7	220,3	267,4
SL182936	**XL**	6,2	**180**	250	42	2	3	200,7	224
SL183036	–	16,1	**180**	280	74	2,1	7	212,2	249,4
SL182236	–	29,8	**180**	320	86	4	7	232,4	279,5
SL182938	**XL**	6,5	**190**	260	42	2	2	211,5	238,5
SL183038	–	17	**190**	290	75	2,1	9	221,8	259
SL182238	–	35,65	**190**	340	92	4	9	243,5	295,5
SL181840	–	2,57	**200**	250	24	1,5	2	216,6	231,6
SL182940	**XL**	9,1	**200**	280	48	2,1	3	225,5	252,4
SL183040	–	21,8	**200**	310	82	2,1	9	236,6	276,2
SL182240	–	43,12	**200**	360	98	4	9	246,6	302,4
SL181844	–	2,8	**220**	270	24	1,5	2	237,3	252,3
SL182944	**XL**	9,9	**220**	300	48	2,1	3	246,3	273,2
SL183044	–	28,4	**220**	340	90	3	9	254,6	299,2
SL181848-E	–	4,29	**240**	300	28	2	2	260,5	281
SL182948	–	10,6	**240**	320	48	2,1	3	267,5	294,4
SL183048	–	30,9	**240**	360	92	3	11	277,5	322,1
SL181852-E	–	4,61	**260**	320	28	2	2	281	301,5
SL182952	–	18,5	**260**	360	60	2,1	5	291,5	323,4
SL183052	–	44,5	**260**	400	104	4	11	304	358,4
SL181856-E	–	6,89	**280**	350	33	2	2,5	304	327
SL182956	–	19,7	**280**	380	60	2,1	3,5	314	348,5
SL183056	–	48	**280**	420	106	4	11	319,5	372,9

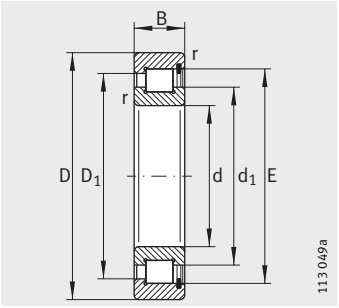


[1] Axial displacement “s”

	Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	N	N	N	min^{-1}	min^{-1}
180	260 000	385 000	57 000	1 960	1 360
198,4	455 000	680 000	85 000	1 850	1 460
222,55	720 000	1 020 000	127 000	1 660	1 190
196,75	340 000	490 000	73 000	1 800	1 340
207,45	480 000	710 000	88 000	1 730	1 380
237,35	830 000	1 180 000	146 000	1 540	1 080
207,6	350 000	520 000	77 000	1 710	1 260
225,45	550 000	820 000	99 000	1 620	1 260
267,1	1 030 000	1 490 000	178 000	1 440	950
218,45	365 000	560 000	80 000	1 620	1 180
243,55	710 000	1 070 000	129 000	1 510	1 110
281,9	1 150 000	1 680 000	199 000	1 350	870
231,85	455 000	690 000	100 000	1 510	1 120
261	820 000	1 260 000	149 000	1 410	1 010
294	1 190 000	1 780 000	204 000	1 300	820
244,15	510 000	790 000	112 000	1 440	1 010
270,6	840 000	1 320 000	155 000	1 350	960
311,5	1 310 000	1 920 000	223 000	1 220	780
237,6	183 000	330 000	33 500	1 440	1 020
261,6	610 000	960 000	134 000	1 350	930
288,6	960 000	1 530 000	178 000	1 270	880
319,4	1 420 000	2 040 000	235 000	1 160	740
258,5	192 000	365 000	36 000	1 320	920
282,45	650 000	1 050 000	144 000	1 250	830
213,1	1 160 000	1 840 000	209 000	1 160	780
287,5	265 000	490 000	51 000	1 200	900
303,7	610 000	1 140 000	124 000	1 160	750
336	1 220 000	2 010 000	224 000	1 080	710
308	275 000	530 000	54 000	1 120	820
333,7	790 000	1 470 000	160 000	1 050	680
375,97	1 620 000	2 550 000	280 000	980	610
335	355 000	670 000	69 000	1 030	750
359,5	920 000	1 740 000	184 000	980	590
390,3	1 670 000	2 700 000	290 000	930	570

Cylindrical roller bearings

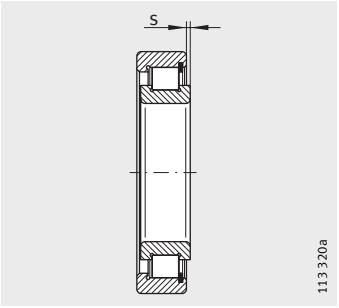
Full complement, single row
Semi-locating bearings



SL1818, SL1829, SL1830
Semi-locating bearings

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					Mounting dimensions	
	m	d	D	B	r	$s^{1)}$	d_1	D_1
	≈kg				min.		≈	≈
SL181860-E	9,79	**300**	380	38	2,1	3	323,5	350,5
SL182960	31,2	**300**	420	72	3	5	338	376,9
SL183060	66,6	**300**	460	118	4	14	353,6	415,6
SL181864-E	10,36	**320**	400	38	2,1	3	344,5	371,5
SL182964	32,9	**320**	440	72	3	5	358,5	397,4
SL183064	71,7	**320**	480	121	4	14	369,5	430,1
SL181868-E	10,93	**340**	420	38	2,1	3	365,5	392,5
SL182968	34,7	**340**	460	72	3	5	379	418,7
SL183068	95,8	**340**	520	133	5	16	396,1	463,9
SL181872-E	11,49	**360**	440	38	2,1	3	387	413,5
SL182972	36,4	**360**	480	72	3	5	399,5	438,6
SL183072	101	**360**	540	134	5	16	414	481,6
SL181876-E	18,87	**380**	480	46	2,1	4	415,5	448
SL182976	52,1	**380**	520	82	4	5	426	472,1
SL183076	106	**380**	560	135	5	16	431,7	499,5
SL181880-E	19,81	**400**	500	46	2,1	4	432	464,5
SL182980	54,3	**400**	540	82	4	5	450	496,1
SL183080	140	**400**	600	148	5	18	462,5	535,1
SL181884-E	20,6	**420**	520	46	2,1	4	457	489,5
SL182984	56,9	**420**	560	82	4	5	462	509
SL181888-E	21,54	**440**	540	46	2,1	4	473,5	506
SL182988	78,1	**440**	600	95	4	7	490	544,6
SL181892-E	33,21	**460**	580	56	3	5	501,5	541
SL182992	81,1	**460**	620	95	4	7	504	559,6
SL181896-E	34,53	**480**	600	56	3	5	522	561
SL182996	94,7	**480**	650	100	5	7	538	596,6
SL1818/500-E	35,73	**500**	620	56	3	5	542	581,5
SL1829/500	98,3	**500**	670	100	5	7	553	612,7

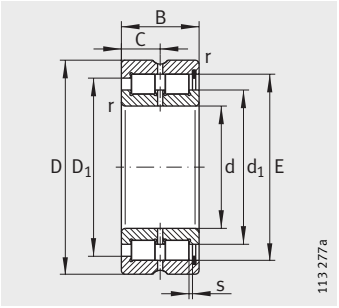


[1] Axial displacement “s”

	Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	N	N	N	min^{-1}	min^{-1}
360	455 000	840 000	86 000	950	700
389,45	1 180 000	2 230 000	235 000	900	530
434,85	2 040 000	3 350 000	325 000	850	500
381	470 000	900 000	90 000	900	640
409,85	1 220 000	2 370 000	246 000	850	485
449,5	2 100 000	3 500 000	340 000	810	475
402,2	485 000	960 000	94 000	850	600
430,2	1 260 000	2 500 000	255 000	810	455
485,65	2 500 000	4 150 000	400 000	750	430
423,5	500 000	1 010 000	98 000	810	550
450,6	1 290 000	2 650 000	265 000	770	420
503,45	2 550 000	4 350 000	410 000	720	405
459	650 000	1 290 000	126 000	750	510
486,7	1 670 000	3 350 000	335 000	720	375
521,25	2 600 000	4 500 000	425 000	690	385
475,5	660 000	1 340 000	130 000	720	475
510,85	1 730 000	3 560 000	350 000	690	350
558,52	3 100 000	5 400 000	500 000	650	345
500	680 000	1 420 000	135 000	690	450
522,95	1 750 000	3 600 000	355 000	660	335
517	700 000	1 470 000	139 000	660	420
562	2 110 000	4 150 000	405 000	620	320
554	940 000	1 890 000	174 000	620	405
576,3	2 140 000	4 300 000	410 000	600	305
474,5	960 000	1 970 000	185 000	600	385
614,75	2 410 000	4 850 000	460 000	570	280
594,5	980 000	2 050 000	190 000	580	365
630	2 450 000	5 000 000	470 000	550	265

Cylindrical roller bearings

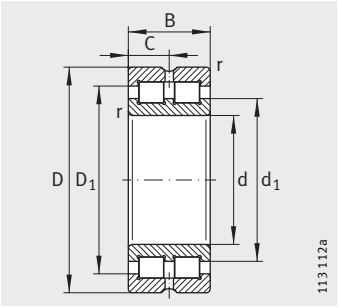
Full complement, double row
Semi-locating, locating and non-locating bearings



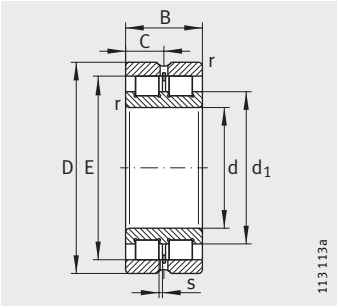
SL1850
Semi-locating bearings

Dimension table · Dimensions in mm

Semi-locating bearings Designation		Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5 412	Mass	Dimensions				
	X-life				m ≈kg	d	D	B	r min.	s
SL185004	**XL**	–	–	–	0,2	**20**	42	30	0,6	1
SL185005	**XL**	–	–	–	0,23	**25**	47	30	0,6	1
SL185006	**XL**	–	–	–	0,35	**30**	55	34	1	1,5
SL185007	**XL**	–	–	–	0,46	**35**	62	36	1	1,5
SL185008	**XL**	–	–	–	0,56	**40**	68	38	1	1,5
SL185009	**XL**	–	–	–	0,71	**45**	75	40	1	1,5
SL185010	**XL**	–	–	–	0,76	**50**	80	40	1	1,5
SL185011	**XL**	–	–	–	1,16	**55**	90	46	1,1	1,5
–	–	**SL014912**	–	NNC 4912 V	0,49	**60**	85	25	1	–
–	–	–	**SL024912**	NNCL 4912 V	0,47	**60**	85	25	1	1
SL185012	**XL**	–	–	–	1,24	**60**	95	46	1,1	1,5
SL185013	**XL**	–	–	–	1,32	**65**	100	46	1,1	1,5
–	–	**SL014914**	–	NNC 4914 V	0,78	**70**	100	30	1	–
–	–	–	**SL024914**	NNCL 4914 V	0,75	**70**	100	30	1	1
SL185014	**XL**	–	–	–	1,85	**70**	110	54	1,1	3
SL185015	**XL**	–	–	–	1,93	**75**	115	54	1,1	3
–	–	**SL014916**	–	NNC 4916 V	0,88	**80**	110	30	1	–
–	–	–	**SL024916**	NNCL 4916 V	0,85	**80**	110	30	1	1
SL185016	–	–	–	–	2,59	**80**	125	60	1,1	3,5
SL185017	–	–	–	–	2,72	**85**	130	60	1,1	3,5
–	–	**SL014918**	–	NNC 4918 V	1,35	**90**	125	35	1,1	–
–	–	–	**SL024918**	NNCL 4918 V	1,3	**90**	125	35	1,1	1,5
SL185018	–	–	–	–	3,62	**90**	140	67	1,5	4
–	–	**SL014920**	–	NNC 4920 V	1,95	**100**	140	40	1,1	–
–	–	–	**SL024920**	NNCL 4920 V	1,9	**100**	140	40	1,1	2
SL185020	–	–	–	–	3,94	**100**	150	67	1,5	4
–	–	**SL014922**	–	NNC 4922 V	2,15	**110**	150	40	1,1	–
–	–	–	**SL024922**	NNCL 4922 V	2,1	**110**	150	40	1,1	2
SL185022	–	–	–	–	6,32	**110**	170	80	2	5
–	–	**SL014924**	–	NNC 4924 V	2,95	**120**	165	45	1,1	–
–	–	–	**SL024924**	NNCL 4924 V	2,85	**120**	165	45	1,1	3
SL185024	–	–	–	–	6,77	**120**	180	80	2	5



SL0148, SL0149
Locating bearings

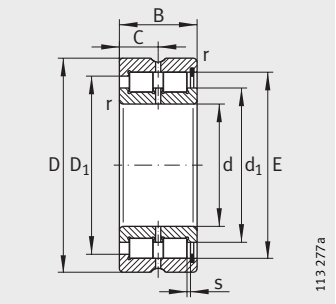


SL0248, SL0249
Non-locating bearings

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1 ≈	D_1 ≈	E	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
15	28,4	33,3	36,81	53 000	53 000	8 900	10 500	7 300
15	34,5	39	42,51	60 000	65 000	11 100	9 000	6 100
17	40	45,3	49,6	78 000	84 000	15 000	7 600	5 300
18	44,9	51,2	55,52	94 000	109 000	18 800	6 700	4 650
19	50,5	57,2	61,74	113 000	136 000	22 400	6 000	4 100
20	55,3	62,6	66,85	120 000	151 000	24 900	5 400	3 800
20	59,1	67,6	72,33	151 000	191 000	30 000	5 000	3 300
23	68,5	78,7	83,54	206 000	275 000	45 000	4 450	2 950
12,5	70,3	73,5	–	71 000	125 000	17 300	4 450	2 600
12,5	70,3	–	77,51	71 000	125 000	17 300	4 450	2 600
23	71,7	81,9	86,74	212 000	290 000	47 500	4 200	2 750
23	78,1	88,3	93,09	223 000	320 000	52 000	3 550	2 550
15	82,5	87,4	–	108 000	189 000	27 000	3 800	2 310
15	82,5	–	91,87	108 000	189 000	27 000	3 800	2 310
27	81,5	95,7	100,28	265 000	355 000	59 000	3 600	2 600
27	89	102,9	107,9	275 000	390 000	65 000	3 400	2 390
15	91,4	96,2	–	115 000	211 000	30 000	3 400	2 030
15	91,4	–	100,78	115 000	211 000	30 000	3 400	2 030
30	95	111,7	117,4	295 000	450 000	62 000	3 150	2 310
30	99	116,1	121,95	305 000	475 000	64 000	3 000	2 190
17,5	103,9	110,7	–	155 000	295 000	39 000	3 000	1 850
17,5	103	–	115,2	155 000	295 000	39 000	3 000	1 850
33,5	106,1	124,5	130,65	355 000	560 000	76 000	2 800	2 120
20	116,4	125	–	196 000	380 000	47 500	2 700	1 720
20	116,4	–	129,6	196 000	380 000	47 500	2 700	1 720
33,5	115,7	134	140,2	375 000	620 000	81 000	2 600	1 900
20	125	133,6	–	204 000	410 000	50 000	2 490	1 570
20	125	–	138,2	204 000	410 000	50 000	2 490	1 570
40	127,3	149,3	156,7	490 000	790 000	104 000	2 310	1 680
22,5	138,6	148,6	–	228 000	455 000	55 000	2 270	1 540
22,5	138,6	–	153,55	228 000	455 000	55 000	2 270	1 540
40	138,8	160,7	168,15	520 000	870 000	111 000	2 160	1 510

Cylindrical roller bearings

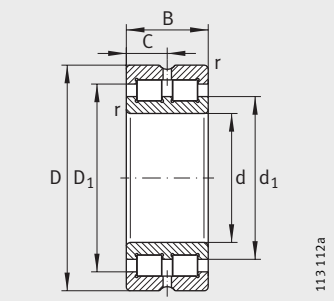
Full complement, double row
Semi-locating, locating and non-locating bearings



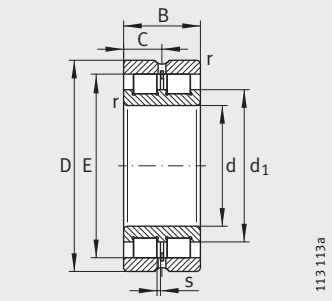
SL1850
Semi-locating bearings

Dimension table (continued) · Dimensions in mm

Semi-locating bearings Designation	Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5 412	Mass	Dimensions				
				m	d	D	B	r	s
				≈kg				min.	
–	**SL014926**	–	NNC 4926 V	3,95	**130**	180	50	1,5	–
–	–	**SL024926**	NNCL 4926 V	3,8	**130**	180	50	1,5	4
SL185026	–	–	–	10,2	**130**	200	95	2	5
–	**SL014928**	–	NNC 4928 V	4,2	**140**	190	50	1,5	–
–	–	**SL024928**	NNCL 4928 V	4,1	**140**	190	50	1,5	4
SL185028	–	–	–	11,1	**140**	210	95	2	5
–	**SL014830**	–	NNC 4830 V	2,9	**150**	190	40	1,1	–
–	–	**SL024830**	NNCL 4830 V	2,8	**150**	190	40	1,1	2
–	**SL014930**	–	NNC 4930 V	6,65	**150**	210	60	2	–
–	–	**SL024930**	NNCL 4930 V	6,45	**150**	210	60	2	4
SL185030	–	–	–	13,3	**150**	225	100	2	6
–	**SL014832**	–	NNC 4832 V	3,1	**160**	200	40	1,1	–
–	–	**SL024832**	NNCL 4832 V	3	**160**	200	40	1,1	2
–	**SL014932**	–	NNC 4932 V	7	**160**	220	60	2	–
–	–	**SL024932**	NNCL 4932 V	6,8	**160**	220	60	2	4
–	**SL014834**	–	NNC 4834 V	4,1	**170**	215	45	1,1	–
–	–	**SL024834**	NNCL 4834 V	3,95	**170**	215	45	1,1	3
–	**SL014934**	–	NNC 4934 V	7,35	**170**	230	60	2	–
–	–	**SL024934**	NNCL 4934 V	7,1	**170**	230	60	2	4
–	**SL014836**	–	NNC 4836 V	4,3	**180**	225	45	1,1	–
–	–	**SL024836**	NNCL 4836 V	4,15	**180**	225	45	1,1	3
–	**SL014936**	–	NNC 4936 V	10,8	**180**	250	69	2	–
–	–	**SL024936**	NNCL 4936 V	10,5	**180**	250	69	2	4
–	**SL014838**	–	NNC 4838 V	5,65	**190**	240	50	1,5	–
–	–	**SL024838**	NNCL 4838 V	5,45	**190**	240	50	1,5	4
–	**SL014938**	–	NNC 4938 V	11,2	**190**	260	69	2	–
–	–	**SL024938**	NNCL 4938 V	10,9	**190**	260	69	2	4
–	**SL014840**	–	NNC 4840 V	5,9	**200**	250	50	1,5	–
–	–	**SL024840**	NNCL 4840 V	5,7	**200**	250	50	1,5	4
–	**SL014940**	–	NNC 4940 V	15,8	**200**	280	80	2,1	–
–	–	**SL024940**	NNCL 4940 V	15,3	**200**	280	80	2,1	5



SL0148, SL0149
Locating bearings

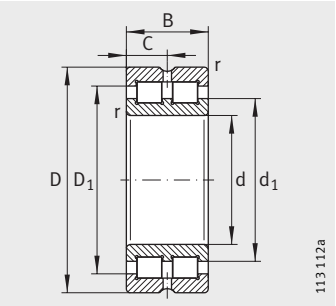


SL0248, SL0249
Non-locating bearings

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1 ≈	D_1 ≈	E	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
25	148,4	160	–	265 000	530 000	63 000	2 090	1 480
25	149,5	–	165,4	265 000	530 000	63 000	2 090	1 480
47,5	148,6	175,5	184,4	740 000	1 230 000	185 000	1 960	1 300
25	159	170,5	–	275 000	570 000	66 000	1 960	1 360
25	160	–	175,9	275 000	570 000	66 000	1 960	1 360
47,5	162,6	189,5	198,4	780 000	1 360 000	169 000	1 850	1 170
20	165,1	174,2	–	237 000	550 000	62 000	1 910	1 240
20	165,1	–	178,3	237 000	550 000	62 000	1 910	1 240
30	171,8	187,2	–	415 000	840 000	98 000	1 800	1 180
30	171,8	–	192,77	415 000	840 000	98 000	1 800	1 180
50	170	198	207,45	810 000	1 390 000	175 000	1 730	1 110
20	173,7	182,8	–	243 000	580 000	64 000	1 800	1 170
20	173,7	–	186,9	243 000	580 000	64 000	1 800	1 170
30	184,2	200,3	–	435 000	900 000	104 000	1 710	1 090
30	184,2	–	206,16	435 000	900 000	104 000	1 710	1 090
22,5	186,3	197	–	265 000	620 000	68 000	1 680	1 160
22,5	186,3	–	201,3	265 000	620 000	68 000	1 680	1 160
30	193,1	209,1	–	445 000	950 000	108 000	1 620	1 110
30	193,1	–	215,08	445 000	950 000	108 000	1 620	1 010
22,5	199,1	209,8	–	275 000	660 000	72 000	1 600	1 070
22,5	199,1	–	214,1	275 000	660 000	72 000	1 600	1 070
34,5	204,9	224,1	–	580 000	1 230 000	140 000	1 510	910
34,5	204,9	–	230,5	580 000	1 230 000	140 000	1 510	910
25	207,6	220,7	–	315 000	750 000	81 000	1 510	1 020
25	207,6	–	225	315 000	750 000	81 000	1 510	1 020
34,5	215	234,3	–	590 000	1 290 000	145 000	1 440	850
34,5	215	–	240,7	590 000	1 290 000	145 000	1 440	850
25	218,1	231,2	–	325 000	790 000	84 000	1 440	950
25	218,1	–	235,5	325 000	790 000	84 000	1 440	950
40	230,5	252,3	–	690 000	1 480 000	165 000	1 350	820
40	230,5	–	259,34	690 000	1 480 000	165 000	1 350	820

Cylindrical roller bearings

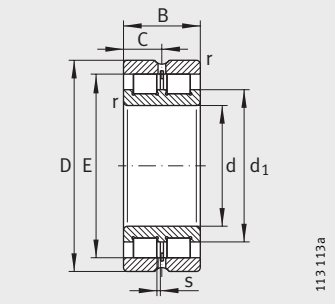
Full complement, double row
Locating and non-locating bearings



SL0148, SL0149
Locating bearings

Dimension table (continued) · Dimensions in mm

Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5 412	Mass	Dimensions				
			m	d	D	B	r	s
			≈kg				min.	
SL014844	–	NNC 4844 V	6,4	**220**	270	50	1,5	–
–	**SL024844**	NNCL 4844 V	6,2	**220**	270	50	1,5	4
SL014944	–	NNC 4944 V	17,2	**220**	300	80	2,1	–
–	**SL024944**	NNCL 4944 V	16,7	**220**	300	80	2,1	5
SL014848	–	NNC 4848 V	10	**240**	300	60	2	–
–	**SL024848**	NNCL 4848 V	9,9	**240**	300	60	2	4
SL014948	–	NNC 4948 V	18,5	**240**	320	80	2,1	–
–	**SL024948**	NNCL 4948 V	17,9	**240**	320	80	2,1	5
SL014852	–	NNC 4852 V	11	**260**	320	60	2	–
–	**SL024852**	NNCL 4852 V	10,6	**260**	320	60	2	4
SL014952	–	NNC 4952 V	32	**260**	360	100	2,1	–
–	**SL024952**	NNCL 4952 V	31,2	**260**	360	100	2,1	6
SL014856	–	NNC 4856 V	16	**280**	350	69	2	–
–	**SL024856**	NNCL 4856 V	15,6	**280**	350	69	2	4
SL014956	–	NNC 4956 V	34	**280**	380	100	2,1	–
–	**SL024956**	NNCL 4956 V	33,1	**280**	380	100	2,1	6
SL014860	–	NNC 4860 V	23	**300**	380	80	2,1	–
–	**SL024860**	NNCL 4860 V	22	**300**	380	80	2,1	6
SL014960	–	NNC 4960 V	53	**300**	420	118	3	–
–	**SL024960**	NNCL 4960 V	51,9	**300**	420	118	3	6
SL014864	–	NNC 4864 V	24	**320**	400	80	2,1	–
–	**SL024864**	NNCL 4864 V	23,5	**320**	400	80	2,1	6
SL014964	–	NNC 4964 V	56	**320**	440	118	3	–
–	**SL024964**	NNCL 4964 V	54,9	**320**	440	118	3	6
SL014868	–	NNC 4868 V	25,5	**340**	420	80	2,1	–
–	**SL024868**	NNCL 4868 V	25	**340**	420	80	2,1	6
SL014968	–	NNC 4968 V	59	**340**	460	118	3	–
–	**SL024968**	NNCL 4968 V	57,8	**340**	460	118	3	6

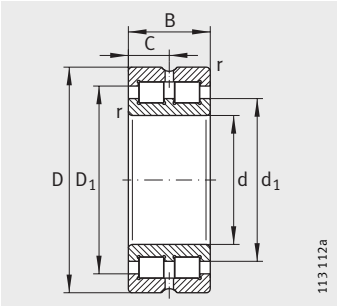


SL0248, SL0249
Non-locating bearings

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1 ≈	D_1 ≈	E	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
25	239,1	252,3	–	340 000	870 000	90 000	1 320	840
25	239,1	–	256,5	340 000	870 000	90 000	1 320	840
40	248	268,5	–	720 000	1 590 000	174 000	1 250	730
40	248	–	276,52	720 000	1 590 000	174 000	1 250	730
30	259,5	276,7	–	520 000	1 290 000	134 000	1 200	720
30	259,5	–	281,9	520 000	1 290 000	134 000	1 200	720
40	270,6	292,3	–	750 000	1 740 000	186 000	1 160	660
40	270,6	–	299,46	750 000	1 740 000	186 000	1 160	660
30	281,8	298,8	–	540 000	1 400 000	143 000	1 120	650
30	281,8	–	304,2	540 000	1 400 000	143 000	1 120	650
50	294,5	322,1	–	1 120 000	2 500 000	270 000	1 050	570
50	294,5	–	331,33	1 120 000	2 500 000	270 000	1 050	570
34,5	306,8	326,4	–	710 000	1 860 000	189 000	1 030	570
34,5	306,8	–	332,4	710 000	1 860 000	189 000	1 030	570
50	316,5	344,6	–	1 170 000	2 700 000	285 000	980	520
50	316,5	–	353,34	1 170 000	2 700 000	285 000	980	520
40	327,9	349,9	–	830 000	2 120 000	214 000	950	540
40	327,9	–	356,7	830 000	2 120 000	214 000	950	540
59	340,7	374,3	–	1 650 000	3 800 000	390 000	900	435
59	340,7	–	385,51	1 650 000	3 800 000	390 000	900	435
40	350,9	372,9	–	860 000	2 280 000	225 000	900	490
40	350,9	–	379,7	860 000	2 280 000	225 000	900	490
59	367,5	401,1	–	1 720 000	4 100 000	415 000	850	400
59	367,5	–	412,27	1 720 000	4 100 000	415 000	850	400
40	368,1	390,1	–	880 000	2 390 000	233 000	850	460
40	368,1	–	396,9	880 000	2 390 000	233 000	850	460
59	385,3	418,9	–	1 770 000	4 300 000	430 000	810	375
59	385,3	–	430,11	1 770 000	4 300 000	430 000	810	375

Cylindrical roller bearings

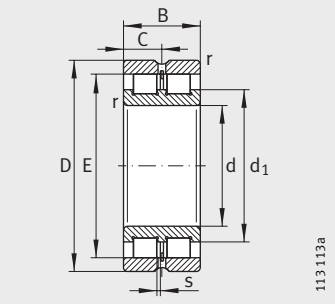
Full complement, double row
Locating and non-locating bearings



SL0148, SL0149
Locating bearings

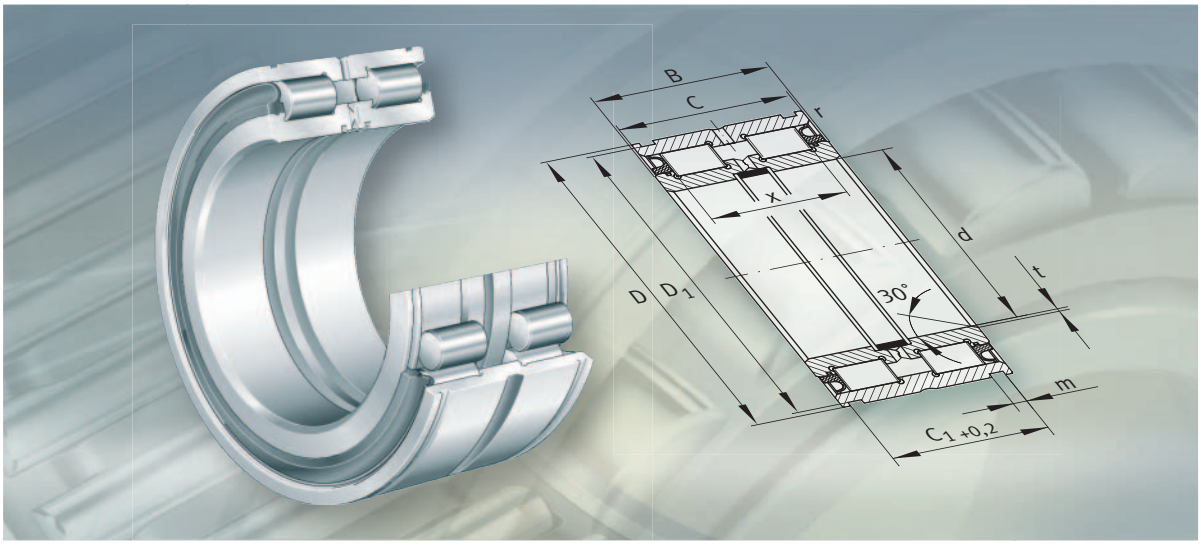
Dimension table (continued) · Dimensions in mm

Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5 412	Mass	Dimensions				
			m	d	D	B	r	s
			≈kg				min.	
SL014872	–	NNC 4872 V	27	**360**	440	80	2,1	–
–	**SL024872**	NNCL 4872 V	26	**360**	440	80	2,1	6
SL014972	–	NNC 4972 V	62,1	**360**	480	118	3	–
–	**SL024972**	NNCL 4972 V	60,8	**360**	480	118	3	6
SL014876	–	NNC 4876 V	45,5	**380**	480	100	2,1	–
–	**SL024876**	NNCL 4876 V	44	**380**	480	100	2,1	6
SL014976	–	NNC 4976 V	92,4	**380**	520	140	4	–
–	**SL024976**	NNCL 4976 V	90,5	**380**	520	140	4	7
SL014880	–	NNC 4880 V	46,5	**400**	500	100	2,1	–
–	**SL024880**	NNCL 4880 V	45,8	**400**	500	100	2,1	6
SL014980	–	NNC 4980 V	96,5	**400**	540	140	4	–
–	**SL024980**	NNCL 4980 V	94,6	**400**	540	140	4	7



SL0248, SL0249
Non-locating bearings

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1 ≈	D_1 ≈	E	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G min^{-1}	n_B min^{-1}
40	391	413,2	–	910 000	2 550 000	244 000	810	425
40	391	–	419,8	910 000	2 550 000	244 000	810	425
59	404	436,8	–	1 810 000	4 500 000	445 000	770	350
59	404	–	447,95	1 810 000	4 500 000	445 000	770	350
50	419	447,2	–	1 330 000	3 550 000	345 000	750	380
50	419	–	455,8	1 330 000	3 550 000	345 000	750	380
70	430,2	468,7	–	2 280 000	5 600 000	560 000	720	320
70	430,2	–	481,35	2 280 000	5 600 000	560 000	720	320
50	433,8	462	–	1 360 000	3 700 000	355 000	720	355
50	433,8	–	470,59	1 360 000	3 700 000	355 000	720	355
70	450,5	489	–	2 340 000	5 900 000	580 000	690	300
70	450,5	–	501,74	2 340 000	5 900 000	580 000	690	300



Full complement cylindrical roller bearings with snap ring grooves

Full complement cylindrical roller bearings with snap ring grooves

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Product overview	Full complement cylindrical roller bearings with snap ring grooves	454
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	Axial location	456
	Support of sealing rings	456
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Accuracy	Radial internal clearance	457
Dimension tables	Cylindrical roller bearings with snap ring grooves	458

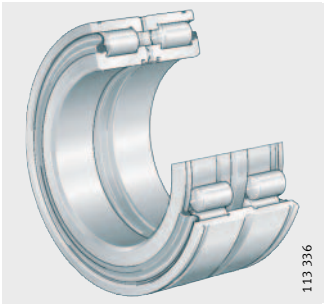


Full complement cylindrical roller bearings with snap ring grooves

Locating bearings

Lip seals

SL0450..-PP
SL04..-PP



Full complement cylindrical roller bearings with snap ring grooves

Features

Cylindrical roller bearings with snap ring grooves are full complement, double row units comprising solid outer and inner rings with ribs, rib-guided cylindrical rollers and sealing rings.

The outer rings have grooves for retaining rings.
The inner rings are axially split, 1 mm wider than the outer rings and held together by a rolled-in steel strip.

The bearings are available as a light series SL04..-PP and in the dimension series 50 as SL0450..-PP.

Locating bearings

Cylindrical roller bearings with snap ring grooves are locating bearings. These bearings are very rigid and can support axial forces in both directions as well as high radial forces.

Due to their full complement design, they have the maximum possible number of rolling elements and therefore the maximum basic dynamic and static load ratings. Due to the kinematic conditions, however, they do not achieve the high speeds that are possible when using cylindrical roller bearings with cage.

Bearings for cable sheaves

Due to the grooves in the outer rings, the bearing rings can easily be axially located. The bearings are therefore highly suitable for cable sheave bearing arrangements.



Sealing/lubricant

Sealing rings on both sides protect the running system against contamination and moisture.

The cylindrical roller bearings are greased with a lithium complex soap grease to GA08 and can be relubricated via the outer and inner ring.

Operating temperature

Caution!

The cylindrical roller bearings are suitable for operating temperatures from –20 °C to +80 °C, limited by the grease and the seal material.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
C3	Radial internal clearance larger than normal	Special design[1)]
C4	Radial internal clearance larger than C3	Special design[1)]
C5	Radial internal clearance larger than C4	Special design[1)]
P	Sealing ring on one side	Special design[1)]
PP	Sealing rings on both sides	Standard
RR	Corrosion-resistant design with Corrotect® plating	Special design[1)]
2NR	Bearings with two retaining rings WRE supplied loose	Special design[1)]
–	Without seals	Special design[1)]

1) Available by agreement.

Full complement cylindrical roller bearings with snap ring grooves

Design and safety guidelines

Radial location

The bearings normally have a circumferential load on the outer ring – for example in cable sheaves. The outer ring must therefore have a press fit.

Axial location

The abutting shoulders (shaft/housing) should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seating to the abutting shoulder must be designed with rounding to DIN 5 418 or an undercut to DIN 509.

Note the minimum chamfer dimensions r as given in the dimension tables.

Caution! The split inner ring must be axially located on both sides, *Figure 1*. The fasteners on the split inner ring must not be subjected to axial load.

Location by retaining rings

The grooves allow the outer rings to be axially located using retaining rings, *Figure 1*. Suitable fasteners are WRE rings or rings to DIN 471. Locating rings are not included in the delivery.
The design 2NR is supplied with two retaining rings WRE packed loose.

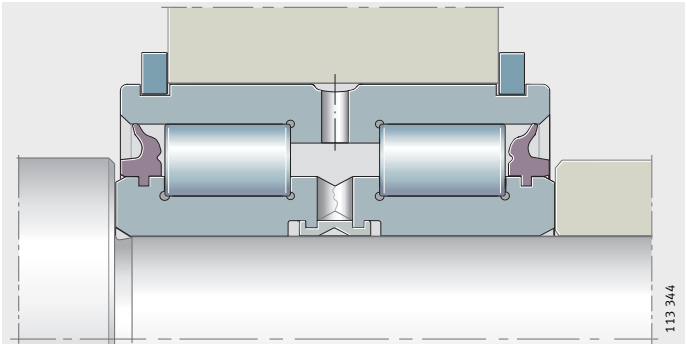


Figure 1
Axial location of inner and outer ring

Support of sealing rings

The sealing rings must be supported to a sufficient height, so that they are not pressed out during lubrication of the bearings, *Figure 2*. The dimension d_2 given in the dimension table must be observed.

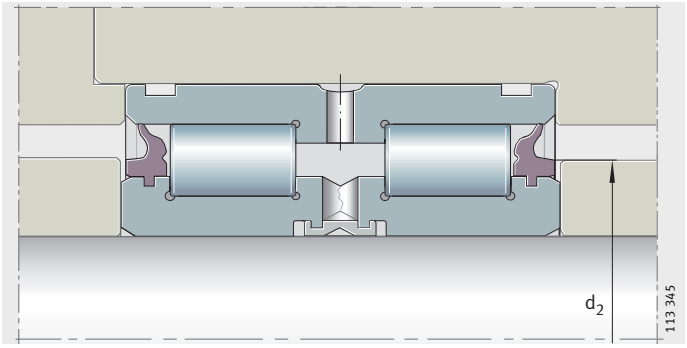


Figure 2
Support of sealing rings

Fitting and dismantling

Caution! During fitting and dismantling of the bearings, the mounting forces must never be directed through the rolling elements, sealing rings or the fasteners on the split inner ring.

Accuracy

The dimensional and geometrical tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

The radial internal clearance corresponds to internal clearance group CN.

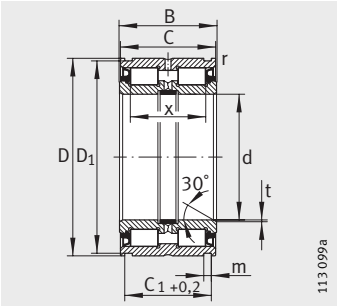
Radial internal clearance to DIN 620-4

Bore d mm		Radial internal clearance							
		CN µm		C3 µm		C4 µm		C5 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
–	24	20	45	35	60	50	75	65	90
24	30	20	45	35	60	50	75	70	95
30	40	25	50	45	70	60	85	80	105
40	50	30	60	50	80	70	100	95	125
50	65	40	70	60	90	80	110	110	140
65	80	40	75	65	100	90	125	130	165
80	100	50	85	75	110	105	140	155	190
100	120	50	90	85	125	125	165	180	220
120	140	60	105	100	145	145	190	200	245
140	160	70	120	115	165	165	215	225	275
160	180	75	125	120	170	170	220	250	300
180	200	90	145	140	195	195	250	275	330
200	225	105	165	160	220	220	280	305	365
225	250	110	175	170	235	235	300	330	395
250	280	125	195	190	260	260	330	370	440
280	315	130	205	200	275	275	350	410	485



Cylindrical roller bearings with snap ring grooves

Full complement, sealed
Locating bearings



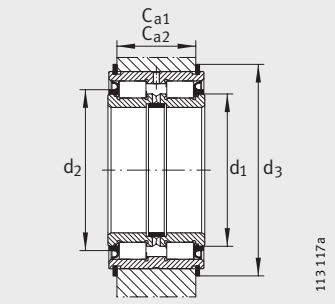
SL0450..-PP
SL04..-PP

Dimension table · Dimensions in mm

Designation	Mass	Dimensions									
	m	d	D	B	C	C_1	D_1	m	r	t	x
	≈kg						+0,2				
SL045004-PP	0,2	**20**	42	30	29	24,7	40,2	1,8	0,3	0,5	22,5
SL045005-PP	0,24	**25**	47	30	29	24,7	45,2	1,8	0,3	0,5	22,5
SL045006-PP	0,37	**30**	55	34	33	28,2	53	2,1	0,3	0,5	25,5
SL045007-PP	0,48	**35**	62	36	35	30,2	60	2,1	0,3	0,5	27,5
SL045008-PP	0,56	**40**	68	38	37	32,2	65,8	2,7	0,6	0,8	28,5
SL045009-PP	0,7	**45**	75	40	39	34,2	72,8	2,7	0,6	0,8	30,5
SL045010-PP	0,76	**50**	80	40	39	34,2	77,8	2,7	0,6	0,8	30,5
SL045011-PP	1,18	**55**	90	46	45	40,2	87,4	3,2	0,6	1	36
SL045012-PP	1,26	**60**	95	46	45	40,2	92,4	3,2	0,6	1	36
SL045013-PP	1,33	**65**	100	46	45	40,2	97,4	3,2	0,6	1	36
SL045014-PP	1,87	**70**	110	54	53	48,2	107,1	4,2	0,6	1	42
SL045015-PP	1,96	**75**	115	54	53	48,2	112,1	4,2	0,6	1	42
SL045016-PP	2,71	**80**	125	60	59	54,2	122,1	4,2	0,6	1,5	48
SL045017-PP	2,83	**85**	130	60	59	54,2	127,1	4,2	0,6	1,5	48
SL045018-PP	3,71	**90**	140	67	66	59,2	137	4,2	0,6	1,5	54
SL045019-PP	3,88	**95**	145	67	66	59,2	142	4,2	0,6	1,5	54
SL045020-PP	3,95	**100**	150	67	66	59,2	147	4,2	0,6	1,5	54
SL045022-PP	6,57	**110**	170	80	79	70,2	167	4,2	0,6	1,8	64
SL045024-PP	7,04	**120**	180	80	79	71,2	176	4,2	0,6	1,8	64
SL045026-PP	10,5	**130**	200	95	94	83,2	196	4,2	0,6	1,8	77
SL04130-PP	7,5	**130**	190	80	79	71,2	186	4,2	0,6	1,8	64
SL045028-PP	11,1	**140**	210	95	94	83,2	206	5,2	0,6	1,8	77
SL04140-PP	8	**140**	200	80	79	71,2	196	4,2	0,6	1,8	64
SL045030-PP	13,3	**150**	225	100	99	87,2	221	5,2	0,6	2	80
SL04150-PP	8,4	**150**	210	80	79	71,2	206	5,2	0,6	1,8	64
SL045032-PP	16,6	**160**	240	109	108	95,2	236	5,2	0,6	2	89
SL04160-PP	8,8	**160**	220	80	79	71,2	216	5,2	0,6	1,8	64

1) For snap rings WRE.

2) For retaining ring to DIN 471.

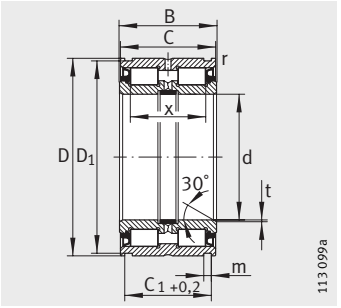


Mounting dimensions

Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Snap ring WRE	Retaining ring to DIN 471
C_{a1} [1] −0,2	C_{a2} [2] −0,2	d_1	d_2	d_3 [1]	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}		
21,5	21	30,55	34	47	40 500	49 000	6 900	4 000	WRE42	42X1,75
21,5	21	35,35	39	52	44 500	58 000	8 100	3 600	WRE47	47X1,75
25	24	40,6	44	60	50 000	67 000	9 500	3 000	WRE55	55X2
27	26	46,1	50	67	63 000	88 000	12 400	2 600	WRE62	62X2
28	27	51,4	55	75	76 000	103 000	16 000	2 400	WRE68	68X2,5
30	29	57	61	82	92 000	130 000	19 900	2 200	WRE75	75X2,5
30	29	61,8	66	87	97 000	142 000	21 700	2 000	WRE80	80X2,5
35	34	68,6	73	99	115 000	175 000	25 500	1 800	WRE90	90X3
35	34	73,7	79	104	120 000	189 000	27 500	1 700	WRE95	95X3
35	34	78,8	84	109	125 000	203 000	29 500	1 600	WRE100	100X3
43	40	84,5	91	119	168 000	265 000	36 000	1 400	WRE110	110X4
43	40	89,95	97	124	194 000	300 000	42 000	1 400	WRE115	115X4
49	46	97,1	105	137	203 000	325 000	45 000	1 300	WRE125	125X4
49	46	103,9	112	142	211 000	350 000	47 500	1 200	WRE130	130X4
54	51	109,3	118	152	305 000	510 000	69 000	1 100	WRE140	140X4
54	51	113,35	122	157	315 000	530 000	71 000	1 100	WRE145	145X4
54	51	117,35	128	162	330 000	550 000	73 000	1 000	WRE150	150X4
65	62	131,55	143	182	395 000	680 000	89 000	900	WRE170	170X4
65	63	140,9	153	196	410 000	740 000	94 000	900	WRE180	180X4
77	75	156,75	170	216	540 000	960 000	122 000	800	WRE200	200X4
65	63	150,55	160	206	430 000	790 000	99 000	800	WRE190	190X4
77	73	165,4	181	226	610 000	1 100 000	139 000	750	WRE210	210X5
65	63	159,95	170	216	445 000	840 000	104 000	750	WRE200	200X4
81	77	175,7	192	245	710 000	1 260 000	156 000	700	WRE225	225X5
65	61	174,4	185	226	465 000	920 000	111 000	700	WRE210	210X5
89	85	189	207	260	740 000	1 360 000	165 000	650	WRE240	240X5
65	61	184,05	196	236	480 000	970 000	116 000	700	WRE220	220X5

Cylindrical roller bearings with snap ring grooves

Full complement, sealed
Locating bearings



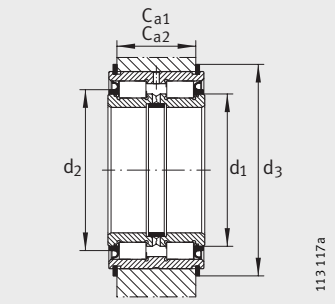
SL0450..-PP
SL04..-PP

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions									
	m	d	D	B	C	C_1	D_1	m	r	t	x
	≈kg						+0,2				
SL045034-PP	22,6	**170**	260	122	121	107,2	254	5,2	0,6	2	100
SL04170-PP	9,3	**170**	230	80	79	71,2	226	5,2	0,6	1,8	64
SL045036-PP	30,1	**180**	280	136	135	118,2	274	5,2	0,6	2	112
SL04180-PP	9,8	**180**	240	80	79	71,2	236	5,2	0,6	1,8	64
SL045038-PP	31,5	**190**	290	136	135	118,2	284	5,2	0,6	2	112
SL04190-PP	12,7	**190**	260	80	79	73,2	254	5,2	0,6	1,8	64
SL045040-PP	40,8	**200**	310	150	149	128,2	304	6,3	0,6	2	126
SL04200-PP	13,2	**200**	270	80	79	73,2	264	5,2	0,6	1,8	64
SL045044-PP	52,5	**220**	340	160	159	138,2	334	6,3	1	2	132
SL04220-PP	19,5	**220**	300	95	94	83,2	294	5,2	1	2	72
SL045048-PP	56	**240**	360	160	159	138,2	354	6,3	1	2	132
SL04240-PP	21	**240**	320	95	94	83,2	314	6,3	1	2	72
SL045052-PP	84,5	**260**	400	190	189	162,2	394	6,3	1,1	3	150
SL04260-PP	22,5	**260**	340	95	94	83,2	334	6,3	1	3	75
SL045056-PP	90	**280**	420	190	189	163,2	413	7,3	1,1	3	150
SL045060-PP	126	**300**	460	218	216	185,2	453	7,3	1,1	3	170
SL04300-PP	25,5	**300**	380	95	94	83,2	374	6,3	1	3	75

[3] For snap rings WRE.

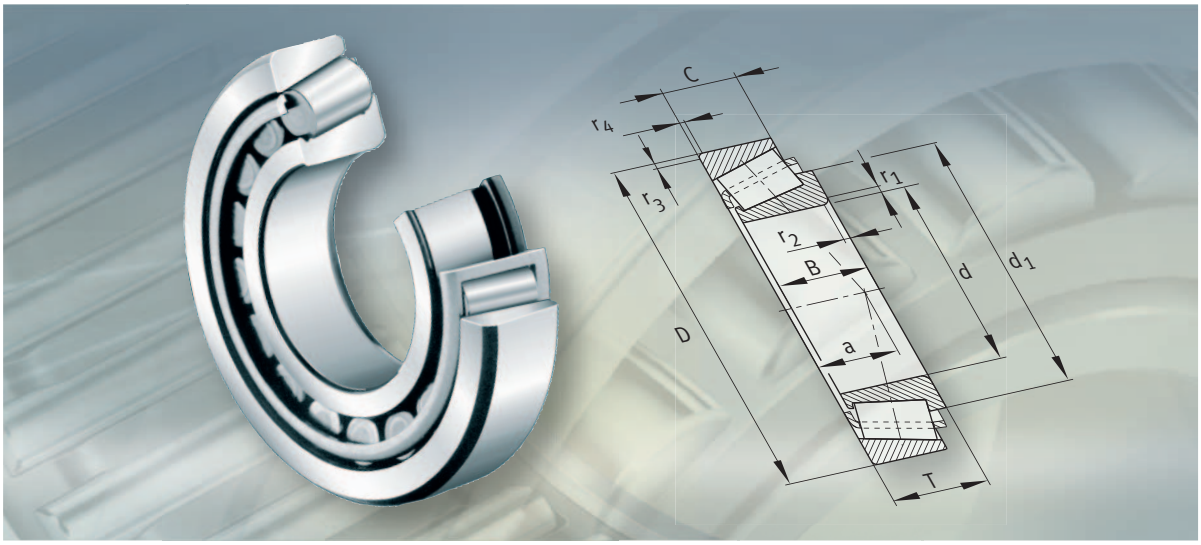
[4] For retaining ring to DIN 471.



Mounting dimensions

Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Snap ring WRE	Retaining ring to DIN 471
C_{a1} [3] −0,2	C_{a2} [4] −0,2	d_1	d_2	d_3 [3]	dyn. C_r N	stat. C_{0r} N	C_{ur} N	n_G grease min^{-1}		
99	97	200,7	220	282	960 000	1 750 000	212 000	600	WRE260	260X5
65	61	193,9	206	250	490 000	1 030 000	120 000	650	WRE230	230X5
110	108	217,8	239	302	1 140 000	2 130 000	255 000	550	WRE280	280X5
65	61	203,1	216	260	500 000	1 080 000	125 000	600	WRE240	240X5
110	108	225,65	248	312	1 160 000	2 210 000	260 000	550	WRE290	290X5
65	63	217,55	231	282	520 000	1 130 000	131 000	550	WRE260	260X5
120	116	243,05	267	336	1 350 000	2 600 000	300 000	500	WRE310	310X6
65	63	227,15	241	292	540 000	1 210 000	136 000	550	WRE270	270X5
130	126	259,85	286	366	1 570 000	3 050 000	350 000	480	WRE340	340X6
75	73	248,7	264	322	700 000	1 550 000	174 000	480	WRE300	300X5
130	126	279,25	305	386	1 630 000	3 300 000	370 000	440	WRE360	360X6
75	71	271,7	287	346	740 000	1 700 000	186 000	480	WRE320	320X6
154	150	304,95	336	426	2 380 000	4 700 000	520 000	400	WRE400	400X6
75	71	292,7	310	366	840 000	1 990 000	215 000	440	WRE340	340X6
154	149	320,95	354	453	2 600 000	5 200 000	570 000	380	WRE420	420X7
176	171	346,85	375	493	3 000 000	5 800 000	620 000	340	WRE460	460X7
75	71	328	346	406	900 000	2 250 000	234 000	380	WRE380	380X6

FAG



Tapered roller bearings

Tapered roller bearings

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Product overview Tapered roller bearings

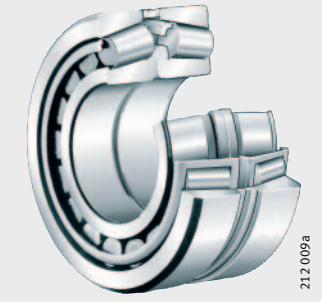
Single row

302, 303, 313, 320, 322, 323, 323..-A, 323..-B, 329, 330, 331, 332, T, K



Matched in pairs

313..-N11CA



Tapered roller bearings

Features

Tapered roller bearings comprise solid inner and outer rings with tapered raceways and tapered rollers with cages made from pressed sheet steel. The bearings are not self-retaining.
As a result, the inner ring with the rollers and the cage can be fitted separately from the outer ring.

Radial and axial load capacity

Tapered roller bearings can support axial forces in one direction and high radial forces. They must normally be axially adjusted against a second bearing fitted in a mirror image arrangement. This bearing combination is fitted in an O or X arrangement, *Figure 1*, *Figure 2*, page 467.

The axial load carrying capacity is dependent on the contact angle; i.e. the larger the angle, the higher the axial load to which the bearing can be subjected. The bearing-specific value e in the dimension tables indicates the contact angle and therefore the load carrying capacity. Bearings of series 313, 323..-B, T5ED and T7FC have a very high axial load carrying capacity due to their particularly large contact angle.

Matched bearings

Tapered roller bearings 313..-N11CA are matched in pairs in an X arrangement and can therefore support high axial forces in both directions and moment loads.

The axial internal clearance of the bearing pair is defined by a ring between the two outer rings and is indicated in the suffix, see Axial internal clearance, page 474.



Speeds for matched bearings: see page 470.

When ordering matched bearings, please state the number of bearings, not the number of bearing pairs.

Metric and inch sizes

Tapered roller bearings are available in metric and inch sizes.

Bearings with a K in the designation are inch sizes.

For new designs, bearings in metric sizes should be used in preference.

Sealing/lubrication

Tapered roller bearings are not sealed and not greased. They can be lubricated using oil or grease.

Compensation of angular misalignments

The modified line contact between the tapered rollers and the raceways ensures optimum stress distribution at the contact points, prevents edge stresses and allows the bearings to undergo angular adjustment.

At a load ratio $P/C_r \leqq 0{,}2$, the tilting of the bearing rings relative to each other must not exceed a maximum of 4 angular minutes. For higher loads or tilting angles, please contact us.

Tapered roller bearings

Operating temperature

Tapered roller bearings can be used at operating temperatures from −30 °C to +120 °C.

Bearings with an outside diameter of more than 90 mm are dimensionally stable up to +150 °C, bearings with an outside diameter of more than 120 mm up to +200 °C.

Cages

Tapered roller bearings have pressed cages made from sheet steel. Since these project laterally to a certain extent, the mounting dimensions in the dimension tables and the cage projection, page 470, must be observed.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
A	Modified internal construction	Standard
N11CA-A..	Two tapered roller bearings matched in an X arrangement, with an intermediate ring between the other rings. Axial internal clearance in µm	Standard
B	Increased contact angle	Standard
P5	Increased accuracy	Special design[1)]
X	Outer dimensions matched to international standards	Standard

[1)] Available by agreement and in certain series only.

Design and safety guidelines

Calculation of axial force

Under radial load, an internal axial force is induced in the bearing that must be supported by a second bearing and taken into consideration when calculating the equivalent bearing load.

Depending on the bearing arrangement (O or X arrangement), the axial force must first be determined for bearings adjusted clearance-free without preload, see table Load ratio and axial bearing load, *Figure 1*, *Figure 2*, page 467.

The following preconditions apply:

- The radial forces act at the central pressure points and are positive,
- Bearing A is subjected to a radial load F_{rA}, bearing B to F_{rB}
- F is an external axial force acting on bearing A.

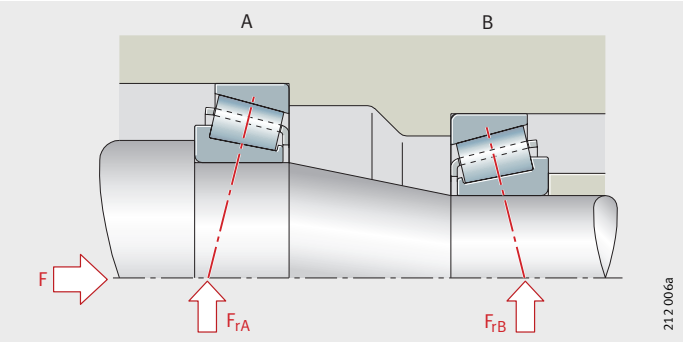


Figure 1
Bearings in O arrangement

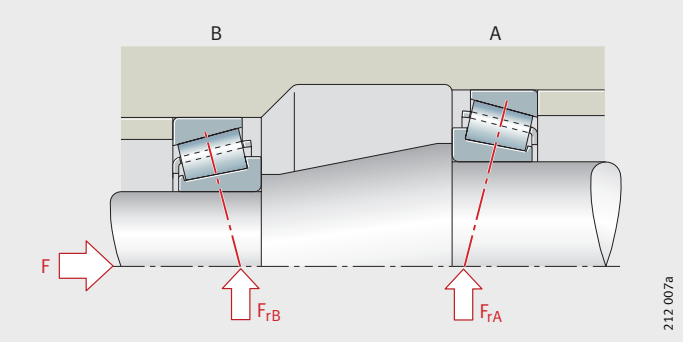


Figure 2
Bearings in X arrangement



Load ratio and axial bearing load

Load ratio		Axial force F_a [1]	
Radial bearing load	External axial force	Bearing A	Bearing B
$\frac{F_{rA}}{Y_A} \leqq \frac{F_{rB}}{Y_B}$	$F \geqq 0$	$F_a = F + 0{,}5 \cdot \frac{F_{rB}}{Y_B}$	[2]
$\frac{F_{rA}}{Y_A} > \frac{F_{rB}}{Y_B}$	$F > 0{,}5 \cdot \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	$F_a = F + 0{,}5 \cdot \frac{F_{rB}}{Y_B}$	[2]
	$F \leqq 0{,}5 \cdot \left(\frac{F_{rA}}{Y_A} - \frac{F_{rB}}{Y_B}\right)$	[2]	$F_a = 0{,}5 \cdot \frac{F_{rA}}{Y_A} - F$

1) Axial force F_a, to be used in calculation of the equivalent dynamic bearing load.
2) If no formula is given, the axial force is not taken into consideration.

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

Single bearing under dynamic load

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = 0{,}4 \cdot F_r + Y \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load
e, Y –
Factors from dimension tables.

For bearing pairs under dynamic load in an X or O arrangement:

Bearing pairs under dynamic load

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r + 1{,}12 \cdot Y \cdot F_a$
$\frac{F_a}{F_r} > e$	$P = 0{,}67 \cdot F_r + 1{,}68 \cdot Y \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load of bearing pair
F_r N
Radial dynamic bearing load of bearing pair
e, Y –
Factors for single bearings from dimension tables.

For matched bearing pairs 313..-N11CA under dynamic load:

Matched bearing pairs under dynamic load

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r + Y_1 \cdot F_a$
$\frac{F_a}{F_r} > e$	$P = 0{,}67 \cdot F_r + Y_2 \cdot F_a$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load of bearing pair
F_r N
Radial dynamic bearing load of bearing pair
e, Y_1, Y_2 –
Factors for bearing pairs from dimension tables.

Equivalent static bearing load

For single bearings under static load, the following applies:

Single bearing under static load

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leqq \frac{1}{2 \cdot Y_0}$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > \frac{1}{2 \cdot Y_0}$	$P_0 = 0{,}5 \cdot F_{0r} + Y_0 \cdot F_{0a}$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load
Y_0 –
Factor from dimension tables.

For bearing pairs under static load in an X or O arrangement:

Bearing pairs under static load

$$P_0 = F_{0r} + 2 \cdot Y_0 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load of bearing pair
F_{0r} N
Radial static bearing load of bearing pair
Y_0 –
Factor for single bearings from dimension tables.



For matched bearing pairs 313..-N11CA under static load:

Matched bearing pairs under static load

$$P_0 = F_{0r} + Y_0 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load of bearing pair
F_{0r} N
Radial static bearing load of bearing pair
Y_0 –
Factor for bearing pairs from dimension tables.

Tapered roller bearings

Basic dynamic and static load ratings for bearing pairs

If two bearings of the same size and design are fitted immediately adjacent to each other in an O or X arrangement, the basic dynamic load rating C_r and basic static load rating C_{0r} of the bearing pair are as follows:

- $C_r = 1{,}715 \cdot C_{r\ \text{single bearing}}$
- $C_{0r} = 2 \cdot C_{0r\ \text{single bearing}}$

Matched bearings

For matched bearing pairs 313..-N11CA, the basic dynamic and static load ratings are given in the dimension tables.

Minimum radial load

In order to ensure slippage-free operation, the bearings must be subjected to a minimum radial load. This applies particularly in the case of high speeds and high accelerations. In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}01$ is necessary for roller bearings with cage.

Speeds

Caution!

The limiting speeds n_G given in the dimension tables must not be exceeded.

Matched bearings

For matched bearings 313..-N11CA, the operating speed is approximately 20% below the calculated permissible operating speed of the single bearing.

The limiting speed n_G is possible if the less favourable thermal balance of the bearing pair is taken into consideration in the operating conditions.

Cage projection

Caution!

The cages project laterally to a certain extent. In order to prevent grazing, the lateral minimum distances C_a and C_b in the dimension tables must be taken into consideration in the design of the adjacent construction.

Accuracy
Tapered roller bearings in metric sizes

The main dimensions of the bearings conform to DIN ISO 355 and DIN 720.

The dimensional and geometrical tolerances conform to DIN 620-2.

Tapered roller bearings with width tolerance to tolerance class PN

Tapered roller bearings 303, 313, 313..-N11CA, 322, 323..-A, 323..-B, T2EE, T4CB, T4DB, T5ED and T7FC correspond to tolerance class PN.

Bearings 320, 329, 330, 331 and 332 for shaft diameters over 200 mm also have width tolerances to tolerance class PN.

Inner ring tolerances, Part 1

Bore mm d		Bore deviation µm Δ_{dmp}		Variation µm		Radial runout µm K_{ia}
				V_{dp}	V_{dmp}	
over	incl.	max.	min.	max.	max.	max.
10	18	0	−12	12	9	15
18	30	0	−12	12	9	18
30	50	0	−12	12	9	20
50	80	0	−15	15	11	25
80	120	0	−20	20	15	30
120	180	0	−25	25	19	35
180	250	0	−30	30	23	50
250	315	0	−35	35	26	60
315	400	0	−40	40	30	70



Inner ring tolerances, Part 2

Bore mm d		Width deviation µm Δ_{Bs}		Width deviation µm Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	incl.	max.	min.	max.	min.	max.	min.	max.	min.
10	18	0	−120	+200	0	+100	0	+100	0
18	30	0	−120	+200	0	+100	0	+100	0
30	50	0	−120	+200	0	+100	0	+100	0
50	80	0	−150	+200	0	+100	0	+100	0
80	120	0	−200	+200	−200	+100	−100	+100	−100
120	180	0	−250	+350	−250	+150	−150	+200	−100
180	250	0	−300	+350	−250	+150	−150	+200	−100
250	315	0	−350	+350	−250	+150	−150	+200	−100
315	400	0	−400	+400	−400	+200	−200	+200	−200

Outer ring tolerances

Outside diameter mm D		Outside diameter deviation µm Δ_{Dmp}		Variation µm V_{Dp}	V_{Dmp}	Radial runout µm K_{ea}
over	incl.	max.	min.	max.	max.	max.
18	30	0	–12	12	9	18
30	50	0	–14	14	11	20
50	80	0	–16	16	12	25
80	120	0	–18	18	14	35
120	150	0	–20	20	15	40
150	180	0	–25	25	19	45
180	250	0	–30	30	23	50
250	315	0	–35	35	26	60
315	400	0	–40	40	30	70
400	500	0	–45	45	34	80

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

Tapered roller bearings with width tolerance to tolerance class P6X

Tapered roller bearings 320, 329, 330, 331 and 332 for shaft diameters up to 200 mm have restricted width tolerances to tolerance class P6X.

Inner ring tolerances, Part 1

Bore mm d		Bore deviation µm Δ_{dmp}		Variation µm V_{dp}	V_{dmp}	Radial runout µm K_{ia}
over	incl.	max.	min.	max.	max.	max.
10	18	0	–12	12	9	15
18	30	0	–12	12	9	18
30	50	0	–12	12	9	20
50	80	0	–15	15	11	25
80	120	0	–20	20	15	30
120	180	0	–25	25	19	35
180	200	0	–30	30	23	50

Inner ring tolerances, Part 2

Bore mm d		Width deviation µm Δ_{Bs}		Width deviation µm Δ_{Ts}		Δ_{T1s}		Δ_{T2s}	
over	incl.	max.	min.	max.	min.	max.	min.	max.	min.
10	18	0	–50	+100	0	+50	0	+50	0
18	30	0	–50	+100	0	+50	0	+50	0
30	50	0	–50	+100	0	+50	0	+50	0
50	80	0	–50	+100	0	+50	0	+50	0
80	120	0	–50	+100	0	+50	0	+50	0
120	180	0	–50	+150	0	+50	0	+100	0
180	200	0	–50	+150	0	+50	0	+100	0

Outer ring tolerances

Outside diameter mm D		Outside diameter deviation µm Δ_{Dmp}		Variation µm V_{Dp}	V_{Dmp}	Radial runout µm K_{ea}	Width deviation µm Δ_{Cs}	
over	incl.	max.	min.	max.	max.	max.	max.	min.
30	50	0	–14	14	11	20	0	–100
50	80	0	–16	16	12	25	0	–100
80	120	0	–18	18	14	35	0	–100
120	150	0	–20	20	15	40	0	–100
150	180	0	–25	25	19	45	0	–100
180	250	0	–30	30	23	50	0	–100
250	315	0	–35	35	26	60	0	–100

Total width tolerance of matched bearings

The tolerance for the total width of the bearing pair 313..-N11CA is determined from the axial internal clearance and the deviations of the width Δ_{Ts} of the single bearings, see Inner ring tolerances, Part 2 on page 471.

Tapered roller bearings in inch sizes

Tapered roller bearings of series K in inch sizes are manufactured as standard with normal tolerances to ANSI/ABMA.

The width deviation Δ_{Bs} and radial runout correspond to tolerance class PN in accordance with DIN 620-2.

In contrast to the metric bearings, bearings in inch sizes have plus tolerances on the bore and outside diameter.



Inner ring tolerances, Part 1

Bore mm d		Bore deviation µm Δ_{dmp}		Width deviation µm Δ_{Ts}	
over	incl.	max.	min.	max.	min.
–	81	+13	0	+200	0
81	102	+25	0	+200	0

Inner ring tolerances, Part 2

Bore mm d		Width deviation (in relation to bore) µm Δ_{Bs}		Radial runout µm K_{ia}
over	incl.	max.	min.	
10	18	0	–120	15
18	30	0	–120	18
30	50	0	–120	20
50	80	0	–150	25
80	120	0	–200	30

Outer ring tolerances

Outside diameter mm D		Outside diameter deviation µm Δ_{Dmp}		Radial runout µm K_{ea}
over	incl.	max.	min.	
18	30	+25	0	18
30	50	+25	0	20
50	80	+25	0	25
80	120	+25	0	35
120	150	+25	0	40

Chamfer dimensions for bearings in inch sizes

The values for the chamfer dimensions r apply to tapered roller bearings in inch sizes. Values for metric tapered roller bearings: see page 123.

Limit values for chamfer dimensions r_{max} for the inner ring

Nominal bearing bore diameter d mm		Chamfer dimension[1]	
		r_1 mm	r_2 mm
over	incl.		
–	50,8	+0,4	+0,9
50,8	101,6	+0,5	+1,25
101,6	254	+0,65	+1,8

1) $\overline{r_{min}}$: see dimension tables.

Limit values for chamfer dimensions r_{max} for the outer ring

Nominal bearing bore diameter d mm		Chamfer dimension[1]	
		r_3 mm	r_4 mm
over	incl.		
–	101,6	+0,6	+1,05
101,6	168,3	+0,65	+1,15
168,3	266,7	+0,85	+1,35
266,7	355,6	+1,7	+1,7

1) $\overline{r_{min}}$: see dimension tables.

Axial internal clearance

In tapered roller bearings, the axial internal clearance is the result of mounting against a second bearing during installation.

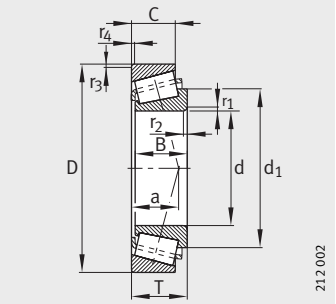
Matched bearings

The axial internal clearance is defined by an intermediate ring and is indicated in the suffix. Example: A80-120 indicates that the axial internal clearance of the bearing pair before fitting is between 80 µm and 120 µm.

Once bearing pairs are fitted, the preset axial internal clearance is reduced by the fit conditions and the axial clamping forces.

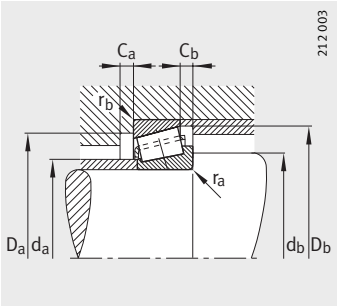


Tapered roller bearings



Dimension table · Dimensions in mm

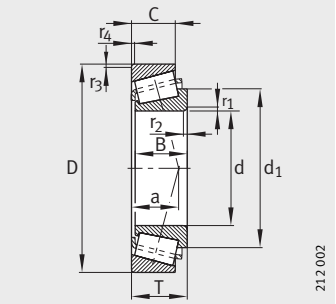
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
30202-A	–	0,054	**15**	35	11	10	11,75	0,6	0,6	8	26,4	20	19	29
30302-A	T2FB015	0,096	**15**	42	13	11	14,25	1	1	10	28,2	22	21	36
30203-A	T2DB017	0,056	**17**	40	12	11	13,25	1	1	10	29,1	23	23	34
32203-A	T2DD017	0,105	**17**	40	16	14	17,25	1	1	11	28,7	22	23	34
30303-A	T2FB017	0,129	**17**	47	14	12	15,25	1	1	11	31,6	25	23	40
32303-A	T2FD017	0,18	**17**	47	19	16	20,25	1	1	12	31,5	24	23	39
32004-X	T3CC020	0,108	**20**	42	15	12	15	0,6	0,6	10	33	25	25	36
30204-A	T2DB020	0,092	**20**	47	14	12	15,25	1	1	11	34,5	27	26	40
31304	–	0,174	**20**	52	15	11	16,25	1,5	1,5	16	37,3	27	27	40
30304-A	T2FB020	0,188	**20**	52	15	13	16,25	1,5	1,5	11	36,1	28	27	44
32304-A	T2FD020	0,241	**20**	52	21	18	22,25	1,5	1,5	14	35,3	27	27	43
32005-X	T4CC025	0,12	**25**	47	15	11,5	15	0,6	0,6	12	38	30	30	40
30205-A	T3CC025	0,155	**25**	52	15	13	16,25	1	1	13	38,5	31	31	44
32205-A	T2CD025	0,186	**25**	52	18	16	19,25	1	1	14	40,2	31	31	44
33205	T2DE025	0,214	**25**	52	22	18	22	1	1	14	39,6	30	31	43
31305-A	T7FB025	0,297	**25**	62	17	13	18,25	1,5	1,5	20	46,3	34	32	47
30305-A	T2FB025	0,289	**25**	62	17	15	18,25	1,5	1,5	13	42,3	34	32	54
32305-A	T2FD025	0,362	**25**	62	24	20	25,25	1,5	1,5	16	42,3	33	32	53
320/28-X	T4CC028	0,156	**28**	52	16	12	16	1	1	13	41	33	34	45
32006-X	T4CC030	0,195	**30**	55	17	13	17	1	1	14	44,1	35	36	48
30206-A	T3DB030	0,237	**30**	62	16	14	17,25	1	1	14	45,6	37	36	53
32206-A	T3DC030	0,274	**30**	62	20	17	21,25	1	1	16	45,9	37	36	52
33206	T2DE030	0,394	**30**	62	25	19,5	25	1	1	16	46,1	36	36	53
31306-A	T7FB030	0,441	**30**	72	19	14	20,75	1,5	1,5	24	54	40	37	55
30306-A	T2FB030	0,445	**30**	72	19	16	20,75	1,5	1,5	15	49,3	40	37	62
32306-A	T2FD030	0,587	**30**	72	27	23	28,75	1,5	1,5	18	49,3	39	37	59
320/32-X	T4CC032	0,188	**32**	58	17	13	17	1	1	14	46,5	38	38	50
32007-X	T4CC035	0,257	**35**	62	18	14	18	1	1	15	50	40	41	54
30207-A	T3DB035	0,334	**35**	72	17	15	18,25	1,5	1,5	15	52,7	44	42	62
32207-A	T3DC035	0,482	**35**	72	23	19	24,25	1,5	1,5	18	53,9	43	42	61
33207	T2DE035	0,585	**35**	72	28	22	28	1,5	1,5	18	53	42	42	61
31307-A	T7FB035	0,582	**35**	80	21	15	22,75	2	1,5	26	59,9	44	44	62
30307-A	T2FB035	0,573	**35**	80	21	18	22,75	2	1,5	16	55,2	45	44	70
32307-B	T5FE035	0,802	**35**	80	31	25	32,75	2	1,5	25	59,8	42	44	61
32307-A	T2FE035	0,741	**35**	80	31	25	32,75	2	1,5	20	55,2	44	44	66



Mounting dimensions

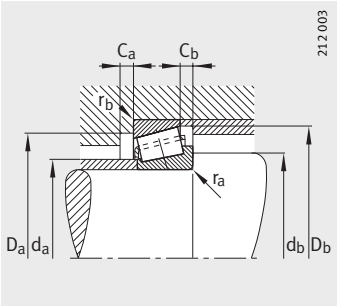
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
29	32	2	1,5	0,6	0,6	14 200	13 500	0,35	1,73	0,95	1 320	24 000	13 500
36	38	2	3	1	1	22 900	20 300	0,29	2,11	1,16	2 110	20 000	12 500
34	37	2	2	1	1	18 500	17 800	0,35	1,74	0,96	1 890	20 000	12 100
34	37	3	3	1	1	28 500	29 000	0,31	1,92	1,06	3 250	20 000	10 800
41	42	2	3	1	1	27 500	24 500	0,29	2,11	1,16	2 600	18 000	11 200
41	43	3	4	1	1	36 000	35 000	0,29	2,11	1,16	4 050	18 000	10 400
37	39	3	3	0,6	0,6	23 500	27 500	0,37	1,6	0,88	3 000	18 000	9 200
41	43	2	3	1	1	26 500	26 500	0,35	1,74	0,96	2 900	17 000	10 500
45	48	3	5	1,5	1,5	30 000	29 500	0,73	0,82	0,45	3 300	14 000	10 100
45	47	2	3	1,5	1,5	34 000	32 000	0,3	2	1,1	3 600	15 000	9 800
45	47	3	4	1,5	1,5	45 500	47 500	0,3	2	1,1	5 600	15 000	9 300
42	44	3	3,5	0,6	0,6	26 000	33 000	0,43	1,39	0,77	3 550	15 000	7 700
46	48	2	3	1	1	32 000	34 500	0,37	1,6	0,88	3 900	14 000	9 100
46	48	3	3	1	1	39 500	43 500	0,36	1,67	0,92	5 100	14 000	8 100
46	49	4	4	1	1	48 500	58 000	0,35	1,71	0,94	6 900	14 000	7 200
55	59	3	5	1,5	1,5	37 000	38 000	0,83	0,73	0,4	4 400	12 000	8 700
55	57	2	3	1,5	1,5	47 000	45 000	0,3	2	1,1	5 100	13 000	8 200
55	57	3	5	1,5	1,5	62 000	65 000	0,3	2	1,1	7 800	13 000	7 900
46	49	3	4	1	1	33 500	40 000	0,43	1,39	0,77	4 550	13 000	7 000
49	52	3	4	1	1	37 500	45 500	0,43	1,39	0,77	5 300	13 000	6 700
56	57	2	3	1	1	43 500	47 500	0,37	1,6	0,88	5 500	12 000	7 400
56	59	3	4	1	1	53 000	62 000	0,37	1,6	0,88	7 400	12 000	6 700
56	59	5	5,5	1	1	65 000	77 000	0,34	1,76	0,97	9 400	11 000	6 300
65	68	3	6,5	1,5	1,5	45 000	46 500	0,83	0,73	0,4	5 300	10 000	7 800
65	66	3	4,5	1,5	1,5	60 000	61 000	0,31	1,9	1,05	6 900	10 000	7 200
65	66	4	5,5	1,5	1,5	81 000	90 000	0,31	1,9	1,05	10 800	10 000	6 900
52	55	3	4	1	1	38 500	47 500	0,45	1,32	0,73	5 600	12 000	6 300
56	59	4	4	1	1	45 500	57 000	0,45	1,32	0,73	6 700	11 000	5 900
65	67	3	3	1,5	1,5	53 000	58 000	0,37	1,6	0,88	6 800	10 000	6 400
65	67	3	5,5	1,5	1,5	70 000	83 000	0,37	1,6	0,88	10 200	10 000	5 900
65	68	5	6	1,5	1,5	86 000	105 000	0,35	1,7	0,93	12 800	10 000	5 500
71	76	4	7,5	2	1,5	60 000	64 000	0,83	0,73	0,4	7 400	9 000	6 900
71	74	3	4,5	2	1,5	75 000	78 000	0,31	1,9	1,05	8 600	9 500	6 600
71	76	4	7,5	2	1,5	96 000	117 000	0,55	1,1	0,6	14 300	9 000	6 300
71	74	4	7,5	2	1,5	101 000	114 000	0,31	1,9	1,05	13 600	9 500	6 400

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

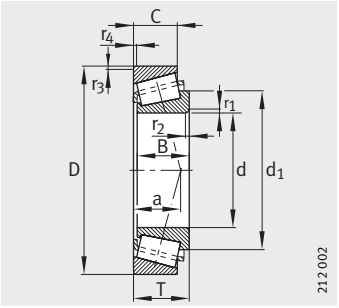
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32008-XA	T3CD040	0,312	**40**	68	19	14,5	19	1	1	15	55	46	46	60
33108	T2CE040	0,541	**40**	75	26	20,5	26	1,5	1,5	18	58,7	47	47	65
30208-A	T3DB040	0,435	**40**	80	18	16	19,75	1,5	1,5	17	58,4	49	47	69
32208-A	T3DC040	0,551	**40**	80	23	19	24,75	1,5	1,5	19	59,2	48	47	68
33208	T2DE040	0,741	**40**	80	32	25	32	1,5	1,5	21	60,1	47	47	67
31308-A	T7FB040	0,727	**40**	90	23	17	25,25	2	1,5	30	68,2	51	49	71
30308-A	T2FB040	0,812	**40**	90	23	20	25,25	2	1,5	20	63,3	52	49	77
32308-A	T2FD040	1,06	**40**	90	33	27	35,25	2	1,5	23	63,3	50	49	73
32308-B	T5FD040	1,18	**40**	90	33	27	35,25	2	1,5	28	67	50	49	69
32009-XA	T3CC045	0,329	**45**	75	20	15,5	20	1	1	17	62	51	51	67
33009	T2CE045	0,432	**45**	75	24	19	24	1	1	16	61,8	51	51	67
33109	T3CE045	0,597	**45**	80	26	20,5	26	1,5	1,5	19	63,8	52	52	69
30209-A	T3DB045	0,47	**45**	85	19	16	20,75	1,5	1,5	18	64	54	52	74
32209-A	T3DC045	0,57	**45**	85	23	19	24,75	1,5	1,5	20	64,8	53	52	73
33209	T3DE045	0,895	**45**	85	32	25	32	1,5	1,5	22	66,2	52	52	72
T7FC045	–	0,933	**45**	95	26,5	20	29	2,5	2,5	33	73,6	53	59	71
31309-A	T7FB045	0,998	**45**	100	25	18	27,25	2	1,5	32	75,8	56	54	79
30309-A	T2FB045	1	**45**	100	25	22	27,25	2	1,5	21	70,7	59	54	86
32309-BA	T5FD045	1,48	**45**	100	36	30	38,25	2	1,5	30	74,2	55	54	76
32309-A	T2FD045	1,43	**45**	100	36	30	38,25	2	1,5	25	71,1	56	54	82
32010-X	T3CC050	0,384	**50**	80	20	15,5	20	1	1	18	67,5	56	56	72
33010	T2CE050	0,47	**50**	80	24	19	24	1	1	17	65,8	56	56	72
33110	T3CE050	0,604	**50**	85	26	20	26	1,5	1,5	20	69,1	56	57	74
30210-A	T3DB050	0,603	**50**	90	20	17	21,75	1,5	1,5	20	68,8	58	57	79
32210-A	T3DC050	0,602	**50**	90	23	19	24,75	1,5	1,5	21	70	58	57	78
33210	T3DE050	0,971	**50**	90	32	24,5	32	1,5	1,5	23	71,8	57	57	77
T7FC050	–	1,38	**50**	105	29	22	32	3	3	36	81,3	59	65	78
31310-A	T7FB050	1,23	**50**	110	27	19	29,25	2,5	2	35	81,4	62	60	87
30310-A	T2FB050	1,27	**50**	110	27	23	29,25	2,5	2	23	77,6	65	60	95
32310-B	T5FD050	1,9	**50**	110	40	33	42,25	2,5	2	33	82,6	60	60	83
32310-A	T2FD050	1,9	**50**	110	40	33	42,25	2,5	2	29	78,4	62	60	90



Mounting dimensions

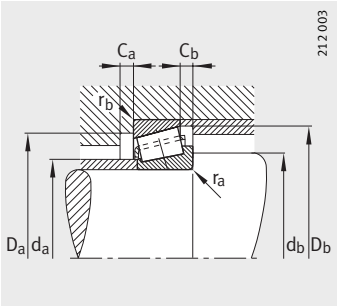
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
62	65	4	4,5	1	1	52 000	68 000	0,38	1,58	0,87	8 300	10 000	5 200
68	71	4	5,5	1,5	1,5	78 000	103 000	0,36	1,69	0,93	12 800	9 000	4 900
73	74	3	3,5	1,5	1,5	61 000	66 000	0,37	1,6	0,88	7 600	9 000	5 900
73	75	3	5,5	1,5	1,5	79 000	93 000	0,37	1,6	0,88	11 200	9 000	5 300
73	76	5	7	1,5	1,5	105 000	134 000	0,36	1,68	0,92	16 600	8 500	5 100
81	86	4	8	2	1,5	76 000	83 000	0,83	0,73	0,4	9 400	7 500	6 200
81	82	3	5	2	1,5	92 000	103 000	0,35	1,74	0,96	11 900	8 000	5 800
81	82	4	8	2	1,5	121 000	148 000	0,35	1,74	0,96	17 900	8 000	5 600
81	85	4	8	2	1,5	121 000	151 000	0,55	1,1	0,6	18 200	7 500	5 500
69	72	4	4,5	1	1	60 000	84 000	0,39	1,53	0,84	10 200	9 000	4 700
69	71	4	5	1	1	70 000	101 000	0,29	2,04	1,12	12 600	9 000	4 450
73	77	4	5,5	1,5	1,5	83 000	114 000	0,38	1,57	0,86	14 300	8 500	4 450
78	80	3	4,5	1,5	1,5	70 000	82 000	0,4	1,48	0,81	9 600	8 000	5 400
78	80	3	5,5	1,5	1,5	82 000	99 000	0,4	1,48	0,81	12 000	8 000	4 900
78	81	5	7	1,5	1,5	107 000	146 000	0,39	1,56	0,86	18 200	8 000	4 650
83	91	5	9	2,5	2,5	88 000	107 000	0,87	0,69	0,38	12 900	7 000	5 600
91	95	4	9	2	1,5	95 000	107 000	0,83	0,73	0,4	12 600	6 700	5 500
91	92	3	5	2	1,5	112 000	127 000	0,35	1,74	0,96	14 800	7 000	5 200
91	94	5	8	2	1,5	147 000	192 000	0,55	1,1	0,6	23 500	7 000	5 000
91	93	4	8	2	1,5	155 000	194 000	0,35	1,74	0,96	23 900	7 000	4 950
74	77	4	4,5	1	1	62 000	91 000	0,42	1,42	0,78	11 100	8 000	4 300
74	76	4	5	1	1	74 000	111 000	0,32	1,9	1,04	13 900	8 000	4 100
78	82	4	6	1,5	1,5	85 000	120 000	0,41	1,46	0,8	15 100	7 500	4 100
83	85	3	4,5	1,5	1,5	79 000	95 000	0,42	1,43	0,79	11 300	7 500	5 000
83	85	3	5,5	1,5	1,5	87 000	109 000	0,42	1,43	0,79	13 200	7 500	4 700
83	87	5	7,5	1,5	1,5	114 000	162 000	0,41	1,45	0,8	20 400	7 000	4 200
91	100	5	10	3	3	106 000	132 000	0,87	0,69	0,38	16 000	6 300	5 300
100	104	4	10	2,5	2	109 000	123 000	0,83	0,73	0,4	14 600	6 300	5 100
100	102	4	6	2,5	2	130 000	148 000	0,35	1,74	0,96	17 600	6 300	4 800
100	103	5	9	2,5	2	165 000	223 000	0,55	1,1	0,6	28 000	6 300	4 650
100	102	5	9	2,5	2	187 000	237 000	0,35	1,74	0,96	29 500	6 300	4 550

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

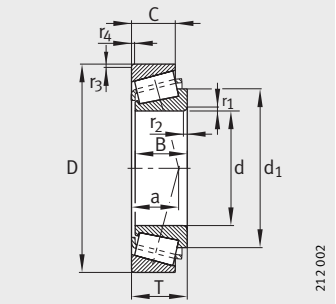
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32011-X	T3CC055	0,64	**55**	90	23	17,5	23	1,5	1,5	20	75,8	63	62	81
33011	T2CE055	0,673	**55**	90	27	21	27	1,5	1,5	19	74,2	63	62	81
33111	T3CE055	0,894	**55**	95	30	23	30	1,5	1,5	22	76,2	62	62	83
30211-A	T3DB055	0,92	**55**	100	21	18	22,75	2	1,5	21	76,5	64	64	88
32211-A	T3DC055	0,87	**55**	100	25	21	26,75	2	1,5	23	76,2	63	64	87
33211	T3DE055	1,17	**55**	100	35	27	35	2	1,5	26	78,8	62	64	85
T7FC055	–	1,8	**55**	115	31	23,5	34	3	3	40	89	65	72	86
31311-A	T7FB055	1,57	**55**	120	29	21	31,5	2,5	2	39	88	68	65	94
30311-A	T2FB055	1,8	**55**	120	29	25	31,5	2,5	2	25	84,7	71	65	104
32311-B	T5FD055	2,47	**55**	120	43	35	45,5	2,5	2	36	89,6	65	65	91
32311-A	T2FD055	2,4	**55**	120	43	35	45,5	2,5	2	30	85	68	65	99
32012-X	T4CC060	0,614	**60**	95	23	17,5	23	1,5	1,5	21	80	67	67	85
33012	T2CE060	0,714	**60**	95	27	21	27	1,5	1,5	20	78,6	67	67	85
33112	T3CE060	1,01	**60**	100	30	23	30	1,5	1,5	23	81,3	67	67	88
30212-A	T3EB060	0,919	**60**	110	22	19	23,75	2	1,5	22	82,3	70	69	96
32212-A	T3EC060	1,18	**60**	110	28	24	29,75	2	1,5	24	82,8	69	69	95
33212	T3EE060	1,55	**60**	110	38	29	38	2	1,5	28	86,2	69	69	93
T2EE060	–	1,85	**60**	115	39	33	40	2,5	2,5	28	86,1	70	73	98
T7FC060	–	2,05	**60**	125	33,5	26	37	3	3	42	96,5	71	78	94
31312-A	T7FB060	1,94	**60**	130	31	22	33,5	3	2,5	41	95,6	73	72	103
30312-A	T2FB060	2,02	**60**	130	31	26	33,5	3	2,5	26	92,1	77	72	112
32312-BA	T5FD060	3,15	**60**	130	46	37	48,5	3	2,5	39	97	71	72	100
32312-A	T2FD060	3,19	**60**	130	46	37	48,5	3	2,5	32	92,1	74	72	107
32013-X	T4CC065	0,62	**65**	100	23	17,5	23	1,5	1,5	23	85,2	72	72	90
33013	T2CE065	0,766	**65**	100	27	21	27	1,5	1,5	21	84,6	72	72	89
33113	T3DE065	1,31	**65**	110	34	26,5	34	1,5	1,5	26	89,6	73	72	96
30213-A	T3EB065	1,27	**65**	120	23	20	24,75	2	1,5	23	90	77	74	106
32213-A	T3EC065	1,49	**65**	120	31	27	32,75	2	1,5	27	91	76	74	104
T5ED065	–	1,91	**65**	120	38	31	39	4	2,5	35	95,9	74	80	95
33213	T3EE065	2,02	**65**	120	41	32	41	2	1,5	30	92,5	74	74	102
31313-A	T7GB065	2,36	**65**	140	33	23	36	3	2,5	44	102,6	79	77	111
30313-A	T2GB065	2,4	**65**	140	33	28	36	3	2,5	28	99,6	83	77	122
32313-BA	T5GD065	3,7	**65**	140	48	39	51	3	2,5	42	104,3	77	77	109
32313-A	T2GD065	3,61	**65**	140	48	39	51	3	2,5	34	99,6	80	77	117



Mounting dimensions

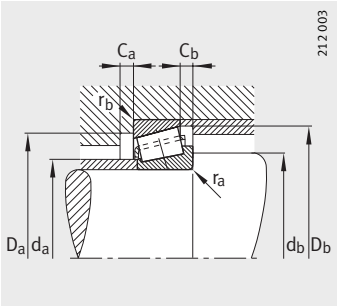
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
83	86	4	5,5	1,5	1,5	79 000	116 000	0,41	1,48	0,81	14 500	7 000	4 000
83	86	5	6	1,5	1,5	93 000	141 000	0,31	1,92	1,06	17 900	7 000	3 750
88	91	5	7	1,5	1,5	113 000	163 000	0,37	1,6	0,88	20 400	6 700	3 800
91	94	4	4,5	2	1,5	91 000	107 000	0,4	1,48	0,81	12 400	6 700	4 600
91	95	4	5,5	2	1,5	110 000	137 000	0,4	1,48	0,81	16 200	6 700	4 100
91	96	6	8	2	1,5	138 000	193 000	0,4	1,5	0,83	24 300	6 700	3 950
101	109	5	10,5	3	3	128 000	164 000	0,87	0,69	0,38	20 000	5 600	4 800
110	113	4	10,5	2,5	2	122 000	137 000	0,83	0,73	0,4	16 300	5 600	4 850
110	111	4	6,5	2,5	2	151 000	174 000	0,35	1,74	0,96	20 600	6 000	4 500
110	112	5	10,5	2,5	2	193 000	265 000	0,55	1,1	0,6	33 000	5 600	4 350
110	111	5	10,5	2,5	2	211 000	270 000	0,35	1,74	0,96	33 500	6 000	4 300
88	91	4	5,5	1,5	1,5	80 000	121 000	0,43	1,39	0,77	15 100	6 700	3 750
88	90	5	6	1,5	1,5	95 000	147 000	0,33	1,83	1,01	18 700	6 700	3 500
93	96	5	7	1,5	1,5	116 000	171 000	0,4	1,51	0,83	21 500	6 300	3 550
101	103	4	4,5	2	1,5	102 000	121 000	0,4	1,48	0,81	14 000	6 300	4 200
101	104	4	5,5	2	1,5	133 000	170 000	0,4	1,48	0,81	20 600	6 000	3 800
101	105	6	9	2	1,5	169 000	237 000	0,4	1,48	0,82	29 500	6 000	3 600
103	108	7	7	2,5	2,5	189 000	250 000	0,33	1,8	0,99	31 500	6 000	3 800
111	119	6	11	3	3	150 000	195 000	0,82	0,73	0,4	24 300	5 300	4 500
118	123	5	11,5	3	2,5	147 000	169 000	0,83	0,73	0,4	20 100	5 300	4 450
118	120	5	7,5	3	2,5	176 000	204 000	0,35	1,74	0,96	24 200	5 300	4 350
118	122	6	11,5	3	2,5	224 000	310 000	0,55	1,1	0,6	38 500	5 300	4 050
118	120	6	11,5	3	2,5	242 000	310 000	0,35	1,74	0,96	38 500	5 300	4 000
93	97	4	5,5	1,5	1,5	81 000	124 000	0,46	1,31	0,72	15 800	6 300	3 550
93	96	5	6	1,5	1,5	98 000	158 000	0,35	1,72	0,95	20 300	6 300	3 250
103	106	6	7,5	1,5	1,5	148 000	222 000	0,39	1,55	0,85	28 500	6 000	3 300
111	113	4	4,5	2	1,5	119 000	142 000	0,4	1,48	0,81	16 600	5 600	3 850
111	115	4	5,5	2	1,5	156 000	200 000	0,4	1,48	0,81	24 500	5 600	3 600
108	115	6	8	4	2,5	160 000	234 000	0,56	1,07	0,59	29 500	5 300	3 600
111	115	6	9	2	1,5	203 000	285 000	0,39	1,54	0,85	35 500	5 600	3 350
128	132	5	13	3	2,5	165 000	191 000	0,83	0,73	0,4	22 400	5 000	4 300
128	130	5	8	3	2,5	201 000	236 000	0,35	1,74	0,96	27 000	5 000	3 950
128	133	6	12	3	2,5	250 000	345 000	0,55	1,1	0,6	43 500	5 000	3 800
128	130	6	12	3	2,5	275 000	350 000	0,35	1,74	0,96	43 500	5 000	3 800

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

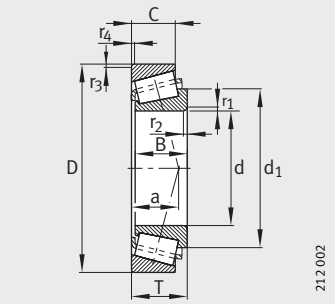
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32014-X	T4CC070	0,967	**70**	110	25	19	25	1,5	1,5	24	92	78	77	98
33014	T2CE070	1,14	**70**	110	31	25,5	31	1,5	1,5	22	91	78	77	99
33114	T3DE070	1,71	**70**	120	37	29	37	2	1,5	28	96	79	79	104
30214-A	T3EB070	1,31	**70**	125	24	21	26,25	2	1,5	25	95,4	81	79	110
32214-A	T3EC070	1,82	**70**	125	31	27	33,25	2	1,5	28	96	80	79	108
33214	T3EE070	2,06	**70**	125	41	32	41	2	1,5	31	97,9	79	79	107
T7FC070	–	2,66	**70**	140	35,5	27	39	3	3	47	109,6	81	90	106
31314-A	T7GB070	2,9	**70**	150	35	25	38	3	2,5	47	109	84	82	118
30314-A	T2GB070	3,02	**70**	150	35	30	38	3	2,5	30	106,6	89	82	130
32314-BA	T5GD070	4,52	**70**	150	51	42	54	3	2,5	44	112	83	82	117
32314-A	T2GD070	4,27	**70**	150	51	42	54	3	2,5	37	106,6	86	82	125
32015-X	T4CC075	0,922	**75**	115	25	19	25	1,5	1,5	25	97,3	83	82	103
33015	T2CE075	1,16	**75**	115	31	25,5	31	1,5	1,5	23	96,4	83	82	104
33115	T3DE075	1,79	**75**	125	37	29	37	2	1,5	30	101,4	84	84	109
30215-A	T4DB075	1,55	**75**	130	25	22	27,25	2	1,5	27	100,1	86	84	115
32215-A	T4DC075	1,93	**75**	130	31	27	33,25	2	1,5	29	101,6	85	84	115
33215	T3EE075	2,47	**75**	130	41	31	41	2	1,5	32	104,5	83	84	111
T7FC075	–	3,23	**75**	150	38	29	42	3	3	51	116,2	87	96	114
31315	T7GB075	3,79	**75**	160	37	26	40	3	2,5	50	115,8	91	87	127
30315-A	T2GB075	3,64	**75**	160	37	31	40	3	2,5	32	114	95	87	139
32315-B	T5GD075	5,7	**75**	160	55	45	58	3	2,5	47	120,4	90	87	124
32315-A	T2GD075	5,37	**75**	160	55	45	58	3	2,5	39	114	91	87	133
32016-X	T3CC080	1,29	**80**	125	29	22	29	1,5	1,5	27	103,6	89	87	112
33016	T2CE080	1,67	**80**	125	36	29,5	36	1,5	1,5	26	102,6	90	87	112
33116	T3DE080	1,9	**80**	130	37	29	37	2	1,5	31	106,6	89	89	114
30216-A	T3EB080	1,68	**80**	140	26	22	28,25	2,5	2	28	106,9	91	90	124
32216-A	T3EC080	2,36	**80**	140	33	28	35,25	2,5	2	31	107,5	90	90	122
33216	T3EE080	2,93	**80**	140	46	35	46	2,5	2	35	111,8	89	90	119
T7FC080	–	4	**80**	160	41	31	45	3	3	54	125	93	103	121
31316	T7GB080	4,19	**80**	170	39	27	42,5	3	2,5	53	122,4	97	92	134
30316-A	T2GB080	4,34	**80**	170	39	33	42,5	3	2,5	34	121,7	102	92	148
32316-B	T5GD080	7,02	**80**	170	58	48	61,5	3	2,5	49	126,9	96	92	130
32316-A	T2GD080	6,57	**80**	170	58	48	61,5	3	2,5	42	122	98	92	142



Mounting dimensions

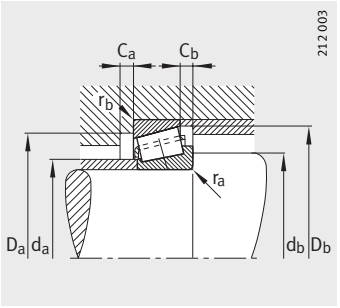
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
103	105	5	6	1,5	1,5	103 000	157 000	0,43	1,38	0,76	20 000	5 600	3 250
103	105	5	5,5	1,5	1,5	134 000	220 000	0,28	2,11	1,16	28 500	5 600	3 050
111	115	6	8	2	1,5	174 000	260 000	0,38	1,58	0,87	33 000	5 300	3 150
116	118	4	5	2	1,5	130 000	160 000	0,42	1,43	0,79	19 000	5 300	3 700
116	119	4	6	2	1,5	163 000	214 000	0,42	1,43	0,79	26 500	5 300	3 400
116	120	7	9	2	1,5	210 000	300 000	0,41	1,47	0,81	38 000	5 300	3 150
126	133	6	12	3	3	178 000	240 000	0,87	0,69	0,38	29 000	4 800	4 000
138	141	5	13	3	2,5	190 000	223 000	0,83	0,73	0,4	26 000	4 800	4 000
138	140	5	8	3	2,5	227 000	270 000	0,35	1,74	0,96	31 000	4 800	3 750
138	143	7	12	3	2,5	290 000	400 000	0,55	1,1	0,6	49 500	4 800	3 600
138	140	6	12	3	2,5	315 000	410 000	0,35	1,74	0,96	49 500	4 800	3 500
108	110	5	6	1,5	1,5	104 000	163 000	0,46	1,31	0,72	20 900	5 600	3 350
108	110	6	5,5	1,5	1,5	137 000	229 000	0,3	2,01	1,11	30 000	5 600	2 850
116	120	6	8	2	1,5	178 000	275 000	0,4	1,51	0,83	34 500	5 300	2 950
115	124	4	5	2	1,5	137 000	172 000	0,44	1,38	0,76	20 300	5 300	3 600
121	124	4	6	2	1,5	171 000	229 000	0,44	1,38	0,76	28 000	5 000	3 200
121	125	7	10	2	1,5	206 000	310 000	0,43	1,4	0,77	39 000	5 000	3 000
136	143	6	13	3	3	201 000	275 000	0,87	0,69	0,38	33 000	4 800	3 800
148	151	6	14	3	2,5	204 000	238 000	0,83	0,73	0,4	27 500	4 500	3 850
148	149	5	9	3	2,5	255 000	300 000	0,35	1,74	0,96	34 500	4 500	3 550
148	151	7	14	3	2,5	335 000	475 000	0,55	1,1	0,6	58 000	4 500	3 350
148	149	7	13	3	2,5	360 000	475 000	0,35	1,74	0,96	57 000	4 500	3 300
117	120	6	7	1,5	1,5	136 000	209 000	0,42	1,42	0,78	26 000	5 000	2 950
117	119	6	6,5	1,5	1,5	174 000	285 000	0,28	2,16	1,19	37 000	5 000	2 800
121	126	6	8	2	1,5	188 000	300 000	0,42	1,44	0,79	37 000	5 000	2 750
130	132	4	6	2,5	2	154 000	191 000	0,42	1,43	0,79	21 900	5 000	3 350
130	134	5	7	2,5	2	198 000	260 000	0,42	1,43	0,79	31 000	5 000	3 050
130	135	7	11	2,5	2	249 000	380 000	0,43	1,41	0,78	47 000	4 800	2 900
146	152	7	14	3	3	228 000	315 000	0,87	0,69	0,38	37 500	4 500	3 600
158	159	6	15,5	3	2,5	228 000	270 000	0,83	0,73	0,4	30 500	4 500	3 650
158	159	5	9,5	3	2,5	290 000	350 000	0,35	1,74	0,96	39 500	4 500	3 300
158	160	7	13,5	3	2,5	360 000	510 000	0,55	1,1	0,6	61 000	4 300	3 250
158	159	7	13,5	3	2,5	405 000	540 000	0,35	1,74	0,96	64 000	4 500	3 200

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

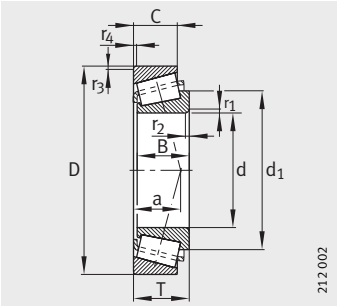
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32017-X	T4CC085	1,36	**85**	130	29	22	29	1,5	1,5	29	109,5	94	92	117
33017	T2CE085	1,75	**85**	130	36	29,5	36	1,5	1,5	26	108,5	94	92	118
33117	T3DE085	2,38	**85**	140	41	32	41	2,5	2	33	114,2	95	95	122
30217-A	T3EB085	2,29	**85**	150	28	24	30,5	2,5	2	30	114,4	97	95	132
32217-A	T3EC085	2,72	**85**	150	36	30	38,5	2,5	2	34	114,6	96	95	130
33217	T3EE085	3,58	**85**	150	49	37	49	2,5	2	37	117,8	95	95	128
T7FC085	–	0,578	**85**	170	45	33	48	4	4	55	131,1	100	110	131
31317	T7GB085	4,88	**85**	180	41	28	44,5	4	3	55	129,3	103	99	143
30317-A	T2GB085	4,83	**85**	180	41	34	44,5	3	3	36	127,6	107	99	156
32317-B	T5GD085	7,86	**85**	180	60	49	63,5	4	3	51	133,9	102	99	138
32317-A	T2GD085	7,5	**85**	180	60	49	63,5	4	3	44	128	103	99	150
32018-XA	T3CC090	1,76	**90**	140	32	24	32	2	1,5	30	115,3	100	99	125
33018	T2CE090	2,48	**90**	140	39	32,5	39	2	1,5	28	116	100	99	127
33118	T3DE090	3,19	**90**	150	45	35	45	2,5	2	36	121,5	100	100	130
30218-A	T3FB090	2,64	**90**	160	30	26	32,5	2,5	2	32	121,3	103	100	140
32218-A	T3FC090	3,78	**90**	160	40	34	42,5	2,5	2	36	122	102	100	138
T7FC090	–	5,09	**90**	175	45	33	48	4	4	58	136,3	104	114	134
31318	T7GB090	5,5	**90**	190	43	30	46,5	4	3	58	135,9	109	104	151
30318-A	T2GB090	5,83	**90**	190	43	36	46,5	4	3	37	135	113	104	165
32318-A	T2GD090	8,51	**90**	190	64	53	67,5	4	3	47	137,4	108	104	157
32919	T2BC095	0,825	**95**	130	23	18	23	1,5	1,5	23	113	102	102	121
32019-XA	T4CC095	1,86	**95**	145	32	24	32	2	1,5	32	121	105	104	130
33019	T2CE095	2,33	**95**	145	39	32,5	39	2	1,5	29	120,2	104	104	131
30219-A	T3FB095	3,13	**95**	170	32	27	34,5	3	2,5	34	128	110	107	149
32219-A	T3FC095	4,24	**95**	170	43	37	45,5	3	2,5	39	129,6	108	107	145
31319-A	T7GB095	7,08	**95**	200	45	32	49,5	4	3	61	142,5	114	109	157
30319-A	T2GB095	6,77	**95**	200	45	38	49,5	4	3	40	139	118	109	172
32319-A	T2GD095	10,3	**95**	200	67	55	71,5	4	3	49	141	115	109	166
32020-X	T4CC100	1,94	**100**	150	32	24	32	2	1,5	33	126,6	109	109	134
33020	T2CE100	2,42	**100**	150	39	32,5	39	2	1,5	29	124,7	108	109	135
T5ED100	–	3,25	**100**	160	40	34	42	5	3	42	133,8	110	117	135
30220-A	T3FB100	3,75	**100**	180	34	29	37	3	2,5	36	135	116	112	157
32220-A	T3FC100	5,15	**100**	180	46	39	49	3	2,5	42	138,5	114	112	154
30320-A	T2GB100	8,3	**100**	215	47	39	51,5	4	3	42	151	127	114	184
31320-X	T7GB100	8,81	**100**	215	51	35	56,5	4	3	68	159,5	121	114	168
32320-A	T2GD100	12,9	**100**	215	73	60	77,5	4	3	53	152	123	114	177



Mounting dimensions

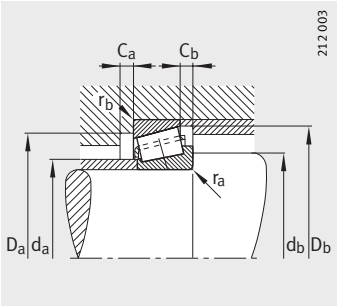
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
122	125	6	7	1,5	1,5	141 000	223 000	0,44	1,36	0,75	28 000	5 000	2 800
122	125	6	6,5	1,5	1,5	182 000	310 000	0,29	2,06	1,13	39 500	5 000	2 600
130	135	7	9	2,5	2	219 000	345 000	0,41	1,48	0,81	43 000	4 800	2 700
140	141	5	6,5	2,5	2	175 000	220 000	0,42	1,43	0,79	25 500	4 800	3 200
140	142	5	8,5	2,5	2	226 000	305 000	0,42	1,43	0,79	36 000	4 800	2 900
140	144	7	12	2,5	2	295 000	435 000	0,42	1,43	0,79	53 000	4 500	2 700
153	161	7	15	4	4	260 000	365 000	0,8	0,75	0,41	42 500	4 300	3 200
166	169	6	16,5	4	3	255 000	305 000	0,83	0,73	0,4	34 000	4 300	3 450
166	167	6	10,5	3	3	315 000	380 000	0,35	1,74	0,96	42 000	4 300	3 150
166	169	7	14,5	4	3	410 000	590 000	0,55	1,1	0,6	70 000	4 300	2 950
166	167	8	14,5	4	3	435 000	580 000	0,35	1,74	0,96	68 000	4 300	3 000
131	134	6	8	2	1,5	163 000	255 000	0,42	1,42	0,78	30 500	4 800	2 750
131	135	7	6,5	2	1,5	215 000	360 000	0,27	2,23	1,23	45 000	4 800	2 500
140	144	7	10	2,5	2	260 000	420 000	0,4	1,51	0,83	51 000	4 500	2 550
150	150	5	6,5	2,5	2	199 000	255 000	0,42	1,43	0,79	28 500	4 500	3 050
150	152	5	8,5	2,5	2	260 000	355 000	0,42	1,43	0,79	42 000	4 500	2 950
158	166	7	15	4	4	270 000	385 000	0,83	0,72	0,4	44 000	4 000	3 000
176	179	6	16,5	4	3	275 000	330 000	0,83	0,73	0,4	35 500	4 000	3 350
176	176	6	10,5	4	3	335 000	405 000	0,35	1,74	0,96	43 500	4 000	3 050
176	177	8	14,5	4	3	490 000	670 000	0,35	1,74	0,96	76 000	4 000	2 750
123	125	5	5	1,5	1,5	100 000	177 000	0,36	1,68	0,92	21 900	4 800	2 450
136	140	6	8	2	1,5	169 000	270 000	0,44	1,36	0,75	32 500	4 500	2 600
136	139	7	6,5	2	1,5	220 000	375 000	0,28	2,16	1,19	46 500	4 500	2 390
158	159	5	7,5	3	2,5	225 000	290 000	0,42	1,43	0,79	32 000	4 300	2 900
158	161	5	8,5	3	2,5	300 000	420 000	0,42	1,43	0,79	48 500	4 300	2 750
186	187	6	17,5	4	3	310 000	375 000	0,83	0,73	0,4	40 000	3 600	3 200
186	184	6	11,5	4	3	370 000	450 000	0,35	1,74	0,96	47 500	3 600	3 000
186	186	8	16,5	4	3	530 000	720 000	0,35	1,74	0,96	80 000	3 600	2 600
141	144	6	8	2	1,5	174 000	285 000	0,46	1,31	0,72	33 500	4 500	2 470
141	143	7	6,5	2	1,5	224 000	390 000	0,29	2,09	1,15	47 500	4 500	2 290
146	154	6	8	5	3	230 000	390 000	0,53	1,14	0,63	47 000	4 300	2 400
168	168	5	8	3	2,5	250 000	330 000	0,42	1,43	0,79	35 500	4 300	2 800
168	171	5	10	3	2,5	335 000	475 000	0,42	1,43	0,79	54 000	4 000	2 600
201	197	6	12,5	4	3	420 000	510 000	0,35	1,74	0,96	63 000	3 400	2 750
201	202	7	21,5	4	3	385 000	485 000	0,83	0,73	0,4	60 000	3 000	2 950
201	200	8	17,5	4	3	620 000	850 000	0,35	1,74	0,96	108 000	3 400	2 350

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

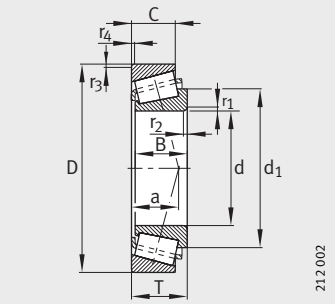
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32921	T2CC105	1,15	**105**	145	25	20	25	1,5	1,5	25	125	114	112	135
32021-X	T4DC105	2,33	**105**	160	35	26	35	2,5	2	35	133	116	115	143
33021	T2DE105	3,34	**105**	160	43	34	43	2,5	2	31	131,5	116	115	145
30221-A	T3FB105	4,23	**105**	190	36	30	39	3	2,5	38	143,2	122	117	165
32221-A	T3FC105	6,07	**105**	190	50	43	53	3	2,5	44	144,6	120	117	161
32321-A	T2GD105	15,1	**105**	225	77	63	81,5	4	3	56	160,9	128	119	185
32022-X	T4DC110	3,35	**110**	170	38	29	38	2,5	2	37	141	122	120	152
33022	T2DE110	4,16	**110**	170	47	37	47	2,5	2	33	139,2	123	120	152
30222-A	T3FB110	5,23	**110**	200	38	32	41	3	2,5	39	148,7	129	122	174
32222-A	T3FC110	7,35	**110**	200	53	46	56	3	2,5	46	153,5	126	122	170
30322-A	T2GB110	11	**110**	240	50	42	54,5	4	3	45	169,2	141	124	206
31322-X	T7GB110	12,3	**110**	240	57	38	63	4	3	75	178	135	124	188
32322-A	T2GD110	19	**110**	240	80	65	84,5	4	3	58	171,5	137	124	198
32924	T2CC120	1,82	**120**	165	29	23	29	1,5	1,5	29	141	128	127	154
T4CB120	–	1,97	**120**	170	25	19,5	27	3	3	35	144,7	130	132	157
32024-X	T4DC120	3,29	**120**	180	38	29	38	2,5	2	40	151	131	130	161
33024	T2DE120	4,55	**120**	180	48	38	48	2,5	2	36	148,5	132	130	160
30224-A	T4FB120	6,25	**120**	215	40	34	43,5	3	2,5	44	163	140	132	187
32224-A	T4FD120	9,28	**120**	215	58	50	61,5	3	2,5	51	165,2	136	132	181
30324-A	T2GB120	14,3	**120**	260	55	46	59,5	4	3	48	183,5	152	134	221
31324-X	T7GB120	15,4	**120**	260	62	42	68	4	3	82	192	145	134	203
32324	T2GD120	21,1	**120**	260	86	69	90,5	4	3	66	187	148	134	213
32926	T2CC130	2,4	**130**	180	32	25	32	2	1,5	32	154,7	141	139	167
T4CB130	–	2,53	**130**	185	27	21	29	3	3	38	156,3	140	143	171
32026-X	T4EC130	5,02	**130**	200	45	34	45	2,5	2	44	166,2	144	140	178
30226-A	T4FB130	7,08	**130**	230	40	34	43,75	4	3	46	177,1	152	144	203
32226-A	T4FD130	11,7	**130**	230	64	54	67,75	4	3	56	178	146	144	193
30326	–	17,2	**130**	280	58	49	63,75	5	4	53	194	164	148	239
31326-X	T7GB130	19,1	**130**	280	66	44	72	5	4	87	206	157	148	218
32326	–	26,7	**130**	280	93	78	98,75	5	4	68	197,3	160	147	230



Mounting dimensions

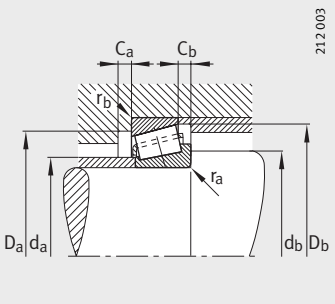
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
136	140	5	5	1,5	1,5	125 000	211 000	0,34	1,75	0,96	25 500	4 500	2 250
150	154	6	9	2,5	2	202 000	330 000	0,44	1,35	0,74	38 000	4 300	2 410
150	153	7	9	2,5	2	265 000	450 000	0,28	2,12	1,17	53 000	4 300	2 240
178	177	6	9	3	2,5	280 000	370 000	0,42	1,43	0,79	40 000	4 000	2 700
178	180	5	10	3	2,5	385 000	550 000	0,42	1,43	0,79	63 000	3 600	2 490
211	209	9	18,5	4	3	670 000	940 000	0,35	1,74	0,96	118 000	3 000	2 220
160	163	7	9	2,5	2	241 000	390 000	0,43	1,39	0,77	45 000	4 000	2 300
160	161	7	10	2,5	2	295 000	520 000	0,29	2,09	1,15	61 000	4 300	2 170
188	187	6	9	3	2,5	315 000	425 000	0,42	1,43	0,79	45 500	3 600	2 550
188	190	6	10	3	2,5	415 000	590 000	0,42	1,43	0,79	66 000	3 400	2 390
226	220	8	12,5	4	3	475 000	580 000	0,35	1,74	0,96	71 000	2 800	2 420
226	224	7	25	4	3	465 000	590 000	0,83	0,73	0,4	70 000	2 800	2 600
226	222	9	19,5	4	3	740 000	1 030 000	0,35	1,74	0,96	127 000	2 800	2 050
158	160	6	6	1,5	1,5	174 000	305 000	0,35	1,72	0,95	34 500	4 000	2 020
157	164	5	7,5	3	3	152 000	235 000	0,47	1,27	0,7	26 000	4 000	2 000
170	173	7	9	2,5	2	250 000	420 000	0,46	1,31	0,72	47 500	3 600	2 120
170	171	6	10	2,5	2	310 000	560 000	0,31	1,97	1,08	69 000	3 600	2 040
203	201	6	9,5	3	2,5	335 000	455 000	0,44	1,38	0,76	57 000	3 000	2 450
203	204	7	11,5	3	2,5	490 000	730 000	0,44	1,38	0,76	93 000	3 000	2 130
246	237	10	13,5	4	3	570 000	710 000	0,35	1,74	0,96	83 000	2 600	2 170
246	244	9	26	4	3	540 000	700 000	0,83	0,73	0,4	82 000	2 600	2 320
246	239	9	21,5	4	3	670 000	970 000	0,39	1,53	0,84	118 000	2 600	2 030
171	173	6	7	2	1,5	208 000	370 000	0,34	1,77	0,97	41 500	3 600	1 900
171	178	6	8	3	3	179 000	275 000	0,47	1,27	0,7	29 500	3 400	1 900
190	192	8	11	2,5	2	330 000	560 000	0,43	1,38	0,76	61 000	3 000	2 030
216	217	7	9,5	4	3	360 000	480 000	0,44	1,38	0,76	58 000	2 800	2 290
216	219	7	13,5	4	3	560 000	860 000	0,44	1,38	0,76	107 000	2 800	1 950
262	255	8	14,5	5	4	610 000	750 000	0,35	1,73	0,95	87 000	2 600	2 020
262	261	9	28	5	4	610 000	790 000	0,83	0,73	0,4	91 000	2 400	2 090
262	260	10	20,5	5	4	840 000	1 130 000	0,34	1,75	0,96	133 000	2 600	1 850

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

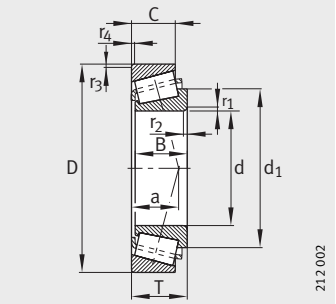
Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
32928	T2CC140	2,6	**140**	190	32	25	32	2	1,5	34	164,8	150	149	177
T4CB140	–	2,41	**140**	195	27	21	29	3	3	41	167,2	150	153	180
32028-X	T4DC140	5,39	**140**	210	45	34	45	2,5	2	46	175,8	153	150	187
30228-A	T4FB140	8,81	**140**	250	42	36	45,75	4	3	48	187	163	154	219
32228-A	T4FD140	14	**140**	250	68	58	71,75	4	3	60	193,5	159	154	210
30328	–	20,5	**140**	300	62	53	67,75	5	4	52	206	176	158	255
31328-X	T7GB140	23,1	**140**	300	70	47	77	5	4	94	223	169	158	235
32328-A	–	37,8	**140**	300	102	85	107,75	5	4	74	215	170	157	247
32930	T2DC150	3,9	**150**	210	38	30	38	2,5	2	36	177,8	162	160	194
32030-X	T4EC150	6,47	**150**	225	48	36	48	3	2,5	50	188	164	162	200
30230-A	T4GB150	11,1	**150**	270	45	38	49	4	3	52	201	175	164	234
32230-A	T4GD150	18,5	**150**	270	73	60	77	4	3	64	206,7	171	164	226
30330-A	T2GB150	25,1	**150**	320	65	55	72	5	4	60	224	189	168	273
31330-X	T7GB150	28	**150**	320	75	50	82	5	4	100	237	181	168	251
32330-A	–	46,1	**150**	320	108	90	114	5	4	79	230	184	167	264
32932	T2DC160	4,13	**160**	220	38	30	38	2,5	2	38	188	173	170	204
32032-X	T4EC160	7,81	**160**	240	51	38	51	3	2,5	53	201	175	172	213
30232	–	13,8	**160**	290	48	40	52	4	3	51	216,5	189	174	252
32232-A	T4GD160	23,4	**160**	290	80	67	84	4	3	69	223	183	174	242
30332-A	T2GB160	29,9	**160**	340	68	58	75	5	4	63	237	201	178	290
T4DB170	–	4,31	**170**	230	30	23	32	3	3	45	199	182	185	214
32934	T3DC170	4,42	**170**	230	38	30	38	2,5	2	42	199	183	180	213
32034-X	T4EC170	11,4	**170**	260	57	43	57	3	2,5	57	216	187	182	230
30234-A	T4GB170	19,2	**170**	310	52	43	57	5	4	60	233	203	188	269
32234-A	T4GD170	28,6	**170**	310	86	71	91	5	4	74	238	196	188	259
32936	T4DC180	7,08	**180**	250	45	34	45	2,5	2	54	217	193	190	225
32036-X	T3FD180	14,2	**180**	280	64	48	64	3	2,5	60	230	199	192	247
30236-A	T4GB180	17,9	**180**	320	52	43	57	5	4	62	242	211	198	278
32236-A	T4GD180	32,5	**180**	320	86	71	91	5	4	77	249,5	204	198	267
32938	T4DC190	7,55	**190**	260	45	34	45	2,5	2	55	226	204	200	235
32038-X	T4FD190	14,8	**190**	290	64	48	64	3	2,5	63	241	209	202	257
30238	–	20,8	**190**	340	55	46	60	5	4	62	258	224	207	298
32238-A	T4GD190	39,1	**190**	340	92	75	97	5	4	81	263	216	207	286



Mounting dimensions

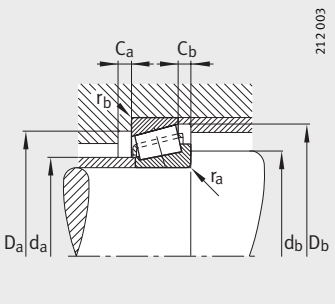
						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
181	184	6	7	2	1,5	214 000	395 000	0,36	1,67	0,92	43 000	3 400	1 780
181	189	6	8	3	3	188 000	300 000	0,5	1,19	0,66	32 000	3 000	1 800
200	202	8	11	2,5	2	340 000	600 000	0,46	1,31	0,72	44 000	2 800	1 900
236	234	9	9,5	4	3	420 000	570 000	0,44	1,38	0,76	67 000	2 600	2 030
236	238	8	13,5	4	3	650 000	1 000 000	0,44	1,38	0,76	121 000	2 600	1 740
282	273	8	14,5	5	4	590 000	740 000	0,28	2,18	1,2	84 000	2 400	1 970
282	280	9	30	5	4	690 000	890 000	0,83	0,73	0,4	101 000	2 400	1 920
282	280	10	22,5	5	4	1 170 000	1 710 000	0,35	1,74	0,96	198 000	2 400	1 460
201	202	7	8	2,5	2	285 000	495 000	0,33	1,83	1,01	61 000	2 800	1 730
213	216	8	12	3	2,5	385 000	680 000	0,46	1,31	0,72	84 000	2 600	1 730
256	250	9	11	4	3	475 000	650 000	0,44	1,38	0,76	74 000	2 600	1 870
256	254	8	17	4	3	740 000	1 160 000	0,44	1,38	0,76	138 000	2 600	1 570
302	292	9	17	5	4	810 000	1 030 000	0,35	1,74	0,96	113 000	2 200	1 650
302	300	9	32	5	4	790 000	1 040 000	0,83	0,73	0,4	115 000	2 200	1 760
302	299	12	24	5	4	1 330 000	1 950 000	0,35	1,74	0,96	221 000	2 200	1 330
210	212	7	8	2,5	2	295 000	530 000	0,35	1,73	0,95	64 000	2 600	1 630
228	231	8	13	3	2,5	430 000	750 000	0,46	1,31	0,72	91 000	2 600	1 620
276	269	9	12	4	3	410 000	580 000	0,37	1,61	0,89	66 000	2 400	1 870
276	274	10	17	4	3	870 000	1 390 000	0,44	1,38	0,76	162 000	2 400	1 420
322	310	9	17	5	4	890 000	1 140 000	0,35	1,74	0,96	123 000	2 200	1 520
216	223	6	9	3	3	231 000	395 000	0,46	1,3	0,72	46 500	2 600	1 400
220	222	7	8	2,5	2	290 000	550 000	0,38	1,57	0,86	66 000	2 600	1 540
248	249	10	14	3	2,5	510 000	890 000	0,44	1,35	0,74	106 000	2 400	1 490
292	288	8	14	5	4	600 000	840 000	0,44	1,38	0,76	92 000	2 200	1 600
292	294	10	20	5	4	990 000	1 590 000	0,44	1,38	0,76	180 000	2 200	1 310
240	241	8	11	2,5	2	360 000	710 000	0,48	1,25	0,69	84 000	2 400	1 440
268	267	10	16	3	2,5	620 000	1 090 000	0,42	1,42	0,78	128 000	2 200	1 340
302	297	9	14	5	4	620 000	880 000	0,45	1,33	0,73	95 000	2 200	1 500
302	303	10	20	5	4	1 020 000	1 670 000	0,45	1,33	0,73	188 000	2 000	1 230
249	251	8	11	2,5	2	370 000	760 000	0,48	1,26	0,69	89 000	2 400	1 350
278	279	10	16	3	2,5	630 000	1 130 000	0,44	1,36	0,75	131 000	2 200	1 280
322	318	9	14	5	4	530 000	780 000	0,39	1,56	0,86	85 000	2 200	1 510
322	323	10	22	5	4	1 150 000	1 840 000	0,44	1,38	0,76	204 000	2 000	1 140

Tapered roller bearings



Dimension table (continued) · Dimensions in mm

Designation	Interchange designation to ISO 355	Mass	Dimensions									Mounting dimensions		
		m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b	D_a
		≈kg						min.	min.	≈	≈	max.	min.	min.
T4DB200	–	5,55	**200**	270	34	27	37	3	3	54	234	214	218	251
32940-A	–	8,97	**200**	280	51	39	51	3	2,5	54	239	216	212	257
32040-X	T4FD200	19	**200**	310	70	53	70	3	2,5	67	256	221	212	273
30240-A	T4GB200	25,5	**200**	360	58	48	64	5	4	69	272	237	217	315
32240-A	T3GD200	43	**200**	360	98	82	104	5	4	83	274,5	226	217	302
32944	T3EC220	10,3	**220**	300	51	39	51	3	2,5	59	260	234	232	275
32044-X	T4FD220	24,3	**220**	340	76	57	76	4	3	73	280	243	234	300
30244-A	–	34,6	**220**	400	65	54	72	5	4	75	299	255	237	348
32244-A	–	59,5	**220**	400	108	90	114	5	4	95	310,5	258	237	336
32948	T4EC240	11	**240**	320	51	39	51	3	2,5	65	281	254	252	294
32048-X	T4FD240	28,2	**240**	360	76	57	76	4	3	79	300	261	254	318
32248-A	–	80,5	**240**	440	120	100	127	5	4	105	332	286	257	372
32952	T3EC260	18,6	**260**	360	63,5	48	63,5	3	2,5	70	309	279	272	328
32052-X	T4FC260	41,1	**260**	400	87	65	87	5	4	86	331,5	287	278	352
32252	–	102	**260**	480	130	106	137	6	5	113	369	306	280	401
32956	T4EC280	19,9	**280**	380	63,5	48	63,5	3	2,5	75	330	298	292	348
32056-X	T4FC280	40,5	**280**	420	87	65	87	5	4	91	349	305	298	370
32960	T3FD300	31,2	**300**	420	76	57	76	4	3	80	362	324	314	383
32060-X	T4GD300	57,2	**300**	460	100	74	100	5	4	98	375	329	318	404
32064-X	T4GD320	60,5	**320**	480	100	74	100	5	4	104	397,5	350	338	424

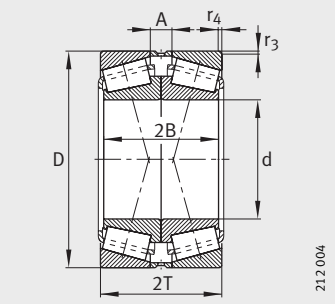


Mounting dimensions

						Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed
D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G	n_B
max.	min.	min.	min.	max.	max.	N	N				N	min^{-1}	min^{-1}
254	262	7	10	3	3	305 000	550 000	0,47	1,27	0,7	61 000	2 200	1 200
268	271	9	12	3	2,5	495 000	930 000	0,39	1,52	0,84	107 000	2 200	1 240
298	297	11	17	3	2,5	760 000	1 380 000	0,43	1,39	0,77	155 000	2 200	1 150
342	336	9	16	5	4	770 000	1 080 000	0,44	1,38	0,76	115 000	2 000	1 300
342	340	11	22	5	4	1 320 000	2 070 000	0,41	1,48	0,81	225 000	2 000	1 070
288	290	9	12	3	2,5	495 000	980 000	0,43	1,41	0,78	110 000	2 000	1 120
326	326	12	19	4	3	890 000	1 640 000	0,43	1,39	0,77	179 000	2 000	1 020
382	371	10	18	5	4	950 000	1 320 000	0,42	1,43	0,79	135 000	1 700	1 140
382	380	12	24	5	4	1 540 000	2 550 000	0,44	1,38	0,76	270 000	1 500	920
308	311	9	12	3	2,5	510 000	1 050 000	0,46	1,31	0,72	116 000	2 000	1 020
346	346	12	19	4	3	900 000	1 680 000	0,46	1,31	0,72	182 000	1 700	950
422	415	14	27	5	4	1 860 000	3 150 000	0,44	1,38	0,76	320 000	1 400	800
348	347	11	15,5	3	2,5	740 000	1 490 000	0,41	1,48	0,81	160 000	1 700	880
382	383	14	22	5	4	1 160 000	2 170 000	0,43	1,38	0,76	226 000	1 500	830
458	455	14	31	6	5	2 240 000	3 800 000	0,43	1,39	0,77	380 000	1 300	700
368	368	11	15,5	3	2,5	740 000	1 520 000	0,43	1,39	0,76	162 000	1 500	820
402	402	14	22	5	4	1 210 000	2 330 000	0,46	1,31	0,72	239 000	1 400	760
406	405	12	19	4	3	980 000	2 020 000	0,39	1,52	0,84	207 000	1 300	730
442	439	15	26	5	4	1 510 000	2 900 000	0,43	1,38	0,76	290 000	1 300	680
462	461	15	26	5	4	1 570 000	3 100 000	0,46	1,31	0,72	305 000	1 200	630

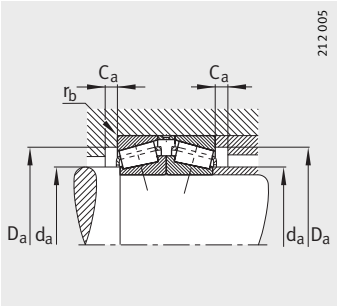
Tapered roller bearings

Matched pairs



Dimension table · Dimensions in mm

Designation	Mass for bearing pair	Dimensions						Mounting dimensions	
	m	d	D	2B	2T	r_3, r_4	A	d_a	D_a
	≈kg					min.		max.	min.
31306-A-N11CA-A50-90	0,85	**30**	72	38	41,5	1,5	13,5	40	55
31307-A-N11CA-A40-70	1,13	**35**	80	42	45,5	1,5	15,5	44	62
31308-A-N11CA-A50-90	1,52	**40**	90	46	50,5	1,5	16,5	51	71
31309-A-N11CA-A60-100	2,1	**45**	100	50	54,5	1,5	18,5	56	79
31310-A-N11CA-A60-100	2,9	**50**	110	54	58,5	2	20,5	62	87
31311-A-N11CA-A80-120	3,4	**55**	120	58	63	2	21	68	94
31312-A-N11CA-A80-120	4,2	**60**	130	62	67	2,5	23	73	103
31313-A-N11CA-A80-120	5,05	**65**	140	66	72	2,5	26	79	111
31314-A-N11CA-A100-140	6,2	**70**	150	70	76	2,5	26	84	118
31315-N11CA-A100-140	7,2	**75**	160	74	80	2,5	28	91	127
31316-N11CA-A100-140	8,9	**80**	170	78	85	2,5	31	97	134
31317-N11CA-A120-160	10,4	**85**	180	82	89	3	33	103	143
31318-N11CA-A120-160	11,8	**90**	190	86	93	3	33	109	151
31318-N11CA-A160-200	11,8	**90**	190	86	93	3	33	109	151
31319-A-N11CA-A120-160	14	**95**	200	90	99	3	35	114	157

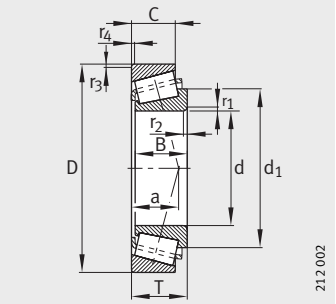


Mounting dimensions

			Basic load ratings for bearing pair		Calculation factors				Fatigue limit load	Limiting speed
D_a	C_a	r_b	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}	Bearing pair
max.	min.	max.	N	N					N	min^{-1}
65	3	1,5	77 000	93 000	0,83	0,82	1,22	0,8	10 600	8 000
71	4	1,5	102 000	128 000	0,83	0,82	1,22	0,8	14 900	7 000
81	4	1,5	130 000	167 000	0,83	0,82	1,22	0,8	18 800	6 000
91	4	1,5	163 000	214 000	0,83	0,82	1,22	0,8	25 500	5 600
100	4	2	187 000	245 000	0,83	0,82	1,22	0,8	29 000	5 000
110	4	2	209 000	275 000	0,83	0,82	1,22	0,8	32 500	4 800
118	5	2,5	250 000	340 000	0,83	0,82	1,22	0,8	40 000	4 500
128	5	2,5	285 000	380 000	0,83	0,82	1,22	0,8	45 000	4 300
138	5	2,5	325 000	445 000	0,83	0,82	1,22	0,8	52 000	4 000
148	6	2,5	350 000	475 000	0,83	0,82	1,22	0,8	55 000	3 600
158	6	2,5	390 000	540 000	0,83	0,82	1,22	0,8	61 000	3 400
166	6	3	435 000	610 000	0,83	0,82	1,22	0,8	68 000	3 000
176	6	3	475 000	660 000	0,83	0,82	1,22	0,8	71 000	2 800
176	6	3	475 000	660 000	0,83	0,82	1,22	0,8	71 000	2 800
186	6	3	530 000	750 000	0,83	0,82	1,22	0,8	80 000	2 600

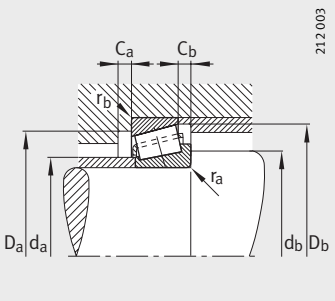
Taper roller bearings

Inch sizes



Dimension table · Dimensions in mm

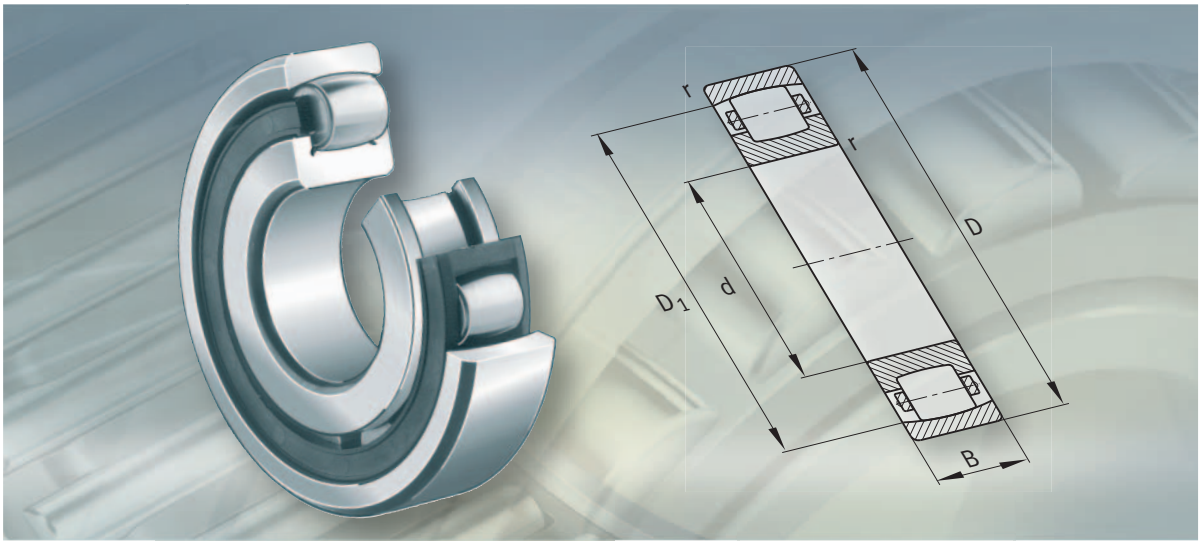
Designation	Mass	Dimensions								
	m	d	D	B	C	T	r_1, r_2	r_3, r_4	a	d_1
	≈kg						min.	min.	≈	≈
KLM11749-LM11710	0,086	**17,462**	39,878	14,605	10,668	13,843	1,3	1,3	9	29,6
KLM11949-LM11910	0,12	**19,05**	45,237	16,637	12,065	15,494	1,3	1,3	10	31,8
KM12649-M12610	0,163	**21,43**	50,005	18,288	13,97	17,526	1,3	1,3	11	34,5
KLM12749-LM12710	0,12	**21,986**	45,237	16,637	12,065	15,494	1,3	1,3	10	34,8
KLM12749-LM12711	0,13	**21,986**	45,974	16,637	12,065	15,494	1,3	1,3	10	34,8
KL44643-L44610	0,129	**25,4**	50,292	14,732	10,668	14,224	1,3	1,3	11	40,1
KL44649-L44610	0,137	**26,988**	50,292	14,732	10,668	14,224	3,5	1,3	11	40,1
KM86649-M86610	0,375	**30,162**	64,292	21,433	16,67	21,433	1,5	1,5	18	50,7
KLM67048-LM67010	0,19	**31,75**	59,131	16,764	11,811	15,875	3,5	1,3	13	45,8
KHM88542-HM88510	0,641	**31,75**	73,025	27,782	23,02	29,37	1,3	3,3	24	58
KLM48548-LM48510	0,273	**34,925**	65,088	18,288	13,97	18,034	3,5	1,3	14	49,7
KHM88649-HM88610	0,5	**34,925**	72,233	25,4	19,842	25,4	2,3	2,3	21	56,8
KL68149-L68110	0,171	**34,988**	59,131	16,764	11,938	15,875	3,5	1,3	13	48,8
KLM29748-LM29710	0,227	**38,1**	65,088	18,288	13,97	18,034	3,5	1,3	13	53
KLM29749-LM29710	0,24	**38,1**	65,088	18,288	13,97	18,034	2,3	1,3	13	53
KLM300849-LM300811	0,255	**40,987**	67,975	18	13,5	17,5	3,5	1,5	14	55,8
KLM501349-LM501310	0,365	**41,275**	73,431	19,812	14,732	19,558	3,5	0,8	16	57,2
KHM804840-HM804810	1,19	**41,275**	95,25	29,37	23,02	30,162	3,5	3,3	26	73,1
KLM603049-LM603011	0,367	**45,242**	77,788	19,842	15,08	19,842	3,5	0,8	18	61,7
KLM503349-LM503310	0,306	**45,987**	74,985	18	14	18	2,3	1,5	16	61,9
KLM503349A-LM503310	0,324	**45,987**	74,985	18	14	18	3,5	1,5	16	61,9
KLM104949-LM104911	0,425	**50,8**	82,55	22,225	16,51	21,59	3,5	1,3	16	66,3
K72200-72487	2,18	**50,8**	123,825	32,791	25,4	36,512	3,5	3,3	38	86,8
KLM806649-LM806610	0,445	**53,975**	88,9	19,05	13,492	19,05	2,3	2	21	72,3
KHM911245-HM911210	2,13	**60,325**	130,175	33,338	23,813	36,513	5,2	3,3	42	97,3
KH913849-H913810	2,96	**69,85**	146,05	39,688	25,4	41,275	3,5	3,3	45	109,4
K47490-47420	1,61	**71,438**	120	32,545	26,195	32,545	3,5	3,3	27	95,2
KHM215249-HM215210	2,26	**75,987**	131,975	39	32	39	7,1	3,5	30	103,2
K34306-34478	0,932	**77,788**	121,442	23,012	17,462	24,608	3,5	2	26	99,7
KHM518445-HM518410	2,94	**88,9**	152,4	39,688	30,163	39,688	6,4	3,3	34	119,5
KHM218248-HM218210	2,57	**89,975**	146,975	40	32,5	40	7,1	3,5	32	119



Mounting dimensions

Mounting dimensions								Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed
d_a	d_b	D_a	D_b	C_a	C_b	r_a	r_b	dyn. C_r	stat. C_{0r}	e	Y	Y_0	C_{ur}	n_G
max.	min.	min.	min.	min.	min.	max.	max.	N	N				N	min^{-1}
21,5	23	34	37	3	3	1,3	1,3	20 500	20 000	0,29	2,1	1,15	2 190	20 000
23,5	25	39,5	41,5	3,5	4,5	1,3	1,3	27 000	27 000	0,3	2	1,1	3 050	18 000
25,5	27,5	44	46	4	3,5	1,3	1,3	37 000	38 000	0,28	2,16	1,19	4 400	17 000
26	27,5	39,5	42	3	3	1,3	1,3	28 000	31 500	0,31	1,96	1,08	3 550	17 000
26	27,5	40	42,5	3	3	1,3	1,3	28 000	31 500	0,31	1,96	1,08	3 550	17 000
30	32	44,5	47	3	3,5	1,3	1,3	25 000	28 500	0,37	1,6	0,88	3 150	14 000
31	37,5	44,5	47	2,5	3,5	3,5	1,3	25 000	28 500	0,37	1,6	0,88	3 150	14 000
38,2	41	54	61	3	4,5	1,5	1,5	52 000	66 000	0,55	1,1	0,6	7 900	11 000
36	42,5	52	56	3,5	4,5	3,5	1,3	33 000	39 000	0,41	1,46	0,8	4 450	12 000
42,6	45,5	59	70	4	6	1,3	3,3	72 000	97 000	0,55	1,1	0,6	12 100	9 500
40	46	58	61	3	4	3,5	1,3	45 500	54 000	0,38	1,59	0,88	6 400	10 000
42,5	48,5	60	69	3	5	2,3	2,3	69 000	91 000	0,55	1,1	0,6	11 300	9 500
39	45,5	53	56	3	4	3,5	1,3	33 000	43 500	0,42	1,44	0,79	5 000	11 000
42,5	49	59	62	2	4	3,5	1,3	44 000	58 000	0,33	1,8	0,99	6 900	10 000
42,5	46	59	62	2	4	2,3	1,3	44 000	58 000	0,33	1,8	0,99	6 900	10 000
45	52	61	65	3	4	3,5	1,5	44 500	60 000	0,35	1,72	0,95	7 300	10 000
46,5	53	67	70	4	4,5	3,5	0,8	55 000	67 000	0,4	1,5	0,83	8 100	9 500
54	61	81	91	4,5	7	3,5	3,3	111 000	151 000	0,55	1,1	0,6	18 800	7 000
50	57	71	74	3	4,5	3,5	0,8	54 000	68 000	0,43	1,41	0,77	8 100	8 500
51	55	67	71	4	3,5	2,3	1,5	47 500	65 000	0,4	1,49	0,82	7 800	9 000
51	57	67	71	3,5	4	3,5	1,5	47 500	65 000	0,4	1,49	0,82	7 800	9 000
55	62	75	78	3	5	3,5	1,3	69 000	92 000	0,31	1,97	1,08	11 400	8 000
67	79	102	116	3,5	8,5	3,5	3,3	135 000	148 000	0,74	0,81	0,45	17 800	5 600
60	63	80	85	4	5,5	2,3	2	59 000	79 000	0,55	1,1	0,6	9 500	7 500
74,4	87	109	123,6	6	4	5,2	3,3	145 000	170 000	0,82	0,73	0,4	20 500	5 300
82	95	124	138	5	12,5	3,5	3,3	201 000	239 000	0,78	0,77	0,42	28 500	4 800
79	86	107	114	4	6	3,5	3,3	152 000	224 000	0,36	1,67	0,92	28 000	5 300
85	98	118	126	7	7	7,1	3,5	206 000	295 000	0,33	1,8	0,99	37 000	5 000
84	90	110	116	3	7	3,5	2	81 000	112 000	0,45	1,33	0,73	13 700	5 300
100	110	134	146	4	8,5	6,4	3,3	242 000	345 000	0,4	1,49	0,82	41 000	4 500
99	112	133	141	5,5	7,5	7,1	3,5	232 000	350 000	0,33	1,8	0,99	43 000	4 800

FAG



Barrel roller bearings

Barrel roller bearings

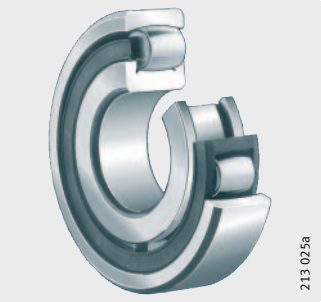
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Product overview Barrel roller bearings

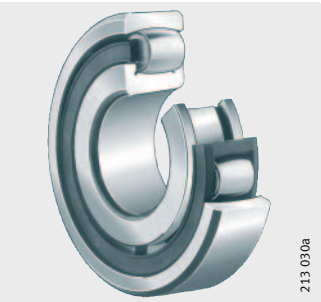
With cylindrical bore

202, 203



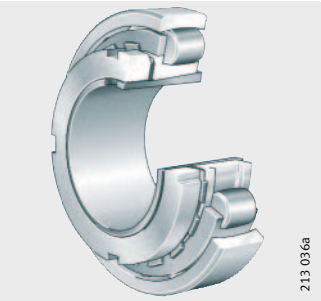
With tapered bore

202..-K, 203..-K



With adapter sleeve

202..-K + H, 203..-K + H



Barrel roller bearings

Features

Barrel roller bearings are single row, self-aligning roller bearings. They comprise solid outer rings with a concave raceway, solid inner rings with two ribs and a cylindrical or tapered bore as well as barrel rollers with cages. The bearings cannot be dismantled.

Barrel roller bearings are particularly suitable where high radial shock type loads occur and misalignments must be compensated, see Compensation of angular misalignments.
They have only a low axial load carrying capacity.

With tapered bore/ with adapter sleeve

Bearings with a tapered bore have a bore taper of 1:12 and the suffix K.

These bearings are also available with an adapter sleeve for location. The adapter sleeves are included in the dimension tables and must be specified in addition when ordering.

Sealing/lubrication

Barrel roller bearings are not sealed and not greased.
They can be lubricated using oil or grease.

Compensation of angular misalignments

Under normal operating conditions and with a rotating inner ring, barrel roller bearings can swivel approx. 4° about their central position. As a result, they permit skewing between the inner and outer ring and can thus compensate misalignments, shaft deflections and housing deformations.

If the outer ring rotates or the inner ring undergoes tumbling motion, the angular adjustment facility is smaller.
In this case, please contact us.

Operating temperature

Barrel roller bearings with brass cages can be used at operating temperatures from –30 °C to +150 °C.

Bearing with an outside diameter over 120 mm are dimensionally stable up to +200 °C.



Caution! Bearings with cages made from glass fibre reinforced polyamide can be used up to +120 °C.

Cages

The standard cages for barrel roller bearings are shown in the table Cage/bore code.

Barrel roller bearings with solid brass cages have the suffix MB. The cages are guided on the inner ring.

Solid window cages made from glass fibre reinforced polyamide are indicated by the suffix TVP.

Caution! Check the chemical resistance of polyamide to synthetic greases and lubricants with EP additives.

Aged oil and additives in the oil can impair the operating life of plastic cages at high temperatures.

The oil change intervals must be observed.

Cage/bore code

Series	Solid window cage made from polyamide[1)] Bore code	Solid brass cage[1)]
202	up to 16	from 17
203	up to 12	from 13

[1)] Other cage designs – for example brass cages instead of polyamide cages – are available by agreement. In such cages, suitability for high speeds and temperatures as well as the basic load ratings may differ from the values for bearings with standard cages.

Barrel roller bearings

Suffixes

Suffixes for the available designs: see table.

Available designs

Suffixes	Description	Design
C3	Radial internal clearance larger than normal	Standard for tapered bore
K	Tapered bore	Standard
MB	Solid brass cage	Standard
TVP	Solid window cage made from glass fibre reinforced polyamide	Standard

Design and safety guidelines

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

$$P = F_r + 9{,}5 \cdot F_a$$

P N
Equivalent dynamic bearing load for combined load
F_a N
Axial dynamic bearing load
F_r N
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r} + 5 \cdot F_{0a}$$

P_0 N
Equivalent static bearing load for combined load
F_{0a} N
Axial static bearing load
F_{0r} N
Radial static bearing load.

Minimum radial load

In order to ensure slippage-free operation, the bearings must be subjected to a minimum radial load. This applies particularly in the case of high speeds and high accelerations. In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}02$ is necessary for roller bearings with cage.

Speeds

DIN 732-1 (draft 1994-12) does not give thermal reference speeds for barrel roller bearings.

Caution! The dimension tables therefore only state limiting speeds n_G. These values are for oil lubrication and must not be exceeded.

Location of bearings with tapered bore

Bearings with a tapered inner ring bore are:

- located either directly on tapered shaft seats or
- located on cylindrical shafts by means of an adapter sleeve.

The dimensions for support rings in the dimension tables must be observed.

Mounting dimensions

The shoulders on the adjacent construction (shaft/housing) must be sufficiently high that adequate abutment surfaces are ensured even with very large chamfer dimensions.

The maximum values for the radii r_a and the diameters of the abutment surfaces d_a, D_a are indicated in the dimension tables.

محرک چرخش

تأمین‌کننده تخصصی بلبرینگ و رولبرینگ

BEARINGS · SEALS · BELTS · POWER TRANSMISSION

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برای استعلام قیمت، اعلام موجودی و ثبت سفارش تکی و عمده بلبرینگ INA با کارشناسان محرک چرخش تماس بگیرید.

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