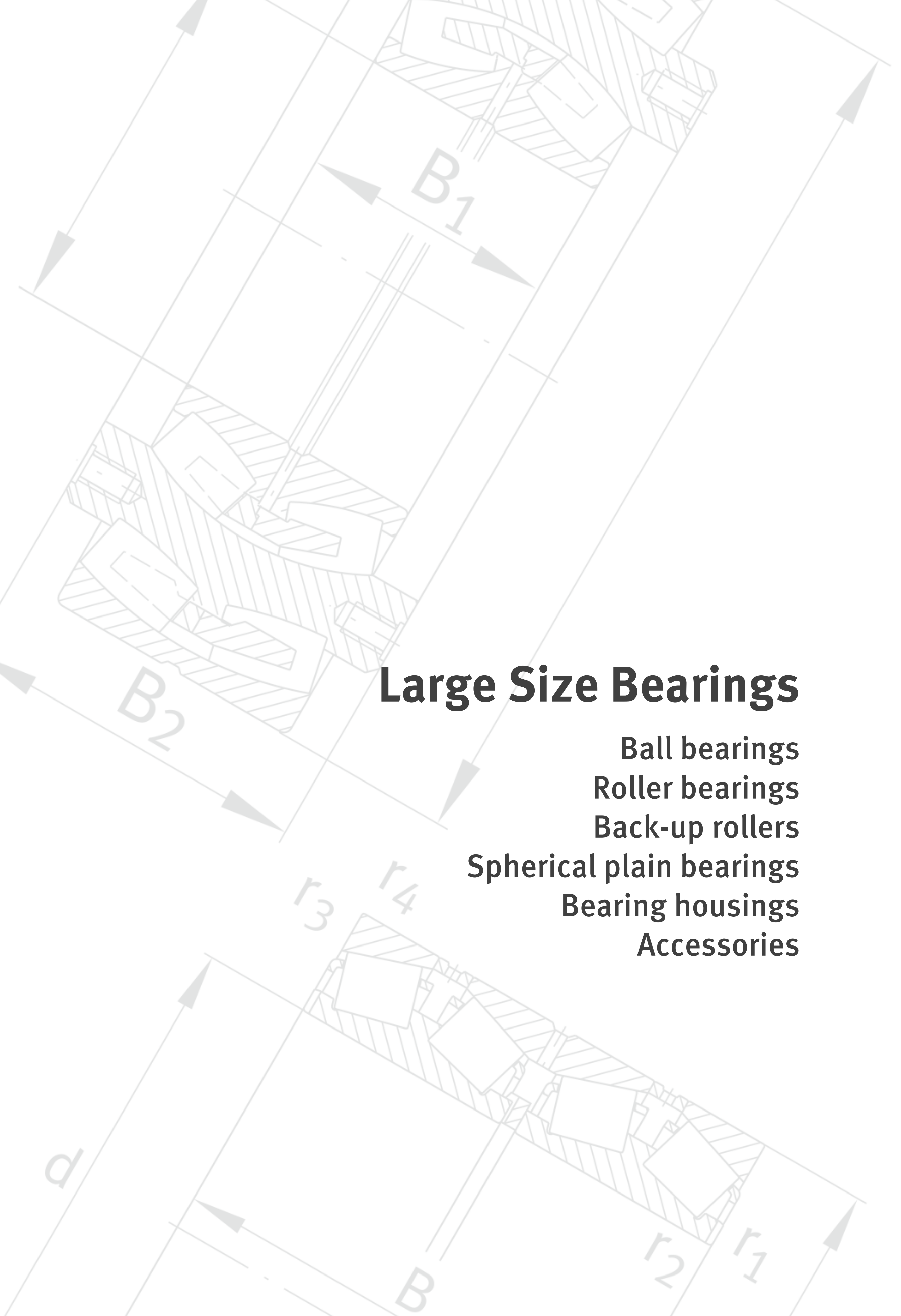
Large Size Bearings

Ball bearings
Roller bearings
Back-up rollers
Spherical plain bearings
Bearing housings
Accessories

SCHAEFFLER



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Foreword

Schaeffler Technologies

Schaeffler Technologies with its brands INA and FAG 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.

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.

Quality
Manufacturing technology
Environmental protection

"Zero defects" is our quality objective. We have matched all our processes, both in product development and in manufacturing, to this target.

Our comprehensive know-how in forming, in forging, in heat treatment and surface technologies, in hard machining by means of grinding and honing and in assembly processes is applied in order to ensure that our products fulfil the required quality level.

Our manufacturing processes are monitored by means of systematic quality inspections. This ensures that all products continuously fulfil the same high standard of quality.

All Schaeffler sites worldwide are certified to ISO/TS 16949:2009 and DIN EN ISO 9001:2008.

With the validation and certification of our manufacturing sites, we are taking a pioneering role in environmental protection.
All larger manufacturing sites are certified to ISO 14001 and 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. 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.

Large size bearing catalogue GL 1

An engineering compendium

Catalogue GL 1 is based on our proven catalogue HR 1, Rolling Bearings. It gives descriptions of standard rolling bearings with an outside diameter of 320 mm or greater and the appropriate accessories as well as numerous special rolling bearings and large plain bearings.

We are thus offering an overview of our product range for large and heavy machinery for the original equipment manufacture, distribution and aftermarket sectors. In order to facilitate the selection of suitable products, reference is made at many points to typical applications.

The catalogue shows which products can be considered for a bearing arrangement, the factors that must be taken into consideration in the design, the tolerances required on the adjacent construction and how the bearing arrangement is sealed.
It gives detailed information on the calculation of bearing rating life, on temperatures and loads, on the lubricants that are most suitable for the bearing arrangement and, last but not least, on how the products are correctly mounted and maintained.

The data represent the state of current technology and manufacture as at April 2009. They take account of the progress in rolling bearing technology as well as the experience gained in numerous applications. Any information in publications that does not concur with the data in this catalogue is therefore invalid.

Definition of the Attention symbol

This catalogue gives descriptions of standard and special bearings. Since these are used in numerous applications, we cannot make a judgement as to whether any malfunctions will cause harm to persons or property.

Follow instructions

It is always and fundamentally the responsibility of the designer and user to ensure that all specifications are observed and that all necessary information is communicated to the end user.
This applies in particular to applications in which product failure and malfunction may constitute a hazard to human beings.

! In line with ANSI 535.6-2006, we have replaced the old Attention symbol by this new symbol.

In case of non-compliance, damage or malfunctions in the product or the adjacent construction may occur.

X-life
Maximum customer benefit

X-life is the premium brand of Schaeffler. It brings together the strengths of the two brands and gives 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 lubricant concept. In addition, 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.

Foreword

medias® *professional* Electronic information system

medias® *professional*, the proven selection and information system, presents the INA and 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® *professional* is available online in several languages, is easy to navigate and is particularly 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 integration of 3D models.

medias® *professional* focusses on the individual bearing. The complete shaft can be simulated and any influences on the bearings as a result of shaft deformation 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 and FAG homepage).

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

Other technical publications

This catalogue contains a large proportion of the core rotary rolling bearing range as well as numerous special rolling bearings of the brands INA and FAG. It also includes large INA radial and axial spherical plain bearings.

Furthermore, we develop and manufacture many other products and systems that are of significant 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 technical publications that can be obtained upon request.

INA and FAG

When it comes to motion

Catalogue GL 1 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 bearing arrangements. To this end, this catalogue is an important instrument.

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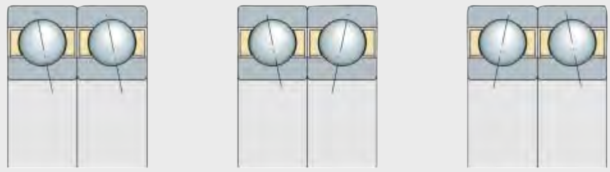

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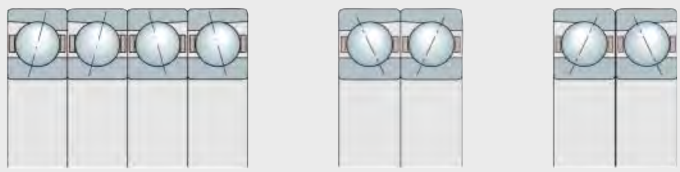

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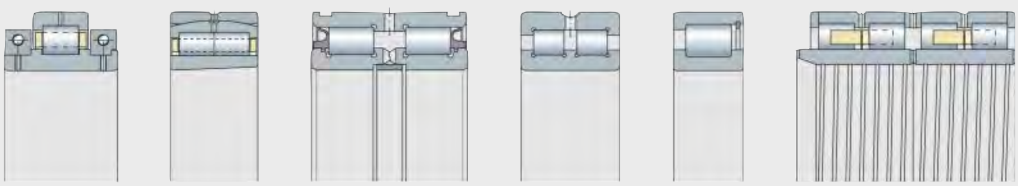

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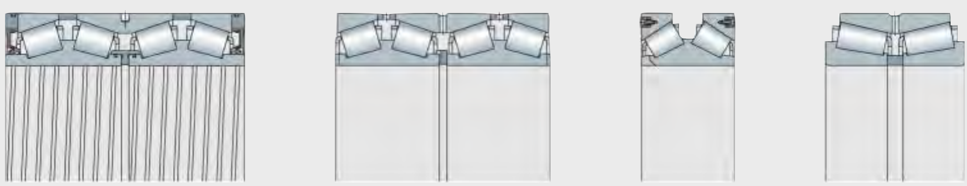

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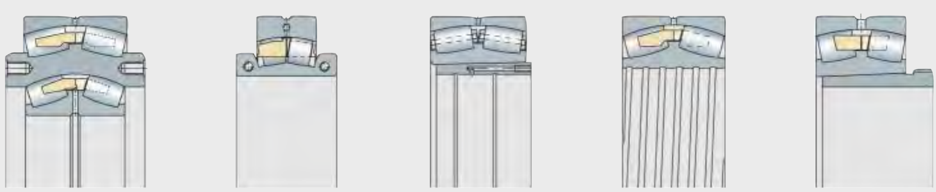

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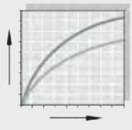

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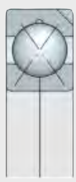

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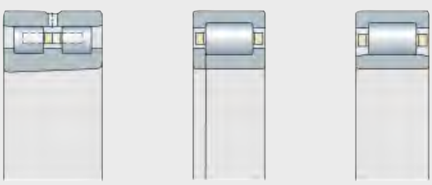
Four point contact bearings



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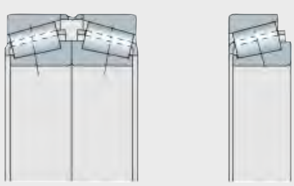
Cylindrical roller bearings



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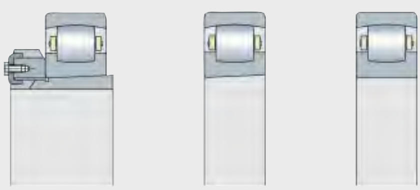
Tapered roller bearings



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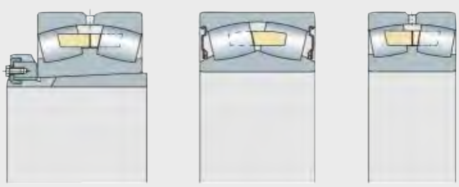
Barrel roller bearings



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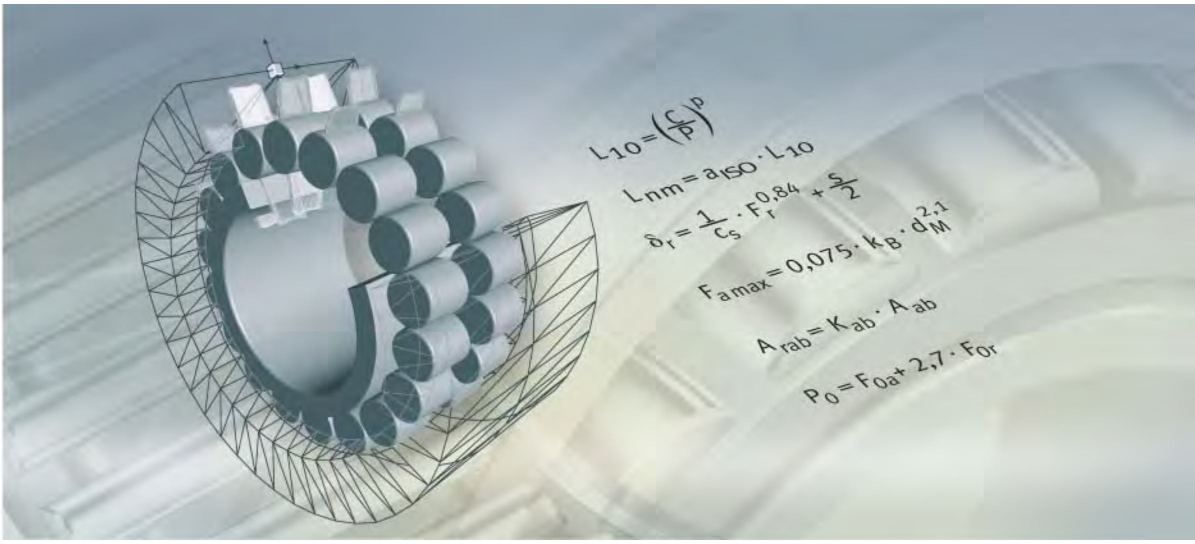

Technical principles

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Bearing data

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Load carrying capacity and life

Schaeffler introduced the “Expanded calculation of the adjusted rating life” in 1997. This method was standardised for the first time in DIN ISO 281 Appendix 1 and has been a constituent part of the international standard ISO 281 since 2007.

As part of the international standardisation work, the life adjustment factor a_{DIN} was renamed as a_{ISO} but without any change to the calculation method.

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 for the basic rating life under favourable operating conditions. Ioannides and Harris have developed a further model of fatigue in rolling contact that expands on the theory by Lundberg and Palmgren 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.

! The influencing factors, particularly those relating to contamination, are very complex. A great deal of experience is required in order to arrive at an accurate assessment. Further advice should therefore be sought from the engineering service of Schaeffler Technologies.

The tables and diagrams can give only guide values.

Dimensioning of rolling bearings

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

- rating life
- load carrying capacity
- operational reliability.

Dynamic load carrying capacity and life

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 empirically proven performance standards and 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 fatigue life is dependent on:

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

For rotating rolling bearings, the decisive parameter is the basic dynamic load rating C.
This 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.

Calculation of the rating life

The methods for calculating the rating life are:

- the basic rating life L_{10} and L_{10h} to ISO 281,
  see section Basic rating life, page 32
- the adjusted rating life L_{na} to DIN ISO 281:1990
  (no longer a constituent part of ISO 281),
  see section Adjusted rating life, page 33
- the expanded adjusted rating life L_{nm} to ISO 281,
  see section Expanded adjusted rating life, page 36.

Load carrying capacity and life

Basic rating life

The basic rating life L_{10} and L_{10h} is determined as follows:

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

$$L_{10\,h} = \frac{16\,666}{n} \cdot \left(\frac{C}{P}\right)^p$$

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

L_{10h} h
The basic rating life in operating hours according to the definition for L_{10}

C N
Basic dynamic load rating

P N
Equivalent dynamic bearing load for radial and axial bearings

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

n min^{-1}
Operating speed.

Equivalent dynamic bearing load

The equivalent dynamic load P is a calculated value. This value is constant in magnitude 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.

This calculation method cannot be applied to axial cylindrical roller bearings. Combined loads are not permissible with these bearings.

Adjusted rating life

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

- special material characteristics
- lubrication
- a requisite reliability other than 90%.

This calculation method was replaced in ISO 281:2007 by calculation of the expanded adjusted rating life L_{nm}, see page 36.

$$L_{na} = a_1 \cdot a_2 \cdot a_3 \cdot L_{10}$$

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

L_{10} — 10^6 revolutions
Basic rating life

a_1 — –
Life adjustment factor for a requisite reliability other than 90%.
In ISO 281:2007, the values for the life adjustment factor a_1 were redefined, see table Life adjustment factor a_1 for requisite reliability, page 36

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 equation on page 34.

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

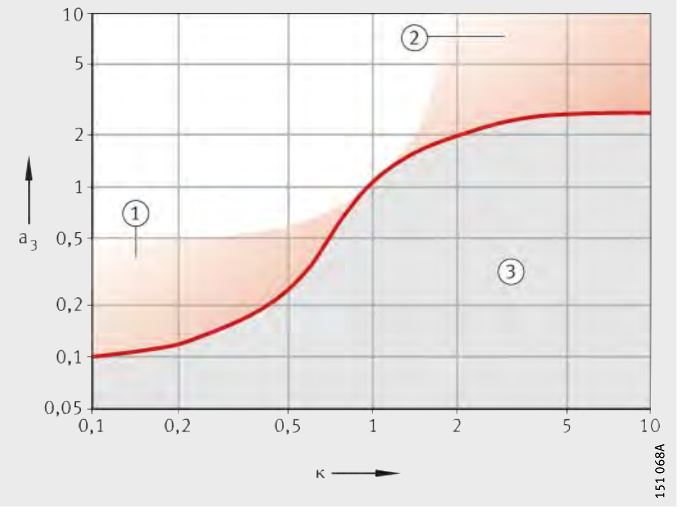


Figure 1
Life adjustment factor a_3

Viscosity ratio

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

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

ν $\mathrm{mm^2 s^{-1}}$
Kinematic viscosity of the lubricant at operating temperature

ν_1 $\mathrm{mm^2 s^{-1}}$
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*, page 35.

The nominal viscosity of the oil at +40 °C is determined from the required operating viscosity ν and the operating temperature ϑ, *Figure 3*, page 35. 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 sources).

Taking account of EP additives in calculation of the expanded adjusted rating life L_{nm}: see page 36.

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

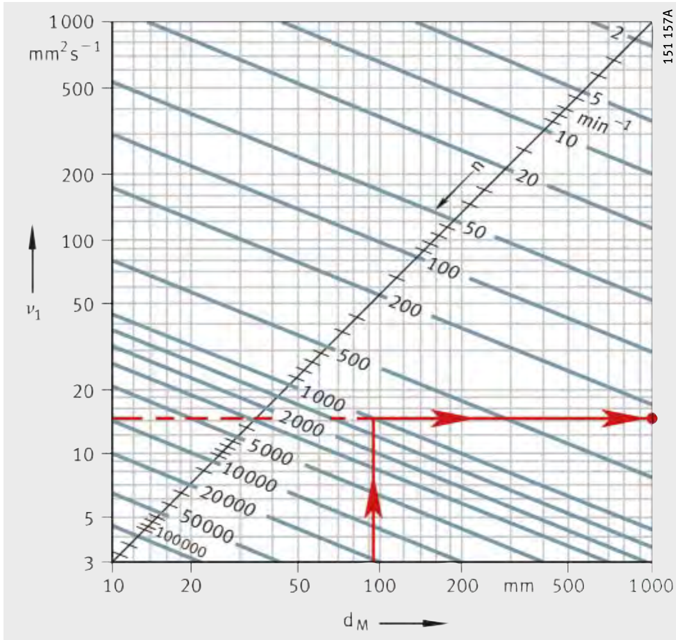


Figure 2
Reference viscosity ν_1

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

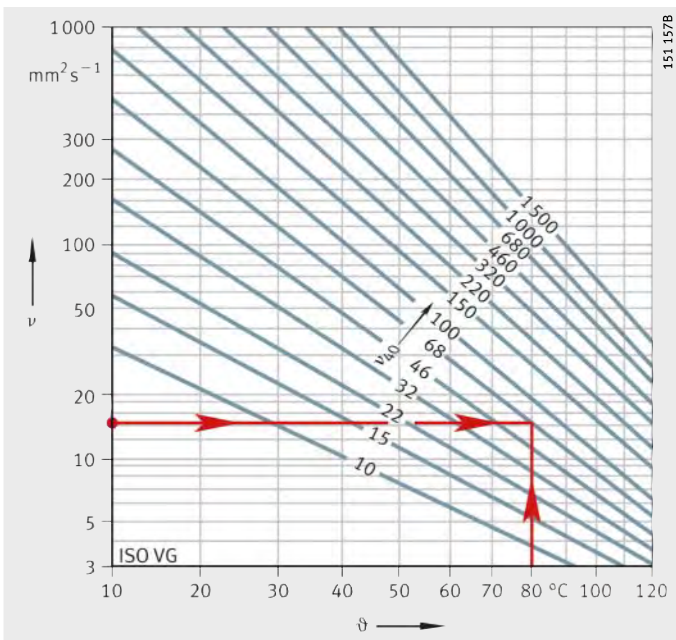


Figure 3
V/T diagram for mineral oils

Expanded adjusted rating life

The calculation of the expanded adjusted rating life L_{nm} was standardised in DIN ISO 281 Appendix 1. Since 2007, it has been standardised in the worldwide standard ISO 281. Computer-aided calculation in accordance with DIN ISO 281 Appendix 4 has been specified in ISO/TS 16 281 since 2008.

L_{nm} is calculated as follows:

$$L_{nm} = a_1 \cdot a_{ISO} \cdot L_{10}$$

L_{nm} 10^6 revolutions
Expanded adjusted rating life in 10^6 revolutions to ISO 281

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

a_{ISO} –
Life adjustment factor for operating conditions

L_{10} 10^6 revolutions
Basic rating life, see page 32.

The values for the life adjustment factor a_1 were redefined in ISO 281:2007 and differ from the previous data.

Life adjustment factor a_1 for requisite reliability

Requisite reliability %	Expanded adjusted rating life L_{nm}	Life adjustment factor a_1
90	L_{10m}	1
95	L_{5m}	0,64
96	L_{4m}	0,55
97	L_{3m}	0,47
98	L_{2m}	0,37
99	L_{1m}	0,25
99,2	$L_{0,8m}$	0,22
99,4	$L_{0,6m}$	0,19
99,6	$L_{0,4m}$	0,16
99,8	$L_{0,2m}$	0,12
99,9	$L_{0,1m}$	0,093
99,92	$L_{0,08m}$	0,087
99,94	$L_{0,06m}$	0,08
99,95	$L_{0,05m}$	0,077

Life adjustment factor a_{ISO} for operating conditions

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

- 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.

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

a_{ISO} –
Life adjustment factor for operating conditions, *Figure 4*, page 38 to *Figure 7*, page 39

e_C –
Life adjustment factor for contamination, see table, page 40

C_u N
Fatigue limit load

P N
Equivalent dynamic bearing load

κ –
Viscosity ratio, see page 34.
For $\kappa > 4$ a value $\kappa = 4$ should be expected.
This calculation method cannot be used for $\kappa < 0{,}1$.

Taking account of EP additives in the lubricant

In accordance with ISO 281, EP additives in the lubricant can be taken into consideration as follows:

- At a viscosity ratio $\kappa < 1$ and a contamination factor $e_C \geqq 0{,}2$, a value $\kappa = 1$ can be used in calculation in the case of lubricants with EP additives that have proven effective.
  Under 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 51 819-1.

  Where a value $\kappa = 1$ is used in calculation in the case of EP additives that have proven effective, the life adjustment factor must be restricted to $a_{ISO} \leqq 3$. If the value a_{ISO} calculated for the actual κ is greater than 3, this value can be used in calculation.

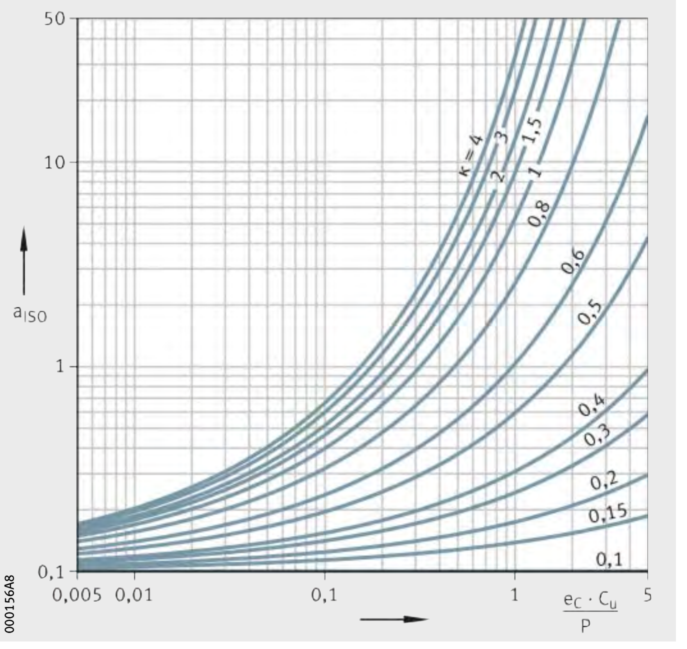


Figure 4
Life adjustment factor a_{ISO} for radial roller bearings

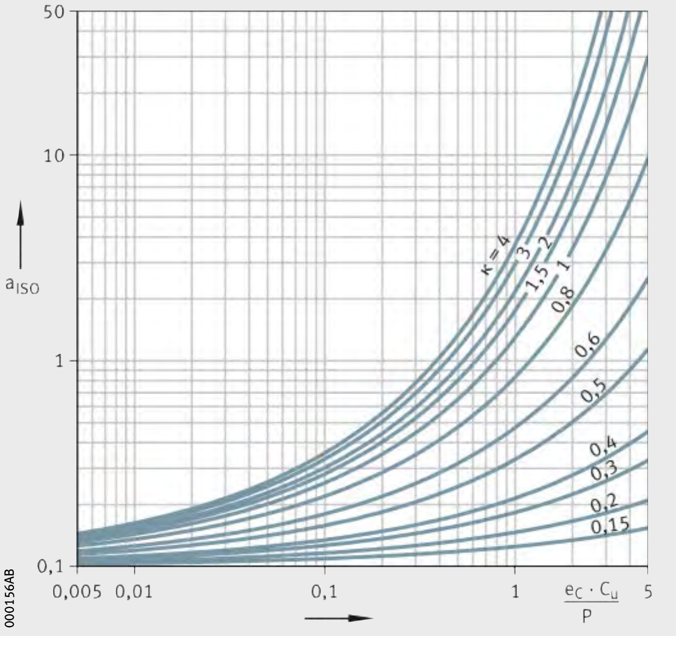


Figure 5
Life adjustment factor a_{ISO} for axial roller bearings

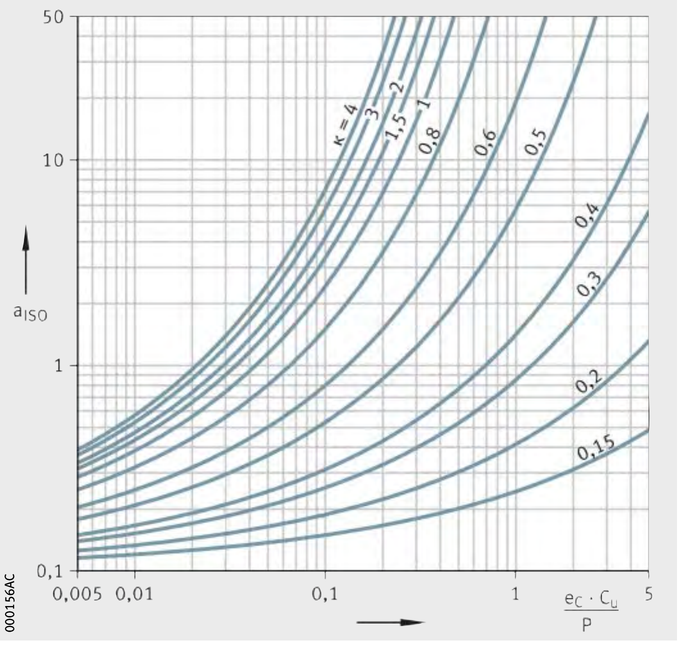


Figure 6
Life adjustment factor a_{ISO}
for radial ball bearings

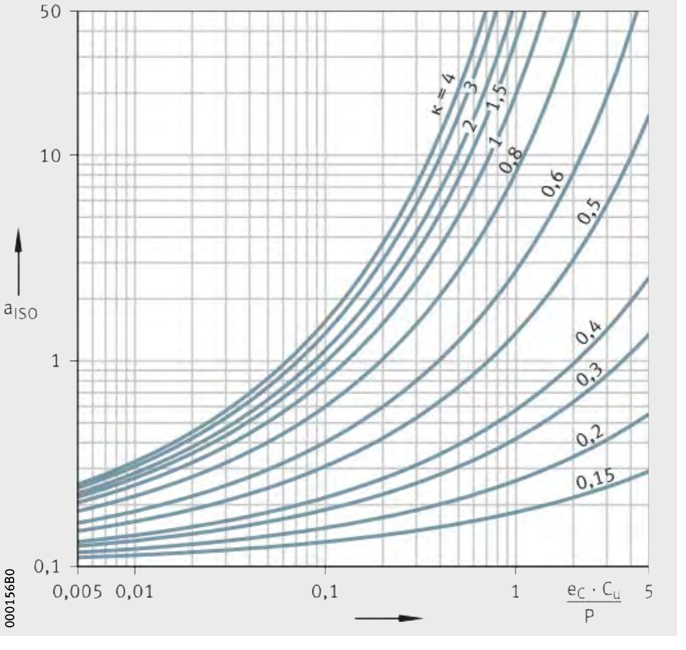


Figure 7
Life adjustment factor a_{ISO}
for axial ball bearings

Fatigue limit load

The fatigue limit load C_u in accordance with ISO 281 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 account of the influence of contamination in the lubrication gap on the rating life, see table.

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

- the type, size, hardness and quantity of particles
- the relative lubricant 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 (factor e_C). They do not take account of other contamination such as that caused by water or other fluids.

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 for contamination

Contamination	Factor e_C	
	$d_M < 100$ mm[1]	$d_M \geqq 100$ mm[1]
Extreme cleanliness - particle size of the order of magnitude of the 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 wear debris from other machine elements	0,3 to 0,1	0,4 to 0,2
Heavy contamination - bearing environment heavily contaminated - bearing arrangement insufficiently sealed	0,1 to 0	0,1 to 0
Very heavy contamination	0	0

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

Equivalent operating values

The rating life equations 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.

The operating values calculated here already take account of the life adjustment factors a_3 or a_{ISO}. 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, n and 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 a time period T and the speed is constant, 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, 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, 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 is calculated as follows:

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

The equation 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.

φ = angle of oscillation

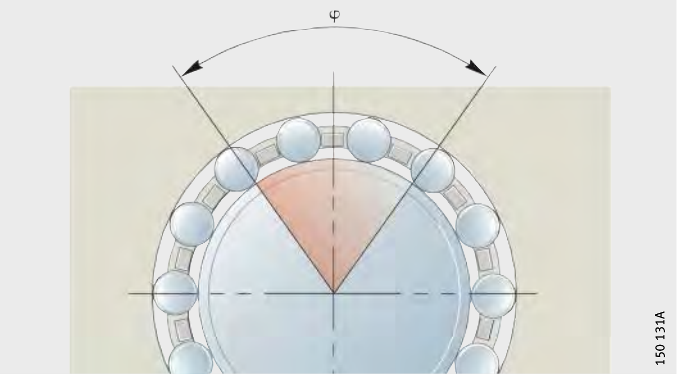


Figure 8
Angle of oscillation

Symbols, units and definitions

n $\quad$ min^{-1}
Mean speed

T $\quad$ min
Time period under consideration

P $\quad$ N
Equivalent bearing load

p $\quad$ –
Life exponent;
for roller bearings: $p = 10/3$
for ball bearings: $p = 3$

a_i, $a(t)$ $\quad$ –
Life adjustment factor a_{ISO} for current operating condition, see page 37

n_i, $n(t)$ $\quad$ min^{-1}
Bearing speed during current operating condition

q_i $\quad$ %
Duration of operating condition as a proportion of the total operating period;
$q_i = (\Delta t_i/T) \cdot 100$

F_i, $F(t)$ $\quad$ N
Bearing load during current operating condition

n_{osc} $\quad$ min^{-1}
Frequency of to and fro movement

φ $\quad$ °
Angle of oscillation, *Figure 8*.

Required rating life

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

Do not overspecify the bearing. If the calculated rating life is $> 60\,000$ 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.

Rail vehicles

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
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

Electric motors

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Large motors	32 000	63 000	50 000	110 000

Rolling mills, steelworks equipment

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
Roll stands	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

Gearboxes in general machine building

Mounting location	Recommended rating life in h			
	Ball bearings		Roller bearings	
	from	to	from	to
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
Belt drums	–	–	50 000	75 000
Bucket wheel excavators, travel drive	7 800	21 000	10 000	35 000
Bucket wheel excavators, bucket wheel	–	–	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

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

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, material processing	–	–	80 000	120 000
Paper machinery, wet section	–	–	100 000	150 000
Paper machinery, dry section	–	–	120 000	250 000
Paper machinery, calenders	–	–	80 000	120 000
Printing machinery	32 000	46 000	50 000	75 000

Operating life

The operating life is defined as the life actually achieved by the bearing. It may differ significantly from the calculated value.

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

- deviations in the operating data
- misalignment between the shaft and housing
- insufficient or excessive operating clearance
- contamination
- insufficient lubrication
- excessive operating temperature
- oscillating bearing movement with very small angles of oscillation (false brinelling)
- high vibration loads and false brinelling
- very high shock loads (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.

Load carrying capacity and life

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
- the tilting of the bearing.

! Ribs subjected to load must be supported across their entire height.

The permissible axial load $F_{a\ per}$ must not be exceeded, in order to avoid impermissibly high temperatures.

The limiting load $F_{a\ max}$ must not be exceeded, in order to avoid unacceptable pressure at the contact surfaces.

The ratio F_a/F_r must not exceed the value 0,4.
For bearings of the TB design, the value 0,6 is permissible.

Continuous axial loading without simultaneous radial loading is not permissible.

Bearings of TB design

In the case of these bearings, the axial load carrying capacity has been significantly improved through the use of new calculation and manufacturing methods.

A special curvature on the end faces of the rollers ensures optimum contact conditions between the roller and rib.
As a result, the axial contact pressures on the rib are significantly minimised and a lubricant film capable of supporting higher loads is formed. Under normal operating conditions, wear and fatigue at the rib contact running and roller end faces is completely eliminated.
The axial frictional torque is reduced by up to 50%.
The bearing temperature during operation is therefore significantly lower.

Permissible and maximum axial load

$F_{a\,per}$ and $F_{a\,max}$ are calculated using the following equations.

Bearings of standard design

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

Bearings of TB design

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

Bearings of standard and TB design

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

$F_{a\,per}$ 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, page 48

k_B –
Factor dependent on the bearing series,
see table Bearing factor k_B, page 48

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

n min^{-1}
Operating speed.

Misalignment of bearings

Misalignment caused by shaft deflection, for example, may lead to alternating stresses on the inner ring ribs. In this case, axial loading through to bearing tilting of max. 2 angular minutes must be restricted to F_{as} in accordance with the equation.

$$F_{as} = 20 \cdot d_M^{1,42}$$

If more severe tilting is present, a separate strength analysis is required.

Factor k_S for the 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
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 a reference viscosity ν_1 in accordance with the section Oil lubrication, page 85. Doped oils should be used such as 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	Factor 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	15
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	20
NJ4	22

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 operation of the bearing.

If a rolling bearing operates with only infrequent rotary motion or completely without 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 concentrically acting, constant 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

!

In addition to dimensioning on the basis of the fatigue limit life, it is advisable to check the static load safety factor. The guide values and shock loads occurring in operation according to the table must be taken into consideration, see table Guide values for static load safety factor, page 50.

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_{0r}, C_{0a}) N
Basic static load rating

P_0 (P_{0r}, P_{0a}) N
Equivalent static load on the radial or axial bearing, see page 50.

!

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

Guide values for static load safety factor

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

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

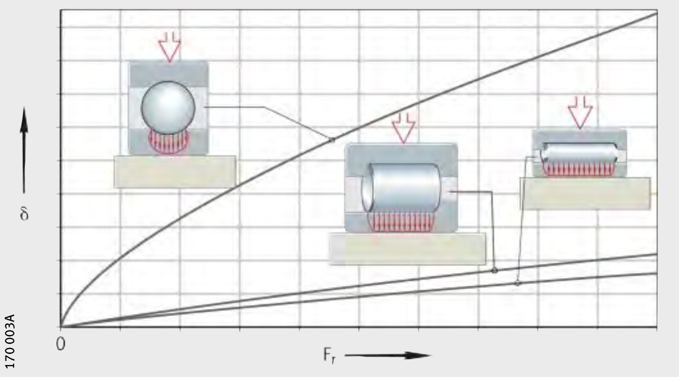
Y_0 –
Axial factor given in the dimension tables or product description.

This calculation method cannot be applied to axial cylindrical roller bearings. Combined loads are not permissible with these bearings.

For all radial cylindrical roller bearings, $P_0 = F_{0r}$.

Rigidity

The rigidity is determined by the type, size and operating clearance of the bearing. It 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 equations.

! The equations 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 bore centre, *Figure 2*, page 52

δ_a — µm
Axial displacement between shaft locating washer and housing locating washer, *Figure 3*, page 52

s — µm
Radial operating clearance of mounted, 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, see table, page 52.

Rigidity

Factor K_c

Bearing series	Factor K_c[1]	Bearing series	Factor K_c[1]
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
K811, 811, K812, 812	36,7	NJ23..-E	16,9
K893, 893, K894, 894	59,7	NU10	9,5
		NU19	11,3
		NN30..-AS-K	18,6

[1] K_c values for other series available by agreement.

Radial cylindrical roller bearing

δ_r = radial displacement
F_r = radial bearing load

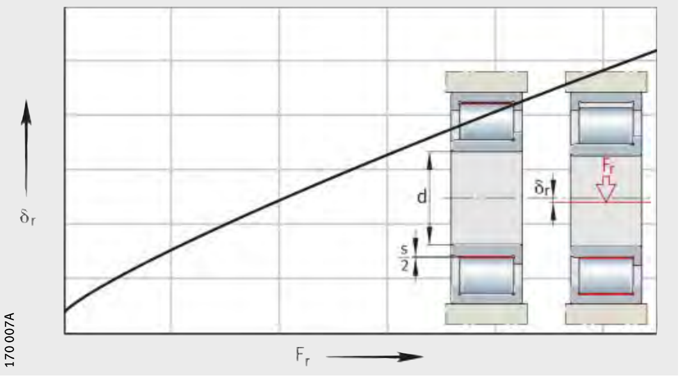


Figure 2
Radial displacement

Axial cylindrical roller bearing

δ_a = axial displacement
F_a = axial bearing load
F_{av} = axial preload force

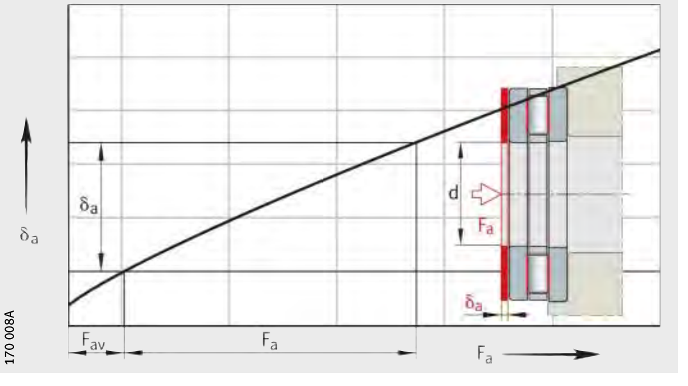


Figure 3
Axial displacement

Friction and increases in temperature

Friction

The friction in a rolling bearing is made up of several components, see table. Due to the large number of influencing factors, such as dynamics in speed and load, tilting and skewing resulting from installation, the actual frictional torques and frictional energy may deviate significantly from the calculated values.
If the frictional torque is an important design criterion, please consult the Schaeffler Engineering Service.

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

Heat dissipation

Friction is converted into heat. This must be dissipated from the bearing. The equilibrium between the frictional energy and heat dissipation allows calculation of the thermally safe operating speed n_{ϑ}, see section Thermally safe operating speed, page 61.

Heat dissipation by the lubricant

Lubricating oil dissipates a portion of the heat.
Recirculating oil lubrication with additional cooling is particularly effective. 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*.

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

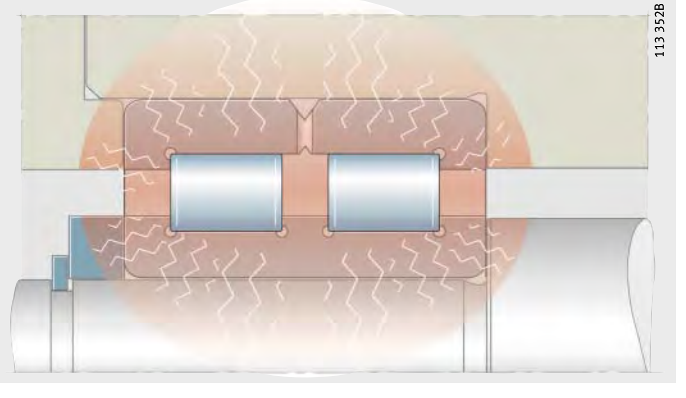


Figure 1
Temperature distribution between bearing, shaft and housing

Determining the friction values

The speed and load must also 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 58):

$$M_R = M_0 + M_1$$

Frictional energy N_R:

$$N_R = M_R \cdot \frac{n}{9\,550}$$

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

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

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 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 torque as a function of speed, *Figure 2*, page 55 and tables from page 55 to page 57

f_1 –
Bearing factor for frictional torque as a function of load, see tables from page 55 to page 57

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_r, F_a N
Radial load for radial bearings, axial load for axial bearings

P_1 N
Decisive load for frictional torque.
For ball bearings, tapered roller bearings and spherical roller bearings, see table, page 57

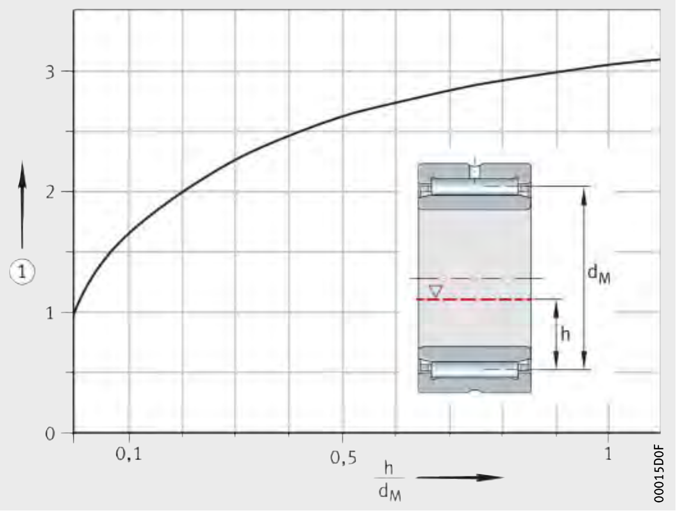
d_M mm
Mean bearing diameter (d + D)/2.

Bearing factors

The bearing factors f_0 and f_1 are mean values derived from series of tests and correspond to the data given in ISO 15 312.

They are valid for bearings that have undergone running-in and have uniform distribution of lubricant. In the freshly greased state, the bearing factor f_0 can be two to five times higher.

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*.



① Increase factor for bearing factor f_0
h = oil level
d_M = mean bearing diameter (d +D)/2

Figure 2
Increase in the bearing factor f_0, as a function of the oil level

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
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	
811, K811	2	3	0,0015
812, K812			
893, K893			
894, K894			

Bearing factors for tapered roller bearings

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

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	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, 619	1,1	1,7	
62	1,3	2	$0,0009 \cdot (P_0/C_0)^{0,5}$
63, 64	1,5	2,3	

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	1,3	2	$0,001 \cdot (P_0/C_0)^{0,33}$
72..-B			
73..-B	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	1	1,5	$0,0012 \cdot (F_a/C_0)^{0,33}$

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	$F_a - 0,1 \cdot F_r$	$1,4 \cdot F_a - 0,1 \cdot F_r$
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 greater value	$1,21 \cdot Y \cdot F_a$ or F_r, use the greater 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 $F_a/F_r \leqq e$	

For $P_1 \leqq F_r$, $P_1 = F_r$ applies.

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 calculated as follows:

$$M_R = M_0 + M_1 + M_2$$

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

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

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* and *Figure 4*, page 59

A –
Bearing parameter according to equation

F_a N
Axial dynamic bearing load

k_B –
Factor as a function of the bearing series, see table, page 59

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

The bearing factors f_2 are subject to wide scatter. They are valid for recirculating oil lubrication with an adequate quantity of oil.
The curves must not be extrapolated, *Figure 3* and *Figure 4*, page 59.

Bearings of TB design

In the case of bearings of TB design, the axial load carrying capacity has been significantly improved through the use of new calculation and manufacturing methods.

A special curvature on the end faces of the rollers ensures optimum contact conditions between the roller and rib.
As a result, the axial contact pressures on the rib are significantly minimised and a lubricant film capable of supporting higher loads is formed. Under normal operating conditions, wear and fatigue at the rib contact running and roller end faces is completely eliminated.

In addition, the axial frictional torque is reduced by up to 50%.
The bearing temperature during operation is therefore significantly lower.

Cylindrical roller bearings of standard design

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

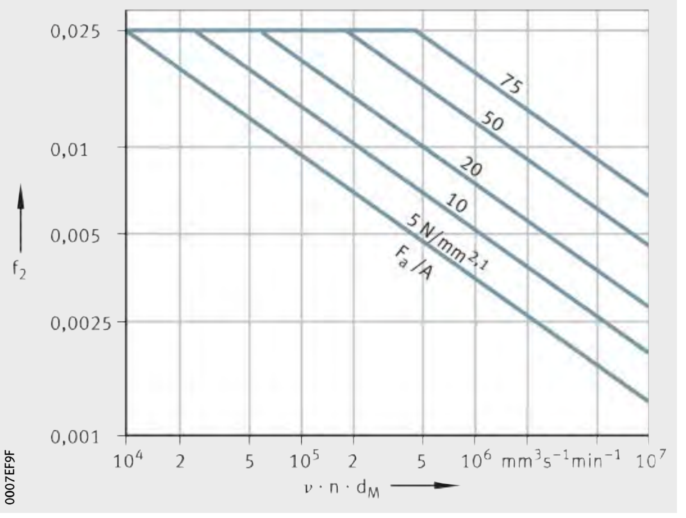


Figure 3
Bearing factor f_2,
as a function of operating parameter

Cylindrical roller bearings of TB design

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

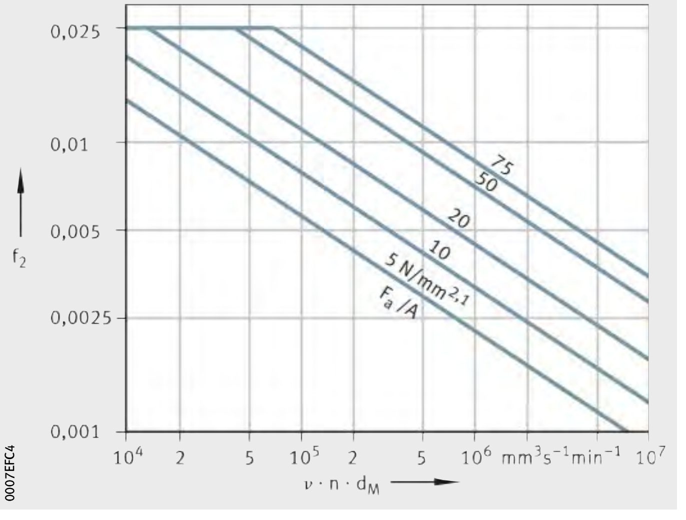


Figure 4
Bearing factor f_2,
as a function of operating parameter

Bearing factor k_B

Bearing series	Factor k_B
SL1818, SL0148	4,5
SL1829, SL0149	11
SL1830, SL1850	17
SL1822	20
LSL1923	28
SL1923	30
NJ2..-E, NJ22..-E, NUP2..-E, NUP22..-E	15
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	20
NJ4	22

Speeds

On the basis of DIN 732-1, calculation of the thermal reference speed n_B has been standardised in ISO 15 312. The calculation of reference speeds has been matched to this standard.
As a result, the values are different from the previous catalogue data.

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

Thermal reference speed

The thermal reference speed n_B is used as an ancillary value when calculating the thermally safe operating speed n_ϑ. It is the speed at which, under defined reference conditions, a bearing 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 in ISO 15 312 as follows:

- mean ambient temperature $\vartheta_{Ar} = +20$ °C
- mean bearing temperature at the outer ring $\vartheta_r = +70$ °C
- load on radial bearings $P_{1r} = 0{,}05 \cdot C_{0r}$
- load on axial bearings $P_{1a} = 0{,}02 \cdot C_{0a}$
- the operating viscosities (axial bearings according to DIN 732-1) For radial bearings, they are such that approximately the same reference speeds are achieved for oil and grease lubrication.
  - radial bearings: 12 mm^2s^{-1} (ISO VG class 32)
  - axial spherical roller bearings: 24 mm^2s^{-1} (ISO VG class 68)
  - axial cylindrical roller bearings: 48 mm^2s^{-1} (ISO VG class 220)
- heat dissipation via the bearing seating surfaces, see equations.

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

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

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

$$q_r = 0{,}016 \cdot \left(\frac{A_r}{50\,000}\right)^{-0{,}34} \mathrm{W/mm^2}$$

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

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

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

$$q_r = 0{,}020 \cdot \left(\frac{A_r}{50\,000}\right)^{-0{,}16} \mathrm{W/mm^2}$$

Limiting speed

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

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

Thermally safe operating speed

The thermally safe operating speed n_ϑ is calculated according to DIN 732-2 (draft).
The basis for the calculation is the heat balance in the bearing, the equilibrium between the frictional energy as a function of speed and the heat dissipation as a function of temperature.
When conditions are in equilibrium, the bearing temperature is constant.

The permissible operating temperature determines the thermally safe operating speed n_ϑ of the bearing. The preconditions for calculation are correct mounting, 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 velocity at the seal lip
- back-up rollers
- axial deep groove and axial angular contact ball bearings.

The limiting speed n_G must always be observed.

Calculation of the thermally safe operating speed

The thermally safe operating speed n_ϑ is a product of the reference speed n_B and the speed ratio f_n:

$$n_\vartheta = n_B \cdot f_n$$

The speed ratio is derived from *Figure 1*, page 63:

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

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

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

Heat dissipation via the bearing seating surfaces $\dot{Q}_S$, *Figure 2*, page 63:

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

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

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

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:

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

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

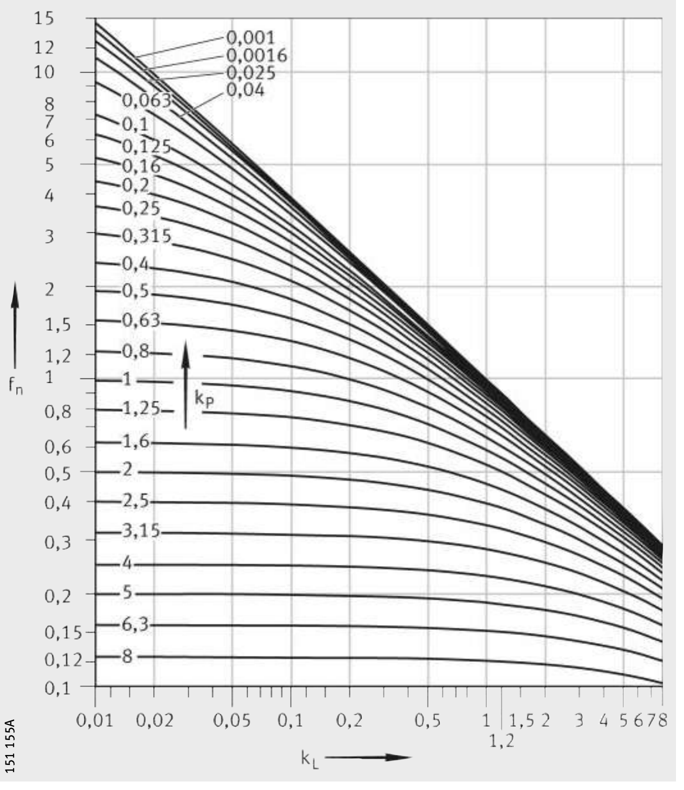


Figure 1
Speed ratio f_n

k_q = heat transfer coefficient
A_r = bearing seating surface
① Reference condition for radial bearings
② Reference condition for axial bearings

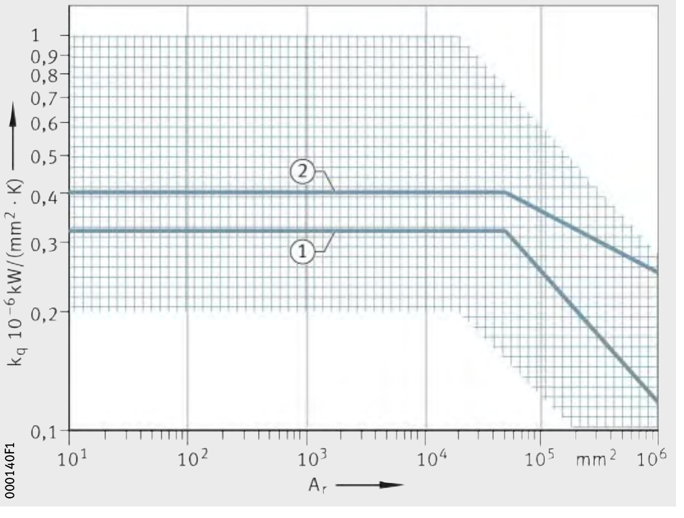


Figure 2
Heat transfer coefficient k_q
as a function
of the bearing seating surface

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 diameter

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 Bearing factors, page 55

f_1 –
Bearing factor for frictional torque as a function of load, see section Bearing factors, page 55

f_n –
Speed ratio, *Figure 1*, page 63

k_L –
Lubricant film parameter

k_P –
Load parameter

k_q $10^{-6}\,kW/(mm^2 \cdot K)$
Heat transfer coefficient of bearing seating surface, *Figure 2*, page 63. It is dependent on the housing design and size, the housing material and the mounting position. In normal applications, the heat transfer coefficient for bearing seating surfaces up to 25 000 mm^2 is between 0,2 and $1{,}0 \cdot 10^{-6}\,kW/(mm^2 \cdot K)$

n_ϑ min^{-1}
Thermally safe operating speed

n_B min^{-1}
Reference speed, see dimension tables

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

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 outlet temperature and oil inlet temperature

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

Lubrication

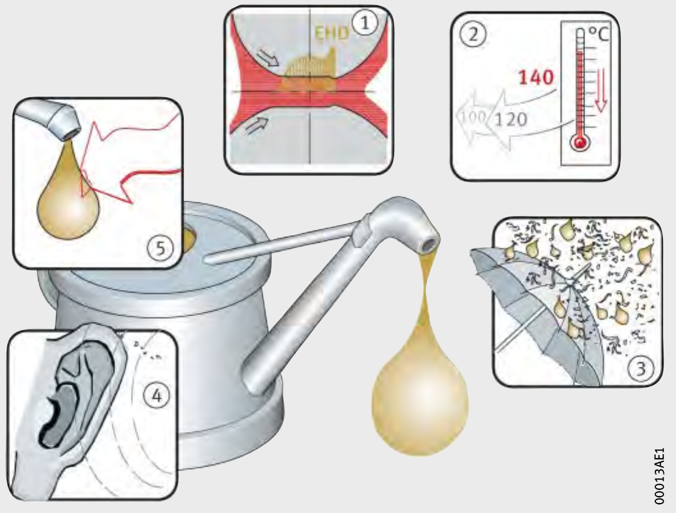
Principles

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

Lubrication

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
- the sealing action
- the reservoir effect
- long operating life with little maintenance work (lifetime 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

The feed lines and lubrication holes in the housings and shafts, *Figure 2* and *Figure 3* must:

- lead directly to the lubrication hole in the rolling bearing
- be as short as possible
- be provided individually for each bearing.

Ensure that the feed lines are filled, *Figure 3*; the feed line should be bled if necessary.

Follow the instructions provided by the lubrication device manufacturer.

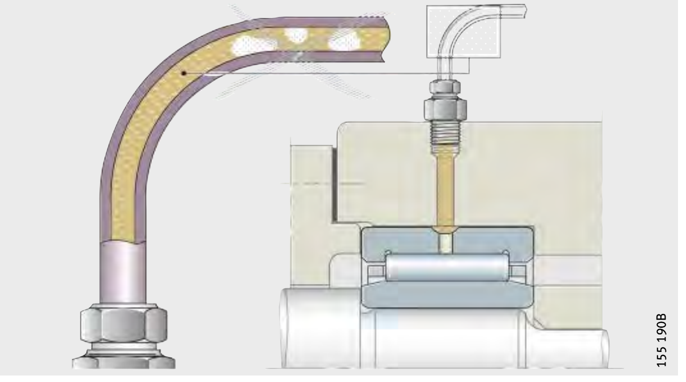


Figure 2
Lubricant feed lines

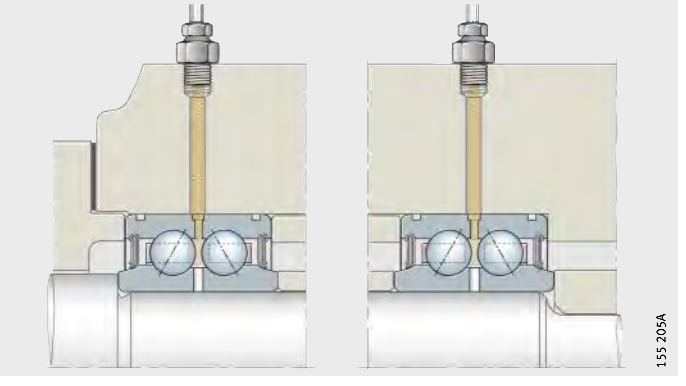


Figure 3
Arrangement of feed to more than one bearing on a shaft

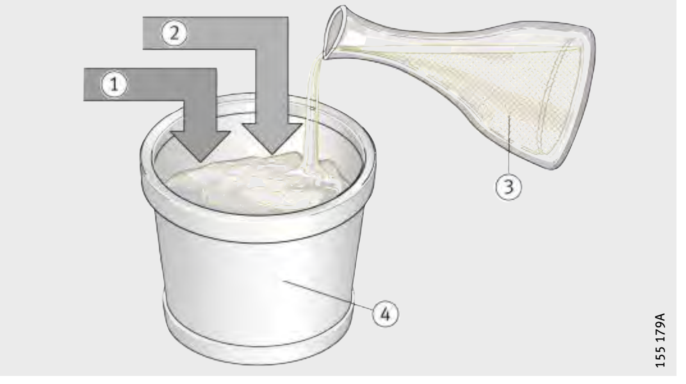
Grease lubrication

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 85.

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

Lubricants must always 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 grades
(NLGI grades to DIN 51 818).

For rolling bearings, grades 1, 2, 3 should be used in preference, *Figure 5*.

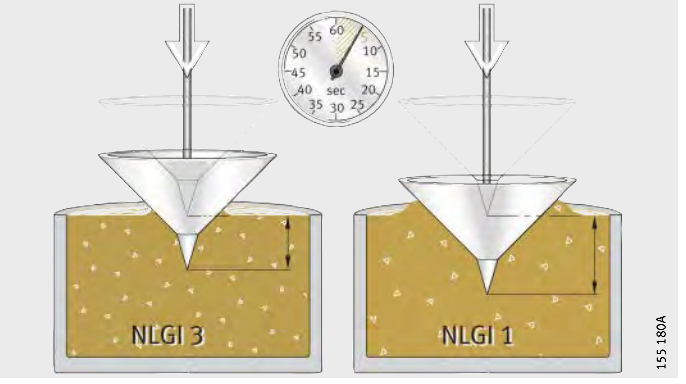


Figure 5
Consistency of greases

Selection of suitable grease

Rolling bearing greases K to DIN 51 825 are suitable.

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

- temperature
- compressive load, see page 72
- speed, see page 72
- the presence of water and moisture, see page 73.

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 on 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 1 000 Nmm and the running torque must not exceed 100 Nmm.

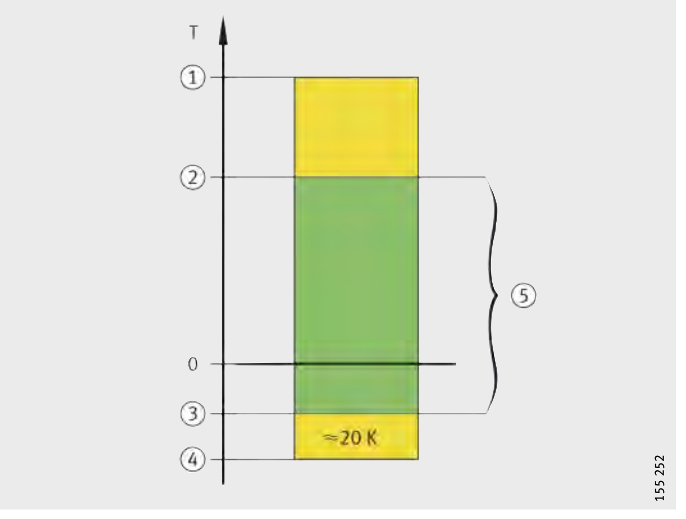
Schaeffler recommends that greases should be used in accordance with the bearing temperature normally occurring in the standard operating range in order to achieve a reliable lubricating action and an acceptable grease operating life, *Figure 6*.

At low temperatures, greases release very little base oil. This can result in lubricant starvation. Schaeffler 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 stated by the grease manufacturer.

The upper continuous limit temperature $T_{upperlimit}$ must not be exceeded if a temperature-induced reduction in the grease operating life is to be avoided; see section Grease operating life, page 76.

!

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.



T = operating temperature
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 (EP = 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 ($P \leqq 0{,}03 \cdot C$).

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

Greases should be selected in accordance with the speed parameter $n \cdot d_M$ for grease, see table, page 74:

- 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 accelerations > 500 g, separation (of the thickener and base oil) may occur. In this case, please consult the lubricant manufacturer.

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

Water and 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, *Figure 7*.
- The anti-corrosion characteristics can be tested according to DIN 51 802 (Emcor test) (information is given in the datasheets from the grease manufacturers).

① Blank
② Grease specimen
③ Glass slide

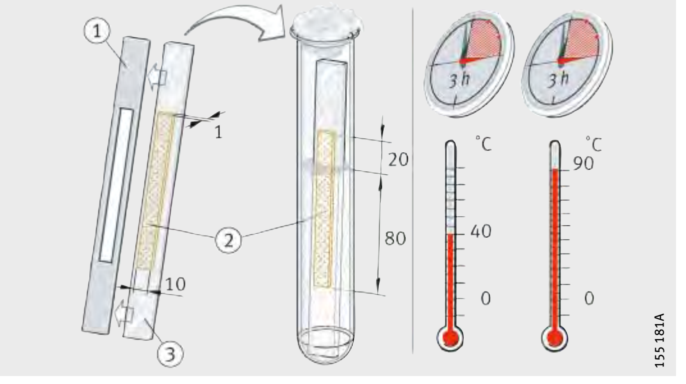


Figure 7
Behaviour in the presence of water in accordance with DIN 51 807

Lubrication

Greases with special suitability

Many of the rolling bearings supplied by Schaeffler Technologies have a grease filling. The greases used have proved particularly suitable for the applications in mechanical-dynamic tests, see table.

Greases

Designation[1]	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 and insert bearing grease for $D > 62$ mm	Lithium soap Mineral oil
GA14	Low-noise ball bearing grease for $D \leqq 62$ 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
GA08	Grease for line contact	Lithium complex soap Mineral 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] GA stands for **G**rease **A**pplication Group, based on Grease Spec 00.

[2] The upper continuous limit temperature $T_{upperlimit}$ must not be exceeded if a temperature-induced reduction in grease operating life is to be avoided.

[3] Dependent on bearing type.

Operating temperature range °C	Upper continuous limit temperature $T_{upperlimit}$[2)] °C	NLGI grade	Speed parameter $n \cdot d_M$ $min^{-1} \cdot mm$	ISO VG class (base oil)[3)]	Designation[1)]	Recommended Arcanol grease for relubrication
−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**	**MULTI3**
−30 to +140	+75	2	500 000	68 to 150	**GA14**	**MULTI2**
−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**	–
−30 to +140	+95	2 to 3	500 000	150 to 320	**GA08**	**LOAD150**
−40 to +250	+180	2	300 000	460 to 680	**GA11**	**TEMP200**
−20 to +140	+70	1 to 2	350 000	150 to 320	**GA47**	–

Arcanol rolling bearing greases

For users who wish to charge their rolling bearings with grease themselves, there is a range of particularly suitable Arcanol rolling bearing greases.

The greases in the range are graded in terms of their performance capability such that they can be used to cover almost all areas of application, see section Arcanol rolling bearing greases, page 1046.

Grease operating life

The grease operating life t_{fG} applies where this is less than the calculated bearing life and the bearings are not lubricated.

A guide value can be determined in approximate terms as follows:

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

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, see page 78 to page 81.

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

Basic grease operating life

This applies under the preconditions according to table.

Preconditions for the basic grease operating life

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

The basic grease operating life t_f is dependent on the bearing-specific speed parameter $k_f \cdot n \cdot d_M$ and is calculated using *Figure 8*.

k_f –
Bearing type factor, see table Factor k_f as a function of bearing type, page 77

n
Operating speed or equivalent speed

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

Calculation of basic grease operating life

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

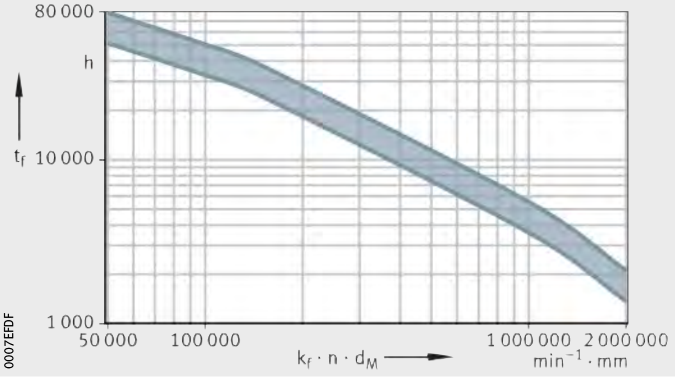


Figure 8
Calculation of basic grease operating life t_f

Factor k_f as a function of bearing type

Bearing type	Factor k_f
Deep groove ball bearings, single row	1
Angular contact ball bearings, single row	1,6
Angular contact ball bearings, double row	2
Four point contact bearings	1,6
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 or without alternating axial load	2
Cylindrical roller bearings, double row[1]	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
Back-up rollers	20
Cylindrical roller bearings LSL	3,1
Axial cylindrical roller bearings	58

[1] Not valid for super precision cylindrical roller bearings NN30 and NNU49. In this case, please use the calculation scheme in the publication Super Precision Bearings, SP 1.

Guidelines on calculating the grease operating life

Combined rolling bearings

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 is the rotating component, there may be a reduction in the grease operating life.

In the case of back-up rollers:

- the 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

The grease operating life cannot be determined using the method described in the following cases:

- if the grease can leave the bearing arrangement
  - if there is excessive evaporation of the base oil
  - in bearing positions 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 high precision bearings for combined loads
- for high precision cylindrical roller bearings.

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 determined from the diagram, *Figure 9*.

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 74. If necessary, a different grease should be selected or contact should be made with the Schaeffler engineering service.

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

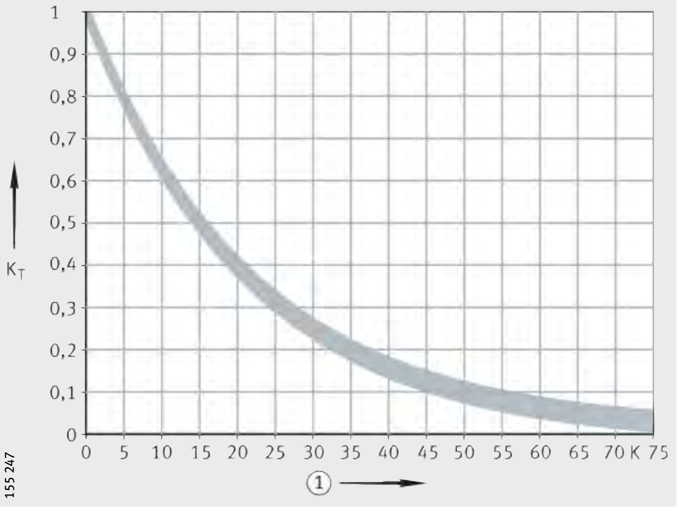


Figure 9
Temperature factor

Load factor K_P

The factor K_P is dependent on the bearing and describes the reduction at higher load (this places greater strain on the grease), *Figure 10* and table.

This is based on high-quality lithium soap greases

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

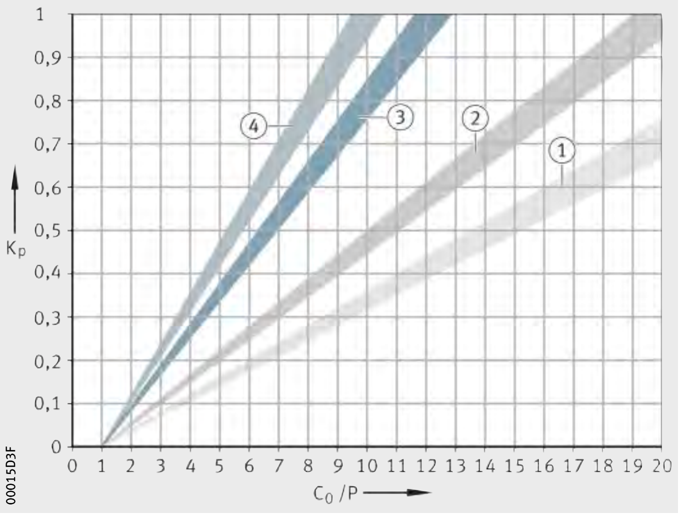


Figure 10
K_P factor for bearings

K_P factor

Curve[1]	Bearing type
①	Axial angular contact ball bearings, double row
	Axial deep groove ball bearings
	Axial cylindrical roller bearings
②	Spherical roller bearings with central rib
	Cylindrical roller bearings, double row (excluding NN30)
	Back-up rollers
③	Cylindrical roller bearings LSL
	Tapered roller bearings
	Spherical roller bearings without central rib (E1)
	Barrel roller bearings
	Cylindrical roller bearings, full complement
	Cylindrical roller bearings, single row (constant or alternating load)
	Four point contact bearings
④	Deep groove ball bearings
	Angular contact ball bearings (single or double row)
	Self-aligning ball bearings

[1] Curves: see *Figure 10*.

Oscillation factor K_R

The factor K_R applies for an angle of oscillation $\varphi < 180°$, *Figure 11* and *Figure 12*. Oscillating motion places a greater strain on the grease than does rotating motion.

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

If the rolling elements do not undergo complete rotation, please contact the Schaeffler engineering service.

φ = angle of oscillation

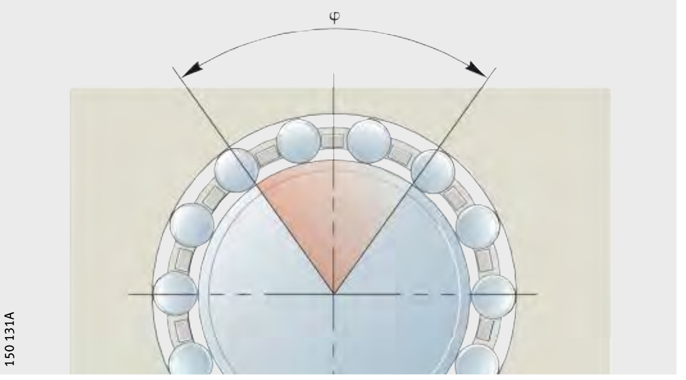


Figure 11
Angle of oscillation

K_R = oscillation factor
φ = angle of oscillation

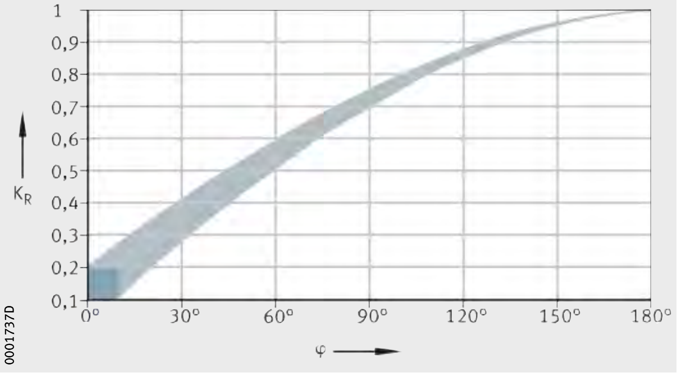


Figure 12
Oscillation factor

Factor K_U for environmental influences

The 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.

It 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, the influence of contamination on rating life calculation must also be noted, see section Load carrying capacity and life, page 30.

Environmental factor K_U

Environmental influence	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 the case of radial bearings with a vertical axis of rotation, the factor K_S according to the table must be taken into consideration.

K_S factor

Arrangement of shaft	Factor K_S
Vertical (depending on sealing)	0,5 to 0,7
Other arrangement	1

Relubrication intervals

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

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

This should be carried out as follows:

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

For reasons of operational reliability, relubrication intervals of $>$ 1 year are not recommended.

Lubrication interval guide value

Experience shows that a guide value for most applications 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, see page 76.

Relubrication conditions

The grease used for relubrication must be the same as that used in initial greasing.

If different greases are used, their miscibility and compatibility must be checked; see section Miscibility, page 84.

Relubrication quantity

Due to the compact construction of the bearings, relubrication should be carried out using 50% to 80% of the initial greasing quantity (recommendation).

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

Relubrication should always be carried out as follows:

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

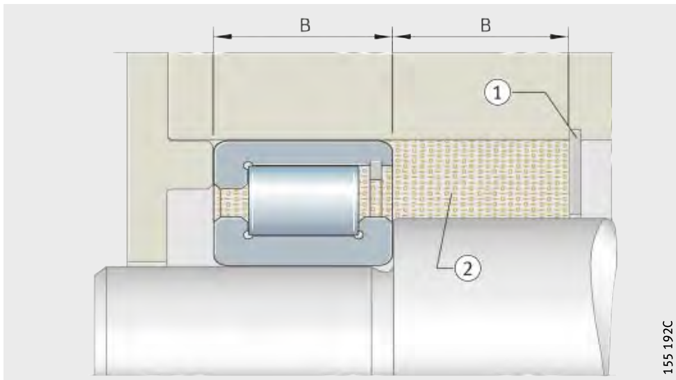
Grease reservoir

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. Increasing the size of the grease reservoir does not lead to a proportional increase in the grease operating life.

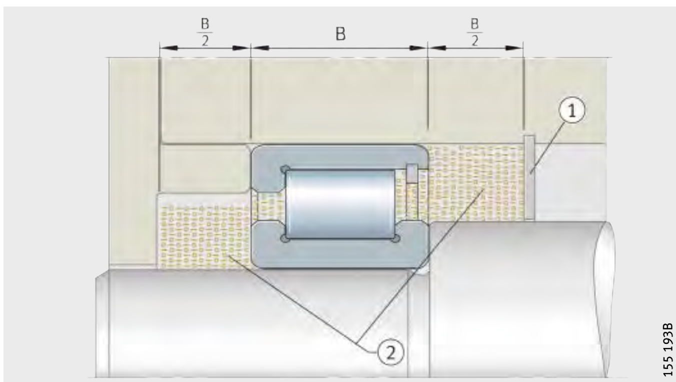
The volume of the grease reservoir should correspond to the area in the bearing between the inner and outer ring (not taking account of the cage and rolling elements), *Figure 13* and *Figure 14*.

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



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

Miscibility

Mixtures of greases should be avoided if at all possible.

Preconditions

If they are unavoidable, the following preconditions must be fulfilled:

- The base oil must be the same.
- The thickener types must match.
- The base oil viscosities must be similar (they must not differ by more than one ISO VG class).
- The consistency must be identical (NLGI grade).

! Miscibility of greases must be always be agreed in consultation with the lubricant manufacturer.

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

If a decision is taken to change to a different grease grade, the grease should be rinsed out if this is possible. Further relubrication should be carried out after a shortened period.

If incompatible greases are mixed, this can leading to considerable structural changes. Substantial softening of the grease mixture may also occur.

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

Storage

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

Preconditions

The preconditions are:

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

Lubricants age due to environmental influences. The information provided by lubricant manufacturers must always be observed.

! 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, Schaeffler cannot offer any guarantees either for the lubricants used by customers for relubrication or for their characteristics.

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.

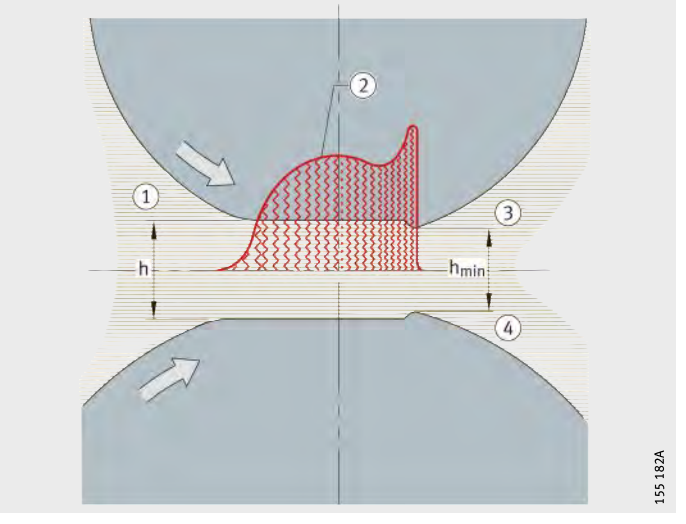
In these cases, please consult the lubricant manufacturer or the Schaeffler engineering service.

Operating temperatures

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

Selection of suitable oil

The achievable bearing 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, page 30.



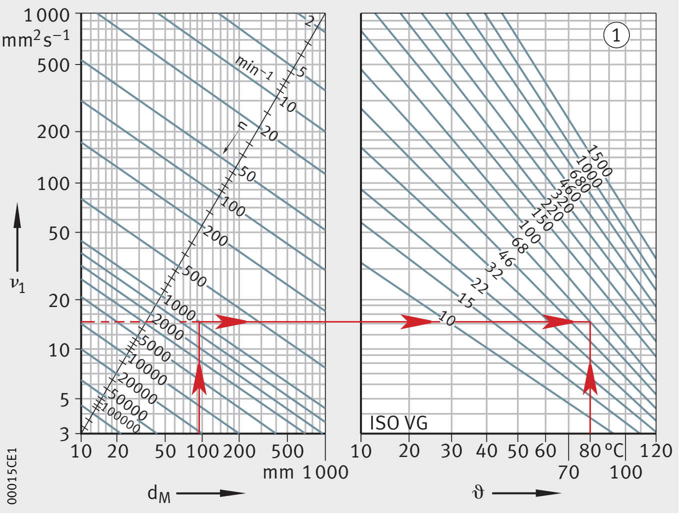
① Entry zone
② Pressure curve according to EHD theory
③ Exit zone
④ Lubricant

Figure 15
Lubricant film in the contact zones

Reference viscosity for mineral oils

The guide value for ν_1 is dependent on the mean bearing diameter d_M and the speed n. It takes account of the EHD theory of lubricant film formation and practical experience.

Depending on the operating speed, the oil at operating temperature must have at least the reference viscosity ν_1, *Figure 16*, page 86.



ν_1 = reference viscosity
d_M = mean bearing diameter (d + D)/2
n = operating speed
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

The reference viscosity ν_1 is determined as follows:

- 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 to the nearest ISO VG (due to the steps between groups).

This method cannot be used for synthetic oils, since these have different V/P (viscosity/pressure) and V/T (viscosity/temperature) characteristics.

In these cases, please consult the Schaeffler 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, the VI index should be at least 95.

When selecting the viscosity, the lower operating temperature must be taken into consideration, since the increasing viscosity will reduce the flowability of the lubricant. As a result, the level of power losses may increase.

A 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 power losses arising from lubricant friction, there may be problems with the feed and removal of oil at low or even at normal temperatures.

The oil selected must be sufficiently viscous that it gives the highest possible fatigue life. It must also be ensured that the bearings are always supplied with adequate quantities of oil.

Pressure properties and anti-wear additives

If the bearings are subjected to high loads or if 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 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 points (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 to DIN 51 819).

Silicone oils should only be used for low loads ($P \leqq 0{,}03 \cdot C$).

Compatibility

Before an oil is used, its behaviour must be checked in relation to plastics, seal materials (elastomers) and light and non-ferrous metals.

This must always be checked under dynamic loading and at operating temperature.

Synthetic oils must always be checked for their compatibility. The lubricant manufacturer must be consulted on this at the same time.

Miscibility

The 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 HLP can be mixed with HLP.
The viscosities should vary by no more than one ISO VG class.

Synthetic oils must always be checked for their compatibility. The lubricant manufacturer must be consulted on this at the same time.

Miscibility must be checked in advance for each individual case.

Cleanliness

The cleanliness of the oil influences the rating life of bearings, see also section Load carrying capacity and life, page 30.

Schaeffler therefore recommends that an oil filter should be provided; attention must be paid to the filtration rate. The filter mesh should be $< 25\ \mu m$.

Lubrication methods

The essential lubrication methods are:
- drip feed oil lubrication
- pneumatic oil lubrication
  (to protect the environment, this should be used as a substitute for oil mist lubrication)
- oil bath lubrication
  (immersion or sump lubrication)
- recirculating oil lubrication.

Drip feed oil lubrication

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

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).

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

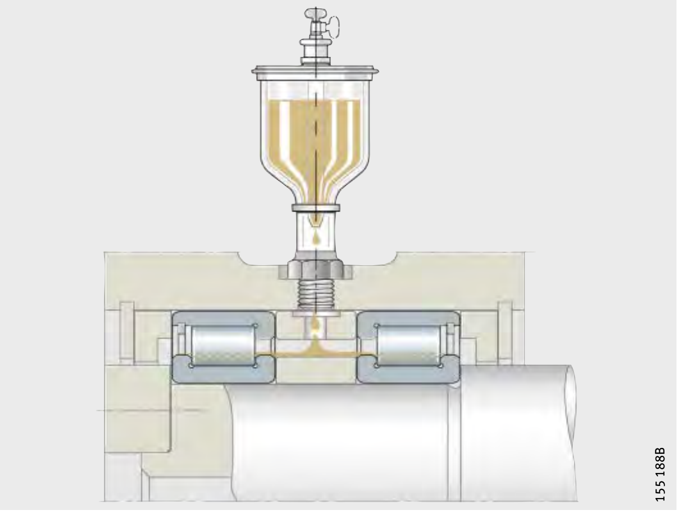


Figure 17
Drip feed oil lubrication (schematic)

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} · mm), *Figure 18*.

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

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

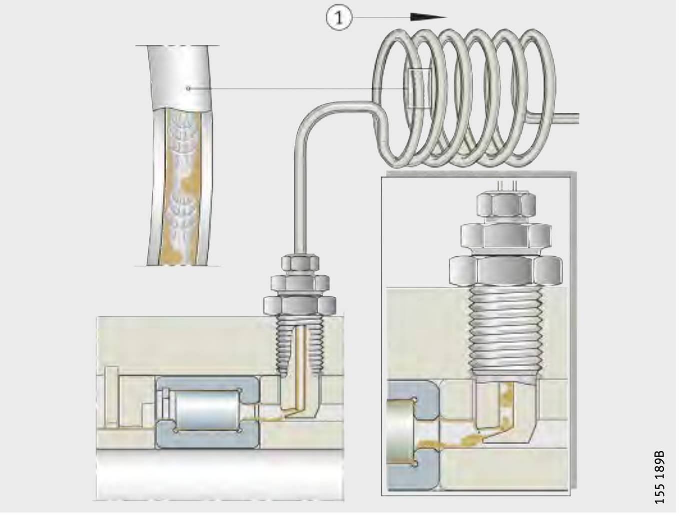
Parameters for design of the lubrication system should be requested from the equipment manufacturers.

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

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

Pneumatic oil lubrication has little cooling effect.

Follow the instructions provided by the manufacturers of the lubrication systems.



1 To the pneumatic oil unit

Figure 18
Pneumatic oil lubrication (schematic)

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 as a result of losses due to splashing. Furthermore, foaming of the oil may occur.

In general, it is suitable for speeds up to $n \cdot d_M = 300\,000\ \text{min}^{-1} \cdot \text{mm}$.
At $n \cdot d_M < 150\,000\ \text{min}^{-1} \cdot \text{mm}$, the bearing may be completely 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.

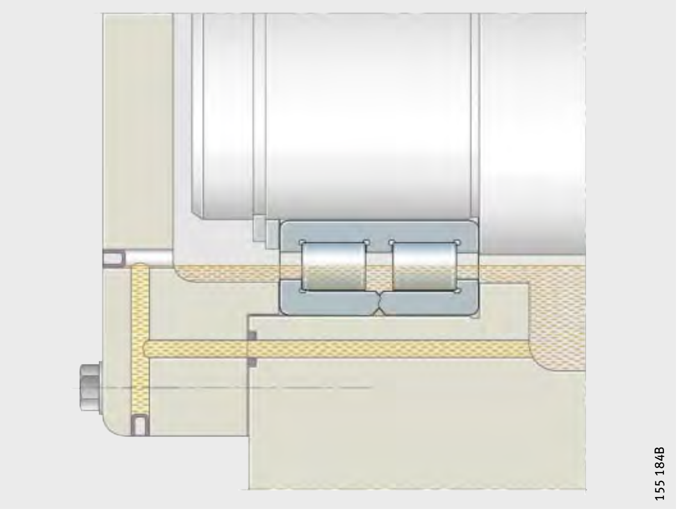
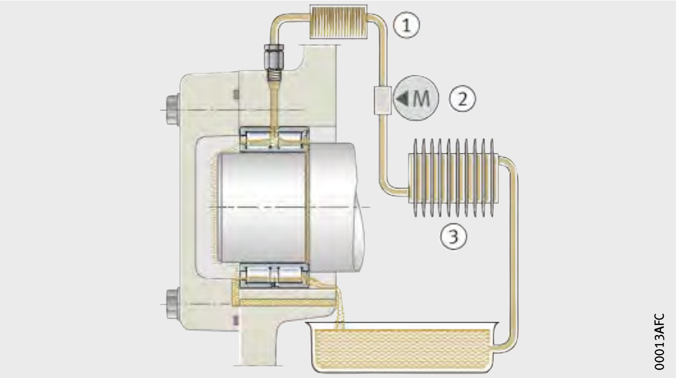


Figure 19
Oil bath lubrication (schematic)

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, page 60.

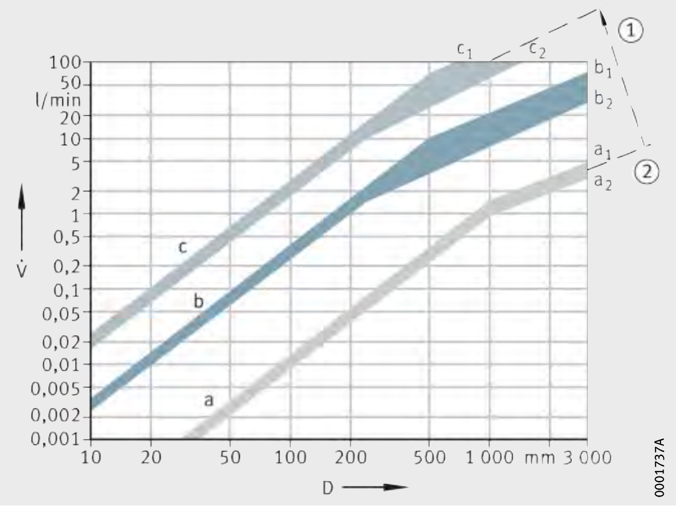


① Filter
② Pump
③ Cooling system

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.



$\dot{V}$ = oil quantity
D = outside bearing diameter
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

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*.

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 viscosity into consideration

K_{ab} –
Correction factor for viscosity, see table

A_{ab} mm^2
Outlet cross-section, *Figure 22*.

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

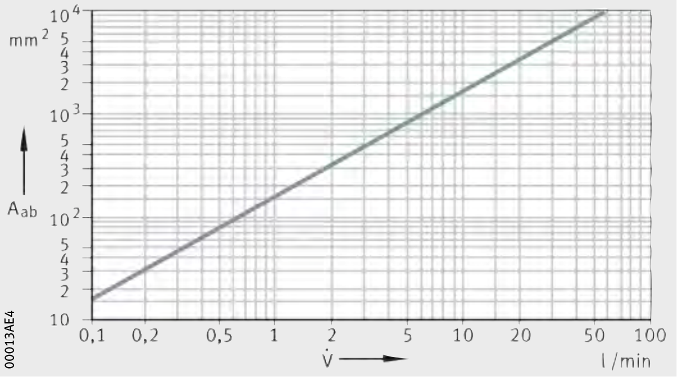


Figure 22
Outlet cross-section (guide values)

Correction factor K_{ab}

Viscosity mm$^2 \cdot$ s^{-1}	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, *Figure 23*.
Injection lubrication using large recirculation quantities is associated with high power loss.

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

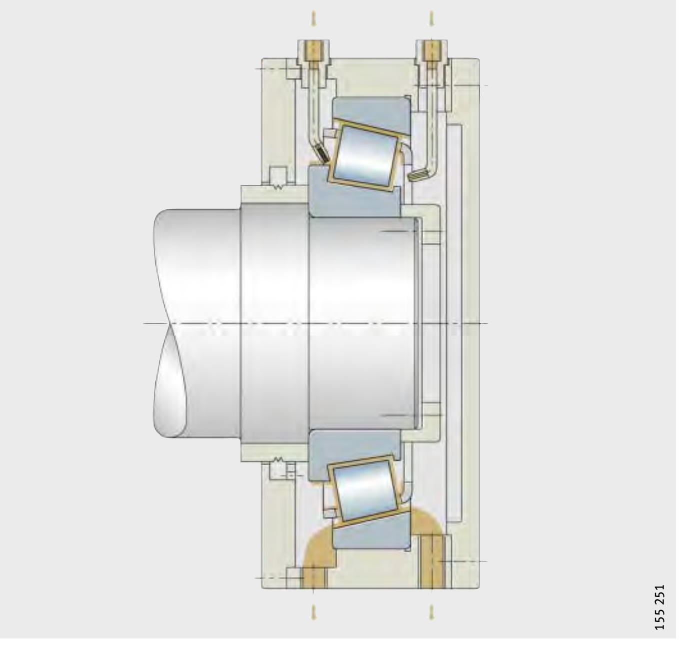


Figure 23
Oil injection lubrication (oil feed from both sides for tapered roller bearing running at high speeds)

Lubrication

Heat dissipation by the lubricant

Oil can dissipate frictional heat from the bearing. It is possible to calculate the heat flow $\dot{Q}_L$ that is dissipated with the lubricant and the necessary 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 inlet and oil outlet temperature.

Guide values for the oil quantity in cooling and lubrication

If these values cannot be calculated, the guide values according to *Figure 24* apply for the temperature difference of $\Delta\vartheta_L$ = 10 K.

$\dot{V}$ = oil quantity
N_R = frictional power
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

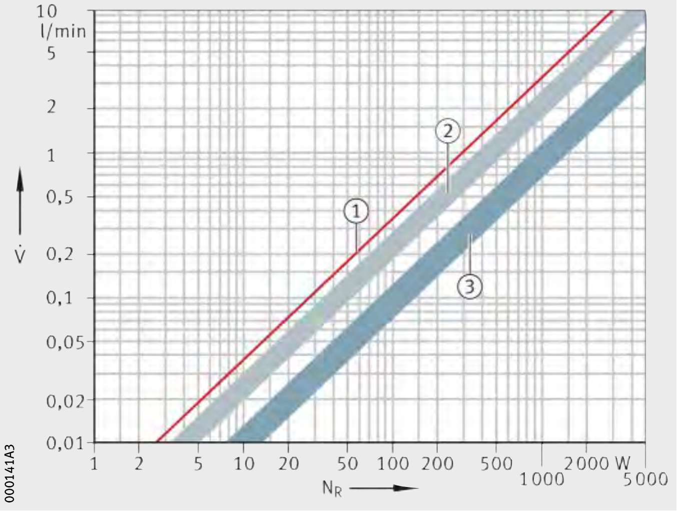


Figure 24
Guide values for the oil quantity in cooling and lubrication

Oil changes

At temperatures in the bearing of less than +50 °C and with only slight contamination, an oil change once per year is generally sufficient.

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

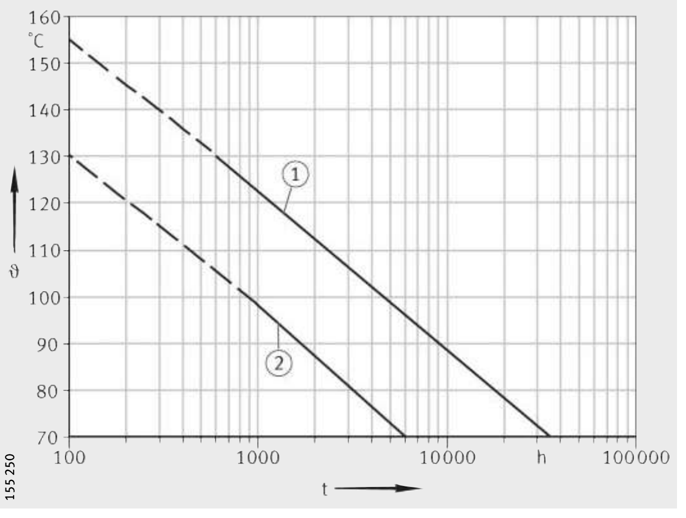
The precise oil change intervals should be agreed in consultation with the oil manufacturer.

Severe operating conditions

Under severe conditions, the oil should be changed more often. This applies, for example, in the case of higher temperatures and low oil quantities with a high circulation index.

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

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



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

Figure 25
Oil change intervals

Bearing data

Radial internal clearance

The radial internal clearance applies to bearings with an inner ring before the bearing is mounted. 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*.

In accordance with DIN 620-4, ISO 5 753, the radial internal clearance is divided into groups, *Figure 1* and table.

CN, C2, C3, C4, C5 = internal clearance groups

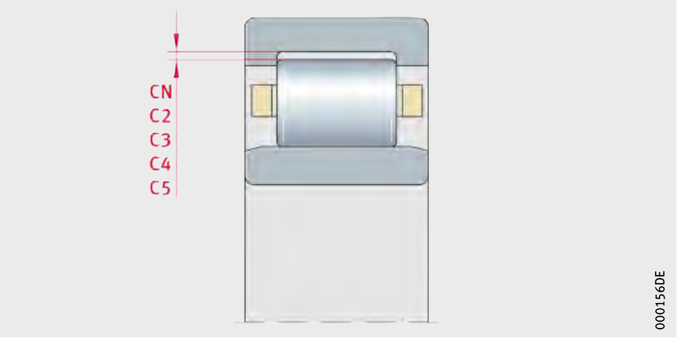


Figure 1
Radial internal clearance

Radial internal clearance groups

Internal clearance group	Description	Standard	Application
CN	Normal radial internal clearance CN is not included in bearing designations	DIN 620-4 ISO 5 753	For normal operating conditions with shaft and housing tolerances, see section Operating clearance value, page 97
C2	Internal clearance < CN		For heavy alternating loads combined with oscillating motion
C3	Internal clearance > CN		For bearing rings with press fits and large temperature differential between the inner and outer ring
C4	Internal clearance > C3		
C5	Internal clearance > C4	ISO 5 753	

Enveloping circle

For bearings without an inner ring, the enveloping circle F_w is used. This is the inner inscribed circle of the cylindrical rollers in clearance-free contact with the outer raceway, *Figure 2*. Before the bearings are mounted, it is in the tolerance zone F6. Deviations for F6, see table, page 146.

① Cylindrical roller
② Outer raceway
F_w = enveloping circle diameter

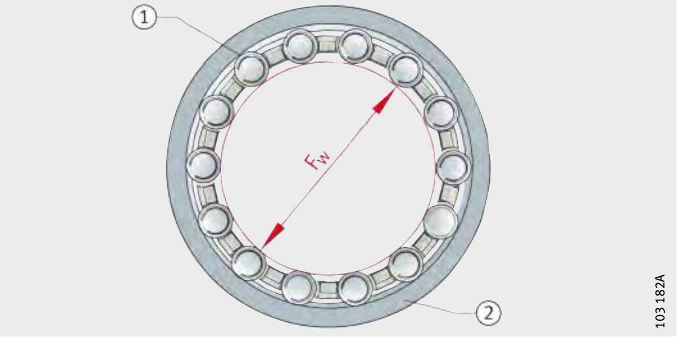


Figure 2
Enveloping circle

Operating clearance

The operating clearance is determined on a mounted 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 mounted condition.

s = operating clearance

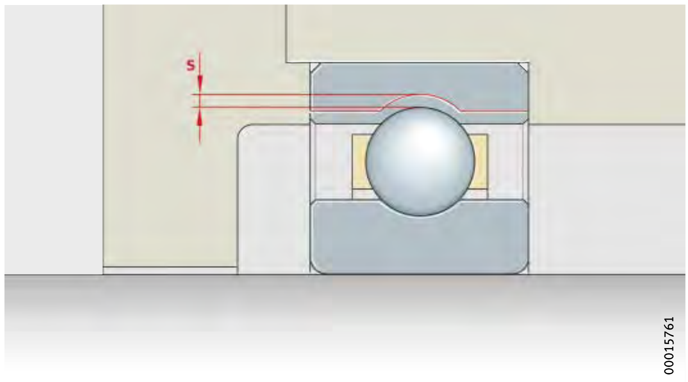


Figure 3
Operating clearance

Operating clearance value

The operating clearance value is dependent on the operating and installation conditions of the bearing, see also section Design of bearing arrangements, page 120.

A larger operating clearance is, for example, necessary 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 120.

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 mounted 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.

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 mounted parts with firm seating. The theoretical oversize of the mounted parts with a firm seating is determined from the mean deviations and the upper and lower deviations of the tolerance zones of the mounted parts reduced by $^1/_3$ of their acceptable value. This must be reduced by the amount by which parts are smoothed during mounting
F mm
Raceway diameter of the inner ring.

! 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 contraction of the outer 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 radial internal clearance due to temperature

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

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

Δs_T μm
Reduction in 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
(usual temperature difference between inner and outer ring: 5 K to 10 K).

Where shafts start up quickly, a larger radial internal clearance should be used 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.

Axial internal clearance

The axial internal clearance s_a is the extent to which one bearing ring can be displaced in relation to the other, without load, along the bearing axis, *Figure 4*.

s_a = axial internal clearance
s_r = radiale internal clearance

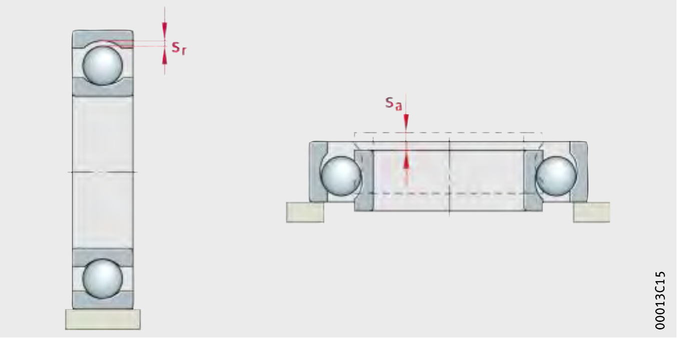


Figure 4
Axial internal clearance in comparison with radial internal clearance

In various bearing types, there is a relationship between the radial internal clearance s_r and the axial internal clearance s_a.
Guide values for the correlation between the radial and axial internal clearance are shown for some bearing types in the table.

Correlation between axial internal clearance and radial internal clearance

Bearing type			Ratio of axial internal clearance to radial internal clearance $\frac{s_a}{s_r}$
Spherical roller bearings			$2{,}3 \cdot Y_0$[1]
Tapered roller bearings	Single row, arranged in pairs		$4{,}6 \cdot Y_0$[1]
	Matched pairs (N11CA)		$2{,}3 \cdot Y_0$[1]
Angular contact ball bearings	Double row, contact angle 40°		2
	Single row	Series 72..-B and 73..-B, arranged in pairs	1,2
Four point contact bearings			1,4

[1] Y_0 factor, see dimension tables.

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

Special bearings made from HNS (High Nitrogen Steel, supplied by agreement) can achieve adequate life values even under the most challenging conditions (high temperatures, moisture, contamination).

High performance steels Cronidur and Cronitect®

For increased performance requirements, highly corrosion-resistant, nitrogen-alloyed martensitic HNS steels are available such as Cronidur and the newly developed steel Cronitect®.

In contrast to Cronidur, the more economical alternative Cronitect® has nitrogen introduced into the structure by means of a surface layer hardening process.

Both steels are considerably superior in terms of corrosion and wear resistance as well as fatigue strength to the conventional corrosion-resistant steels for rolling bearings, see also TPI 64, Corrosion-resistant Products.

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

The following table shows suitable materials and their application in bearing technology.

Materials and bearing components

Material	Bearing components (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	For example, outer ring of back-up rollers
Silicon nitride	Ceramic balls
Brass alloy	Cage
Aluminium alloy	Cage
NBR, FPM, PUR	Sealing ring

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 dismounted or swivelled out
- to guide the rolling elements in the unloaded 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 5*, page 103. 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 6*. 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.

Cage designs

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

Figure 5
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 cages

Figure 6
Solid section brass cages

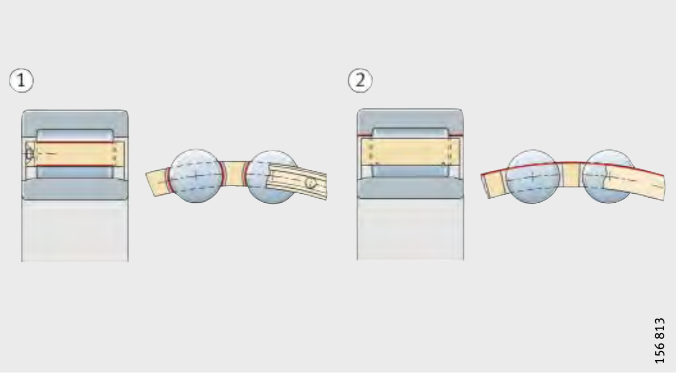
Guidance method

A further means of distinguishing between cages is their guidance method, *Figure 7*. 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 7
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 (certain series up to +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 suffixes S1, S2, S3 and S4 to DIN 623-1, see table.

The temperature data in the product descriptions must be observed.

Suffixes for bearings for high temperatures

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

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.

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 dismounting of a bearing.

High temperatures are critical especially in the case of seals made from fluoro elastomer (FKM, FPM, for example Viton) or fluoride-containing greases such as the rolling bearing greases 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.

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 such 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. These bearings have the prefix S. For higher requirements, it may be advisable to use the high performance steels Cronidur and Cronitect®, see page 101.

Corrotect® coating

In many applications, the special coating Corrotect® is more cost-effective than corrosion-resistant steel.

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.

Advantages of the coating

The advantages of the special coating Corrotect® are all-round rust protection, including the turned surfaces of chamfers and radii, *Figure 8*. 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 uncoated parts, operating life is significantly increased by the anti-corrosion protection. Uncoated bearings can be easily replaced by coated bearings of the same dimensions and there is no decrease in load carrying capacity (such as occurs in the use of corrosion-resistant steels). During storage, there is no need to use organic-based preservatives.

1 With Corrotect® coating
2 Uncoated

Figure 8
Bearing rings
after the salt spray test

Mounting of coated bearings

!

Before bearings with Corrotect® coating are mounted, compatibility with the media should always be checked.

For lower press-in forces, the surface of the parts should be lightly greased; the tolerances are increased by the thickness of the coating.

Dimensional and geometrical tolerances

Unless stated otherwise, the tolerances for radial rolling bearings correspond to DIN 620-2 (ISO 492), while the tolerances for axial rolling bearings correspond to DIN 620-3 (ISO 199), *Figure 9*.

The accuracy corresponds to tolerance class PN. For bearings with increased accuracy, the tolerances are restricted to the values of classes P6, P5, P4 and P2. Tolerance tables for the individual tolerance classes, see page 109 to page 115.

High precision bearings

In addition to the standardised tolerance classes, high precision bearings are also produced in the tolerance classes P4S, SP and UP. These tolerances are listed in the product descriptions for the high precision bearings.

Measurement methods

Measurement methods according to DIN 620-1 (ISO 1 132-2) are valid for the acceptance inspection of rolling bearings.

Further information on the measurement methods is given in TPI 138, Rolling Bearing Tolerances, Definitions and Measurement Principles. This TPI can be ordered via the Internet.

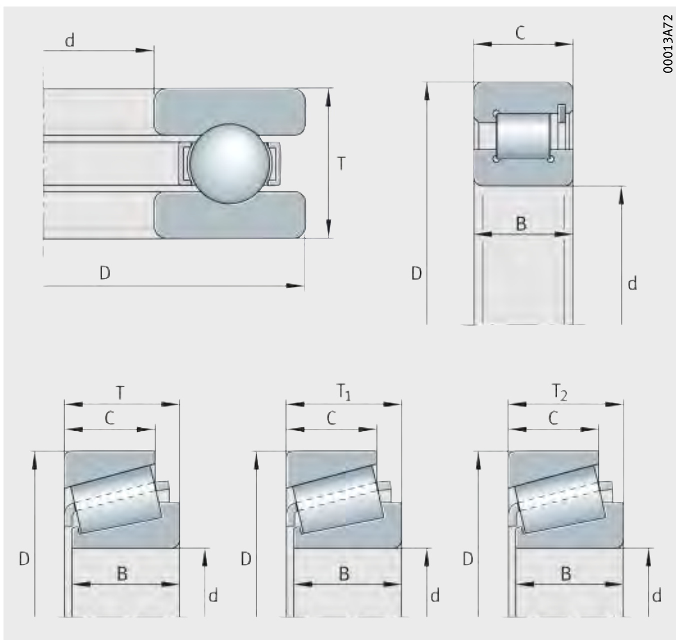


Figure 9
Main dimensions to DIN 620

Dimensional and tolerance symbols

Dimensional and tolerance symbols	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	Axial 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
T	Total width of tapered roller bearing
T_{1s}	Total width of tapered roller bearing over inner ring and normal outer ring measured at one point
T_{2s}	Total width of tapered roller bearing over outer ring and normal inner ring measured at one point
Δ_{Ts}, Δ_{T1s}, Δ_{T2s}	Deviation in total width from nominal dimension of tapered roller bearing measured at one point

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.
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[1]		
over	incl.	upper	lower	upper	lower	max.
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] Only for bearings manufactured specifically for use as matched pairs.

Tolerance class PN
Outer ring[1)]
Tolerances in μm

D		Δ_{Dmp}		V_{Dsp}				V_{Dmp} [2)]	K_{ea}
				Open bearings Diameter series			Bearings with sealing shields and sealing washers		
mm		Deviation		9	0, 1	2, 3, 4			
over	incl.	upper	lower	max.	max.	max.	max.	max.	max.
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) Δ_{Cs}, Δ_{C1s}, V_{Cs} and V_{C2s} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (table Tolerance class PN Inner ring, page 109).

2) 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.
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[1]		
over	incl.	upper	lower	upper	lower	max.
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] Only for bearings manufactured specifically for use as matched pairs.

Tolerance class P6
Outer ring[1]
Tolerances in μm

D		Δ_{Dmp}		V_{Dsp}				V_{Dmp}[2]	K_{ea}
				Open bearings Diameter series			Bearings with sealing shields and sealing washers		
mm		Deviation		9	0, 1	2, 3, 4			
over	incl.	upper	lower	max.	max.	max.	max.	max.	max.
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] Δ_{Cs}, Δ_{C1s}, V_{Cs} and V_{C2s} are identical to Δ_{Bs} and V_{Bs} for the inner ring of the corresponding bearing (table Tolerance class P6 Inner ring).

[2] 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.
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}[1]	Δ_{Bs}				V_{Bs}
mm			Normal deviation		Modified deviation[2]		
over	incl.	max.	upper	lower	upper	lower	max.
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) Only for deep groove and angular contact ball bearings.

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

Tolerance class P5
Outer ring[1]
Tolerances in μm

D		Δ_{Dmp}		V_{Dsp}[2] Diameter series		V_{Dmp}[3]	K_{ea}	S_D	S_{ea}[4]	V_{Cs}
mm		Deviation		9	0, 1, 2, 3, 4					
over	incl.	upper	lower	max.	max.	max.	max.	max.	max.	max.
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 (table Tolerance class P5 Inner ring).

2) No values are defined for radial ball bearings with sealing shields or sealing washers.

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

4) 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
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	1000	+90	0	–	+90	0
1000	1250	+105	0	–	+105	0
1250	1600	+125	0	–	+125	0
1600	2000	+150	0	–	+150	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
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	1000	+100	0	–	+100	0
1000	1250	+125	0	–	+115	0
1250	1600	+160	0	–	+125	0
1600	2000	+200	0	–	+150	0

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

Taper 1:12
Half of taper angle α = 2°23′ 9,4″;
theoretical large end diameter

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

Taper 1:30
Half of taper angle α = 0°57′ 17,4″;
theoretical large end diameter

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

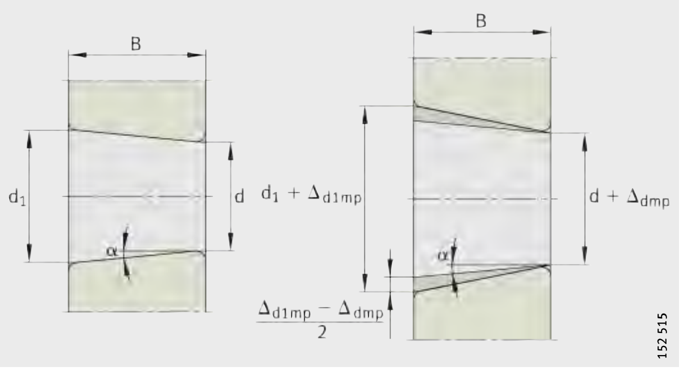


Figure 10
Tolerances for tapered bores

Axial bearings

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

d		PN (normal tolerance), P6 and P5			P4		
		Δ_{dmp} Deviation		V_{dp}	Δ_{dmp} Deviation		V_{dp}
mm							
over	incl.	upper	lower	max.	upper	lower	max.
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, DIN 620-3 Tolerances in μm

D		PN (normal tolerance), P6 and P5			P4		
		Δ_{Dmp} Deviation		V_{Dp}	Δ_{Dmp} Deviation		V_{Dp}
mm							
over	incl.	upper	lower	max.	upper	lower	max.
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 in washer thickness for shaft and housing locating washers Tolerances in μm

d		S_i				S_e
mm		PN (normal tolerance)	P6	P5	P4	PN (normal tolerance), P6, P5, P4
over	incl.	max.	max.	max.	max.	
120	180	15	9	5	4	Identical to S_i for the shaft locating washer of the corresponding bearing
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 tables.
The corresponding dimensional symbols are shown in *Figure 11*.

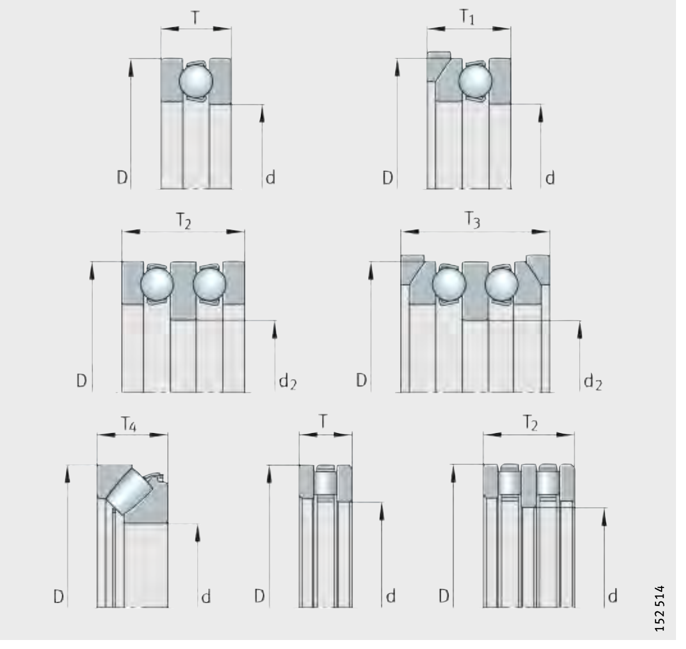


Figure 11
Tolerances for nominal bearing height

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
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
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

For minimum and maximum bearing values, *Figure 12* and table Limit values for chamfer dimensions to DIN 620-6 Values in mm, page 117.

For chamfer dimensions of tapered roller bearings see page 118, for axial bearings see page 119.

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

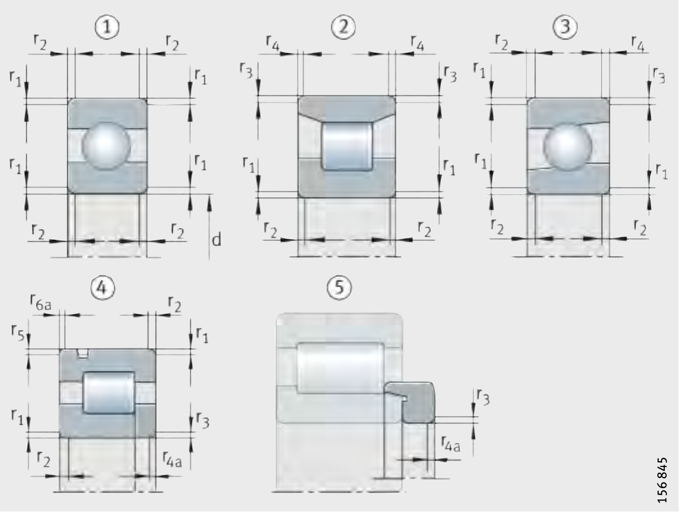


Figure 12
Chamfer dimensions for radial bearings excluding tapered roller bearings

Limit values for chamfer dimensions to DIN 620-6 Values in mm

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.
1	50	–	1	1,9	3	2,2
1,1	120	–	1,1	2,5	4	2,7
1,5	120	–	1,5	3	5	3,5
2	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	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

For minumum and maximum values for metric tapered roller bearings, *Figure 13* and table.

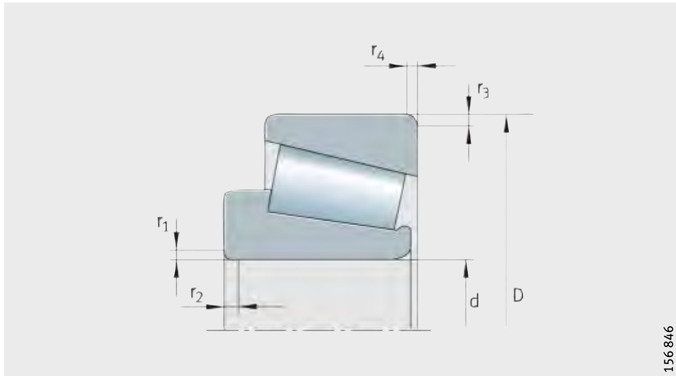


Figure 13
Chamfer dimensions
for metric tapered roller bearings

Limit values for chamfer dimensions
Values in mm

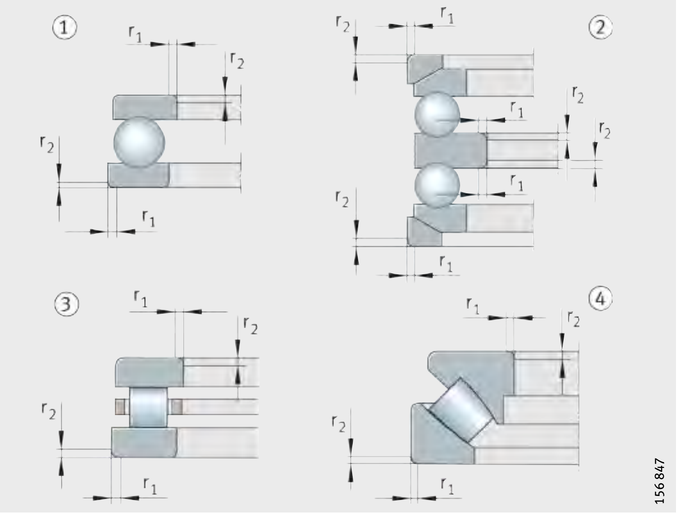
r[1]	d, D		r_1 to r_4	r_1, r_3	r_2, r_4
	over	incl.	min.	max.	max.
1	50	–	1	1,9	3
1,5	120	250	1,5	2,8	3,5
	250	–	1,5	3,5	4
2	120	250	2	3,5	4,5
	250	–	2	4	5
2,5	120	250	2,5	4	5,5
	250	–	2,5	4,5	6
3	120	250	3	4,5	6,5
	250	400	3	5	7
	400	–	3	5,5	7,5
4	120	250	4	5,5	7,5
	250	400	4	6	8
	400	–	4	6,5	8,5
5	–	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}.

Axial bearings

For minimum and maximum bearing values, *Figure 14* and table. The table corresponds to DIN 620-6.

With axial 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 14
Chamfer dimensions for axial bearings

Limit values for chamfer dimensions Values in mm

r[1)]	r_1, r_2	
	min.	max.
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}.

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, *Figure 1*, page 122 to *Figure 4*, page 123.

Non-locating bearings

Ideal non-locating bearings are cylindrical roller bearings with cage N and NU, *Figure 1* ②, page 122. 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*, page 122. The bearing ring subjected to point load therefore has a loose fit; this is normally the outer ring, see section Conditions of rotation, page 128.

Locating bearings

The locating bearing guides the shaft in an axial direction and supports external axial forces. In order to prevent axial stresses, 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, page 122, 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*, page 123, used as locating bearings will provide extremely close axial guidance.

There are particular advantages in using angular contact ball bearings of the universal design, *Figure 5*, page 123. The bearings can be mounted in pairs in any O or X arrangement without shims. Angular contact ball bearings of the universal design are matched such that, when mounted in an X or O arrangement, they have slight axial internal clearance (design UA), are clearance-free (UO) or have slight preload (UL).

Spindle bearings of the universal design UL, *Figure 6*, page 123 have slight preload when mounted in an X or O arrangement (designs with greater preload are available by agreement).

In gearboxes, a four point contact bearing is sometimes mounted directly adjacent to a cylindrical roller bearing to give a locating bearing arrangement, *Figure 3* ③, page 122. 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 NUP can also be used as a locating bearing, *Figure 4* ③, page 123.

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

Mounting is also made easier when using matched pairs of tapered roller bearings as locating bearings (N11CA), *Figure 7* ②, page 123. They are matched with appropriate axial internal clearance such 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

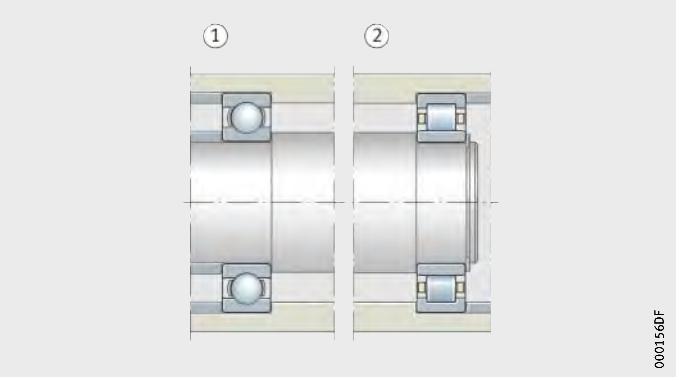


Figure 1
Locating/non-locating bearing arrangements

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

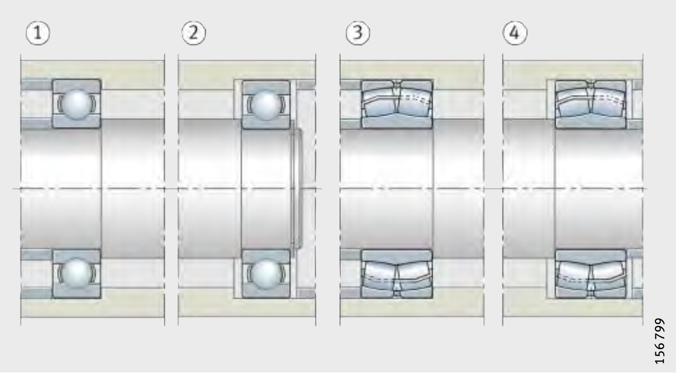


Figure 2
Locating/non-locating bearing arrangements

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

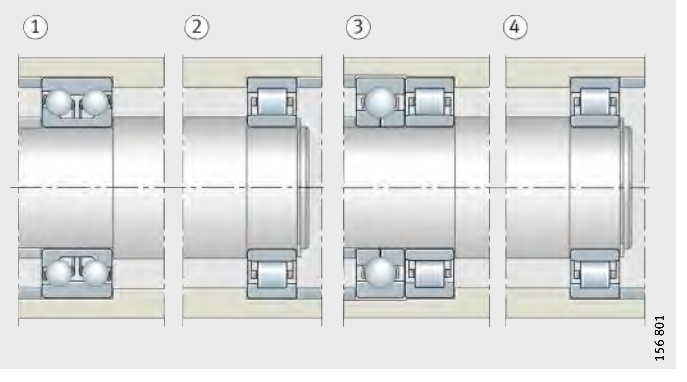
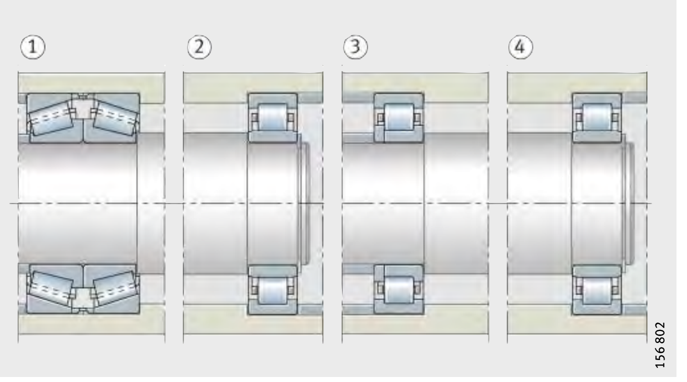


Figure 3
Locating/non-locating bearing arrangements

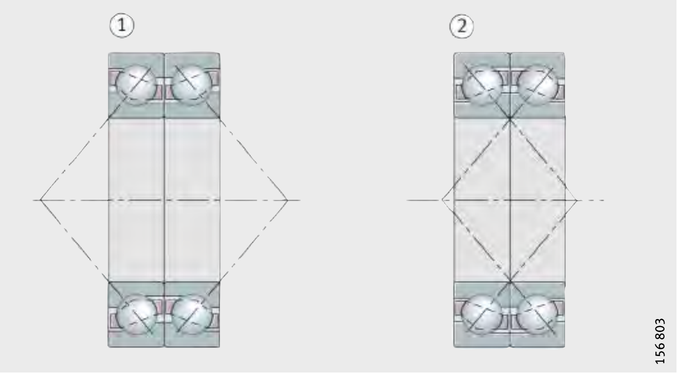
Two tapered roller bearings:
① Locating bearing
Cylindrical roller bearing NU:
② Non-locating bearing
Cylindrical roller bearing NUP:
③ Locating bearing
Cylindrical roller bearing NU:
④ Non-locating bearing

Figure 4
Locating/non-locating bearing arrangements



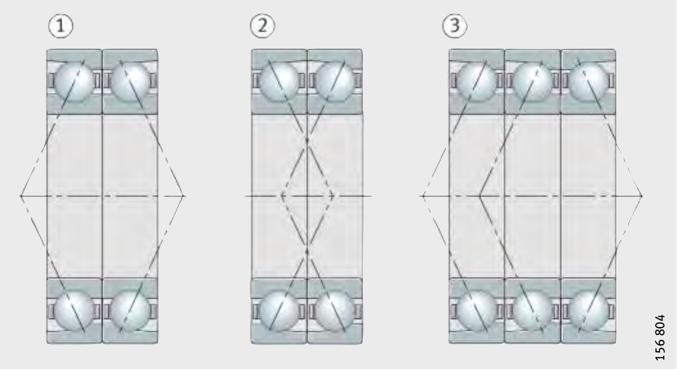
Pair of angular contact ball bearings of universal design:
① O arrangement
② X arrangement

Figure 5
Locating bearing arrangements



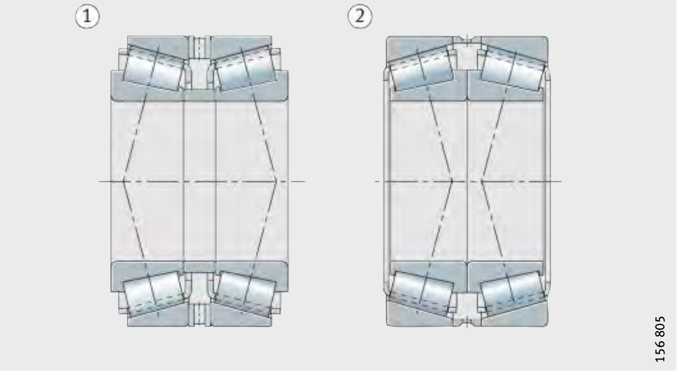
Spindle bearings of universal design:
① O arrangement
② X arrangement
③ Tandem O arrangement

Figure 6
Locating bearing arrangements



Pair of tapered roller bearings:
① O arrangement
② X arrangement

Figure 7
Locating bearing arrangements



Adjusted bearing arrangement

These bearing arrangements normally consist of two symmetrically arranged angular contact ball bearings or tapered roller bearings, *Figure 8*. During mounting, one bearing ring is displaced on its seat until the bearing arrangement achieves the required clearance or the necessary preload.

Area of 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 they 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.

Angular contact ball bearings
① O arrangement
② X arrangement
S = apexes of the pressure cones
H = support distance

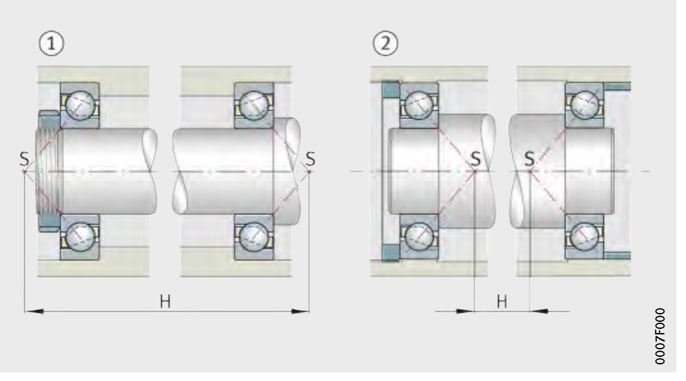


Figure 8
Adjusted bearing arrangement

Influence of thermal expansion in an X or O arrangement

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 internal clearance (preconditions: shaft and housing of identical material, inner ring and complete shaft at identical temperature, outer ring and complete housing at identical temperature).

Tapered roller bearings
X arrangement
S = apexes of the pressure cones
R = roller cone apexes

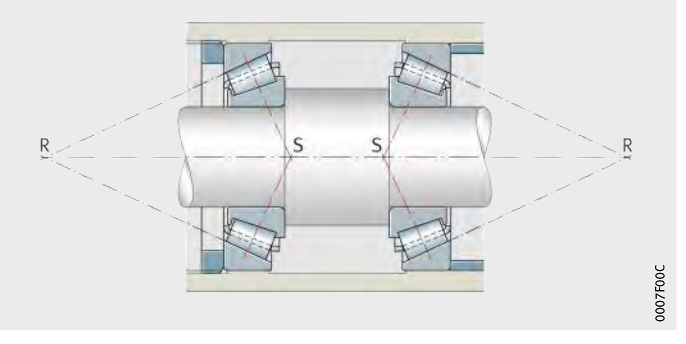
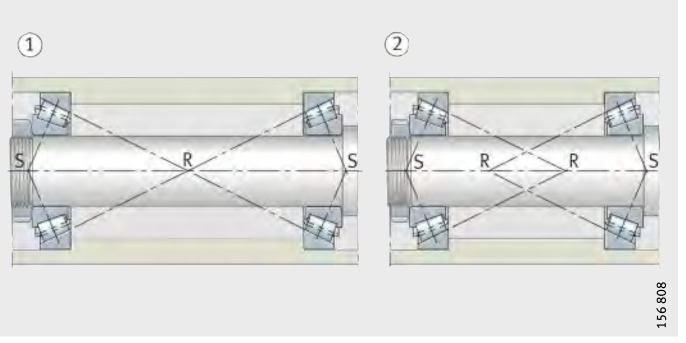


Figure 9
Adjusted bearing arrangement

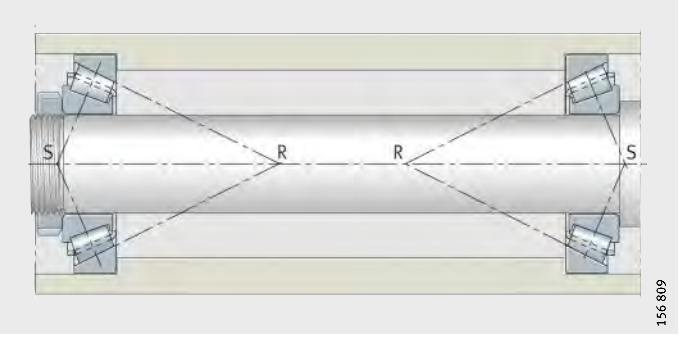
In the O arrangement, a distinction is drawn between three cases:

- The roller cone apexes R, 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*.



Tapered roller bearings in O arrangement
① Intersection points coincide
② Intersection points overlap
S = apexes of the pressure cones
R = roller cone apexes

Figure 10
Adjusted bearing arrangement



Tapered roller bearings in O arrangement, without overlapping of roller cone apexes
S = apexes of the pressure cones
R = roller cone apexes

Figure 11
Adjusted bearing arrangement

Floating bearing arrangement

The floating bearing arrangement is an economical solution where close axial guidance of the shaft is not required, *Figure 12*. 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 stressed even under unfavourable thermal conditions.

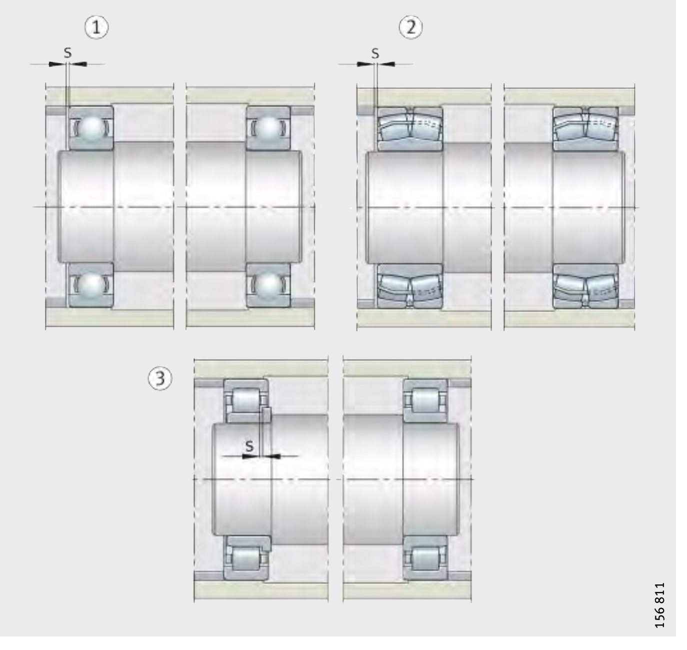
Suitable bearings

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 and cylindrical roller bearings with cage NJ, the length compensation takes place within the bearings. The inner and outer rings can have tight fits, *Figure 12* 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 12
Floating bearing arrangements

Fits

Rolling bearings are located on the shaft and in the housing in a radial, axial and tangential direction in accordance with their function. Radial and tangential location is normally achieved by force locking, i.e. by tight fits on the bearing rings. Axial location of the bearings is normally achieved by form fit.

Criteria for selection of fits

The following must be taken into consideration in the selection of fits:

- The bearing rings must be well supported on their circumference in order to allow full utilisation of the load carrying capacity of the bearing.
- 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 the length of the shaft and housing and must therefore be capable of axial displacement.
- The bearings must be easy to mount and dismount.

Good support of the bearing rings on their circumference requires rigid seating. The requirement that rings must not creep on their mating parts also requires rigid seating. If non-separable bearings must be mounted and dismounted, a tight fit can only be achieved for one bearing ring.

In cylindrical roller bearings N und NU, both rings can have tight fits, since the length compensation takes place within the bearing and since the rings can be mounted 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 radial internal clearance.

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

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 narrower geometrical tolerances.

Seats for axial bearings

Axial bearings, which support axial loads only, must not be guided radially – with the exception of axial cylindrical roller bearings which have a degree of freedom in the radial direction due to flat raceways. This is not present in the case of groove-shaped raceways and must be achieved by a loose fit for the stationary washer. A tight fit is normally selected for the rotating washer.

Where axial bearings also support radial 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 (axial runout tolerance to IT5 or better), in order to ensure uniform load distribution over all the rolling elements.

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.

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.

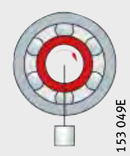
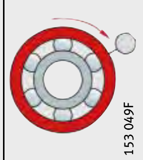
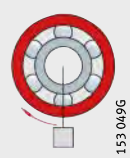
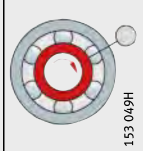
There is no risk that the seating surface will be damaged and a loose fit is possible.

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.

As damage to the bearing seating surface can occur, a tight fit should be used.

Conditions of rotation

Conditions of motion	Example	Schematic	Load case	Fit
Rotating inner ring Stationary outer ring Non-variable load direction	Shaft with weight load		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		and Point load on outer ring	
Stationary inner ring Rotating outer ring Non-variable load direction	Back-up roller (hub bearing arrangement)		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		and Circumferential load on outer ring	

Shaft and housing tolerances

The fit is determined by the ISO tolerances for shafts and housings (ISO 286-1:1988) in conjunction with the tolerances Δ_{dmp} for the bore and Δ_{Dmp} for the outside diameter of the bearings (DIN 620).

Tolerance zones

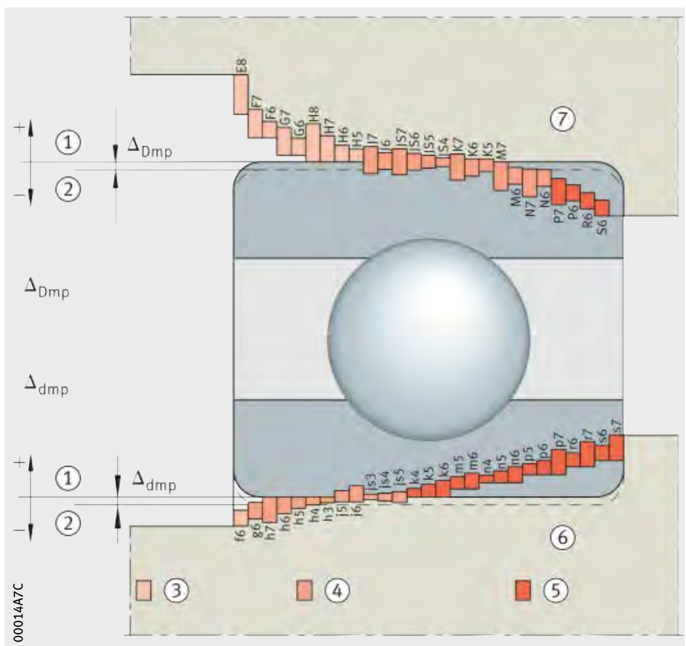
The ISO tolerances are defined in the form of tolerance zones. They are determined by their position relative to the zero line (= tolerance position) and their size (= tolerance grade, see ISO 286-1:1988). The tolerance position is indicated by letters (upper case for housings, lower case for shafts). For a schematic representation of the most common rolling bearing fits, see *Figure 13*.

Reference to tables of shaft and housing tolerances

The tables on pages 130 and 132 contain recommendations for the selection of shaft and housing tolerances that are valid for normal mounting and operating conditions.

Deviations are possible if particular requirements apply, for example in relation to running accuracy, smooth running or operating temperature. Increased running accuracies thus require closer tolerances such as tolerance grade 5 instead of 6. If the inner ring is warmer than the shaft during operation, the seating may loosen to an impermissible extent. A tighter fit must then be selected, for example m6 instead of k6.

In such cases, the question of fits can only be resolved by a compromise. The individual requirements must be weighed against each other and those fulfilled that give the best overall solution.



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

Figure 13
Fits for rolling bearings

Shaft tolerances for radial bearings with cylindrical bore

Conditions of rotation	Bearing type	Shaft diameter mm	Displacement facility Load	Tolerance zone
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	h6 (j6)
Circumferential load on inner ring or indeterminate load direction	Ball bearings	100 to 200	Low loads[1]	k6 (m6)
			Normal and high loads[2]	m6 (m5)
		over 200	Low loads	m6 (m5)
			Normal and high loads	n6 (n5)
	Roller bearings	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

[1] $C/P > 10$.

[2] $C/P < 10$.

Shaft tolerances for axial bearings

Load	Bearing type	Shaft diameter	Operating conditions	Tolerance zone
Axial load	Axial deep groove ball bearings	All sizes	–	j6
	Axial cylindrical roller bearings with shaft locating washer		–	h6 (j6)
	Axial cylindrical roller and cage assembly		–	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 for radial bearings

Conditions of rotation	Displacement facility Load	Operating conditions	Tolerance zone
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, housing split	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 shocks, outer ring cannot be displaced	High running accuracy required 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 housings made from GG if bearing outside diameter $D > 250$ mm and temperature differential between outer ring and housing > 10 K.

2) F7 for housings made from GG if bearing outside diameter $D > 250$ mm and temperature differential between outer ring and housing > 10 K.

Housing tolerances for axial bearings

Load	Bearing type	Operating conditions	Tolerance zone
Axial load	Axial deep groove ball bearings	Normal running accuracy High running accuracy	E8 H6
	Axial cylindrical roller bearings with housing locating washer	–	H7 (K7)
	Axial cylindrical roller and cage assembly	–	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 of shaft and housing fits

The numerical values for the fits, page 134 to page 145, are valid for solid shafts made from steel and for 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 mounting of rolling bearings.

Shaft fits

In each cell are five numbers in accordance with the following scheme, for example for shaft ∅200 m6.

Example: table entry for shaft fit

Shaft deviation µm		Fit interference or fit clearance µm	
Maximum material value	+46	**76**[2]	Interference or fit clearance if the maximum material values are combined
		56[1,2]	Probable interference or fit clearance
Minimum material value	+17	**17**[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.

Shaft fits: see page 134 to page 141.

Housing fits

In each cell are five numbers in accordance with the following scheme, for example for housing ∅360 H6.

Example: table entry for housing fit

Housing deviation µm		Fit interference or fit clearance µm	
Minimum material value	+36	**0**[2]	Interference or fit clearance if the maximum material values are combined
		25[1,2]	Probable interference or fit clearance
Maximum material value	0	76[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 page 142 to page 145.

Shaft fits

Nominal shaft diameter in mm								
over incl.	**120** **140**		**140** **160**		**160** **180**		**180** **200**	
Deviation of bearing bore diameter in μm (normal tolerance)								
Δ_{dmp}	0 −25		0 −25		0 −25		0 −30	
Shaft deviation, fit interference or fit clearance in μm								
g5	−14 −32	**11** 3 32	−14 −32	**11** 3 32	−14 −32	**11** 3 32	−15 −35	**15** 2 35
g6	−14 −39	**11** 6 39	−14 −39	**11** 6 39	−14 −39	**11** 6 39	−15 −44	**15** 5 44
h5	0 −18	**25** **11** 18	0 −18	**25** **11** 18	0 −18	**25** **11** 18	0 −20	**30** **13** 20
h6	0 −25	**25** **8** 25	0 −25	**25** **8** 25	0 −25	**25** **8** 25	0 −29	**30** **10** 29
j5	+7 −11	**32** **18** 11	+7 −11	**32** **18** 11	+7 −11	**32** **18** 11	+7 −13	**37** **20** 13
j6	+14 −11	**39** **22** 11	+14 −11	**39** **22** 11	+14 −11	**39** **22** 11	+16 −13	**46** **26** 13
js5	+9 −9	**34** **20** 9	+9 −9	**34** **20** 9	+9 −9	**34** **20** 9	+10 −10	**40** **23** 10
js6	+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
k5	+21 +3	**46** **32** **3**	+21 +3	**46** **32** **3**	+21 +3	**46** **32** **3**	+24 +4	**54** **37** **4**
k6	+28 +3	**53** **36** **3**	+28 +3	**53** **36** **3**	+28 +3	**53** **36** **3**	+33 +4	**63** **43** **4**
m5	+33 +15	**58** **44** **15**	+33 +15	**58** **44** **15**	+33 +15	**58** **44** **15**	+37 +17	**67** **50** **17**
m6	+40 +15	**65** **48** **15**	+40 +15	**65** **48** **15**	+40 +15	**65** **48** **15**	+46 +17	**76** **56** **17**

	200 **225**		**225** **250**		**250** **280**		**280** **315**		**315** **355**		**355** **400**		**400** **450**		**450** **500**	
	0 −30		0 −30		0 −35		0 −35		0 −40		0 −40		0 −45		0 −45	
	−15 −35	**15** 2 35	−15 −35	**15** 2 35	−17 −40	**18** 1 40	−17 −40	**18** 1 40	−18 −43	**22** **0** 43	−18 −43	**22** **0** 43	−20 −47	**25** **1** 47	−20 −47	**25** **1** 47
	−15 −44	**15** 5 44	−15 −44	**15** 5 44	−17 −49	**18** 4 49	−17 −49	**18** 4 49	−18 −54	**22** 3 54	−18 −54	**22** 3 54	−20 −60	**25** 3 60	−20 −60	**25** 3 60
	0 −20	**30** **13** 20	0 −20	**30** **13** 20	0 −23	**35** **16** 23	0 −23	**35** **16** 23	0 −25	**40** **18** 25	0 −25	**40** **18** 25	0 −27	**45** **21** 27	0 −27	**45** **21** 27
	0 −29	**30** **10** 29	0 −29	**30** **10** 29	0 −32	**35** **13** 32	0 −32	**35** **13** 32	0 −36	**40** **15** 36	0 −36	**40** **15** 36	0 −40	**45** **17** 40	0 −40	**45** **17** 40
	+7 −13	**37** **20** 13	+7 −13	**37** **20** 13	+7 −16	**42** **23** 16	+7 −16	**42** **23** 16	+7 −18	**47** **25** 18	+7 −18	**47** **25** 18	+7 −20	**52** **28** 20	+7 −20	**52** **28** 20
	+16 −13	**46** **26** 13	+16 −13	**46** **26** 13	+16 −16	**51** **29** 16	+16 −16	**51** **29** 16	+18 −18	**58** **33** 18	+18 −18	**58** **33** 18	+20 −20	**65** **37** 20	+20 −20	**65** **37** 20
	+10 −10	**40** **23** 10	+10 −10	**40** **23** 10	+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	+13,5 −13,5	**59** **35** 14	+13,5 −13,5	**59** **35** 14
	+14,5 −14,5	**45** **25** 15	+14,5 −14,5	**45** **25** 15	+16 −16	**51** **29** 16	+16 −16	**51** **29** 16	+18 −18	**58** **33** 18	+18 −18	**58** **33** 18	+20 −20	**65** **37** 20	+20 −20	**65** **37** 20
	+24 +4	**54** **37** **4**	+24 +4	**54** **37** **4**	+27 +4	**62** **43** **4**	+27 +4	**62** **43** **4**	+29 +4	**69** **47** **4**	+29 +4	**69** **47** **4**	+32 +5	**77** **53** **5**	+32 +5	**77** **53** **5**
	+33 +4	**63** **43** **4**	+33 +4	**63** **43** **4**	+36 +4	**71** **49** **4**	+36 +4	**71** **49** **4**	+40 +4	**80** **55** **4**	+40 +4	**80** **55** **4**	+45 +5	**90** **62** **5**	+45 +5	**90** **62** **5**
	+37 +17	**67** **50** **17**	+37 +17	**67** **50** **17**	+43 +20	**78** **59** **20**	+43 +20	**78** **59** **20**	+46 +21	**86** **64** **21**	+46 +21	**86** **64** **21**	+50 +23	**95** **71** **23**	+50 +23	**95** **71** **23**
	+46 +17	**76** **56** **17**	+46 +17	**76** **56** **17**	+52 +20	**87** **65** **20**	+52 +20	**87** **65** **20**	+57 +21	**97** **72** **21**	+57 +21	**97** **72** **21**	+63 +23	**108** **80** **23**	+63 +23	**108** **80** **23**

Shaft fits
continued

Nominal shaft diameter in mm								
over incl.	**500** **560**		**560** **630**		**630** **710**		**710** **800**	
Deviation of bearing bore diameter in µm (normal tolerance)								
Δ_{dmp}	0 –50		0 –50		0 –75		0 –75	
Shaft deviation, fit interference or fit clearance in µm								
g5	–22 –51	**28** **1** 51	–22 –51	**28** **1** 51	–24 –56	**51** **15** 56	–24 –56	**51** **15** 56
g6	–22 –66	**28** 4 66	–22 –66	**28** 4 66	–24 –74	**51** **9** 74	–24 –74	**51** **9** 74
h5	0 –29	**50** **23** 29	0 –29	**50** **23** 29	0 –32	**75** **39** 32	0 –32	**75** **39** 32
h6	0 –44	**50** **18** 44	0 –44	**50** **18** 44	0 –50	**75** **33** 50	0 –50	**75** **33** 50
j5	–	–	–	–	–	–	–	–
j6	+22 –22	**72** **40** 22	+22 –22	**72** **40** 22	+25 –25	**100** **58** 25	+25 –25	**100** **58** 25
js5	+14,5 –14,5	**65** **38** 15	+14,5 –14,5	**65** **38** 15	+16 –16	**91** **55** 16	+16 –16	**91** **55** 16
js6	+22 –22	**72** **40** 22	+22 –22	**72** **40** 22	+25 –25	**100** **58** 25	+25 –25	**100** **58** 25
k5	+29 0	**79** **53** **0**	+29 0	**79** **53** **0**	+32 0	**107** **71** **0**	+32 0	**107** **71** **0**
k6	+44 0	**94** **62** **0**	+44 0	**94** **62** **0**	+50 0	**125** **83** **0**	+50 0	**125** **83** **0**
m5	+55 +26	**105** **78** **26**	+55 +26	**105** **78** **26**	+62 +30	**137** **101** **30**	+62 +30	**137** **101** **30**
m6	+70 +26	**120** **88** **26**	+70 +26	**120** **88** **26**	+80 +30	**155** **113** **30**	+80 +30	**155** **113** **30**

800 900		900 1000		1 000 1 120		1 120 1 250		1 250 1 600		1 600 2 000		2 000 2 500	
0 −100		0 −100		0 −125		0 −125		0 −160		0 −200		0 −250	
−26 −62	**74** **29** 62	−26 −62	**74** **29** 62	−28 −70	**97** **41** 70	−28 −70	**97** **41** 70	−30 −80	**130** **60** 80	−32 −92	**168** **81** 92	−34 −104	**216** **109** 104
−26 −82	**74** **24** 82	−26 −82	**74** **24** 82	−28 −94	**97** **33** 94	−28 −94	**97** **33** 94	−30 −108	**130** **41** 108	−32 −124	**168** **71** 124	−34 −144	**216** **96** 144
0 −36	**100** **55** 36	0 −36	**100** **55** 36	0 −42	**125** **69** 42	0 −42	**125** **69** 42	0 −50	**160** **90** 50	0 −60	**200** **119** 60	0 −70	**250** **143** 70
0 −56	**100** **48** 56	0 −56	**100** **48** 56	0 −66	**125** **61** 66	0 −66	**125** **61** 66	0 −78	**160** **81** 78	0 −92	**200** **103** 92	0 −110	**250** **130** 110
–	–	–	–	–	–	–	–	–	–	–	–	–	–
+28 −28	**128** **76** 28	+28 −28	**128** **76** 28	+33 −33	**158** **94** 33	+33 −33	**158** **94** 33	+39 −39	**199** **120** 39	+46 −46	**246** **149** 46	+55 −55	**305** **185** 55
+18 −18	**118** **73** 18	+18 −18	**118** **73** 18	+21 −21	**146** **90** 21	+21 −21	**146** **90** 21	+25 −25	**185** **115** 25	+30 −30	**230** **143** 30	+35 −35	**285** **178** 35
+28 −28	**128** **76** 28	+28 −28	**128** **76** 28	+33 −33	**158** **94** 33	+33 −33	**158** **94** 33	+39 −39	**199** **120** 39	+46 −46	**246** **149** 46	+55 −55	**305** **185** 55
+36 0	**136** **91** **0**	+36 0	**136** **91** **0**	+42 0	**167** **111** **0**	+42 0	**167** **111** **0**	+50 0	**210** **140** **0**	+60 0	**260** **173** **0**	+70 0	**320** **213** **0**
+56 0	**156** **104** **0**	+56 0	**156** **104** **0**	+66 0	**191** **127** **0**	+66 0	**191** **127** **0**	+78 0	**238** **159** **0**	+92 0	**292** **195** **0**	+110 0	**360** **240** **0**
+70 +34	**170** **125** **34**	+70 +34	**170** **125** **34**	+82 +40	**207** **151** **40**	+82 +40	**207** **151** **40**	+98 +48	**258** **188** **48**	+118 +58	**318** **193** **58**	+138 +68	**388** **236** **68**
+90 +34	**190** **138** **34**	+90 +34	**190** **138** **34**	+106 +40	**231** **167** **40**	+106 +40	**231** **167** **40**	+126 +48	**286** **207** **48**	+150 +58	**350** **214** **58**	+178 +68	**428** **263** **68**

Shaft fits

Nominal shaft diameter in mm								
over incl.	**120** **140**		**140** **160**		**160** **180**		**180** **200**	
Deviation of bearing bore diameter in μm (normal tolerance)								
Δ_{dmp}	0 –25		0 –25		0 –25		0 –30	
Shaft deviation, fit interference or fit clearance in μm								
n5	+45 +27	**70** **56** **27**	+45 +27	**70** **56** **27**	+45 +27	**70** **56** **27**	+51 +31	**81** **64** **31**
n6	+52 +27	**77** **60** **27**	+52 +27	**77** **60** **27**	+52 +27	**77** **60** **27**	+60 +31	**90** **70** **31**
p6	+68 +43	**93** **76** **43**	+68 +43	**93** **76** **43**	+68 +43	**93** **76** **43**	+79 +50	**109** **89** **50**
p7	+83 +43	**108** **87** **43**	+83 +43	**108** **87** **43**	+83 +43	**108** **87** **43**	+96 +50	**126** **101** **50**
r6	+88 +63	**113** **97** **63**	+90 +65	**115** **99** **65**	+93 +68	**118** **102** **68**	+106 +77	**136** **116** **77**
r7	+103 +63	**128** **107** **63**	+105 +65	**130** **109** **65**	+108 +68	**133** **112** **68**	+123 +77	**153** **128** **77**
Shaft tolerances for adapter sleeves and withdrawal sleeves								
h7/ $\frac{IT5}{2}$	0 –40	*9*	0 –40	*9*	0 –40	*9*	0 –46	*10*
h8/ $\frac{IT5}{2}$	0 –63	*9*	0 –63	*9*	0 –63	*9*	0 –72	*10*
h9/ $\frac{IT6}{2}$	0 –100	*12,5*	0 –100	*12,5*	0 –100	*12,5*	0 –115	*14,5*

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

200 **225**		**225** **250**		**250** **280**		**280** **315**		**315** **355**		**355** **400**		**400** **450**	
0 −30		0 −30		0 −35		0 −35		0 −40		0 −40		0 −45	
+51 +31	**81** **64** **31**	+51 +31	**81** **64** **31**	+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**
+60 +31	**90** **70** **31**	+60 +31	**90** **70** **31**	+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**
+79 +50	**109** **89** **50**	+79 +50	**109** **89** **50**	+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**
+96 +50	**126** **101** **50**	+96 +50	**126** **101** **50**	+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**
+109 +80	**139** **119** **80**	+113 +84	**143** **123** **84**	+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**
+126 +80	**156** **131** **80**	+130 +84	**160** **135** **84**	+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**
0 −46	*10*	0 −46	*10*	0 −52	*11,5*	0 −52	*11,5*	0 −57	*12,5*	0 −57	*12,5*	0 −63	*13,5*
0 −72	*10*	0 −72	*10*	0 −81	*11,5*	0 −81	*11,5*	0 −89	*12,5*	0 −89	*12,5*	0 −97	*13,5*
0 −115	*14,5*	0 −115	*14,5*	0 −130	*16*	0 −130	*16*	0 −140	*18*	0 −140	*18*	0 −155	*20*

Shaft fits
continued

Nominal shaft diameter in mm								
over incl.	**450** **500**		**500** **560**		**560** **630**		**630** **710**	
Deviation of bearing bore diameter in μm (normal tolerance)								
Δ_{dmp}	0 −45		0 −50		0 −50		0 −75	
Shaft deviation, fit interference or fit clearance in μm								
n5	+67 +40	**112** **88** **40**	+73 +44	**123** **96** **44**	+73 +44	**123** **96** **44**	+82 +50	**157** **121** **50**
n6	+80 +40	**125** **97** **40**	+88 +44	**138** **106** **44**	+88 +44	**138** **106** **44**	+100 +50	**175** **133** **50**
p6	+108 +68	**153** **125** **68**	+122 +78	**172** **140** **78**	+122 +78	**172** **140** **78**	+138 +88	**213** **171** **88**
p7	+131 +68	**176** **139** **68**	+148 +78	**198** **158** **78**	+148 +78	**198** **158** **78**	+168 +88	**243** **199** **88**
r6	+172 +132	**217** **189** **132**	+194 +150	**244** **212** **150**	+199 +155	**249** **217** **155**	+225 +175	**300** **258** **175**
r7	+195 +132	**240** **204** **132**	+220 +150	**270** **230** **150**	+225 +155	**275** **235** **155**	+255 +175	**330** **278** **175**
Shaft tolerances for adapter sleeves and withdrawal sleeves								
h7/ $\frac{IT5}{2}$	0 −63	*13,5*	0 −70	*14,5*	0 −70	*14,5*	0 −80	*16*
h8/ $\frac{IT5}{2}$	0 −97	*13,5*	0 −110	*14,5*	0 −110	*14,5*	0 −125	*16*
h9/ $\frac{IT6}{2}$	0 −155	*20*	0 −175	*22*	0 −175	*22*	0 −200	*25*

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

710 **800**		**800** **900**		**900** **1000**		**1000** **1120**		**1120** **1250**		**1250** **1600**		**1600** **2000**		**2000** **2500**	
0 −75		0 −100		0 −100		0 −125		0 −125		0 −160		0 −200		0 −250	
+82 +50	**157** **121** **50**	+92 +56	**192** **147** **56**	+92 +56	**192** **147** **56**	+108 +66	**233** **177** **66**	+108 +66	**233** **177** **66**	+128 +78	**288** **218** **78**	+152 +92	**352** **204** **92**	+180 +110	**430** **283** **110**
+100 +50	**175** **133** **50**	+112 +56	**212** **160** **56**	+112 +56	**212** **160** **56**	+132 +66	**257** **193** **66**	+132 +66	**257** **193** **66**	+156 +78	**316** **237** **78**	+184 +92	**384** **225** **92**	+220 +110	**470** **277** **110**
+138 +88	**213** **171** **88**	+156 +100	**256** **204** **100**	+156 +100	**256** **204** **100**	+186 +120	**311** **247** **120**	+186 +120	**311** **247** **120**	+218 +140	**378** **299** **140**	+262 +170	**462** **251** **170**	+305 +195	**555** **305** **195**
+168 +88	**243** **199** **88**	+190 +100	**290** **227** **100**	+190 +100	**290** **227** **100**	+225 +120	**350** **273** **120**	+225 +120	**350** **273** **120**	+265 +140	**425** **330** **140**	+320 +170	**520** **290** **170**	+370 +195	**620** **348** **195**
+235 +185	**310** **268** **185**	+266 +210	**366** **314** **210**	+276 +220	**376** **324** **220**	+316 +250	**441** **377** **250**	+326 +260	**451** **387** **260**	–	–	–	–	–	–
+265 +185	**340** **288** **185**	+300 +210	**400** **337** **210**	+310 +220	**410** **347** **220**	+355 +250	**480** **403** **250**	+365 +260	**490** **413** **260**	–	–	–	–	–	–
0 −80	*16*	0 −90	*18*	0 −90	*18*	0 −105	*21*	0 −105	*21*	0 −125	*25*	0 −150	*30*	0 −175	*35*
0 −125	*16*	0 −140	*18*	0 −140	*18*	0 −165	*21*	0 −165	*21*	0 −195	*25*	0 −230	*30*	0 −280	*35*
0 −200	*25*	0 −230	*28*	0 −230	*28*	0 −260	*33*	0 −260	*33*	0 −310	*39*	0 −370	*46*	0 −440	*55*

Housing fits

Nominal housing bore diameter in mm								
over incl.	**315** **400**		**400** **500**		**500** **630**		**630** **800**	
Deviation of bearing outside diameter in µm (normal tolerance)								
Δ_{Dmp}	0 –40		0 –45		0 –50		0 –75	
Housing deviation, fit interference or fit clearance in µm								
E8	+214 +125	125 168 254	+232 +135	135 182 277	+255 +145	145 199 305	+285 +160	160 227 360
F7	+119 +62	62 94 159	+131 +68	68 104 176	+146 +76	76 116 196	+160 +80	80 132 235
G6	+54 +18	18 43 94	+60 +20	20 48 105	+66 +22	22 54 116	+74 +24	24 66 149
G7	+75 +18	18 50 115	+83 +20	20 56 128	+92 +22	22 62 142	+104 +24	24 76 179
H6	+36 0	**0** 25 76	+40 0	**0** 28 85	+44 0	**0** 32 94	+50 0	**0** 42 125
H7	+57 0	**0** 32 97	+63 0	**0** 36 108	+70 0	**0** 40 120	+80 0	**0** 52 155
H8	+89 0	**0** 43 129	+97 0	**0** 47 142	+110 0	**0** 54 160	+125 0	**0** 67 200
J6	+29 –7	**7** 18 69	+33 –7	**7** 21 78	–	–	–	–
J7	+39 –18	**18** 14 79	+43 –20	**20** 16 88	–	–	–	–
JS6	+18 –18	**18** 6 58	+20 –20	**20** 8 65	+22 –22	**22** 10 72	+25 –25	**25** 17 100
JS7	+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
K6	+7 –29	**29** **4** 47	+8 –32	**32** **4** 53	0 –44	**44** **12** 50	0 –50	**50** **8** 75
K7	+17 –40	**40** **8** 57	+18 –45	**45** **9** 63	0 –70	**70** **30** 50	0 –80	**80** **28** 75

800 1000		1000 1250		1250 1600		1600 2000		2000 2500		2500 3150	
0 –100		0 –125		0 –160		0 –200		0 –250		0 –300	
+310 +170	170 250 410	+360 +195	195 292 485	+415 +220	220 338 575	+470 +240	240 384 670	+540 +260	260 436 790	+620 +290	290 500 920
+176 +86	86 149 276	+203 +98	98 175 328	+235 +110	110 205 395	+270 +120	120 237 470	+305 +130	130 271 555	+355 +145	145 315 655
+82 +26	26 78 182	+94 +28	28 93 219	+108 +30	30 109 268	+124 +32	32 130 324	+144 +34	34 154 394	+173 +38	38 183 473
+116 +26	26 89 216	+133 +28	28 105 258	+155 +30	30 125 315	+182 +32	32 149 382	+209 +34	34 175 459	+248 +38	38 208 548
+56 0	**0** 52 156	+66 0	**0** 64 191	+78 0	**0** 79 238	+92 0	**0** 98 292	+110 0	**0** 120 360	+135 0	**0** 145 435
+90 0	**0** 63 190	+105 0	**0** 77 230	+125 0	**0** 95 285	+150 0	**0** 117 350	+175 0	**0** 142 425	+210 0	**0** 170 510
+140 0	**0** 80 240	+165 0	**0** 97 290	+195 0	**0** 118 355	+230 0	**0** 143 430	+280 0	**0** 177 530	+330 0	**0** 210 630
–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–
+28 –28	**28** 24 128	+33 –33	**33** 31 158	+39 –39	**39** 40 199	+46 –46	**46** 52 246	+55 –55	**55** 65 305	+67 –67	**67** 78 367
+45 –45	**45** 18 145	+52 –52	**52** 24 177	+62 –62	**62** 32 222	+75 –75	**75** 42 275	+87 –87	**87** 54 337	+105 –105	**105** 65 405
0 –56	**56** **4** 100	0 –66	**66** **2** 125	0 –78	**78** 1 160	0 –92	**92** 6 200	0 –110	**110** 10 250	0 –135	**135** 10 300
0 –90	**90** **27** 100	0 –105	**105** **28** 125	0 –125	**125** **30** 160	0 –150	**150** **33** 200	0 –175	**175** **34** 250	0 –210	**210** **40** 300

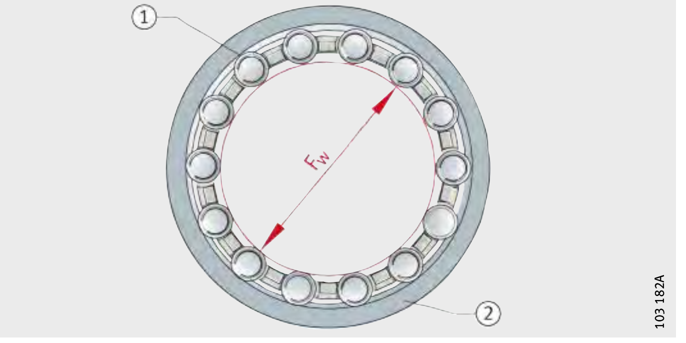
Housing fits

Nominal housing bore diameter in mm								
over incl.	**315** **400**		**400** **500**		**500** **630**		**630** **800**	
Deviation of bearing outside diameter in μm (normal tolerance)								
Δ_{Dmp}	0 −40		0 −45		0 −50		0 −75	
Housing deviation, fit interference or fit clearance in μm								
M6	−10 −46	**46** **21** 30	−10 −50	**50** **22** 35	−26 −70	**70** **38** 24	−30 −80	**80** **38** 45
M7	0 −57	**57** **25** 40	0 −63	**63** **27** 45	−26 −96	**96** **56** 24	−30 −110	**110** **58** 45
N6	−26 −62	**62** **37** 14	−27 −67	**67** **39** 18	−44 −88	**88** **56** 6	−50 −100	**100** **58** 25
N7	−16 −73	**73** **41** 24	−17 −80	**80** **44** 28	−44 −114	**114** **74** 6	−50 −130	**130** **78** 25
P6	−51 −87	**87** **62** **11**	−55 −95	**95** **67** **10**	−78 −122	**122** **90** **28**	−88 −138	**138** **96** **13**
P7	−41 −98	**98** **66** **1**	−45 −108	**108** **72** **0**	−78 −148	**148** **108** **28**	−88 −168	**168** **126** **13**

800 **1000**		**1000** **1250**		**1250** **1600**		**1600** **2000**		**2000** **2500**		**2500** **3150**	
0 −100		0 −125		0 −160		0 −200		0 −250		0 −300	
−34 −90	**90** **38** 66	−40 −106	**106** **45** 85	−48 −126	**126** **47** 112	−58 −150	**150** **52** 142	−68 −178	**178** **58** 182	−76 −211	**211** **66** 224
−34 −124	**124** **61** 66	−40 −145	**145** **68** 85	−48 −173	**173** **78** 112	−58 −208	**208** **91** 142	−68 −243	**243** **102** 182	−76 −286	**286** **116** 224
−56 −112	**112** **60** 44	−66 −132	**132** **67** 59	−78 −156	**156** **77** 82	−92 −184	**184** **86** 108	−110 −220	**220** **100** 140	−135 −270	**270** **125** 165
−56 −146	**146** **83** 44	−66 −171	**171** **94** 59	−78 −203	**203** **108** 82	−92 −242	**242** **125** 108	−110 −285	**285** **144** 140	−135 −345	**345** **175** 165
−100 −156	**156** **104** **0**	−120 −186	**186** **121** 5	−140 −218	**218** **139** 20	−170 −262	**262** **164** 30	−195 −305	**305** **185** 55	−240 −375	**375** **230** 60
−100 −190	**190** **127** **0**	−120 −225	**225** **148** 5	−140 −265	**265** **159** 20	−170 −320	**320** **203** 30	−195 −370	**370** **229** 55	−240 −450	**450** **280** 60

Enveloping circle

For bearings without an inner ring, the enveloping circle F_w is used. This is the inner inscribed circle of the cylindrical rollers in clearance-free contact with the outer raceway, *Figure 14*. Before the bearings are mounted, it is in the tolerance zone F6. Deviations for F6, see table.



① Cylindrical roller
② Outer raceway
F_w = enveloping circle diameter

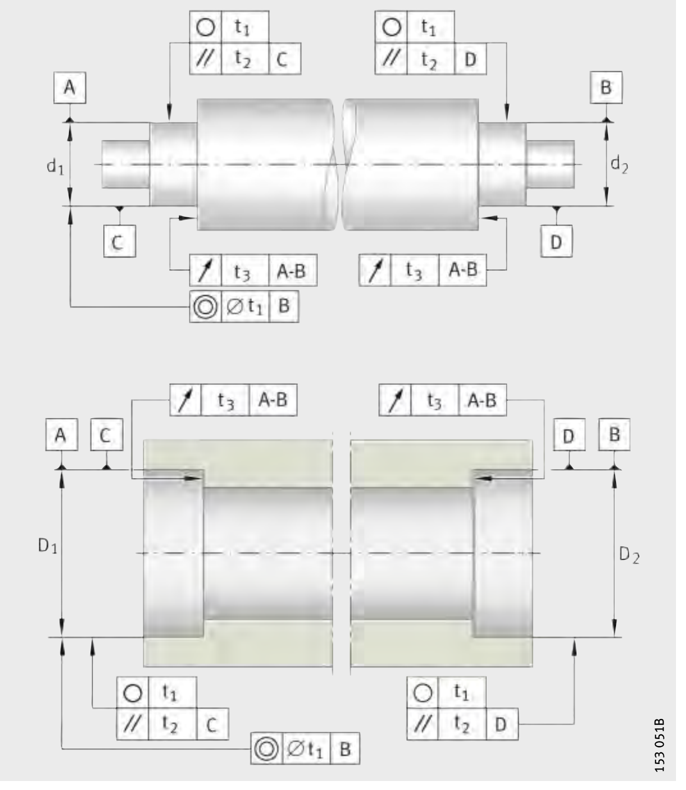
Figure 14
Enveloping circle

Deviations for the enveloping circle diameter

Enveloping circle diameter F_w mm		Tolerance zone F6 Tolerance for enveloping circle diameter F_w	
		Upper deviation	Lower deviation
over	incl.	µm	µm
250	315	+88	+56
315	400	+98	+62
400	500	+108	+68
500	630	+120	+76
630	800	+130	+80
800	1 000	+142	+86
1 000	1 250	+164	+98
1 250	1 600	+188	+110
1 600	2 000	+212	+120

Geometrical tolerances of bearing seating surfaces

In order to achieve the required fit, the bearing seats and fit surfaces of the shaft and housing bore must conform to certain tolerances, *Figure 15* and table, page 148.



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

Figure 15
Dimensional and 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 table, page 148, and by the ISO fundamental tolerances (ISO 286-1:1988).

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 1 101) must be based on the angular adjustment facility of the bearing. Misalignments due to elastic deformation of the shaft and housing must be taken into consideration.

Housings

For 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 face runout 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 IT3/2	IT2	IT2
			Point load IT4/2	IT3	
	Housing	IT6	Circumferential load IT4/2	IT3	IT3
			Point load IT5/2	IT4	
P4 SP	Shaft	IT4	Circumferential load IT2/2	IT1	IT1
			Point load IT3/2	IT2	
	Housing	IT5	Circumferential load IT3/2	IT2	IT2
			Point load IT4/2	IT3	
UP P4S	Shaft	IT3	Circumferential load IT1/2	IT0	IT0
			Point load IT2/2	IT1	
	Housing	IT4	Circumferential load IT2/2	IT1	IT1
			Point load IT3/2	IT2	

ISO fundamental tolerances (IT grades) to ISO 286-1:1988, see page 150.

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. Guide values: see table.

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.

Guide values for roughness of bearing seating surfaces

Diameter of bearing seat d (D) mm		Recommended mean roughness values R_a[2] for ground bearing seats Corresponding diameter tolerance µm			
over	incl.	IT7	IT6	IT5	IT4
80	500	1,6 (N7)	1,6 (N7)	0,8 (N6)	0,4 (N5)
500	1 250	3,2 (N8)[1]	1,6 (N7)	1,6 (N7)	0,8 (N6)

1) When mounting is carried out using the hydraulic method, R_a = 1,6 µm should not be exceeded.

2) The values in brackets are roughness classes to DIN ISO 1302.

Values for IT grades

The table shows numerical values for the ISO fundamental tolerances (IT grades) to ISO 286-1:1988.

IT grades and values

Nominal dimension in mm				
over	**120**	**180**	**250**	**315**
incl.	**180**	**250**	**315**	**400**
Values in µm				
IT0	2	3	4	5
IT1	3,5	4,5	6	7
IT2	5	7	8	9
IT3	8	10	12	13
IT4	12	14	16	18
IT5	18	20	23	25
IT6	25	29	32	36
IT7	40	46	52	57
IT8	63	72	81	89
IT9	100	115	130	140
IT10	160	185	210	230
IT11	250	290	320	360
IT12	400	460	520	570

400	**500**	**630**	**800**	**1 000**	**1 250**	**1 600**	**2 000**	**2 500**
500	**630**	**800**	**1 000**	**1 250**	**1 600**	**2 000**	**2 500**	**3150**
6	–	–	–	–	–	–	–	–
8	–	–	–	–	–	–	–	–
10	–	–	–	–	–	–	–	–
15	–	–	–	–	–	–	–	–
20	–	–	–	–	–	–	–	–
27	29	32	36	47	50	60	70	86
40	44	50	56	66	78	92	110	135
63	70	80	90	105	125	150	175	210
97	110	125	140	165	195	230	280	330
155	175	200	230	260	310	370	440	540
250	280	320	360	420	500	600	700	860
400	440	500	560	660	780	920	1 100	1 350
630	700	800	900	1 050	1 250	1 500	1 750	2 100

Raceways for bearings without inner and/or outer ring

In rolling bearings which do not have an inner and/or outer ring to provide a raceway, the rolling elements run directly on the shaft or in the housing bore.

!

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

The raceways must always be free from undulations and precision machined (grinding and honing). At a mean roughness $R_a > 0{,}2\ \mu m$, it is not possible to utilise the full load carrying capacity of the bearings.

The guidelines on shaft design in the product sections must also 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 (such as 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 (such as 17MnCr5, 16CrNiMo6) or EN 10 084 (such as 16MnCr5).

Flame or induction hardening

For flame and induction hardening, steels to ISO 683-17 (such as Cf54, 43CrMo4) or DIN 17 212 (such as Cf53) must be used.

Surface hardness and hardening depth

The values apply to raceways, axial washers and shaft shoulders. Steels hardened by means of case, flame or induction hardening must have a surface hardness of 670 HV + 170 HV and a sufficient hardening depth CHD or SHD.

In accordance with DIN 50 190, the hardening depth is 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.

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

f_H = factor for taking account of raceway hardness

HRC, HV = surface hardness

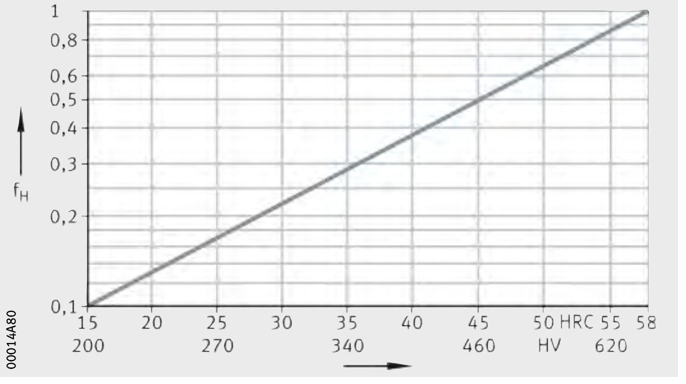


Figure 16
Taking account of the raceway hardness

Hardness curves

The hardness curves are shown schematically, *Figure 17* and *Figure 18*. The required hardness curve is derived from the strain on the material.

The equations are based on hardness curves achieved with normal specialist heat treatment.

Case hardening:

$$\mathrm{CHD} \geqq 0{,}078 \cdot D_w$$

Flame or induction hardening:

$$\mathrm{SHD} \geqq 140 \cdot D_w / R_{p0,2}$$

CHD mm
Case hardening depth

SHD mm
Surface hardening depth

D_w mm
Rolling element diameter

$R_{p\,0,2}$ N/mm²
Proof stress.

① Case hardening
② Required hardness
③ Hardness
④ Distance from surface
CHD = case hardening depth with hardness 550 HV

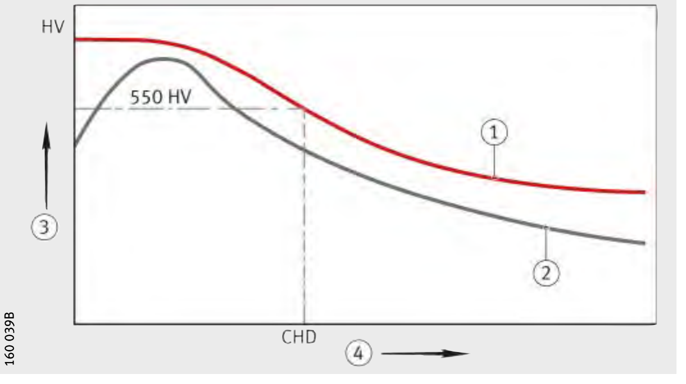


Figure 17
Case hardening depth CHD and hardness curve

① Flame or induction hardening
② Required hardness
③ Hardness
④ Distance from surface
SHD = surface hardening depth

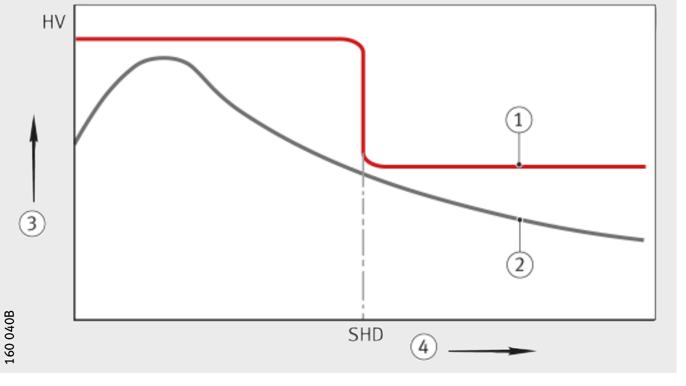


Figure 18
Surface hardening depth SHD and hardness curve

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 156 to *Figure 25*, page 158.

Design guidelines

The bearing rings must be located by force locking or form fit 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 or r_{a1} and the diameters of the abutment shoulders (D_a or d_a).

Any special characteristics of the individual bearing types, e.g. for 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. Shoulders on the shaft and housing, snap rings, housing covers, shaft covers, nuts and spacer rings are suitable.

Non-locating bearings

Non-locating bearings only need to support slight axial forces occurring in thermal expansion. The axial location method only needs to prevent creep of the rings. A tight fit is often sufficient.

Self-retaining bearings

In non-separable bearings, one bearing ring requires a tight fit, while the other ring is retained by the rolling elements.

Deep groove ball bearings, double row angular contact ball bearings

Supported on both sides, inner and outer rings

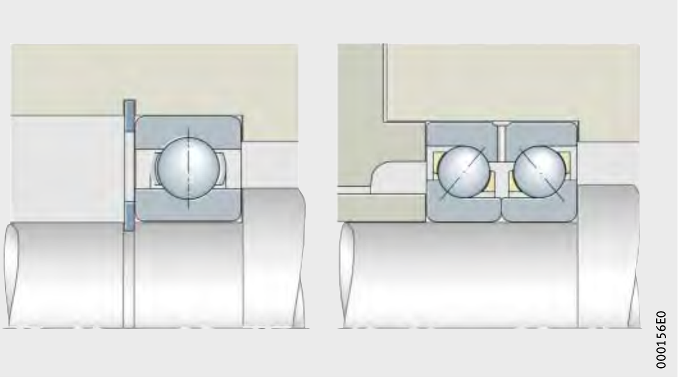


Figure 19
Locating bearings

Supported on both sides, inner ring

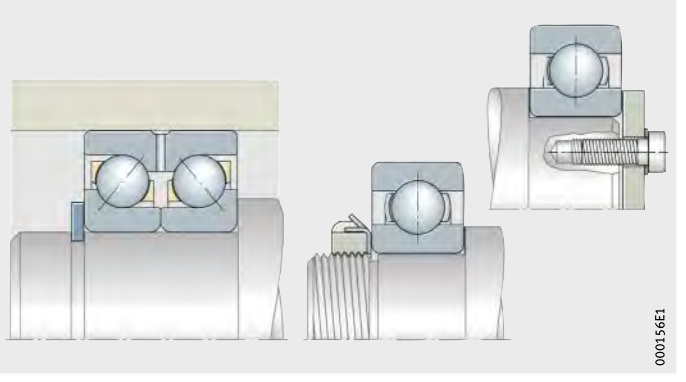


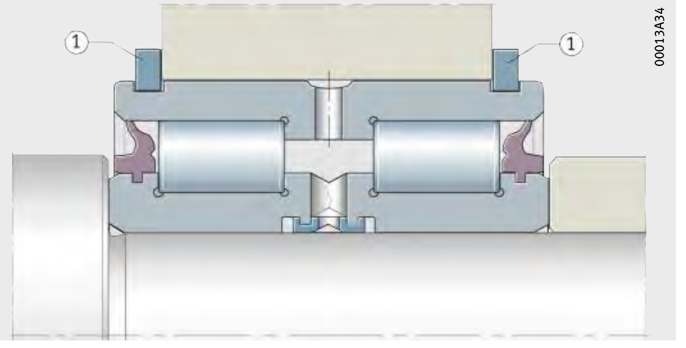
Figure 20
Non-locating bearings

Cylindrical roller bearings

The bearings must be supported on both sides on the inner and outer rings, *Figure 21* to *Figure 23*, page 157.

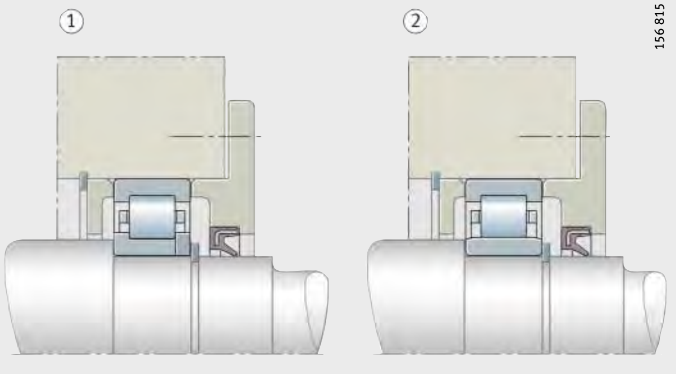
The ribs of axially loaded cylindrical roller bearings must be supported up to dimension d_1 or D_1.
Dimensions d_1, D_1: see dimension tables.

For semi-locating bearings, the bearing rib only requires support on one side, on the rib supporting the axial load.



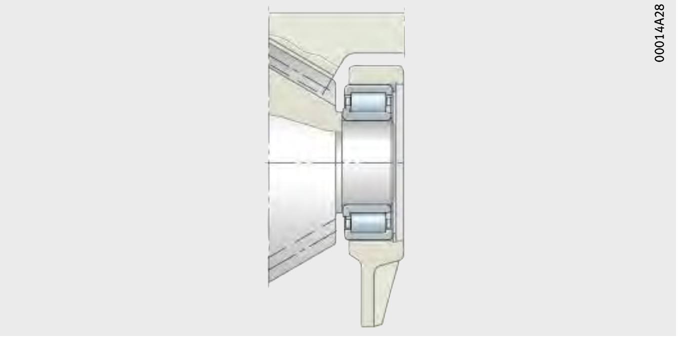
Outer ring axially located by retaining rings
① Retaining rings

Figure 21
Locating bearing



Axial location by form fit
① Locating bearing
② Non-locating bearing

Figure 22
Locating and non-locating bearings



The inner ring rib prevents axial creep to one side

Figure 23
Non-locating bearing

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 24* and *Figure 25*.
Shaft nuts, ring nuts, covers or spacer washers are suitable as adjustment elements.

In floating bearing arrangements, lateral movement of the rings is prevented by shaft or housing shoulders, covers, snap rings, *Figure 25*.

Axial location

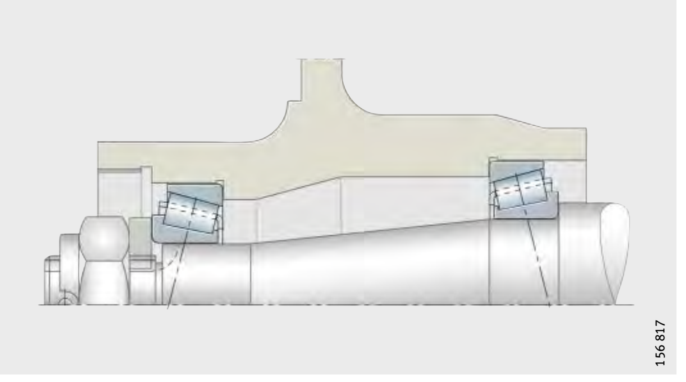


Figure 24
Adjusted bearing arrangement

Axial location

a = guidance clearance;
a < b (b = axial labyrinth gap)

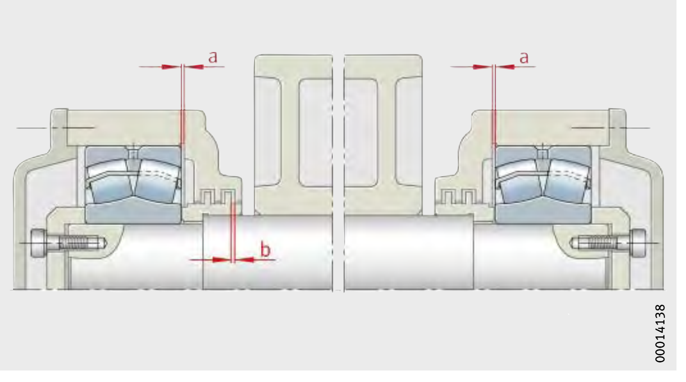


Figure 25
Floating bearing arrangement

Seals

The sealing arrangement 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 clearance or noise brings 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, only lubricant friction occurs in the lubrication gap. 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 26*.

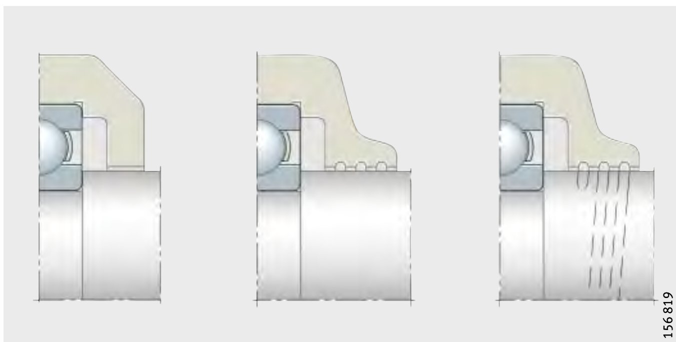


Figure 26
Simple gap seals

Labyrinth seals

A considerably greater sealing effect than with gap seals is achieved by labyrinths incorporating gaps filled with grease, *Figure 27*.

In contaminated environments, grease should be pressed from the interior into the seal gap at short intervals.

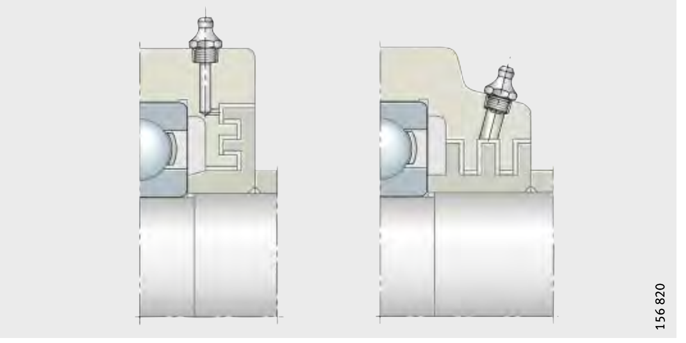


Figure 27
Labyrinth seals

Splash ring

Where oil lubrication is used with a horizontal shaft, splash rings are suitable for preventing the escape of oil, *Figure 28*.

The oil outlet hole on the underside of the seal location must be sufficiently large that it cannot be clogged by contamination.

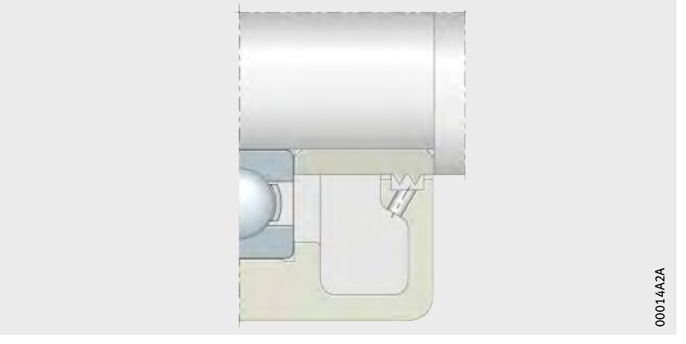


Figure 28
Splash ring

Flinger shields

Co-rotating flinger shields have the effect of shielding the seal gap from heavy contamination, *Figure 29*.

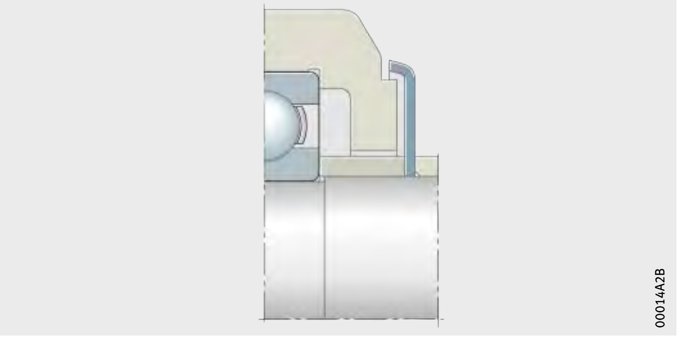


Figure 29
Flinger shield

Baffle plates

Stationary (rigid) baffle plates ensure that grease remains in the area around the bearing, *Figure 30*.

The grease collar that forms at the seal gap protects the bearing against contamination.

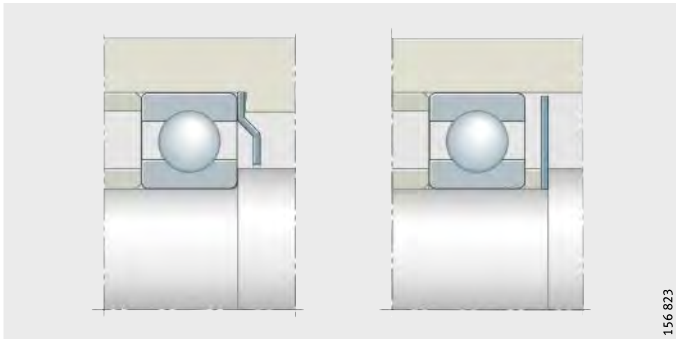


Figure 30
Rigid baffle plates

Lamellar rings

Lamellar rings made from steel and radially sprung either outwards or inwards require little mounting space, *Figure 31*.
They give protection against loss of grease and ingress of dust and are also used as an outer seal against spray water.

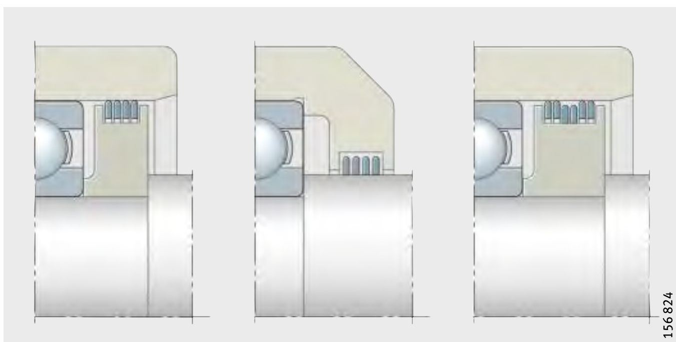


Figure 31
Lamellar rings

Non-contact seals in the bearing

Sealing shields in the bearing

Sealing shields are compact sealing elements fitted on one or both sides of the bearing.

Bearings with sealing shields on both sides are supplied with a grease filling.

We supply large bearings fitted with sealing shields by agreement only.

Contact seals in the adjacent construction

Contact seals are normally in contact with the running surface under radial contact force. 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 velocity.

With grease lubrication

Felt rings and felt strips are sealing elements that have proved very effective with grease lubrication, *Figure 32*. They are impregnated with oil before mounting 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.

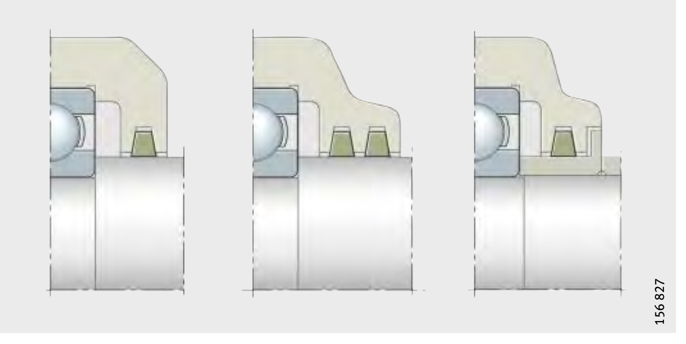


Figure 32
Felt rings or felt strips

With oil lubrication

If oil lubrication is used, sealing is primarily carried out with rotary shaft seals to DIN 3 760 und DIN 3 761, *Figure 33*. The seal collar with one lip is pressed against the shaft running surface by a spring.

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 nitrile butadiene rubber (NBR) are suitable, when used with oil lubrication, for circumferential speeds at the running surface of up to 12 m/s.

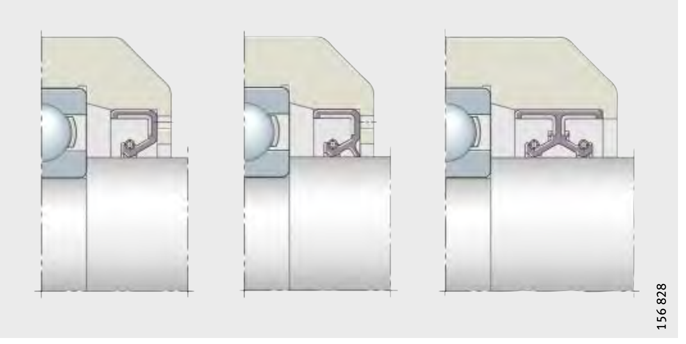


Figure 33
Rotary shaft seals

Lip seal with axial sealing action

The V ring, *Figure 34*, is a lip seal with axial sealing action. During mounting, 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, when used with grease lubrication, for circumferential speeds of up to 12 m/s, while stationary V rings are suitable for up to 20 m/s. At circumferential speeds over 8 m/s, the V ring must be axially supported; at speeds of 12 m/s or more it must also be radially clamped.

V rings are frequently used as outer seals in order to keep contamination away from a rotary shaft seal.

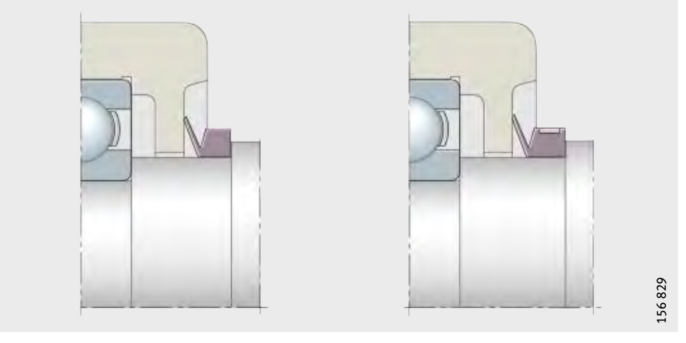


Figure 34
V ring

Axial spring seals

When using grease lubrication, effective sealing can also be achieved by means of axial spring seals, *Figure 35*.
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.

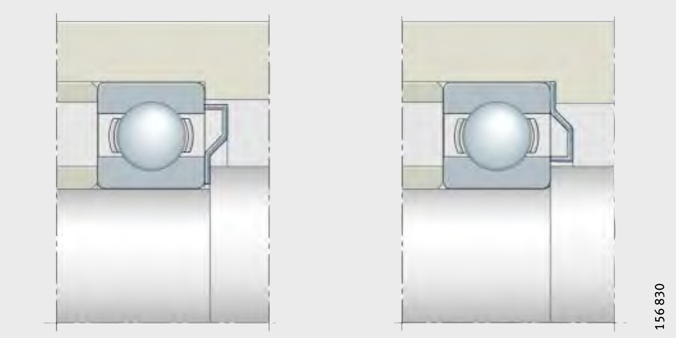


Figure 35
Spring seals

Contact seals in the bearing

Sealing washers

Work roll bearing arrangements in hot or cold rolling lines must be effectively sealed against large quantities of water or roll coolant that are mixed with contaminants. These bearing arrangements are normally lubricated with grease. For cost and environmental reasons, it is desirable to achieve low levels of grease consumption. Four-row tapered roller bearings with integrated seals have therefore been developed, *Figure 36*. These bearings have main dimensions identical to those of the unsealed bearings.
Only small quantities of the high quality rolling bearing grease used are required. Although the basic load ratings of the sealed bearings are lower, they normally have a longer life than the open bearings due to the improved cleanliness in the lubrication gap.

The rotary shaft seals on the sealed bearings are made from fluoro elastomer, which can give off gases and vapours harmful to health at approx. +300 °C or higher. This may occur, for example, if a welding torch is used in the dismounting of the bearings.
If high temperatures are unavoidable, attention must be paid to the valid safety data sheet for the material.

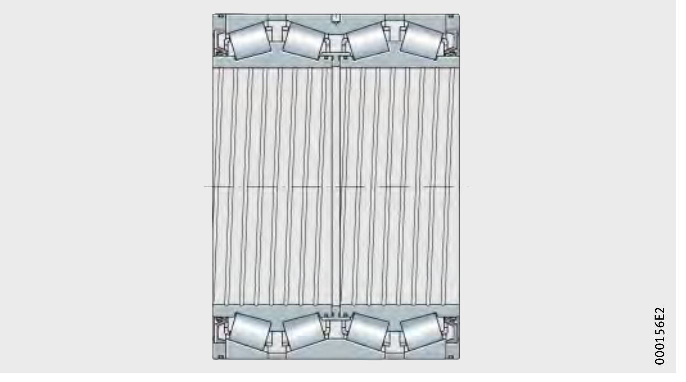


Figure 36
Sealing washers on both sides

Handling

Rolling bearings, rolling bearing parts and Arcanol rolling bearing greases are high quality goods and must therefore be handled with care.

Storage of rolling bearings

The performance capability of modern rolling bearings lies at the boundaries of what is technically achievable. The materials, dimensional and geometrical tolerances, surface quality and lubrication have been optimised for maximum levels of function, which means that even slight deviations in functional areas, such as those caused by corrosion, can impair the performance capacity. In order to realise the full performance capability of rolling bearings, it is essential to match the anti-corrosion protection, packaging, storage and handling to each other.

Corrosion protection and packaging constitute part of the bearing and are optimised such that they preserve all characteristics of the product at the same time as far as possible. In addition to protecting the surface against corrosion, this includes emergency running lubrication, friction, lubricant compatibility, noise behaviour, resistance to ageing and compatibility with rolling bearing components (cage and seal material).

Storage conditions for rolling bearings

!

As a basic prerequisite, parts must be stored in a closed storage area which cannot be affected by any aggressive media, such as exhaust gases from vehicles or gases, mist or aerosols of acids, lyes or salts. Direct sunlight should be avoided since, apart from the harmful effects of UV radiation, it can lead to wide temperature fluctuations in the packaging. The temperature should be constant and air humidity should be as low as possible. Jumps in temperature and increased humidity lead to condensation.

The following conditions must be fulfilled:

- frost-free storage, i.e. at a temperature $>$ +5 °C (to prevent formation of white frost, a limit of +2 °C is permissible for a maximum of 12 hours per day)
- maximum temperature +40 °C (to prevent excessive drainage of anti-corrosion oils)
- relative humidity $<$ 65% (if changes in temperature occur, a limit of 70% is permissible for up to 12 hours per day).

The temperature and humidity must be continuously monitored. This can be carried out using a datalogger. The measurements must be taken at intervals of no more than 2 hours.

At least 2 measurement points must be selected: the highest point and the lowest point in the vicinity of an external wall at which the goods can be stored.

Larger bearings with rings of relatively small thickness should not be stored standing but lying flat and supported over their whole circumference.

Storage periods for rolling bearings

Rolling bearings should not be stored for longer than 3 years. This applies both to open and to greased bearings with sealing shields or washers. In particular, specifically greased rolling bearings should not be stored for too long, since the chemical-physical behaviour of greases may change during storage. Even if the minimum performance capacity remains, the safety reserves of the grease may have diminished.

In general, rolling bearings can be used even after their permissible storage period has been exceeded if the storage conditions during storage and transport were observed.
If the conditions are not fulfilled, shorter storage periods must be anticipated. If the periods are exceeded, it is recommended that the bearing should be checked for corrosion, the condition of the anti-corrosion oil and the condition of the grease before it is used.

Storage of Arcanol rolling bearing greases

The information on storage of rolling bearings apply as appropriate to Arcanol rolling bearing greases. The precondition is that the grease is stored in closed, completely filled original containers.

Storage periods for Arcanol rolling bearing greases

Rolling bearing greases are mixtures of oil, thickener and additives. Such mixtures of liquid and solid substances do not have unlimited stability. During storage, their chemical-physical characteristics may change and they should therefore be used up as soon as possible.

If the storage conditions are observed, Arcanol lubricating greases can be stored without loss of performance for 3 years. As in the case of rolling bearings, however, the permissible storage period should not be seen as a rigid limit.

If storage is carried out as prescribed, most greases can be used even after 3 years, if allowances are made for small changes.
If there is any doubt when using older greases, random sample checking of chemical-physical characteristics is recommended in order to determine any changes in the grease.
It is therefore not possible to state storage periods for containers that have been opened. If containers are to be stored after opening, the grease surface should always be brushed flat, the container should be sealed airtight and it should be stored such that the empty space is upwards. High temperatures should be avoided in all cases.

Unpacking of rolling bearings

Perspiration leads to corrosion. Hands should be kept clean and dry and protective gloves worn if necessary. Bearings should only be removed from their original packaging immediately before mounting. If bearings are removed from multi-item packaging with dry preservation, the package must be closed again immediately, since the protective vapour phase is only effective in closed packaging. Bearings should be oiled or greased immediately after unpacking.

Compatibility, miscibility

The anti-corrosion agents in bearings with an oil-based preservative are compatible and miscible with oils and greases having 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 bearings are contaminated.
If in doubt, please contact the relevant lubricant manufacturer.

Cleaning of rolling bearings

The following are suitable for degreasing and washing of rolling bearings:

- aqueous neutral, acid 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.

Cleaning should be carried out using brushes, paint brushes or lint-free cloths. In the case of resinous oil or grease residues, precleaning by mechanical means followed by treatment with an aqueous, strongly alkaline cleaning agent is recommended.

!

Legal regulations relating to handling, environmental protection and health and safety at work must be complied with. The specifications of the cleaning agent manufacturer must be observed.

Paraffin oil, petroleum ether, spirit and dewatering fluids are flammable, 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).

After cleaning, rolling bearings must be dried and preservative applied immediately (risk of corrosion).

Mounting

Comprehensive information on mounting and dismounting is given in the publications WL 80100, Mounting of Rolling Bearings and IS 1, Mounting and Maintenance of Rolling Bearings.

For more extensive work, a mounting manual should be available that precisely describes all relevant work.
The manual should also contain details on means of transport, mounting equipment, measurement tools, type and quantity of lubricant and a precise description of the mounting procedure.

Guidelines for mounting

!

The following guidelines must always be taken into account:

- 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.
- Before mounting work is started, familiarise yourself with the design by means of the final assembly drawing.
- Before mounting, check whether the bearing presented for mounting corresponds to the data in the drawing.
- Check the housing bore and shaft seat for dimensional and geometrical accuracy and cleanliness.
- Check that the shaft and housing bore have a lead chamfer of 10° to 15°.
- Wipe away any anti-corrosion agent from the seating and contact surfaces, wash anti-corrosion agent out of tapered bores.
- Lightly oil or rub solid lubricant into the bearing ring seating surfaces.
- Do not cool the bearings excessively. Moisture due to condensation can lead to corrosion in the bearings and bearing seats.
- After mounting, provide the rolling bearings with lubricant.
- Check the correct functioning of the bearing arrangement.

Mounting of rolling bearings with cylindrical seats

!

Avoid applying direct blows to the bearing rings with a hammer.

Non-separable bearings

In non-separable bearings, apply the mounting forces to the ring with a tight fit, which should also be mounted first, *Figure 1*.

If the inner ring of a non-separable bearing will have a tight fit, press the bearing onto the shaft first, *Figure 1*. The bearing together with the shaft is then pushed into the housing (fit clearance).

Tight fit of the inner ring, mounting this ring first

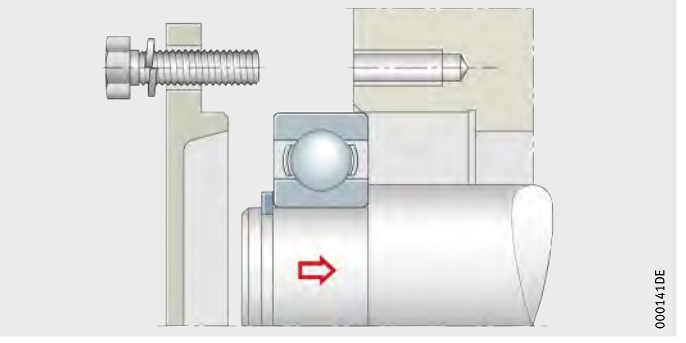


Figure 1
Non-separable bearing

Separable bearings

In separable bearings, mounting is easier; both rings can be mounted individually, *Figure 2*. Rotating the ring during mounting to give a screwdriver effect will help to avoid scraping marks.

Tight fit of the inner ring, individual mounting of rings

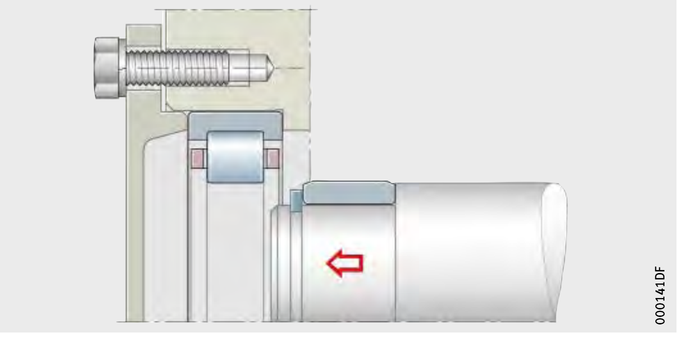
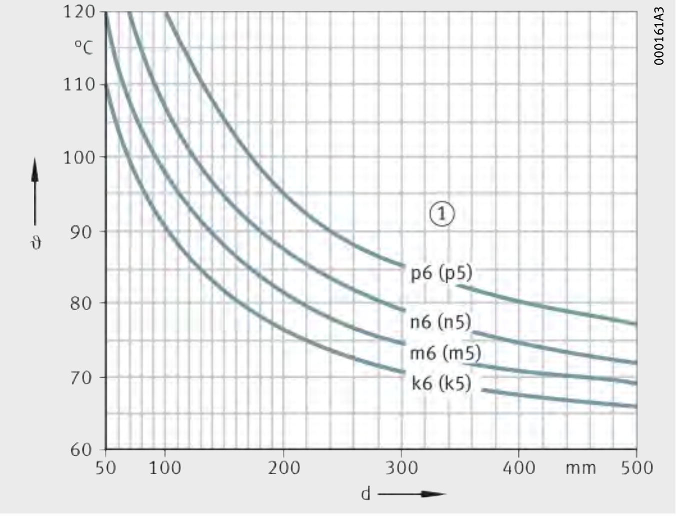


Figure 2
Separable bearing

Heating of bearings

Bearings with a cylindrical bore should be heated before mounting if a tight fit on the shaft is intended and excessive effort is required for pressing by mechanical means. The temperature required for mounting is shown in *Figure 3*. The data are valid for maximum fit interference, a room temperature of +20 °C and an excess temperature safety margin of 30 K.



ϑ = heating temperature
d = bearing bore diameter
① Shaft tolerance

Figure 3
Heating temperature

Induction heating devices

Induction heating devices give rapid, safe and clean heating. The devices are used mainly in volume mounting work.

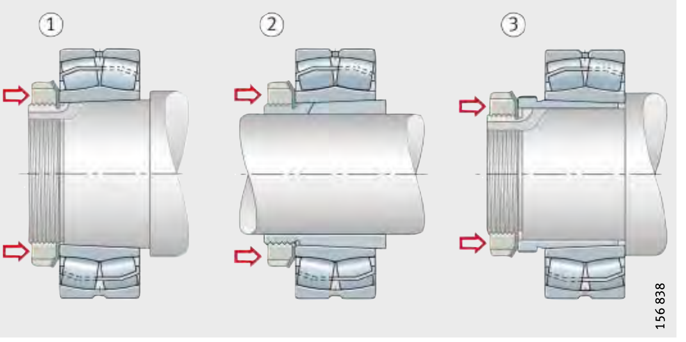
Oil bath

With the exception of sealed, greased bearings and high precision bearings, rolling bearings of all sizes and types can be heated in an oil bath. A thermostatic controller is advisable (temperature +80 °C to +100 °C). In order that the bearings are heated uniformly, they should be laid on a grid or suspended in the oil bath.

! With this method, please note the risk of accidents, environmental pollution by oil vapour, flammability of hot oil and risk of bearing contamination.

Mounting 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 withdrawal sleeve on a cylindrical shaft, *Figure 4* ①, ②, ③.



① Mounting using a locknut
② Mounting on an adapter sleeve using the adapter sleeve nut
③ Mounting on a withdrawal sleeve using a locknut

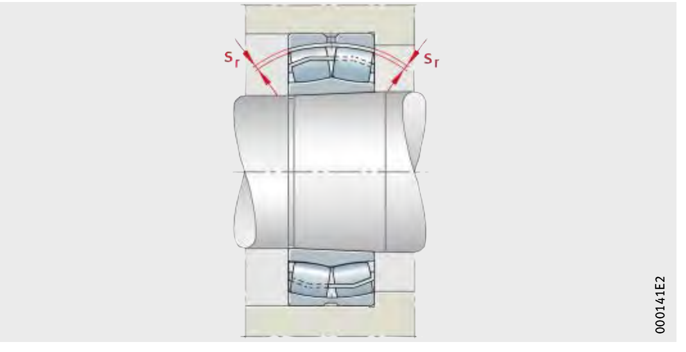
Figure 4
Mounting of rolling bearings with a tapered bore

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 5*.
Alternatively, the axial displacement is measured.

For values for the reduction in radial internal clearance and the displacement in spherical roller bearings, see section Spherical roller bearings, page 624 and page 625.

For the measurement of radial internal clearance, aids such as feeler gauges FEELER-GAUGE-100 and FEELER-GAUGE-300 are suitable.



Spherical roller bearings
s_r = radial internal clearance

Figure 5
Radial internal clearance

Mounting using pressure screws or hydraulic tool

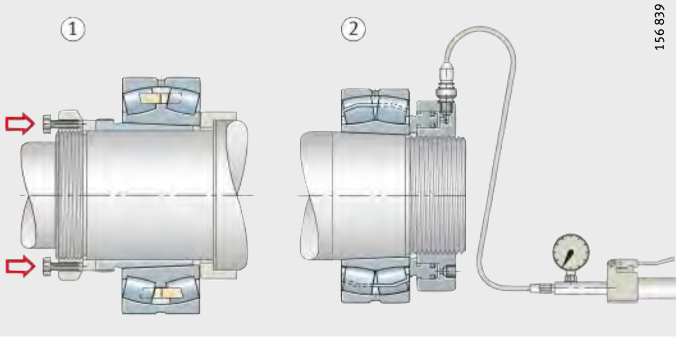
Even in the case of medium sized bearings, the forces required to tighten nuts are considerable. In such cases, mounting can be made easier by using locknuts with pressure screws, *Figure 6* ①. This method is not suitable for spherical roller bearings of E1 design.

For the mounting of large bearings, a hydraulic device should be used to drive up the product or press in the sleeve, *Figure 6* ②. Hydraulic nuts are available for all common threaded sleeves and shafts.

Hydraulic method

The hydraulic method gives considerable assistance in the mounting and particularly in the dismounting of bearings of approx. d = 160 mm and above.

For mounting, an oil with a viscosity of 75 mm^2/s at +20 °C (nominal viscosity 32 mm^2/s at +40 °C) is recommended.



① Mounting on withdrawal sleeve using locknut and pressure screws

② Mounting on tapered shaft using hydraulic nut

Figure 6
Mounting of rolling bearings with a tapered bore

Guidelines for dismounting

Information on mounting and dismounting is given in the publications WL 80100, Mounting of Rolling Bearings and IS 1, Mounting and Maintenance of Rolling Bearings.

Dismounting should be taken into consideration in the original design of the bearing position. If bearing rings are to be mounted with a tight fit, slots should be provided in the shaft or housing bore, for example, to allow removal of the rings.

If the bearing is to be reused, the following guidelines should be taken into consideration:

- Do not use a concentrated or hard flame.
- Avoid direct blows on the bearing rings.
- Do not apply dismounting forces through the rolling elements.
- Clean the bearings carefully after dismounting.

Dismounting of rolling bearings on cylindrical seats

If the bearings and adjacent parts are to be reused, the removal tool should be applied to the ring mounted with a tight fit.
In non-separable bearings, the ring mounted with a sliding fit is dismounted first and the ring with a tight fit is then removed.

Removal of inner rings using an induction device

Induction heating devices are used to remove the shrink-mounted inner rings of cylindrical roller bearings, *Figure 7*.

Heating is achieved quickly and the rings are loosened easily without the transfer of substantial heat to the shaft.

Figure 7
Induction heating device

Heating rings

Heating rings made from light metal with radial slots can be used to dismount the inner rings of cylindrical roller bearings that have no ribs or only one rigid rib, *Figure 8*. The rings are heated on an electric heating plate to between +200 °C and +300 °C, pushed over the bearing ring to be removed and clamped in place using the grips. Once the press fit on the shaft has been eliminated, both rings are removed together.

! The bearing ring must be removed from the heating ring immediately after dismounting in order to prevent overheating.

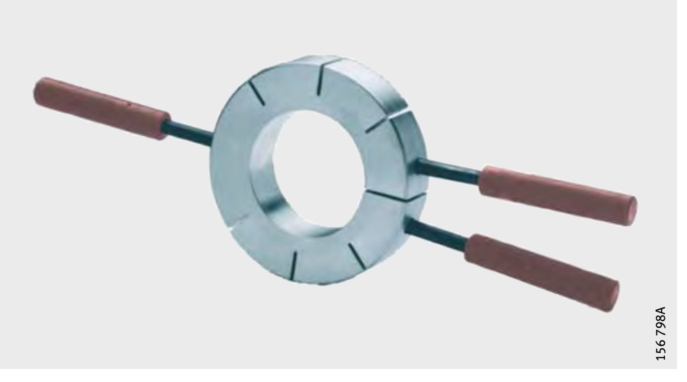


Figure 8
Heating ring

Dismounting of rolling bearings with tapered bore

Mechanical dismounting

Where bearings are mounted directly on a tapered shaft seat or on an adapter sleeve, the locking device on the shaft or adapter sleeve nut must be loosened first. The nut is then unscrewed by the amount of the displacement. The inner ring is then driven off the sleeve or shaft.

Dismounting of large bearings located using a withdrawal sleeve requires considerable force. In this case, locknuts with additional pressure screws can be used, *Figure 9* ①. A disc must be inserted between the inner ring and the pressure screws.

Hydraulic dismounting

An easier and more economical method is the dismounting of withdrawal sleeves using hydraulic nuts, *Figure 9* ②. The protruding withdrawal sleeve is supported by a heavy-section ring.

The dismounting of large bearings can be made easier by using the hydraulic method, *Figure 9* ③ and *Figure 10*. Oil is pressed between the fit surfaces. The adjacent parts can then be 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. The arrangement of oil ducts in the hydraulic method for dismounting of a spherical roller bearing from a tapered shaft seat is shown in *Figure 10*.

! The withdrawal sleeve becomes loose abruptly. Leave the nut on the shaft.

Large adapter and withdrawal sleeves already have the appropriate slots and holes. In this case, a pump must be used to generate the oil pressure required.

Dismounting of a withdrawal sleeve:
① Using a nut and pressure screws
② Using a hydraulic nut

Dismounting of a spherical roller bearing from the withdrawal sleeve:
③ Using the hydraulic method

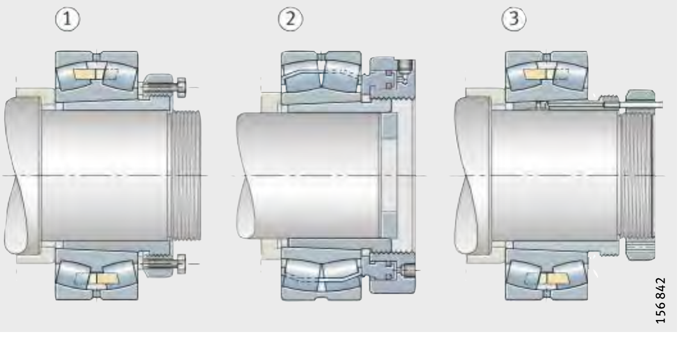


Figure 9
Dismounting of a withdrawal sleeve and spherical roller bearing

B = bearing width

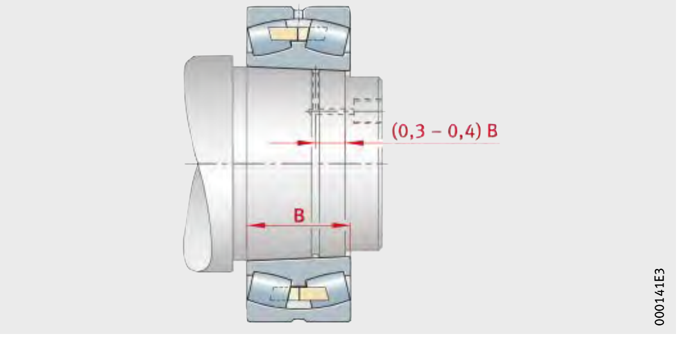


Figure 10
Oil ducts for dismounting a spherical roller bearing

Mounting and dismounting

Suitable oils

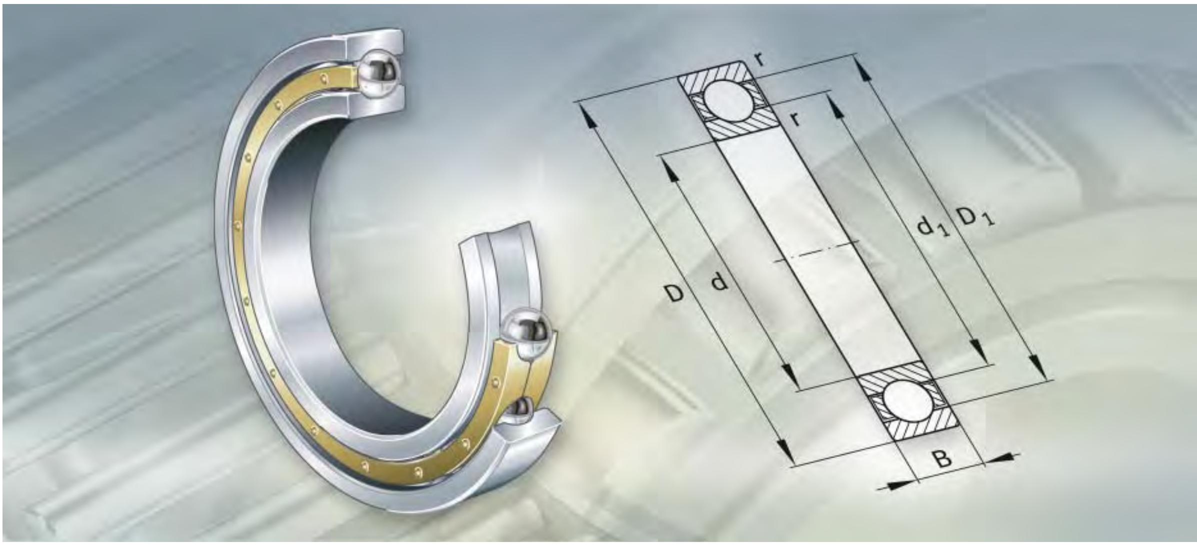
For dismounting, oils with a viscosity of approx. 150 mm^2/s at +20 °C (nominal viscosity 46 mm^2/s at +40 °C) are used.

Fretting corrosion can be dissolved by rust-dissolving additives in the oil.

Disposal of bearings after dismounting

If the bearings are not to be reused after dismounting, the products 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 should be sent for recycling.

FAG



Deep groove ball bearings

Single row

Deep groove ball bearings

Single row

With and without retaining slot

160, 60, 62, 63, 608, 618, 609, 619, Z-5..KL1, F-8..KL1

Z-5..KL1-N1, F-8..KL1-N1

Hybrid deep groove ball bearings

F-HC8..KL1

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.

Single row deep groove ball bearings are of a simple design, robust in operation and easy to maintain.

Due to their low frictional torque, deep groove ball bearings are suitable for high speeds.

Deep groove ball bearings with standardised main dimensions and standardised designations (DIN 625-1) are used, for example, in gearboxes, electric motors, converter drive units and roll stands.

Deep groove ball bearings with non-standardised designations (Z-5..KL, F-8..KL) are used, for example, as axial bearings in roll stands.
Their section height is normally matched to the associated radial bearing.

Hybrid deep groove ball bearings with ceramic balls and steel bearing rings are special bearings for spreader rolls in paper machinery. These are indicated by the designation F-HC8..KL, see section Hybrid deep groove ball bearings, page 182.

Radial and axial load carrying capacity

Due to the raceway geometry and the balls, deep groove ball bearings can support axial loads in both directions as well as radial loads, see section Axial load carrying capacity, page 185.

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 for single row deep groove ball bearings

Series	Adjustment angle	
	Low loads	High loads
62, 622, 63, 623, 64	5′ – 10′	8′ – 16′
618, 619, 160, 60	2′ – 6′	5′ – 10′

Bearings with retaining slot

Deep groove ball bearings with a retaining slot in the outer ring can be easily secured in a circumferential direction. Special bearings that already have a retaining slot are indicated in the dimension table. By agreement, bearings with standardised main dimensions are also available with a retaining slot in the outer ring.
These bearings have the suffix N1.

Hybrid deep groove ball bearings

A special design of deep groove ball bearing is used in high speed spreader rolls in paper machinery. These hybrid bearings with the designation F-HC8..KL have steel bearing rings and ceramic balls. Since the number of balls is reduced in this case, the risk of slippage is significantly lower. Further information on these bearings is given in TPI WL 13-4, Hybrid Deep Groove Ball Bearings for Spreader Rolls.

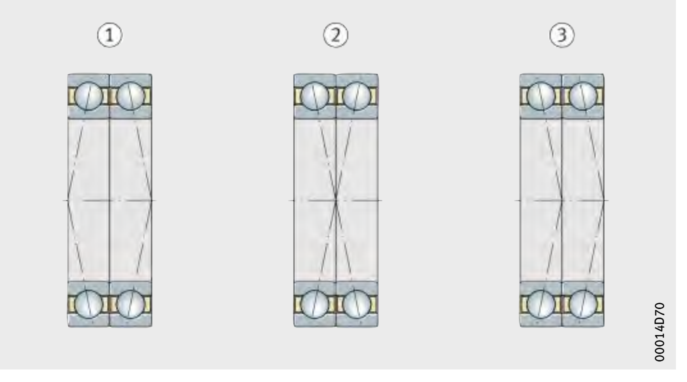
Matched single row deep groove ball bearings

By agreement, deep groove ball bearings of series 160, 60, 62, 63, 64 and 618 are available in different 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 in 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

Sealing

Single row deep groove ball bearings are not sealed.

Lubrication

The bearings can be lubricated with grease or oil.

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.

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.

The suffix MA indicates bearings with a solid brass cage guided on the outer ring.

Cages guided on the inner ring are indicated by the suffix MB.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix[1]	Description	Design
C3	Radial internal clearance larger than normal	Standard
M	Solid brass cage, ball-guided	
MB	Solid brass cage, guided on inner ring	
DB	Two deep groove ball bearings in O arrangement, matched clearance-free	Special design, available by agreement only
DF	Two deep groove ball bearings in X arrangement, matched clearance-free	
DT	Two deep groove ball bearings in tandem arrangement, matched clearance-free	
MA	Solid brass cage, guided on outer ring	
N1	One retaining slot in outer ring (for securing in circumferential direction)	
P6	Tolerance class P6	

[1] In the case of deep groove ball bearings with non-standardised designations, the design (for example radial internal clearance, cage, accuracy) is specified in the designation (Z-5 or F-8).
In the case of these bearings, additional suffixes are only used for deviations from the original design.

Design and safety guidelines

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies:

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic bearing 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 kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, X, Y –
Factors, see table Factors e, X and Y.

The factors e, X and Y required for determining P are dependent on the ratio $f_0 \cdot F_a/C_{0r}$ and the radial internal clearance.
The values in the table 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} kN
Basic static load rating, see dimension tables

f_0 –
Factor, see dimension tables

F_a kN
Axial dynamic bearing load.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads.
It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies:

Load ratio and equivalent static load

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leq 0{,}8$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 0{,}8$	$P_0 = 0{,}6 \cdot F_{0r} + 0{,}5 \cdot F_{0a}$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
Radial static bearing load.

Axial load carrying capacity

Deep groove ball bearings are also suitable for axial loads.

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, ball bearings with cage must be subjected to a minimum radial load of the order of $P/C_r > 0{,}01$.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The dimension tables give the maximum dimension of the radius r_a and the diameters of the abutment shoulders D_a and d_a.

Accuracy

The main dimensions of the standardised single row deep groove ball bearings correspond to DIN 625-1.

The dimensional and running tolerances of the standardised bearings correspond to tolerance class PN to DIN 620. Tolerances for special bearings are available by agreement.

The width tolerance of matched bearings deviates from this standard, see table.

Width tolerance of bearing rings in matched bearings

Bore diameter d mm		Width deviation Δ_{Bs} μm	
over	incl.	min.	max.
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 to DIN 620-4.

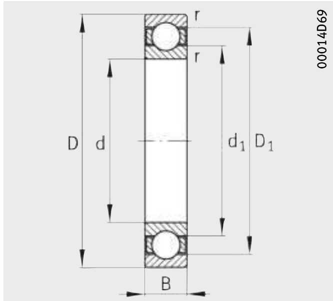
Standardised bearings with increased internal clearance have the suffix C3. Special bearings with radial internal clearance C3 or C4 are indicated in the dimension tables.

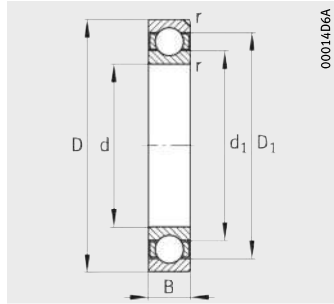
Radial internal clearance

Bore		Radial internal clearance							
d mm		C2 μm		CN μm		C3 μm		C4 μm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
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	2	35	25	85	75	140	125	195
225	250	2	40	30	95	85	160	145	225
250	280	2	45	35	105	90	170	155	245
280	315	2	55	40	115	100	190	175	270
315	355	3	60	45	125	110	210	195	300
355	400	3	70	55	145	130	240	225	340
400	450	3	80	60	170	150	270	250	380
450	500	3	90	70	190	170	300	280	420
500	560	10	100	80	210	190	330	310	470
560	630	10	110	90	230	210	360	340	520
630	710	20	130	110	260	240	400	380	570
710	800	20	140	120	290	270	450	430	630
800	900	20	160	140	320	300	500	480	700
900	1 000	20	170	150	350	330	550	530	770
1 000	1 120	20	180	160	380	360	600	580	850
1 120	1 250	20	190	170	410	390	650	630	920
1 250	1 400	30	200	190	440	420	700	680	990
1 400	1 600	30	210	210	470	450	750	730	1 060

Deep groove ball bearings

Single row



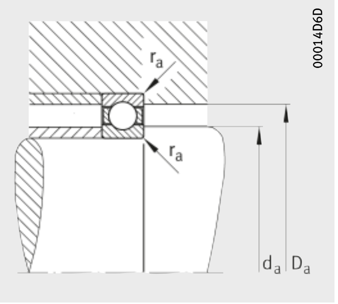


With retaining slot

Dimension table · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
6330-M	26,5	**150**	320	65	4	266,1	205,6
6330-M-C3	26,5	**150**	320	65	4	266,1	205,6
6332-M	31,6	**160**	340	68	4	280,9	219,7
6332-M-C3	31,6	**160**	340	68	4	280,9	219,7
6334-M	37,3	**170**	360	72	4	298	232,6
6334-M-C3	37,3	**170**	360	72	4	298	232,6
6236-M	19	**180**	320	52	4	272	228,7
6236-M-C3	19	**180**	320	52	4	272	228,7
6336-M	43	**180**	380	75	4	317	245,2
6336-M-C3	43	**180**	380	75	4	317	245,2
6238-M	22,6	**190**	340	55	4	291,5	239,9
6238-M-C3	22,6	**190**	340	55	4	291,5	239,9
6338-M	50,4	**190**	400	78	5	330,5	260,2
6338-M-C3	50,4	**190**	400	78	5	330,5	260,2
6240-M	27	**200**	360	58	4	306,5	254,9
6240-M-C3	27	**200**	360	58	4	306,5	254,9
6340-M	56,6	**200**	420	80	5	345,9	274,7
6340-M-C3	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
6044-M-C3	18,8	**220**	340	56	3	303,1	258,1
6244-M	37,9	**220**	400	65	4	337,6	282,2
6244-M-C3	37,9	**220**	400	65	4	337,6	282,2
6344-M	73,7	**220**	460	88	5	383	299,4
6344-M-C3	73,7	**220**	460	88	5	383	299,4
F-801656.KL[1]	11,5	**230**	329,5	40	2,1	298,1	262,8
Z-508729.KL	11,5	**230**	329,5	40	2,1	298,1	262,8
60948-M	6,19	**240**	320	25	1,5	292,3	268,3
61948	6,83	**240**	320	38	2,1	298	262,9
61948-M-C3	8,53	**240**	320	38	2,1	298	262,9
61948-MA	8,48	**240**	320	38	2,1	298,9	262,9
Z-578545.KL	10,4	**240**	329,5	40	2,1	303	268

1) With retaining slot.

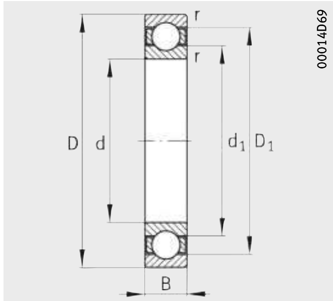


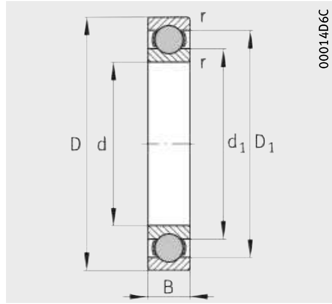
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
167	303	3	280	290	13,1	13,8	4 800	3 000
167	303	3	280	290	13,1	13,8	4 800	3 000
177	323	3	300	325	14	13,9	4 300	2 800
177	323	3	300	325	14	13,9	4 300	2 800
187	343	3	325	365	14,7	13,9	4 000	2 600
187	343	3	325	365	14,7	13,9	4 000	2 600
197	303	3	224	245	10,3	15,3	4 800	2 750
197	303	3	224	245	10,3	15,3	4 800	2 750
197	363	3	355	405	16,3	13,9	3 800	2 440
197	363	3	355	405	16,3	13,9	3 800	2 440
207	323	3	255	280	11,6	15	4 300	2 600
207	323	3	255	280	11,6	15	4 300	2 600
210	380	4	375	440	17,5	14	3 600	2 300
210	380	4	375	440	17,5	14	3 600	2 300
217	343	3	270	310	12,4	15,3	4 000	2 430
217	343	3	270	310	12,4	15,3	4 000	2 430
220	400	4	380	465	18	14,1	3 400	2 170
220	400	4	380	465	18	14,1	3 400	2 170
230,2	329,8	2,1	200	240	8,4	16,3	4 300	2 310
232,4	327,6	2,5	245	290	11,1	15,6	4 000	2 700
232,4	327,6	2,5	245	290	11,1	15,6	4 000	2 700
237	383	3	300	355	13,5	15,2	3 600	2 200
237	383	3	300	355	13,5	15,2	3 600	2 200
240	440	4	440	560	20	14,1	3 200	1 960
240	440	4	440	560	20	14,1	3 200	1 960
240	319	2,1	200	240	8,4	16,3	4 300	–
240	319	2,1	200	240	8,4	16,3	4 300	–
247	313	1,5	108	146	5,1	16	4 300	2 000
250,2	309,8	2,1	200	240	8,4	16,3	4 300	2 330
250,2	309,8	2,1	200	240	8,4	16,3	4 300	2 330
250,2	309,8	2,1	200	240	8,4	16,3	4 300	2 330
250,2	319,3	2,1	196	240	8,7	16,4	4 000	–

Deep groove ball bearings

Single row





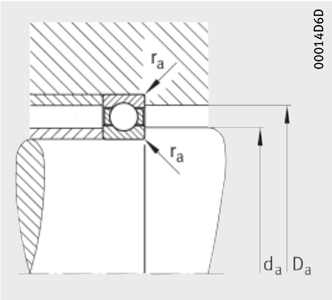
Hybrid deep groove ball bearings with ceramic balls

Dimension table (continued) · Dimensions in mm

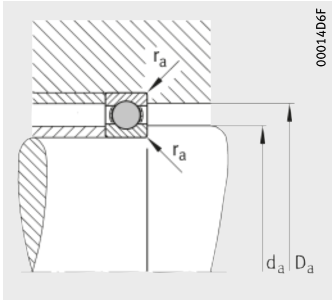
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
16048	12,7	**240**	360	37	2,1	317,4	283,1
6048-M	20,5	**240**	360	56	3	321,9	278,8
6048-M-C3	20,5	**240**	360	56	3	321,9	278,8
6248-M	51,3	**240**	440	72	4	369,6	309,9
6248-M-C3	51,3	**240**	440	72	4	369,6	309,9
6348-M	96,4	**240**	500	95	5	411,3	328,7
6348-M-C3	96,4	**240**	500	95	5	411,3	328,7
60852-M	2,17	**260**	320	19	1	298	282
F-HC808546.KL [1]	3,78	**260**	320	28	2	300,7	279,6
61852	4,23	**260**	320	28	2	300,7	279,6
61852-M	5,11	**260**	320	28	2	299,8	280,5
61852-MA	5,26	**260**	320	28	2	300,7	280,5
60952-M	10,5	**260**	360	31	2	324,3	296,2
61952-M	14,4	**260**	360	46	2,1	329,9	291,2
61952-M-C3	14,4	**260**	360	46	2,1	329,9	291,2
61952-MA	14,4	**260**	360	46	2,1	329,9	291,2
Z-507338.01.KL	16,4	**260**	369,5	46	2,1	329,9	291,2
16052	19,1	**260**	400	44	3	351,2	310
6052-M	29,8	**260**	400	65	4	357	304,6
6052-M-C3	29,8	**260**	400	65	4	357	304,6
6252-M	68,4	**260**	480	80	5	402,4	337,3
6252-M-C3	68,4	**260**	480	80	5	402,4	337,3
6352-M	118	**260**	540	102	6	446,1	355
6352-M-C3	118	**260**	540	102	6	446,1	355
60856-M	5,4	**280**	350	22	1,1	325,4	305,7
F-HC808547.KL [1]	5,63	**280**	350	33	2	328,1	302,7
F-804993.07.KL [2]	5,89	**280**	350	33	2	328,1	302,7
F-808547.KL [2]	5,89	**280**	350	33	2	328,1	302,7
61856	6,34	**280**	350	33	2	328,1	302,7
61856-M	7,56	**280**	350	33	2	327,3	303,4
61856-MA	7,92	**280**	350	33	2	328,1	303,4

[1] Hybrid deep groove ball bearing.

[2] With JN cage.



Mounting dimensions

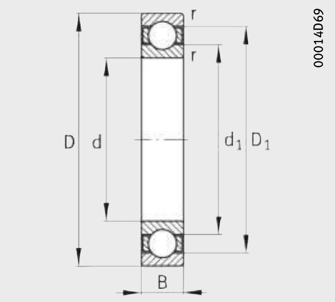


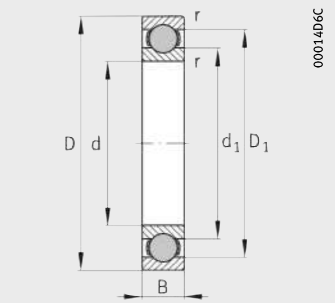
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
250,2	349,8	2,1	204	255	8,5	16,4	3 800	2 100
252,4	347,6	2,5	255	315	11,4	15,8	3 800	2 450
252,4	347,6	2,5	255	315	11,4	15,8	3 800	2 450
257	423	3	360	475	16,7	15,2	3 400	1 980
257	423	3	360	475	16,7	15,2	3 400	1 980
260	480	4	465	620	21,8	14,2	3 000	1 800
260	480	4	465	620	21,8	14,2	3 000	1 800
264,6	315,4	1	67	104	3,6	15,6	4 300	1 700
268,8	311,2	2	42,5	55	1,61	13,2	4 300	–
268,8	311,2	2	96,5	132	4,55	15,8	4 300	2 070
268,8	311,2	2	96,5	132	4,55	15,8	4 300	2 070
268,8	311,2	2	96,5	132	4,55	15,8	4 300	2 070
268,8	351,2	2	153	200	6,4	16,1	3 800	1 900
270,2	349,8	2,1	220	280	8,6	16,3	3 800	2 180
270,2	349,8	2,1	220	280	8,6	16,3	3 800	2 180
270,2	349,8	2,1	220	280	8,6	16,3	3 800	2 180
270	359,5	2,1	220	280	8,6	16,3	3 800	–
272,4	387,6	2,5	236	310	9,9	16,4	3 600	1 960
274,6	385,4	3	300	390	13,3	15,7	3 400	2 260
274,6	385,4	3	300	390	13,3	15,7	3 400	2 260
280	460	4	405	560	19,2	15,2	3 000	1 820
280	460	4	405	560	19,2	15,2	3 000	1 820
265,6	534,4	5	520	720	24,8	14,3	2 800	1 650
265,6	534,4	5	520	720	24,8	14,3	2 800	1 650
286	344	1	90	134	4,55	15,7	4 000	1 600
288,8	341,2	2	60	68	2,05	12,5	3 800	–
288,8	341,2	2	81,5	88	–	16	3 800	–
288,8	341,2	2	81,5	88	2,9	16	3 800	–
288,8	341,2	2	129	176	5,8	16	3 800	1 950
288,8	341,2	2	129	176	5,8	16	3 800	–
288,8	341,2	2	129	176	5,8	16	3 800	–

Deep groove ball bearings

Single row



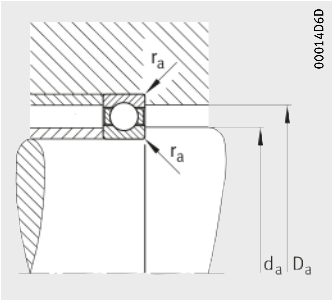


Hybrid deep groove ball bearings with ceramic balls

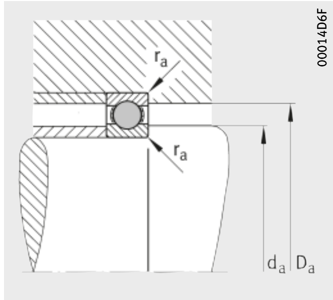
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
60956-M	11,2	**280**	380	31	2	344,3	316,2
61956	12,4	**280**	380	46	2,1	351,1	310,1
61956-M-C3	12,4	**280**	380	46	2,1	351,1	310,1
Z-507341.KL	17,3	**280**	389,5	46	2,1	350,5	310,1
16056-M	23,2	**280**	420	44	3	370,6	329,9
6056-M	31,7	**280**	420	65	4	377,5	324,1
6056-M-C3	31,7	**280**	420	65	4	377,5	324,1
6256-M	72,9	**280**	500	80	5	423	356,7
6256-M-C3	72,9	**280**	500	80	5	423	356,7
6356-M	147	**280**	580	108	6	481,1	384
6356-M-C3	147	**280**	580	108	6	481,1	384
Z-578599.KL	26,2	**290**	409,5	60	3	375	325,6
60860-M	7,55	**300**	380	25	1,5	351,3	329,3
F-HC808548.KL[1]	8,03	**300**	380	38	2,1	354,7	326,2
61860	8,97	**300**	380	38	2,1	354,7	326,2
61860-M	10,7	**300**	380	38	2,1	353,8	327
Z-538205.KL	24,4	**300**	419,5	56	3	383	337,1
60960-M	17,6	**300**	420	37	2,1	376,6	344,3
61960-M	24	**300**	420	56	3	384,2	337,1
61960-M-C3	24	**300**	420	56	3	384,2	337,1
61960-MA	26,2	**300**	420	56	3	385,1	337,1
61960-MB	25,9	**300**	420	56	3	384,2	336,4
16060-M	32,6	**300**	460	50	4	404	357,3
6060-M	44,5	**300**	460	74	4	410,8	350,8
6060-M-C3	44,5	**300**	460	74	4	410,8	350,8
6060-MB-C3	44,5	**300**	460	74	4	410,8	350,8
6260-M	90,5	**300**	540	85	5	456,1	383,3
6260-M-C3	90,5	**300**	540	85	5	456,1	383,3
6360-M	170	**300**	620	109	7,5	511,8	410,5
6360-M-C3	170	**300**	620	109	7,5	511,8	410,5

[1] Hybrid deep groove ball bearing.



Mounting dimensions

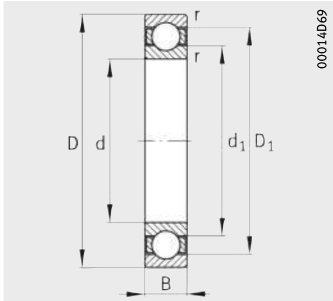


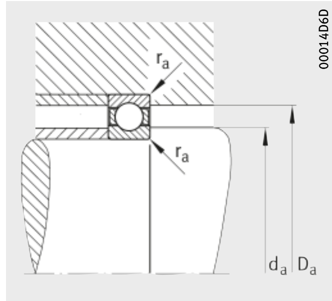
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
288,8	371,2	2	156	216	6,9	16	3 600	1 700
290,2	369,8	2,1	236	310	9,9	16,4	3 600	1 990
290,2	369,8	2,1	236	310	9,9	16,4	3 600	1 990
290	379,5	2,1	236	310	9,4	16,4	3 600	–
292,4	407,6	2,5	240	325	10,1	16,4	3 400	1 800
294,6	405,4	3	320	440	14,4	15,8	3 400	2 070
294,6	405,4	3	320	440	14,4	15,8	3 400	2 070
291	489	4	425	600	20,3	15,3	3 000	1 690
291	489	4	425	600	20,3	15,3	3 000	1 690
285,6	574,4	5	610	915	26	14,3	2 600	1 470
285,6	574,4	5	610	915	26	14,3	2 600	1 470
302,4	397,1	2,5	310	425	13,8	15,9	3 400	–
307	373	1,5	112	166	5,5	15,7	3 600	1 500
310,2	369,8	2,1	71	80	2,22	12,5	3 600	–
310,2	369,8	2,1	153	204	6,3	16	3 600	1 850
310,2	369,8	2,1	153	204	6,3	16	3 600	–
312,4	407,1	2,5	285	400	11,6	16,2	3 200	–
310,2	409,8	2,1	204	275	8,5	16,2	3 400	1 600
312,4	407,6	2,5	285	400	12,4	16,2	3 200	1 890
312,4	407,6	2,5	285	400	12,4	16,2	3 200	1 890
312,4	407,6	2,5	285	400	12,4	16,2	3 200	1 890
312,4	407,6	2,5	285	400	12,4	16,2	3 200	1 890
314,6	445,4	3	300	430	12,7	16,4	3 200	1 670
314,6	445,4	3	365	510	16,7	15,7	3 000	1 930
314,6	445,4	3	365	510	16,7	15,7	3 000	1 930
314,6	445,4	3	365	510	16,7	15,7	3 000	1 930
320	520	4	455	670	19,7	15,3	2 800	1 550
320	520	4	455	670	19,7	15,3	2 800	1 550
332	588	6	640	980	31	14,4	2 400	1 360
332	588	6	640	980	31	14,4	2 400	1 360

Deep groove ball bearings

Single row





Mounting dimensions

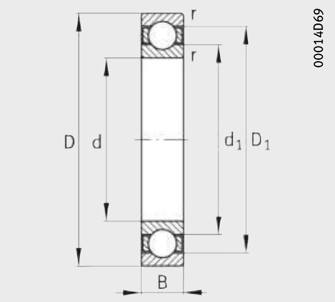
Dimension table (continued) · Dimensions in mm

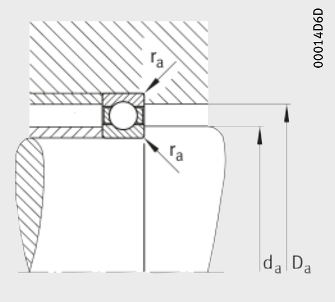
Designation	Mass m ≈kg	Dimensions d	D	B	r min.	D_1 ≈	d_1 ≈
60864-M	7,98	**320**	400	25	1,5	371,5	349,2
61864-M	11,3	**320**	400	38	2,1	373,8	347
60964-M	18,5	**320**	440	37	2,1	395,7	364
61964-M	25,3	**320**	440	56	3	403,9	357,3
61964-M-C3	25,3	**320**	440	56	3	403,9	357,3
61964-MA	25	**320**	440	56	3	405,1	357,3
F-807088.KL	27,6	**320**	449,5	56	3	403,9	356,4
16064-M	34,9	**320**	480	50	4	423,1	377,7
6064-M	47,4	**320**	480	74	4	430,8	370,9
6064-M-C3	47,4	**320**	480	74	4	430,8	370,9
6064-MB-C3	47,4	**320**	480	74	4	430,8	370,9
6264-M	113	**320**	580	92	5	492,5	410
6264-M-C3	113	**320**	580	92	5	492,5	410
Z-507360.01.KL	126	**320**	580	105	5	491,5	410,8
6364-M	205	**320**	670	112	7,5	546,8	446,3
6364-M-C3	205	**320**	670	112	7,5	546,8	446,3
Z-509173.KL	29,6	**330**	460	56	3	423,1	377,9
60868-M	8,22	**340**	420	25	1,5	391,3	369,3
61868-M	12	**340**	420	38	2,1	394,2	366,7
61868-MA	12	**340**	420	38	2,1	394,2	366,7
60968-M	19,8	**340**	460	37	2,1	417	384
61968-M	27,3	**340**	460	56	3	423,1	377,8
61968-MA	27	**340**	460	56	3	424	377,8
61968-MB-C3	27,3	**340**	460	56	3	423,1	377,8
Z-538204.KL	35,4	**340**	479,5	60	3	431,1	388
Z-503809.KL	35,5	**340**	480	60	3	432	388
Z-576368.KL	40,9	**340**	489,5	65	5	442	388,6
16068-M	47,5	**340**	520	57	4	457,1	403,6
6068-M	63,2	**340**	520	82	5	469,6	402,3
6068-M-C3	63,2	**340**	520	82	5	469,6	402,3
6068-MB-C3	63,2	**340**	520	82	5	469,6	402,3
6268-M	118	**340**	620	92	6	530	446,5
6268-M-C3	118	**340**	620	92	6	530	446,5
6368-M	244	**340**	710	118	7,5	578	474
6368-M-C3	244	**340**	710	118	7,5	578	474
Z-532002.KL	44,3	**350**	500	70	4	457,1	402,7

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
327	393	1,5	114	176	5,2	15,7	3 400	1 400
330,2	389,8	2,1	156	220	6,5	15,9	3 400	1 710
330,2	429,8	2,1	204	285	8,6	16,1	3 200	1 500
332,4	427,6	2,5	300	430	12,7	16,4	3 200	1 750
332,4	427,6	2,5	300	430	12,7	16,4	3 200	1 750
332,4	427,6	2,5	300	430	12,7	16,4	3 200	1 750
332,4	437,1	2,5	300	430	12,7	16,4	3 200	–
334,6	465,4	3	305	455	13	16,4	3 000	1 550
334,6	465,4	3	380	560	17,4	15,9	3 000	1 790
334,6	465,4	3	380	560	17,4	15,9	3 000	1 790
334,6	465,4	3	380	560	17,4	15,9	3 000	1 790
340	560	4	530	815	23,5	15,2	2 600	1 430
340	560	4	530	815	23,5	15,2	2 600	1 430
340	560	4	530	815	23,5	15,2	2 600	–
325,6	664,4	6	630	1 000	30,5	14,8	2 200	1 250
325,6	664,4	6	630	1 000	30,5	14,8	2 200	1 250
352,4	447,6	2,5	305	455	13	16,4	3 000	–
347	413	1,5	118	186	5,8	15,6	3 400	1 300
350,2	409,8	2,1	156	220	6,6	15,9	3 200	1 590
350,2	409,8	2,1	156	220	6,6	15,9	3 200	1 590
350,2	449,8	2,1	208	300	8,8	16	3 000	1 400
352,4	447,6	2,5	305	455	13	16,4	3 000	1 630
352,4	447,6	2,5	305	455	13	16,4	3 000	1 630
352,4	447,6	2,5	305	455	13	16,4	3 000	1 630
352,4	467,4	2,5	280	415	11,9	16,5	3 000	–
352,4	467,6	2,5	280	415	11,9	16,5	3 000	–
358	471,5	4	345	510	13,9	16,2	2 800	–
354,6	505,4	3	355	550	17,8	16,3	2 800	1 460
358	502	4	440	695	20,8	15,8	2 800	1 630
358	502	4	440	695	20,8	15,8	2 800	1 630
358	502	4	440	695	20,8	15,8	2 800	1 630
366	594	5	550	900	26	15,5	2 400	1 270
366	594	5	550	900	26	15,5	2 400	1 270
345,6	704,4	6	710	1 180	35	14,9	2 000	1 160
345,6	704,4	6	710	1 180	35	14,9	2 000	1 160
365	485	3	355	550	15,3	16,3	2 800	–

Deep groove ball bearings

Single row





Mounting dimensions

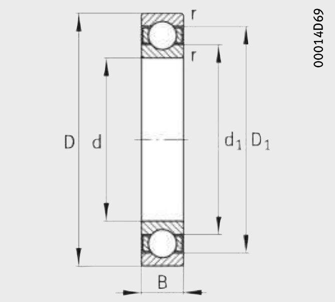
Dimension table (continued) · Dimensions in mm

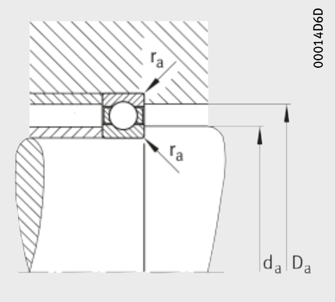
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
60872-M	8,87	**360**	440	25	1,5	411,5	389,2
61872-M	12,8	**360**	440	38	2,1	413	387,7
61872-MA	12,8	**360**	440	38	2,1	414,2	387,7
61872-MB	12,8	**360**	440	38	2,1	413	386,7
F-804093.KL	27,9	**360**	479	56	3	442,8	397
60972-M	20,4	**360**	480	37	2,1	437	404
61972-M	28,7	**360**	480	56	3	442,8	398
61972-MA	30,6	**360**	480	56	3	444	398
61972-MB	28,2	**360**	480	56	3	442,8	397
61972-MB-C3	28,2	**360**	480	56	3	442,8	397
16072-M	49,4	**360**	540	57	4	478,1	423,5
6072-M	66,2	**360**	540	82	5	489	423,7
6072-M-C3	66,2	**360**	540	82	5	489	423,7
6072-MB-C3	66,2	**360**	540	82	5	489	423,7
Z-533303.KL	76,8	**360**	550	85	5	490,3	423,7
6272-M	148	**360**	650	95	6	549	462,7
6272-M-C3	148	**360**	650	95	6	549	462,7
6372-M	293	**360**	750	125	7,5	611	499
6372-M-C3	293	**360**	750	125	7,5	611	499
60876-M	14,2	**380**	480	31	2	444,1	416,7
61876-M	20,6	**380**	480	46	2,1	445,9	414,1
Z-576367.KL	40,3	**380**	519,5	65	4	478,2	423,7
60976-M	30,3	**380**	520	44	3	469,4	431,3
61976-M	40,6	**380**	520	65	4	478	423,5
61976-MA	41,9	**380**	520	65	4	479,3	423,5
61976-MB	41,4	**380**	520	65	4	478	422,5
61976-MB-C3	41,4	**380**	520	65	4	478	422,5
16076-M	51,7	**380**	560	57	4	498	443,5
6076-M	69,6	**380**	560	82	5	504	438,6
6076-M-C3	69,6	**380**	560	82	5	504	438,6
6076-MB-C3	69,6	**380**	560	82	5	504	438,6
6276-M	161	**380**	680	95	6	574	487,7
6276-M-C3	161	**380**	680	95	6	574	487,7
6376-M	317	**380**	780	128	7,5	640	523,5
6376-M-C3	317	**380**	780	128	7,5	640	523,5

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
367	433	1,5	120	196	5,5	15,6	3 200	1 200
370,2	429,8	2,1	160	236	6,9	15,8	3 200	1 480
370,2	429,8	2,1	160	236	6,9	15,8	3 200	1 480
370,2	429,8	2,1	160	236	6,9	15,8	3 200	1 480
372,4	467,6	2,5	310	480	13,3	16,5	3 000	1 500
370,2	469,8	2,1	208	305	8,9	15,9	3 000	1 300
372,4	467,6	2,5	310	480	13,2	16,5	3 000	1 520
372,4	467,6	2,5	310	480	13,2	16,5	3 000	1 520
372,4	467,6	2,5	310	480	13,2	16,5	3 000	1 520
372,4	467,6	2,5	310	480	13,2	16,5	3 000	1 520
374,6	525,4	3	365	585	15,7	16,4	2 800	1 370
378	522	4	455	735	21,5	15,9	2 600	1 530
378	522	4	455	735	21,5	15,9	2 600	1 530
378	522	4	455	735	21,5	15,9	2 600	1 530
378	532	4	455	735	21,5	15,9	2 600	–
362,4	647,6	5	560	900	25,5	15,4	2 200	1 240
362,4	647,6	5	560	900	25,5	15,4	2 200	1 240
365,6	744,4	6	735	1 250	35	14,8	1 900	1 100
365,6	744,4	6	735	1 250	35	14,8	1 900	1 100
388,8	471,2	2	166	260	7,2	15,7	3 000	1 200
390,2	469,8	2,1	220	320	8,9	16	3 000	1 430
394,6	505,4	3	365	585	15,1	16,4	2 800	–
392,4	507,6	2,5	250	390	11,2	16	2 800	1 300
394,6	505,4	3	365	585	15,1	16,4	2 800	1 450
394,6	505,4	3	365	585	15,1	16,4	2 800	1 450
394,6	505,4	3	365	585	15,1	16,4	2 800	1 450
394,6	505,4	3	365	585	15,1	16,4	2 800	1 450
394,6	545,4	3	375	620	16,1	16,5	2 600	1 290
398	542	4	455	750	21,1	16	2 600	1 470
398	542	4	455	750	21,1	16	2 600	1 470
398	542	4	455	750	21,1	16	2 600	1 470
406	654	5	585	980	27	15,6	2 000	1 150
406	654	5	585	980	27	15,6	2 000	1 150
412	748	6	830	1 460	42,5	14,8	1 800	1 020
412	748	6	830	1 460	42,5	14,8	1 800	1 020

Deep groove ball bearings

Single row





Mounting dimensions

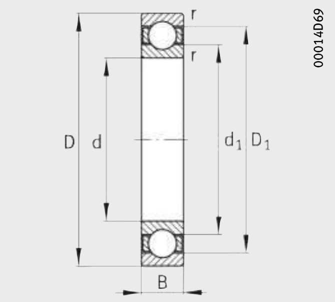
Dimension table (continued) · Dimensions in mm

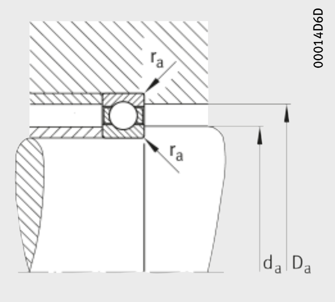
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
60880-M	15,3	**400**	500	31	2	464,1	436,7
61880-M	21,5	**400**	500	46	2,1	467,3	433,7
60980-M	31,7	**400**	540	44	3	488,1	452,8
61980-M	42,5	**400**	540	65	4	498	443,6
61980-MA	42,7	**400**	540	65	4	499,3	443,6
61980-MB	42,6	**400**	540	65	4	498	442,5
61980-MB-C3	42,6	**400**	540	65	4	498	442,5
16080-M	69,3	**400**	600	63	5	525,8	472
6080-M	90,6	**400**	600	90	5	536,3	465
6080-M-C3	90,6	**400**	600	90	5	536,3	465
6080-MB-C3	90,6	**400**	600	90	5	536,3	465
F-801513.KL	90,6	**400**	600	90	5	536,3	465
6280-M	203	**400**	720	103	6	606,2	515,7
6280-M-C3	203	**400**	720	103	6	606,2	515,7
6380-M	371	**400**	820	136	7,5	672	551,5
6380-M-C3	371	**400**	820	136	7,5	672	551,5
60884-M	15,9	**420**	520	31	2	484,4	456,4
61884-M	22,8	**420**	520	46	2,1	485,8	454,3
Z-576366.KL	45,4	**420**	559,5	65	4	517,9	463,5
60984-M	33,3	**420**	560	44	3	508,1	472,9
61984-M	45,6	**420**	560	65	4	517,9	463,5
61984-MA	47,2	**420**	560	65	4	519,3	463,5
61984-MB	44,9	**420**	560	65	4	517,9	462,4
61984-MB-C3	44,9	**420**	560	65	4	517,9	462,4
Z-544178.KL	57	**420**	580	70	4	529	473
Z-508748.KL	60,2	**420**	580	72	3	528	472
16084-M	72,1	**420**	620	63	5	547	494
6084-M	99,7	**420**	620	90	5	556,4	484,9
6084-MB-C3	99,7	**420**	620	90	5	556,4	484,9

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
408,8	491,2	2	170	275	7,4	15,7	2 800	1 100
410,2	489,8	2,1	220	335	8,8	15,9	2 800	1 340
412,4	527,6	2,5	245	390	10,6	15,9	2 800	1 200
414,6	525,4	3	375	620	15,7	16,5	2 600	1 360
414,6	525,4	3	375	620	15,7	16,5	2 600	1 360
414,6	525,4	3	375	620	15,7	16,5	2 600	1 360
414,6	525,4	3	375	620	15,7	16,5	2 600	1 360
418	582	4	380	630	19,1	16,5	2 400	1 240
418	582	4	520	865	23,5	15,9	2 200	1 390
418	582	4	520	865	23,5	15,9	2 200	1 390
418	582	4	520	865	23,5	15,9	2 200	1 390
418	582	4	520	865	23,5	15,9	2 200	–
402,4	717,6	5	620	1 080	27	15,6	1 900	1 100
402,4	717,6	5	620	1 080	27	15,6	1 900	1 100
432	788	6	865	1 600	44	14,9	1 700	980
432	788	6	865	1 600	44	14,9	1 700	980
428,8	511,2	2	173	285	8	15,6	2 800	1 000
430,2	509,8	2,1	224	345	9,2	15,9	2 800	1 260
434,6	545,4	3	390	655	16,3	16,5	2 600	–
432,4	547,6	2,5	250	400	10,8	15,9	2 600	1 100
434,6	545,4	3	390	655	16,3	16,5	2 600	1 280
434,6	545,4	3	390	655	16,3	16,5	2 600	1 280
434,6	545,4	3	390	655	16,3	16,5	2 600	1 280
434,6	545,4	3	390	655	16,3	16,5	2 600	1 280
434,6	565,4	3	380	640	14,4	16,5	2 400	–
432,4	567,6	2,5	380	630	19,1	16,5	2 400	–
438	602	4	390	670	16,8	16,4	2 200	1 170
438	602	4	530	930	24,4	16	2 200	1 310
438	602	4	530	930	24,4	16	2 200	1 310

Deep groove ball bearings

Single row





Mounting dimensions

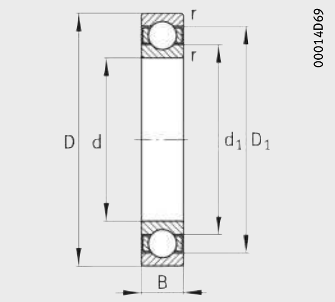
Dimension table (continued) · Dimensions in mm

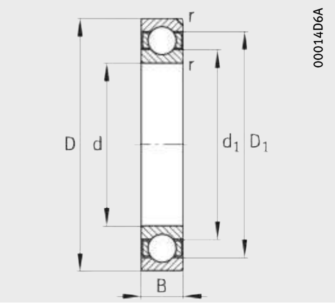
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
60888-M	16,8	**440**	540	31	2	504,1	476,7
61888-M	23,8	**440**	540	46	2,1	505,9	474,2
60988-M	45,5	**440**	600	50	4	540,9	500,2
61988-M	62,1	**440**	600	74	4	549,2	492,4
61988-MB-C3	62,1	**440**	600	74	4	549,2	492,4
16088-M	86,3	**440**	650	67	5	566,8	514
6088-M	108	**440**	650	94	6	583,6	507,7
6088-MB-C3	108	**440**	650	94	6	583,6	507,7
60892-M	26	**460**	580	37	2,1	535,6	504,4
61892-M	35,8	**460**	580	56	3	540,9	500,2
61892-MA	36,7	**460**	580	56	3	542	500,2
60992-M	46,2	**460**	620	50	4	561	520
61992-M	64,6	**460**	620	74	4	569,2	512,4
61992-MA	64,6	**460**	620	74	4	570,4	512,4
61992-MB-C3	64,6	**460**	620	74	4	569,2	512,4
F-803489.KL	126	**460**	679	100	6	612,6	528,7
16092-M	95,9	**460**	680	71	5	595,5	536,1
6092-M	125	**460**	680	100	6	612,6	529,8
6092-MB-C3	127	**460**	680	100	6	612,6	528,7
F-804931.KL	18,1	**480**	580	30	2	543,1	517,7
60896-M	26,6	**480**	600	37	2,1	555,6	524,4
61896-M	37,3	**480**	600	56	3	560,9	520,3
61896-MA	38,6	**480**	600	56	3	562	520,3
60996-M	57	**480**	650	54	4	587,9	544
61996-M	75,6	**480**	650	78	5	595,4	536,2
61996-MA	78,7	**480**	650	78	5	596,9	536,2
61996-MB	74,6	**480**	650	78	5	595,4	535
61996-MB-C3	74,6	**480**	650	78	5	595,4	535
F-801512.KL	104	**480**	680	90	6	618,6	543,8
16096-M	100	**480**	700	71	5	615,4	556,1
6096-M	129	**480**	700	100	6	632,8	549,6
6096-MB-C3	129	**480**	700	100	6	632,8	549,6

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
448,8	531,2	2	173	290	7,6	15,6	2 600	1 000
450,2	529,8	2,1	228	355	9,4	15,8	2 600	1 190
454,6	585,4	3	290	480	12	16	2 400	1 100
454,6	585,4	3	400	695	17,6	16,5	2 200	1 250
454,6	585,4	3	400	695	17,6	16,5	2 200	1 250
458	632	4	400	710	17,2	16,4	2 200	1 140
463	627	5	550	965	25,5	16	2 000	1 250
463	627	5	550	965	25,5	16	2 000	1 250
470,2	569,8	2,1	228	375	10,2	15,7	2 400	950
472,4	567,6	2,5	290	480	12	16	2 400	1 170
472,4	567,6	2,5	290	480	12	16	2 400	1 170
474,6	605,4	3	305	520	13,3	16	2 200	1 000
474,6	605,4	3	415	735	18,1	16,4	2 200	1 180
474,6	605,4	3	415	735	18,1	16,4	2 200	1 180
474,6	605,4	3	415	735	18,1	16,4	2 200	1 180
483	656	5	585	1 060	27	16	1 900	–
478	662	4	440	815	19,6	16,4	2 000	1 090
483	657	5	585	1 060	27	16	1 900	1 200
483	657	5	585	1 060	27	16	1 900	1 200
488,8	571,2	2	156	280	6,9	15,5	2 400	–
490,2	589,8	2,1	232	390	10,3	15,6	2 200	900
492,4	587,6	2,5	290	500	12,1	15,9	2 200	1 110
492,4	587,6	2,5	290	500	12,1	15,9	2 200	1 110
494,6	635,4	3	325	570	14,1	16	2 000	1 000
498	632	4	440	815	18,4	16,4	2 000	1 130
498	632	4	440	815	18,4	16,4	2 000	1 130
498	632	4	440	815	18,4	16,4	2 000	1 130
498	632	4	440	815	18,4	16,4	2 000	1 130
503	657	5	520	950	22,8	16,3	1 900	–
498	682	4	440	800	19,2	16,4	1 900	1 040
503	677	5	610	1 140	28,5	16	1 900	1 140
503	677	5	610	1 140	28,5	16	1 900	1 140

Deep groove ball bearings

Single row



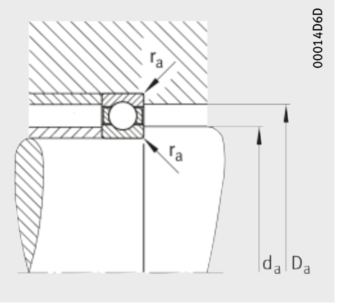


With retaining slot

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
608/500-M	27,9	**500**	620	37	2,1	575,6	544,4
618/500-M	38,7	**500**	620	56	3	580,9	540,4
618/500-MA	40,2	**500**	620	56	3	582	540,4
618/500-MB	40,1	**500**	620	56	3	580,9	539,3
609/500-M	59	**500**	670	54	4	607,9	564
619/500-M	79	**500**	670	78	5	615,4	556,2
619/500-MA	79	**500**	670	78	5	615,4	556,2
619/500-MB	79	**500**	670	78	5	615,4	556,2
619/500-MB-C3	79	**500**	670	78	5	615,4	556,2
F-804943.KL	81,2	**500**	670	78	5	616,9	555,9
Z-530352.KL	116	**500**	700	100	6	640	562
160/500-M	105	**500**	720	71	5	635,9	581,7
60/500-M	133	**500**	720	100	6	657,4	574,9
60/500-MB-C3	133	**500**	720	100	6	657,4	574,9
F-800562.KL	132	**520**	719	100	5	660,5	582
608/530-M	29,4	**530**	650	37	2,1	605,6	574,4
618/530-M	41,3	**530**	650	56	3	610,8	570,4
618/530-MA	42,4	**530**	650	56	3	612	570,4
618/530-MB	42,3	**530**	650	56	3	610,8	569,3
609/530-M	69,8	**530**	710	57	4	646	595,3
619/530-M	92	**530**	710	82	5	652,3	589,7
619/530-MB	92	**530**	710	82	5	652,3	589,7
619/530-MB-C3	92	**530**	710	82	5	652,3	589,7
Z-508780.KL[1]	157	**530**	760	100	6	683	606
160/530-M	142	**530**	780	80	6	688,7	624,7
60/530-M	185	**530**	780	112	6	701,8	610,3
60/530-MB-C3	185	**530**	780	112	6	701,8	610,3
Z-529220.KL[1]	190	**530**	780	112	6	701,8	609,3
608/560-M	30,5	**560**	680	37	2,1	636,7	604,3
618/560-M	35,1	**560**	680	56	3	640,7	600,4
618/560-MA	34,8	**560**	680	56	3	642	600,4
618/560-MB	44,5	**560**	680	56	3	640,7	599,3
609/560-M	81,6	**560**	750	60	4	681	630,4
619/560-M	107	**560**	750	85	5	690	623,9

[1] With retaining slot.

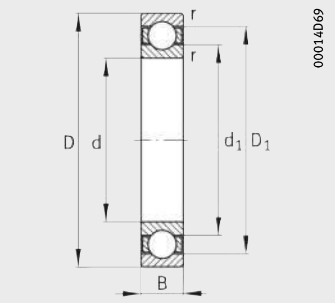


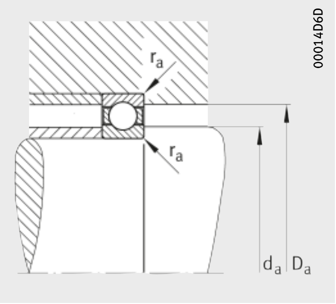
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
510,2	609,8	2,1	232	405	10,3	15,6	2 200	850
512,4	607,6	2,5	300	510	12,3	15,9	2 000	1 060
512,4	607,6	2,5	300	510	12,3	15,9	2 000	1 060
512,4	607,6	2,5	300	510	12,3	15,9	2 000	1 060
514,6	655,4	3	325	585	14,6	15,9	2 000	950
518	652	4	440	800	18,2	16,4	1 900	1 080
518	652	4	440	800	18,2	16,4	1 900	1 080
518	652	4	440	800	18,2	16,4	1 900	1 080
518	652	4	440	800	18,2	16,4	1 900	1 080
518	652	4	440	800	18,2	16,4	1 900	–
523	677	5	585	1 120	27	16,2	900	–
518	702	4	425	780	22	16,3	1 900	980
523	697	5	610	1 140	27,5	16,1	1 800	1 100
523	697	5	610	1 140	27,5	16,1	1 800	1 100
538	701	4	585	1 120	24,7	16,3	1 800	–
540,2	639,8	2,1	236	425	10,5	15,6	2 000	800
542,4	637,6	2,5	305	550	12,8	15,8	2 000	980
542,4	637,6	2,5	305	550	12,8	15,8	2 000	980
542,4	637,6	2,5	305	550	12,8	15,8	2 000	980
544,6	695,4	3	380	720	17,1	16	1 900	850
548	692	4	465	880	20	16,3	1 800	1 010
548	692	4	465	880	20	16,3	1 800	1 010
548	692	4	465	880	20	16,3	1 800	1 010
553	737	5	600	1 160	26,5	16,3	1 700	–
553	757	5	510	1 000	22,5	16,3	1 700	920
553	757	5	710	1 400	32,5	16	1 700	1 000
553	757	5	710	1 400	32,5	16	1 700	1 000
553	757	5	710	1 400	32,5	16	1 700	–
570,2	669,8	2,1	240	440	9,9	15,5	1 900	750
572,4	667,6	2,5	310	560	12,8	15,8	1 900	920
572,4	667,6	2,5	310	560	12,8	15,8	1 900	920
572,4	667,6	2,5	310	560	12,8	15,8	1 900	920
574,6	735,4	3	390	735	16,5	16	1 800	800
578	732	4	510	1 000	22,5	16,3	1 700	940

Deep groove ball bearings

Single row





Mounting dimensions

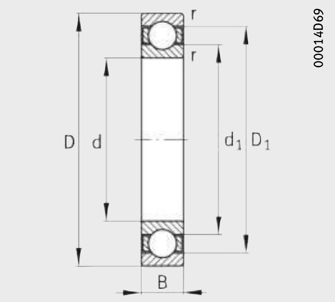
Dimension table (continued) · Dimensions in mm

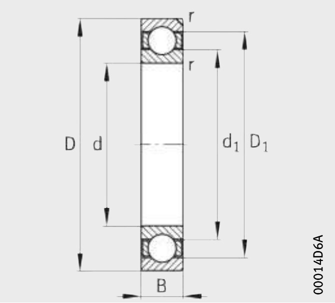
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
619/560-MA	107	**560**	750	85	5	690	623,9
619/560-MB	107	**560**	750	85	5	690	623,9
619/560-MB-C3	107	**560**	750	85	5	690	623,9
160/560-M	137	**560**	820	82	6	732,7	668,3
60/560-M	209	**560**	820	115	6	740,4	643,2
60/560-MB-C3	209	**560**	820	115	6	740,4	643,2
608/600-M	40,1	**600**	730	42	3	683,3	647,8
618/600-M	54,2	**600**	730	60	3	687,8	643,6
618/600-MA	54,3	**600**	730	60	3	689	643,6
609/600-M	96,7	**600**	800	63	5	728,1	673,5
619/600-M	128	**600**	800	90	5	736	666
619/600-MA	128	**600**	800	90	5	736	666
619/600-MB	128	**600**	800	90	5	736	666
619/600-MB-C3	128	**600**	800	90	5	736	666
160/600-M	180	**600**	870	85	6	771	700,5
60/600-M	238	**600**	870	118	6	785,4	688
60/600-MB-C3	238	**600**	870	118	6	785,4	688
608/630-M	56,1	**630**	780	48	3	725,9	685,4
618/630-M	75,9	**630**	780	69	4	730,5	681,1
618/630-MA	77,3	**630**	780	69	4	732	681,1
609/630-M	126	**630**	850	71	5	769	711
619/630-M	167	**630**	850	100	6	780,3	701,7
619/630-MA	167	**630**	850	100	6	780,3	701,7
619/630-MB	167	**630**	850	100	6	780,3	701,7
619/630-MB-C3	167	**630**	850	100	6	780,3	701,7
160/630-M	220	**630**	920	92	6	813,5	738,5
60/630-M	287	**630**	920	128	7,5	831,9	721,2
60/630-MB-C3	287	**630**	920	128	7,5	831,9	721,2
Z-508308.KL	327	**640**	940	128	7,5	844	740
F-800564.KL	268	**650**	919	118	6	831,8	738,7
Z-514645.KL	262	**650**	920	118	6	828,7	738,7

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
578	732	4	510	1 000	22,5	16,3	1 700	940
578	732	4	510	1 000	22,5	16,3	1 700	940
578	732	4	510	1 000	22,5	16,3	1 700	940
583	797	5	550	1 120	24,1	16,3	1 600	840
583	797	5	765	1 530	35,5	16	1 600	950
583	797	5	765	1 530	35,5	16	1 600	950
612,4	717,6	2,5	255	475	10,6	15,5	1 800	700
612,4	717,6	2,5	355	670	15	15,8	1 800	850
612,4	717,6	2,5	355	670	15	15,8	1 800	850
618	782	4	440	880	18,7	16	1 600	750
618	782	4	550	1 120	23,6	16,3	1 600	880
618	782	4	550	1 120	23,6	16,3	1 600	880
618	782	4	550	1 120	23,6	16,3	1 600	880
618	782	4	550	1 120	23,6	16,3	1 600	880
623	847	5	550	1 120	23,4	16,3	1 500	800
623	847	5	780	1 660	36,5	16,1	1 500	850
623	847	5	780	1 660	36,5	16,1	1 500	850
642,4	767,6	2,5	320	630	14,2	15,6	1 700	700
644,6	765,4	3	400	780	17,5	15,9	1 600	830
644,6	765,4	3	400	780	17,5	15,9	1 600	830
648	832	4	480	1 000	21,7	16	1 500	750
653	827	5	630	1 320	28	16,4	1 500	840
653	827	5	630	1 320	28	16,4	1 500	840
653	827	5	630	1 320	28	16,4	1 500	840
653	827	5	630	1 320	28	16,4	1 500	840
653	897	5	585	1 250	25	16,3	1 400	770
658	892	6	880	1 900	41,5	16	1 300	800
658	892	6	880	1 900	41,5	16	1 300	800
668	912	6	815	1 760	36	16,2	1 300	–
673	897	5	750	1 630	33	16,4	1 400	–
673	897	5	750	1 630	33	16,4	1 400	–

Deep groove ball bearings

Single row



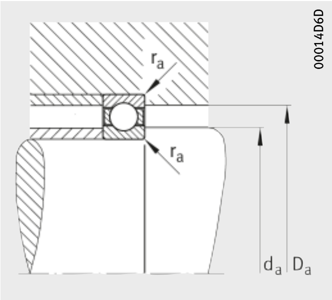


With retaining slot

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
608/670-M	59,6	**670**	820	48	3	765	726
618/670-M	80,4	**670**	820	69	4	770,3	721,1
618/670-MA	84,7	**670**	820	69	4	772	721,1
Z-509029.KL	118	**670**	850	85	6	792,5	727,5
609/670-M	144	**670**	900	73	5	816,7	755
619/670-M	192	**670**	900	103	6	822,2	749,5
619/670-MA	192	**670**	900	103	6	822,2	749,5
619/670-MB	192	**670**	900	103	6	822,2	749,5
619/670-MB-C3	192	**670**	900	103	6	822,2	749,5
160/670-M	272	**670**	980	100	6	867,5	785
60/670-M	350	**670**	980	136	7,5	884,2	769,4
60/670-MB-C3	350	**670**	980	136	7,5	884,2	769,4
608/710-M	69,9	**710**	870	50	4	812,7	770
618/710-M	96	**710**	870	74	4	818,9	762,7
618/710-MA	98,6	**710**	870	74	4	820,4	762,7
609/710-M	165	**710**	950	78	5	862	800
619/710-M	218	**710**	950	106	6	869,1	792,5
619/710-MA	218	**710**	950	106	6	869,1	792,5
619/710-MB	218	**710**	950	106	6	869,1	792,5
619/710-MB-C3	218	**710**	950	106	6	869,1	792,5
Z-502954.KL	368	**710**	1 000	140	7,5	911,5	800
160/710-M	305	**710**	1 030	103	6	914,5	828
60/710-M	394	**710**	1 030	140	7,5	931,1	812,6
60/710-MB-C3	394	**710**	1 030	140	7,5	931,1	812,6
Z-534196.KL[1]	394	**710**	1 030	140	7,5	931,5	812,6
Z-528283.KL[1]	534	**710**	1 080	160	7,5	962	826
608/750-M	84,4	**750**	920	54	4	859	812,4
618/750-M	114	**750**	920	78	5	864,9	806,7
618/750-MA	117	**750**	920	78	5	866,9	806,7
609/750-M	186	**750**	1 000	80	6	910	843
619/750-M	248	**750**	1 000	112	6	919,2	833,2
619/750-MA	248	**750**	1 000	112	6	919,2	833,2
619/750-MB	248	**750**	1 000	112	6	919,2	833,2
619/750-MB-C3	248	**750**	1 000	112	6	919,2	833,2

[1] With retaining slot; radial internal clearance C4.

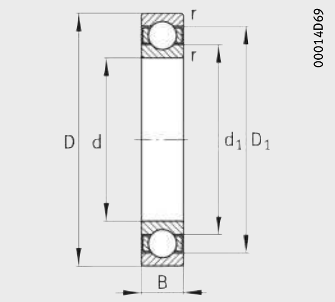


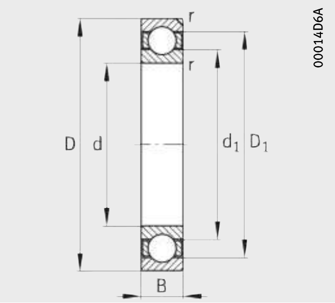
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
682,4	807,6	2,5	325	655	14,4	15,6	1 600	630
684,6	805,4	3	405	815	17,7	15,8	1 500	770
684,6	805,4	3	405	815	17,7	15,8	1 500	770
693	827	5	550	1 180	24,5	16,1	1 500	–
688	882	4	520	1 120	23,6	16	1 400	670
693	877	5	640	1 370	27,5	16,3	1 400	780
693	877	5	640	1 370	27,5	16,3	1 400	780
693	877	5	640	1 370	27,5	16,3	1 400	780
693	877	5	640	1 370	27,5	16,3	1 400	780
693	957	5	655	1 460	28,5	16,3	1 300	720
698	952	6	965	2 160	46	16	1 300	750
698	952	6	965	2 160	46	16	1 300	750
724,6	855,4	3	355	735	16,1	15,6	1 400	600
724,6	855,4	3	465	980	20	15,9	1 400	720
724,6	855,4	3	465	980	20	15,9	1 400	720
728	932	4	530	1 160	24,1	16	1 300	630
733	927	5	680	1 530	30	16,3	1 300	730
733	927	5	680	1 530	30	16,3	1 300	730
733	927	5	680	1 530	30	16,3	1 300	730
733	927	5	680	1 530	30	16,3	1 300	730
738	972	6	930	2 200	44,5	16,3	1 300	–
733	1 007	5	710	1 600	30,5	16,3	1 300	670
738	1 002	6	1 020	2 320	48	16	1 200	700
738	1 002	6	1 020	2 320	48	16	1 200	700
738	1 002	6	1 020	2 320	48	16	1 200	–
785	1 005	7,5	1 140	2 700	55	15,8	1 200	–
764,6	905,4	3	380	830	17,2	15,6	1 300	560
768	902	4	510	1 120	22,6	15,9	1 300	680
768	902	4	510	1 120	22,6	15,9	1 300	680
773	977	5	585	1 340	26	16	1 300	600
773	977	5	720	1 660	32,5	16,3	1 300	690
773	977	5	720	1 660	32,5	16,3	1 300	690
773	977	5	720	1 660	32,5	16,3	1 300	690
773	977	5	720	1 660	32,5	16,3	1 300	690

Deep groove ball bearings

Single row





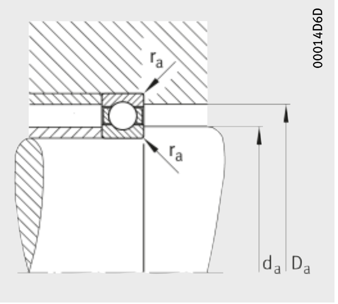
With retaining slot

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
Z-565323.KL[1]	312	**750**	1 016	125	6	933,8	839,3
160/750-M	362	**750**	1 090	109	7,5	966,5	876
60/750-M	469	**750**	1 090	150	7,5	985,3	858,4
60/750-MB-C3	469	**750**	1 090	150	7,5	985,3	858,4
Z-500909.KL[1]	451	**760**	1 080	150	7,5	984,5	858
F-800886.KL	120	**769**	940	78	5	885,5	827,2
Z-556478.KL	61,4	**800**	935	50	5	886,5	849,5
608/800-M	101	**800**	980	57	4	914,1	867,2
618/800-M	136	**800**	980	82	5	921,8	860
618/800-MA	136	**800**	980	82	5	923,5	860
609/800-M	212	**800**	1 060	82	6	965	898
619/800-M	283	**800**	1 060	115	6	976,7	886,2
619/800-MB	283	**800**	1 060	115	6	976,7	886,2
619/800-MB-C3	283	**800**	1 060	115	6	976,7	886,2
Z-526190.KL	313	**800**	1 080	115	6	989	891
160/800-M	403	**800**	1 150	112	7,5	1 024	929
60/800-M	532	**800**	1 150	155	7,5	1 038,2	911,5
60/800-MB-C3	532	**800**	1 150	155	7,5	1 038,2	911,5
F-801911.KL[1]	538	**800**	1 150	155	7,5	1 038	910
Z-572323.KL	278	**830**	1 080	115	6	1 003,8	909,3
608/850-M	106	**850**	1 030	57	4	966,2	915,4
618/850-M	144	**850**	1 030	82	5	971,9	910
618/850-MA	144	**850**	1 030	82	5	973,5	910
609/850-M	241	**850**	1 120	85	6	1 023	950
619/850-M	323	**850**	1 120	118	6	1 033,6	939,2
619/850-MB	323	**850**	1 120	118	6	1 033,6	939,2
619/850-MB-C3	323	**850**	1 120	118	6	1 033,6	939,2
160/850-M	476	**850**	1 220	118	7,5	1 086,5	987
60/850-M	626	**850**	1 220	165	7,5	1 105,9	968,1
60/850-MB-C3	626	**850**	1 220	165	7,5	1 105,9	968,1
Z-501657.KL[2]	642	**850**	1 220	165	7,5	1 105,9	966,8
Z-529055.KL[1]	337	**860**	1 130	120	7,5	1 044	945,5

[1] With retaining slot.

[2] With retaining slot; radial internal clearance 200...300 μm.

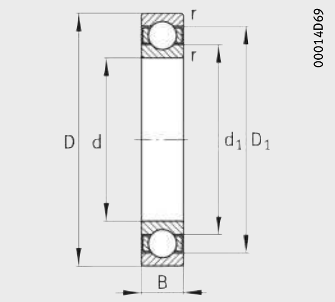


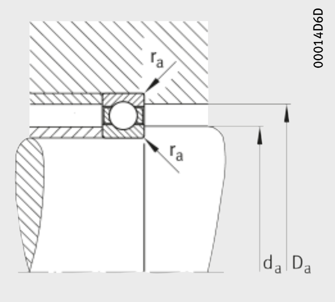
Mounting dimensions

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
773	993	5	830	2 000	38	16,4	1 300	–
778	1 062	6	750	1 730	32	16,3	1 200	640
778	1 062	6	1 100	2 650	52	16	1 100	670
778	1 062	6	1 100	2 650	52	16	1 100	670
788	1 052	6	1 080	2 600	49,5	16,1	1 100	–
787	922	4	510	1 140	23,1	15,8	1 300	–
818	917	4	305	670	14,7	15,4	1 300	–
814,6	965,4	3	430	980	19,7	15,6	1 300	530
818	962	4	550	1 270	23,8	15,8	1 300	630
818	962	4	550	1 270	23,8	15,8	1 300	630
823	1 037	5	610	1 430	27	15,9	1 200	560
823	1 037	5	800	1 900	34,5	16,3	1 200	630
823	1 037	5	800	1 900	34,5	16,3	1 200	630
823	1 037	5	800	1 900	34,5	16,3	1 200	630
823	1 057	5	865	2 080	38,5	16,4	1 100	–
828	1 122	6	815	2 000	35,5	16,3	1 100	590
828	1 122	6	1 140	2 800	55	16,1	1 100	630
828	1 122	6	1 140	2 800	55	16,1	1 100	630
828	1 122	6	1 140	2 800	55	16,1	1 100	–
853	1 057	5	850	2 080	38	16,3	1 100	–
864,6	1 015,4	3	430	1 000	18,4	15,5	1 200	480
868	1 012	4	560	1 290	23,9	15,8	1 200	580
868	1 012	4	560	1 290	23,9	15,8	1 200	580
873	1 097	5	670	1 630	27	15,9	1 100	530
873	1 097	5	850	2 080	37	16,2	1 100	590
873	1 097	5	850	2 080	37	16,2	1 100	590
873	1 097	5	850	2 080	37	16,2	1 100	590
878	1 192	6	865	2 200	38,5	16,2	1 100	550
878	1 192	6	1 220	3 150	57	16,2	1 000	600
878	1 192	6	1 220	3 150	57	16,2	1 000	600
878	1 192	6	1 220	3 150	57	16,2	1 000	–
888	1 102	6	930	2 360	50	16,4	1 100	–

Deep groove ball bearings

Single row





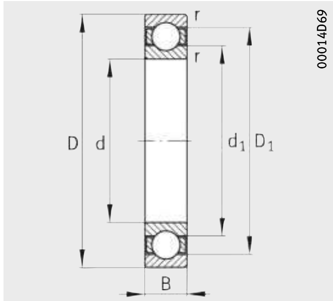
Mounting dimensions

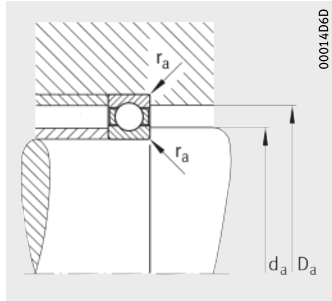
Dimension table (continued) · Dimensions in mm							
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
608/900-M	115	**900**	1 090	60	5	1 022	970
618/900-M	169	**900**	1 090	85	5	1 024,8	965,9
609/900-M	280	**900**	1 180	88	6	1 078,1	1 002
619/900-M	352	**900**	1 180	122	6	1 090,5	991,5
160/900-M	532	**900**	1 280	122	7,5	1 143	1 040,5
60/900-M	705	**900**	1 280	170	7,5	1 161,1	1 022,5
608/950-M	141	**950**	1 150	63	5	1 079	1 023
618/950-M	198	**950**	1 150	90	5	1 082,9	1 017,7
F-807431.KL	259	**950**	1 200	90	5	1 085,6	1 014,6
609/950-M	335	**950**	1 250	95	6	1 141	1 061
619/950-M	443	**950**	1 250	132	7,5	1 152,2	1 050,7
Z-532248.KL	722	**950**	1 320	170	10	1 208	1 066
160/950-M	658	**950**	1 360	132	7,5	1 212	1 101,5
60/950-M	856	**950**	1 360	180	7,5	1 236	1 078,5
608/1000-M	192	**1 000**	1 220	71	5	1 140,5	1 081
618/1000-M	254	**1 000**	1 220	100	6	1 147,8	1 073,3
618/1000-MA	256	**1 000**	1 220	100	6	1 150	1 073,3
609/1000-M	407	**1 000**	1 320	103	6	1 204	1 120
619/1000-M	531	**1 000**	1 320	140	7,5	1 220,7	1 102,4
F-804593.KL	594	**1 000**	1 380	122	6	1 240,6	1 142,1
Z-528268.KL	657	**1 000**	1 380	180	7,5	1 263	1 121,5
160/1000-M	726	**1 000**	1 420	136	7,5	1 279	1 164,5
60/1000-M	944	**1 000**	1 420	185	7,5	1 291	1 133,5
Z-529852.KL	263	**1 030**	1 250	100	5	1 180	1 102
608/1060-M	202	**1 060**	1 280	71	5	1 200,5	1 141
618/1060-M	269	**1 060**	1 280	100	6	1 207,5	1 133,7
618/1060-MA	270	**1 060**	1 280	100	6	1 210	1 133,7
609/1060-M	485	**1 060**	1 400	109	7,5	1 278	1 186
619/1060-M	640	**1 060**	1 400	150	7,5	1 289,9	1 172,9
160/1060-M	834	**1 060**	1 500	140	9,5	1 343,5	1 221
60/1060-M	1 100	**1 060**	1 500	195	9,5	1 365	1 200

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
918	1 072	4	480	1 180	22,7	15,5	1 100	450
918	1 072	4	570	1 370	27	15,7	1 100	550
923	1 157	5	720	1 800	33	15,9	1 100	480
923	1 157	5	900	2 280	50	16,2	1 000	550
928	1 252	6	900	2 320	40	16,2	1 000	520
928	1 252	6	1 290	3 400	60	16,3	950	560
968	1 132	4	520	1 290	23,8	15,5	1 100	430
968	1 132	4	655	1 660	30,5	15,8	1 100	510
968	1 182	4	655	1 660	29	15,8	1 100	–
973	1 227	5	780	2 040	37	15,9	1 000	450
978	1 222	6	965	2 550	43,5	16,2	950	520
986	1 284	8	1 320	3 650	44	16,4	900	–
978	1 332	6	1 000	2 700	45,5	16,2	950	490
978	1 332	6	1 430	3 900	68	16,1	900	530
1 018	1 202	4	585	1 500	27,5	15,6	1 000	430
1 023	1 197	5	735	1 930	34	15,8	1 000	495
1 023	1 197	5	735	1 930	34	15,8	1 000	495
1 028	1 292	6	830	2 240	40	15,9	950	450
1 028	1 292	6	1 160	3 250	54	16,3	900	485
1 023	1 357	5	950	2 550	42,5	16	900	–
1 028	1 352	6	1 370	3 900	64	16,4	900	–
1 028	1 392	6	1 060	2 900	47	16,2	900	455
1 028	1 392	6	1 500	4 150	70	16,3	850	500
1 048	1 232	4	720	1 860	31,5	15,8	950	–
1 078	1 262	4	585	1 500	27,5	15,6	950	380
1 083	1 257	5	765	2 040	35,5	15,8	950	460
1 083	1 257	5	765	2 040	35,5	15,8	950	460
1 088	1 372	6	930	2 600	44	15,9	900	400
1 088	1 372	6	1 140	3 250	52	16,2	850	465
1 094	1 466	8	1 160	3 350	53	16,2	850	430
1 094	1 466	8	1 600	4 650	76	16,3	800	450

Deep groove ball bearings

Single row





Mounting dimensions

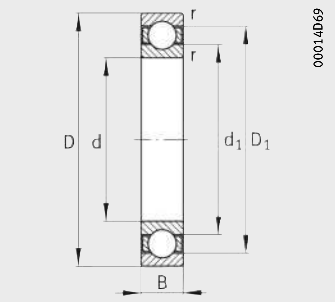
Dimension table (continued) · Dimensions in mm

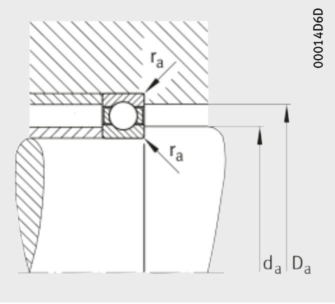
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
608/1120-M	259	**1 120**	1 360	78	5	1 274	1 209
618/1120-M	329	**1 120**	1 360	106	6	1 281,1	1 200,8
618/1120-MA	337	**1 120**	1 360	106	6	1 284	1 200,8
609/1120-M	509	**1 120**	1 460	109	7,5	1 338	1 246
619/1120-M	661	**1 120**	1 460	150	7,5	1 349	1 235
160/1120-M	954	**1 120**	1 580	145	9,5	1 415	1 289
60/1120-M	1 250	**1 120**	1 580	200	9,5	1 439	1 266
608/1180-M	259	**1 180**	1 420	78	5	1 334	1 269
618/1180-M	357	**1 180**	1 420	106	6	1 341,7	1 258,7
618/1180-MA	377	**1 180**	1 420	106	6	1 344	1 258,7
609/1180-M	600	**1 180**	1 540	115	7,5	1 411	1 312
619/1180-M	797	**1 180**	1 540	160	7,5	1 423	1 301
160/1180-M	1 110	**1 180**	1 660	155	9,5	1 489,5	1 355
60/1180-M	1 450	**1 180**	1 660	212	9,5	1 512	1 332
608/1250-M	293	**1 250**	1 500	80	6	1 409,5	1 343
618/1250-M	401	**1 250**	1 500	112	6	1 418,8	1 333,9
618/1250-MA	401	**1 250**	1 500	112	6	1 421,1	1 333,9
609/1250-M	711	**1 250**	1 630	122	7,5	1 493	1 391
619/1250-M	933	**1 250**	1 630	170	7,5	1 507	1 377
60/1250-M	1 650	**1 250**	1 750	218	9,5	1 598	1 408
608/1320-M	399	**1 320**	1 600	88	6	1 498,5	1 424
618/1320-M	523	**1 320**	1 600	122	6	1 504,7	1 416,9
618/1320-MA	525	**1 320**	1 600	122	6	1 508	1 416,9
609/1320-M	830	**1 320**	1 720	128	7,5	1 576	1 468
619/1320-M	1 070	**1 320**	1 720	175	7,5	1 590	1 454
60/1320-M	1 950	**1 320**	1 850	230	12	1 686	1 488
608/1400-M	472	**1 400**	1 700	95	6	1 591,5	1 511
618/1400-M	640	**1 400**	1 700	132	7,5	1 602	1 501,1
618/1400-MA	643	**1 400**	1 700	132	7,5	1 604,5	1 501,1
619/1400-M	1 260	**1 400**	1 820	185	9,5	1 684	1 540
60/1400-M	2 250	**1 400**	1 950	243	12	1 784	1 573

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
1 138	1 342	4	670	1 830	31,5	15,5	900	360
1 143	1 337	5	815	2 240	36	15,8	900	430
1 143	1 337	5	815	2 240	36	15,8	900	430
1 148	1 432	6	950	2 650	45	15,9	850	380
1 148	1 432	6	1 160	3 400	53	16,2	800	435
1 154	1 546	8	1 220	3 550	54	16,2	800	405
1 154	1 546	8	1 760	5 400	87	16,3	750	430
1 198	1 402	4	670	1 930	33	15,5	850	340
1 203	1 397	5	830	2 360	37,5	15,7	850	405
1 203	1 397	5	830	2 360	37,5	15,7	850	405
1 208	1 512	6	1 060	3 150	50	15,9	800	360
1 208	1 512	6	1 290	3 800	60	16,2	750	410
1 214	1 626	8	1 320	4 000	61	16,2	750	380
1 214	1 626	8	1 860	5 850	90	16,3	700	400
1 273	1 477	5	710	2 080	34	15,5	800	320
1 273	1 477	5	900	2 600	39,5	15,7	800	380
1 273	1 477	5	900	2 600	39,5	15,7	800	380
1 278	1 602	6	1 100	3 350	53	15,9	750	340
1 278	1 602	6	1 400	4 300	67	16,2	700	385
1 284	1 716	8	2 000	6 400	96	16,4	670	380
1 343	1 577	5	815	2 500	40	15,5	750	300
1 343	1 577	5	950	2 850	45,5	15,7	750	360
1 343	1 577	5	950	2 850	45,5	15,7	750	360
1 348	1 692	6	1 200	3 750	57	15,9	700	320
1 348	1 692	6	1 530	4 900	71	16,2	700	360
1 362	1 808	10	2 120	7 100	104	16,4	670	360
1 423	1 677	5	900	2 800	43	15,5	700	280
1 428	1 672	6	1 040	3 200	46,5	15,8	700	340
1 428	1 672	6	1 040	3 200	46,5	15,8	700	340
1 434	1 786	8	1 630	5 400	80	16,2	670	335
1 442	1 908	10	2 320	8 000	114	16,4	630	340

Deep groove ball bearings

Single row

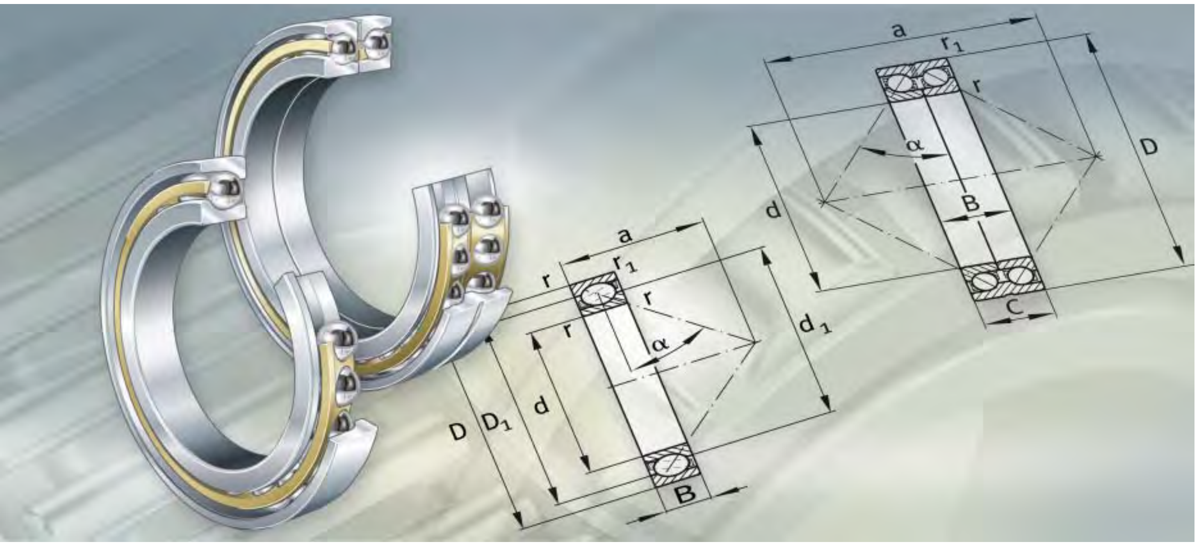




Mounting dimensions

Dimension table (continued) · Dimensions in mm							
Designation	Mass	Dimensions					
	m	d	D	B	r	D_1	d_1
	≈kg				min.	≈	≈
Z-563867.KL	419	**1 500**	1 750	100	6	1 663	1 589
Z-547707.KL	696	**1 500**	1 820	125	7,5	1 715	1 606,5
618/1500-M	778	**1 500**	1 820	140	7,5	1 715,1	1 608,1
618/1500-MA	792	**1 500**	1 820	140	7,5	1 718,7	1 608,1
619/1500-M	1 530	**1 500**	1 950	195	9,5	1 805	1 650
60/1500-M	3 070	**1 500**	2 120	272	12	1 932	1 696
619/1600-M	1 690	**1 600**	2 060	200	9,5	1 914	1 752
60/1600-M	3 460	**1 600**	2 240	280	12	2 045	1 803
619/1700-M	1 980	**1 700**	2 180	212	9,5	2 027	1 859
F-809025.KL	1 960	**1 700**	2 180	212	7,5	2 036	1 847
60/1700-M	3 900	**1 700**	2 360	290	15	2 158	1 910
619/1800-M	2 250	**1 800**	2 300	218	9,5	2 144,9	1 960,5
60/1800-M	4 660	**1 800**	2 500	308	15	2 292	2 018
619/1900-M	2 660	**1 900**	2 430	230	12	2 265	2 072
Z-541682.KL	1 440	**2 000**	2 360	190	9,5	2 260	2 120

Mounting dimensions			Basic load ratings		Fatigue limit load	Factor	Limiting speed	Reference speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	f_0	n_G	n_B
min.	max.	max.	kN	kN	kN		min^{-1}	min^{-1}
1 523	1 727	5	510	1 290	20,6	15,4	670	–
1 528	1 792	6	1 160	3 750	55	15,8	670	–
1 528	1 792	6	1 160	3 750	55	15,8	670	315
1 528	1 792	6	1 160	3 750	55	15,8	670	315
1 534	1 916	8	1 830	6 300	87	16,2	630	310
1 542	2 078	10	2 600	9 300	130	16,3	600	300
1 634	2 026	8	1 900	6 800	95	16,2	600	285
1 642	2 198	10	2 800	10 600	140	16,4	560	280
1 734	2 146	8	2 000	7 350	94	16,1	560	270
1 728	2 152	6	2 160	8 000	104	16,2	560	260
1 750	2 310	12	2 900	11 200	147	16,4	530	260
1 842	2 258	10	2 200	8 300	105	16,2	560	249
1 850	2 450	12	3 350	13 400	167	16,3	530	240
1 942	2 388	10	2 400	9 500	118	16,2	530	233
2 034	2 326	8	1 460	5 600	61	15,6	530	–



Angular contact ball bearings

Single row
Double row

Angular contact ball bearings

Single row angular contact ball bearings

220

In single row angular contact ball bearings, the raceways are arranged such that the forces are transmitted from one raceway to the other at a specific contact angle (oblique to the radial plane).

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.

Single row angular contact ball bearings with standardised main dimensions and standardised designations to DIN 628-1 are used, for example, in gearboxes, rolling mills and electrical machinery.

Special bearings with non-standardised designations (Z-5..SKL or F-8..SKL) and main dimensions are also available.
Such bearings with an extended inner ring are used, for example, as axial bearings for oil film bearings.

Double row angular contact ball bearings

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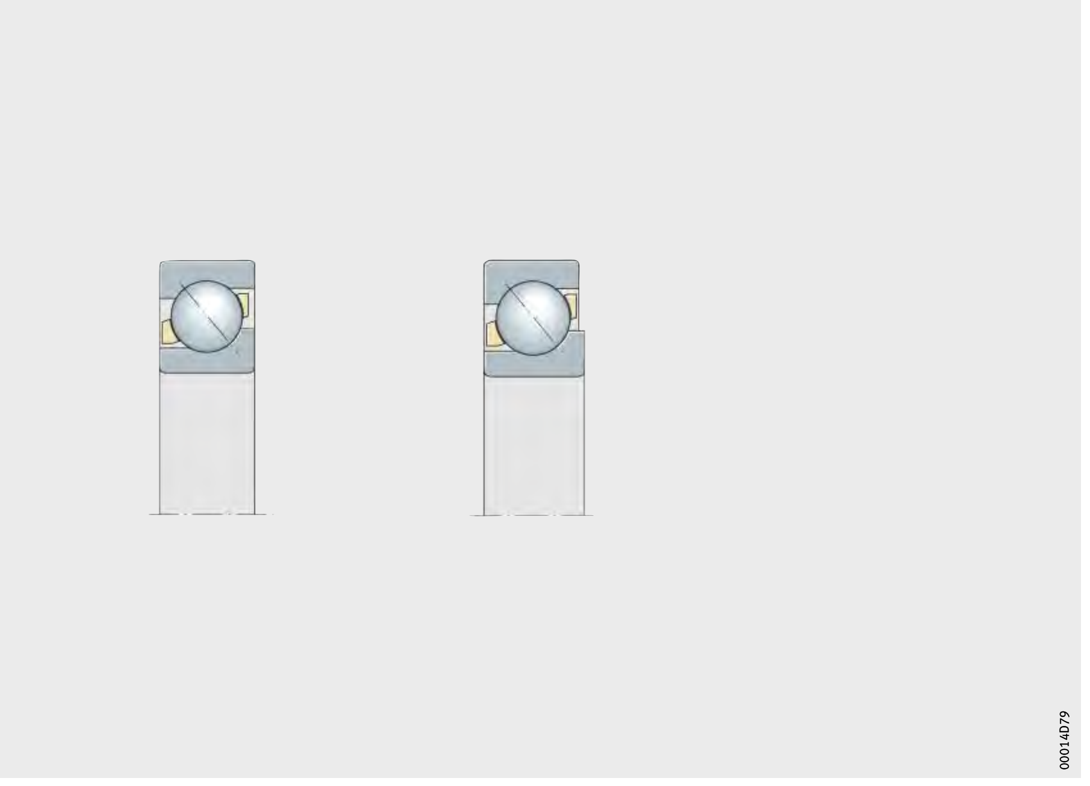
Double row angular contact ball bearings are similar in design to a pair of single row angular contact ball bearings in an O arrangement or an X arrangement. In this case, the apexes of the cones formed by the ball contact lines point outwards or inwards.

Double row bearings can support radial forces as well as axial forces in both directions and are particularly suitable for rigid axial guidance arrangements.

All the double row angular contact ball bearings described here are special bearings with non-standardised main dimensions and designations (Z-5..SKL).

Bearings with a split outer ring (X arrangement) or a split inner ring (O arrangement) are used, for example, as axial bearings in wire rolling mills.

Bearings in an O arrangement with an extended inner ring are frequently used as axial bearings for oil film bearings.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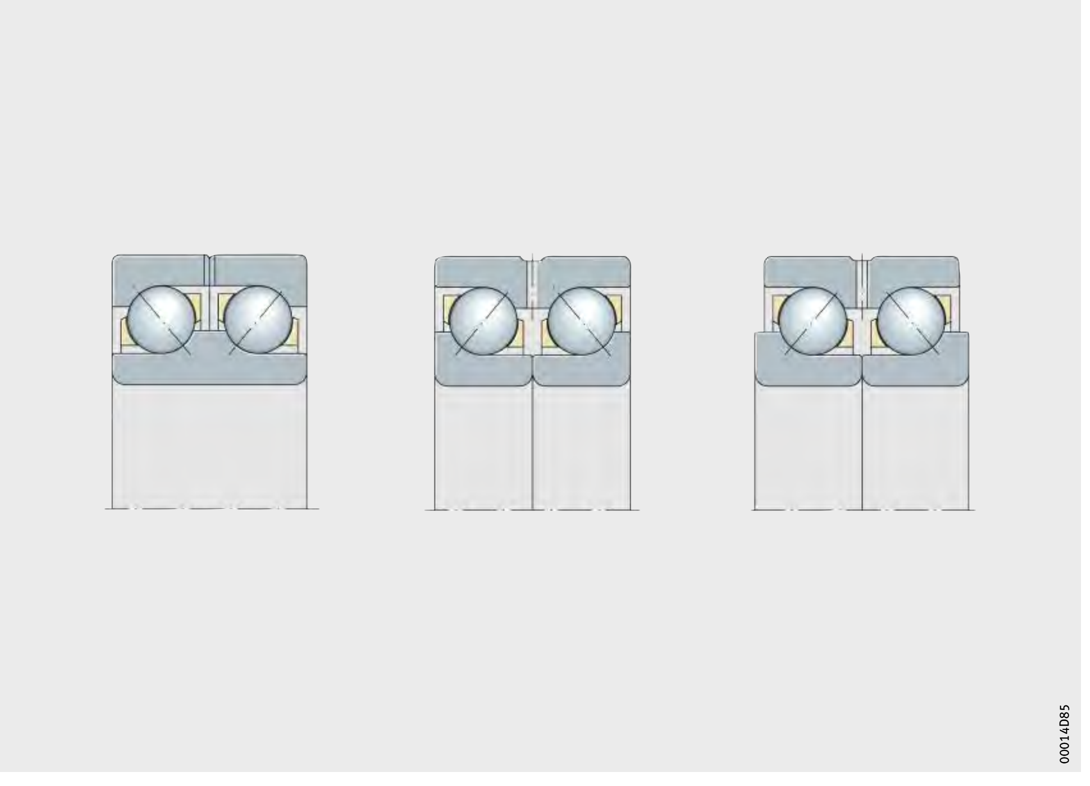
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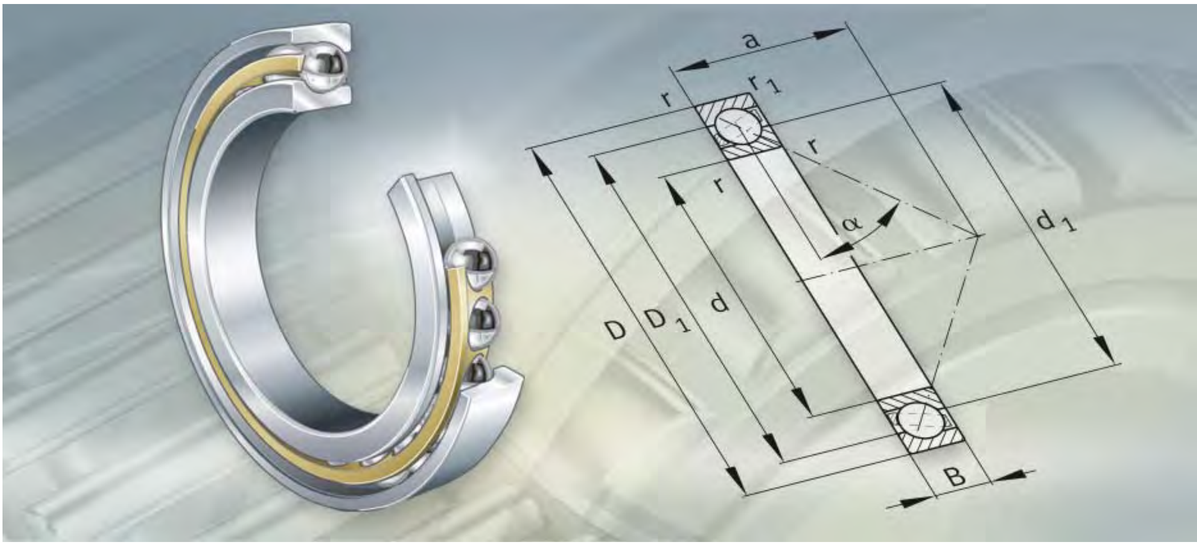


Single row angular contact ball bearings

Single row angular contact ball bearings

Page

Single row

Contact angle $\alpha = 40°$

Contact angle $\alpha = 30°$

70..-B, 72..-B, 73..-B,
Z-5..SKL1-01, F-8..SKL1-01

708, 709, 718, 719, 70,
Z-5..SKL1-02, F-8..SKL1-02

With extended inner ring

Contact angle $\alpha = 40°$

Z-5..SKL1-03

Single row angular contact ball bearings

Features

Single row angular contact ball bearings are, with a few exceptions, self-retaining units with solid inner and outer rings and ball and cage assemblies with cages. The raceways of the inner and outer rings are offset from each other along the bearing axis.
The angular adjustment facility of these bearings is very limited.

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 mounted in a mirror image arrangement.

The axial load carrying capacity is dependent on the contact angle. Bearings with a contact angle 40° have a higher axial load carrying capacity than those with a contact angle 30°.

Universal design

Single row angular contact ball bearings of the universal design have the suffix UA, UL or UO and are intended for mounting in pairs in an X, O or tandem arrangement or mounting in groups.
These bearings can be mounted in any arrangement required.

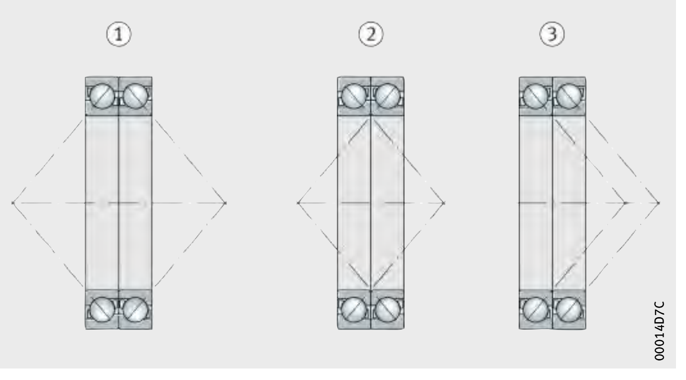
The suffix UA indicates slight axial internal clearance, the suffix UL indicates slight preload and the suffix UO indicates freedom from clearance in an X or O arrangement.

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), *Figure 1*.

When ordering bearings, the number of sets must be stated, not the number of individual bearings.



(1) O arrangement, DB
(2) X arrangement, DF
(3) Tandem arrangement, DT

Figure 1
Matched sets

Single row angular contact ball bearings

Sealing

The bearings are not sealed.

Lubrication

Single row angular contact ball bearings can be lubricated with grease or oil.

Operating temperature

Angular contact ball bearings without seals 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.

Cages

Angular contact ball bearings with ball-guided solid window cages made from brass have, in the case of bearings of standardised series, the suffix MP.

The suffixes MPA or MPB(S) indicate bearings with a solid window cage made from brass that is guided on the outer ring or inner ring.

In the case of bearings with non-standardised designations (Z-5..SKL or F-8..SKL), an enquiry can be placed with us for the cage design.

Suffixes

Suffixes for the available designs of standard bearings: see table.

Available designs

Suffix[1]	Description	Design
B	Modified internal construction	Standard
DB	Two angular contact ball bearings in O arrangement, matched clearance-free	Special design, available by agreement only
DF	Two angular contact ball bearings in X arrangement, matched clearance-free	
DT	Two angular contact ball bearings in tandem arrangement, matched	
MP	Solid brass cage	Standard
MPA	Solid brass cage, guided on outer ring	Special design, available by agreement only
MPB	Solid brass cage, guided on inner ring	
MPBS	Solid brass cage, guided on inner ring, with lubrication slots	
P5	Bearings in tolerance class P5	
UA	Universal design for mounting in pairs, bearing pair has small axial internal clearance in O and X arrangement	Standard
UL	Universal design for mounting in pairs, bearing pair has slight preload in O and X arrangement	
UO	Universal design for mounting in pairs, bearing pair is clearance-free in O and X arrangement	

[1] In the case of angular contact ball bearings with non-standardised designations, the design (for example cage, accuracy) is specified in the designation (Z-5 or F-8). In the case of these bearings, additional suffixes are only used for deviations from the original design.

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, *Figure 2*, *Figure 3* and table Load ratio and axial bearing load, page 226.

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 a load F_{rB}.
- F is an external axial force acting on bearing A.

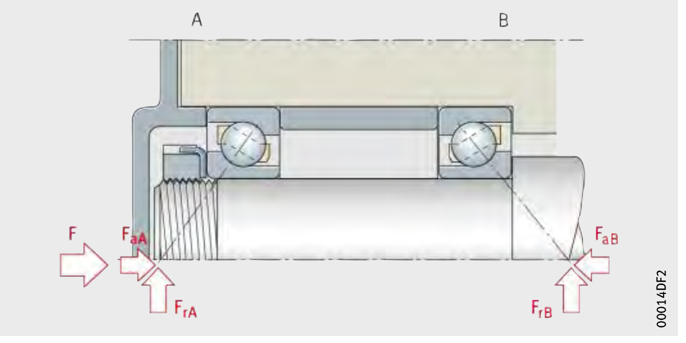


Figure 2
Bearings in O arrangement

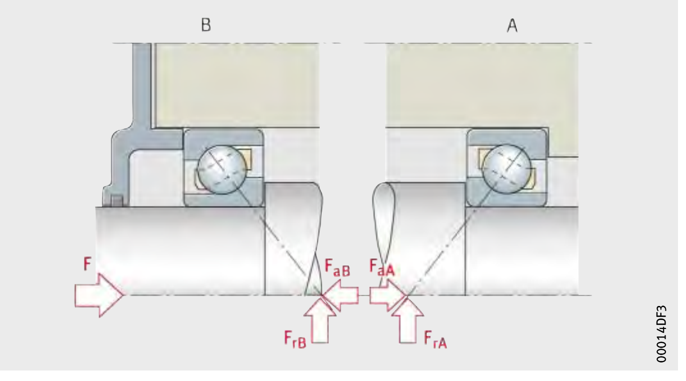


Figure 3
Bearings in X arrangement

Single row angular contact ball bearings

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 equation is given, the axial force is not taken into consideration.

3) For bearings with a contact angle 40° (e = 1,14), Y = 0,57 is used in the equations, for bearings with a contact angle 30° (e = 0,8) the value to be used is Y = 0,76.

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies:

Contact angle 40°

Arrangement of bearings	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 bearings, see table Load ratio and axial bearing load.

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load.

For bearings under dynamic loading, the following applies:

Contact angle 30°

Arrangement of bearings	Load ratio	Equivalent dynamic bearing load
Single bearing[1]	$\frac{F_a}{F_r} \leqq 0,8$	$P = F_r$
	$\frac{F_a}{F_r} > 0,8$	$P = 0,39 \cdot F_r + 0,76 \cdot F_a$
Bearing pair in O or X arrangement	$\frac{F_a}{F_r} \leqq 0,8$	$P = F_r + 0,78 \cdot F_a$
	$\frac{F_a}{F_r} > 0,8$	$P = 0,63 \cdot F_r + 1,24 \cdot F_a$

1) Calculation of axial force for single bearings, see table Load ratio and axial bearing load, page 226.

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads. It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies:

Contact angle 40°

Arrangement of bearings	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 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
Radial static bearing load.

Contact angle 30°

Arrangement of bearings	Load ratio	Equivalent static load
Single bearing	$\frac{F_{0a}}{F_{0r}} \leqq 1{,}5$	$P_0 = F_{0r}$
	$\frac{F_{0a}}{F_{0r}} > 1{,}5$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}33 \cdot F_{0a}$
Bearing pair in O or X arrangement	–	$P_0 = F_{0r} + 0{,}66 \cdot F_{0a}$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
Radial static bearing load.

Basic dynamic and static load ratings for bearing pairs

If two bearings of the same size and design are mounted 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, ball bearings with cage must therefore be subjected to a minimum radial load of the order of $P/C_r > 0{,}01$.

Speeds

For standardised bearings, the dimension tables give the limiting speeds n_G and reference speeds n_B, while only the limiting speeds are given for the other bearings.

! The limiting speeds n_G in the dimension tables must not be exceeded.

Bearings of universal design

Bearings with the suffix UA, UL or 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.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The bearing tables give the maximum dimensions of the radii r_a and r_{a1} and the diameters of the abutment shoulders D_a, D_b and d_a.

Accuracy

Angular contact ball bearings with standardised main dimensions correspond to DIN 628-1.

The dimensional and geometrical tolerances of the standardised bearings correspond to tolerance class PN to DIN 620-2.
We can provide the tolerances of the non-standardised bearings in response to an enquiry.

Tolerances for universal designs and for matched bearings

In addition to normal tolerance (no tolerance suffix), angular contact ball bearings of the universal design UA, UL or UO are also available by agreement in the tolerance class P5 (suffix P5-UL or P5-UA).

Exceptions: 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:

Tolerance for ring width

Bore d mm		Width deviation Δ_{Bs} µm			
		PN		P5	
over	incl.	min.	max.	min.	max.
120	180	0	−500	0	−380
180	315	0	−500	0	−500
315	400	0	−630	0	−630

Axial internal clearance or preload of universal design

Axial internal clearance or preload of series 70..-B, 72..-B and 73..-B of universal design, in pairs in an X or O arrangement, see table.

The axial internal clearance or freedom from clearance do not apply to mounted bearing pairs. If rigid fits are used, this leads to reduced axial internal clearance or increased preload of the bearing pair.

Axial internal clearance and preload

Bore code	Axial internal clearance or preload of bearing pair Nominal dimension µm					Preload $F_{v\,max}$ N		
	UA	UO	UL			UL		
	70..-B, 72..-B, 73..-B		70..-B	72..-B	73..-B	70..-B	72..-B	73..-B
	Tolerance classes							
	PN, P6, P5		P5	P5	P5	P5	P5	P5
30	60	0	–	−13	−18	–	1723	2 500
32	60	0	–	−13	−18	–	1815	2 769
34	70	0	–	−14	−19	–	2 038	3 115
36	75	0	–	−14	−19	–	2 115	3 192
38	80	0	–	−14	−19	–	2 308	3 308
40	90	0	–	−13	−20	–	2 462	3 577
44	100	0	–	−16	−21	–	2 808	4 077
48	110	0	–	−15	−20	–	3 350	4 650
52	120	0	–	−18	−24	–	3 750	5 100
56	130	0	–	−18	−23	–	3 900	5 600
60	145	0	–	−17	−23	–	4 300	5 850
64	160	0	–	−19	−22	–	4 650	6 000

Tolerances for axial internal clearance or preload

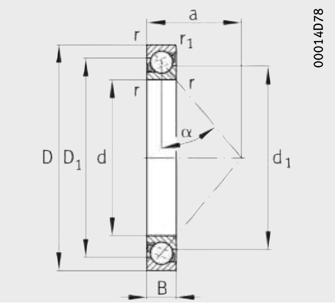
Tolerances for axial internal clearance or preload of unmounted pairs of angular contact ball bearings of universal design in an X or O arrangement, see table.

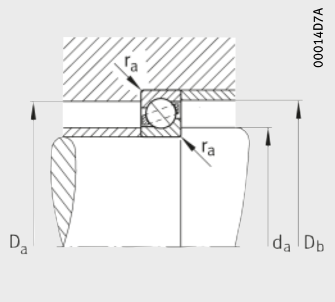
Tolerances in µm

Bore code	70..-B, 72..-B		73..-B	
	Tolerance classes			
	PN, P6	P5	PN, P6	P5
12 to 36	+12	+10	+12	+10
38 to 64	+16	+14	+16	+14

Angular contact ball bearings

Single row



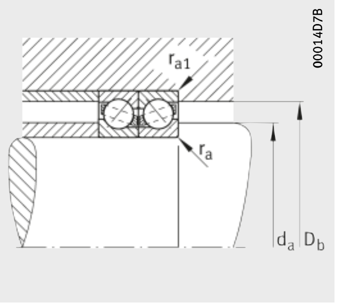


Mounting dimensions

Dimension table · Dimensions in mm

Designation	Mass	Dimensions							
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
7330-B-MP	24,8	**150**	320	65	4	1,5	255,8	218,3	131	40
7332-B-MP	29	**160**	340	68	4	1,5	270	231	139	40
7334-B-MP	34,4	**170**	360	72	4	1,5	290,9	249	147	40
7236-B-MP	17,5	**180**	320	52	4	1,5	265,8	237,4	131	40
7336-B-MP	39,9	**180**	380	75	4	1,5	303	259	155	40
7238-B-MP	21,1	**190**	340	55	4	1,5	281	250	139	40
7338-B-MP	45,9	**190**	400	78	5	2	318	273	163	40
7240-B-MP	25,6	**200**	360	58	4	1,5	297	264	146	40
7340-B-MP	52,2	**200**	420	80	5	2	336,6	288,9	170	40
7044-B-MP	17,2	**220**	340	56	3	1,1	293,8	269	109	40
Z-576434.SKL[1]	18,2	**220**	340	56	3	1,1	293,7	–	109	40
7044-MP	17,3	**220**	340	56	3	1,1	292	268	109	30
7244-B-MP	35,1	**220**	400	65	4	1,5	329,5	294,5	163	40
7344-B-MP	68,3	**220**	460	88	5	2	365,7	315	187	40
70948-MP	5,89	**240**	320	25	1,5	1	287	272,3	93	30
71948-MP	7,21	**240**	320	38	2,1	1,1	288	271	100	30
7048-B-MP	18,6	**240**	360	56	3	1,1	313,8	289,1	154	40
7048-MP	18,6	**240**	360	56	3	1,1	317,2	285,6	115	30
7248-B-MP	47,5	**240**	440	72	4	1,5	361	320	179	40
7348-B-MP	87,1	**240**	500	95	5	2	397	343	203	40
Z-507342.01.SKL[2]	9,46	**250**	340	35 /38[3]	2,1	1,5	304	286	195	40
70852-MP	3,45	**260**	320	19	1	0,6	295,7	284,3	93	30
71852-MP	4,64	**260**	320	28	2	1	296	284	98	30
70952-MP	10,1	**260**	360	31	2	1	320	300,3	105	30
71952-MP	11,7	**260**	360	46	2,1	1,1	324,1	298,2	112	30
7052-MP	27,5	**260**	400	65	4	1,5	349,3	313,7	128	30
7252-B-MP	62,5	**260**	480	80	5	2	393	348	195	40
7352-B-MP	109	**260**	540	102	6	3	431	371	219	40

[1] With MPB cage.
[2] With MP cage.
[3] The outer ring is 35 mm wide, the inner ring is 38 mm wide.

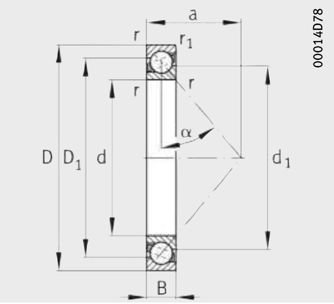


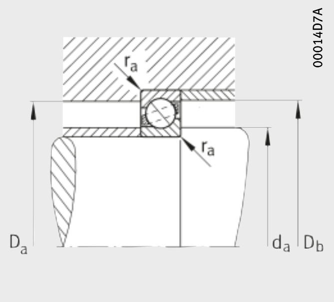
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
167	303	311	3	1,5	325	390	1,14	0,35	0,57	0,26	14,2	3 800	2 200
177	323	331	3	1,5	360	450	1,14	0,35	0,57	0,26	15,1	3 600	2 040
187	343	351	3	1,5	405	530	1,14	0,35	0,57	0,26	18,1	3 200	1 840
197	303	311	3	1,5	275	345	1,14	0,35	0,57	0,26	12,1	3 600	2 290
197	363	371	3	1,5	415	560	1,14	0,35	0,57	0,26	18,4	3 000	1 760
207	323	331	3	1,5	300	390	1,14	0,35	0,57	0,26	13,2	3 200	2 140
210	380	389	4	2	430	600	1,14	0,35	0,57	0,26	18,7	2 800	1 680
217	343	351	3	1,5	320	430	1,14	0,35	0,57	0,26	14	3 000	2 010
220	400	409	4	2	465	655	1,14	0,35	0,57	0,26	20,4	2 800	1 560
232,4	327,6	334	2,5	1	255	355	1,14	0,35	0,57	0,26	11,5	3 000	2 080
232,4	327,6	334	2,5	1	255	355	1,14	0,35	0,57	0,26	11,5	3 000	–
232,4	327,6	334	2,5	1	285	390	0,8	0,39	0,76	0,33	12,8	3 000	–
237	383	391	3	1,5	365	530	1,14	0,35	0,57	0,26	16,5	2 800	1 790
240	440	449	4	2	530	780	1,14	0,35	0,57	0,26	23,4	2 800	1 400
247	313	315,4	1,5	1	125	186	0,8	0,39	0,76	0,33	6,5	3 000	–
250,2	309,8	314	2,1	1	190	260	0,8	0,39	0,76	0,33	8,9	3 000	–
252,4	347,6	354	2,5	1	270	390	1,14	0,35	0,57	0,26	12,2	2 800	1 890
252,4	347,6	354	2,5	1	300	430	0,8	0,39	0,76	0,33	13,7	2 800	–
257	423	431	3	1,5	440	670	1,14	0,35	0,57	0,26	22,3	2 800	1 520
260	480	489	4	2	600	950	1,14	0,35	0,57	0,26	29	2 600	1 220
260,2	333	333	2,1	1,5	186	255	1,14	0,35	0,57	0,26	7,9	2 800	–
264,6	315,4	316,8	1	0,6	76,5	125	0,8	0,39	0,76	0,33	3,8	3 000	–
268,8	311,2	315,4	2	1	122	190	0,8	0,39	0,76	0,33	6,3	3 000	–
268,8	351,2	355,4	2	1	186	270	0,8	0,39	0,76	0,33	8,8	2 800	–
270,2	349,8	354	2,1	1	255	375	0,8	0,39	0,76	0,33	11,9	2 800	–
274,6	385,4	393	3	1,5	365	560	0,8	0,39	0,76	0,33	16,7	2 800	–
280	460	469	4	2	490	765	1,14	0,35	0,57	0,26	21,7	2 600	1 460
286	514	526	5	2,5	655	1 060	1,14	0,35	0,57	0,26	30	2 400	1 140

Angular contact ball bearings

Single row

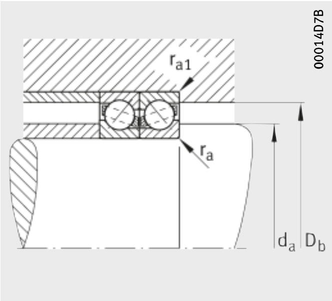




Mounting dimensions

Dimension table (continued) · Dimensions in mm										
Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
70856-MP	5,07	**280**	350	22	1,1	0,6	321,7	308,3	102	30
71856-MP	6,86	**280**	350	33	2	1	323,9	307,8	107	30
F-801617.01.SKL[1)]	9,17	**280**	370	40	3	1,1	336	316,4	114	30
70956-MP	10,8	**280**	380	31	2	1	340	320,3	111	30
71956-MP	14,1	**280**	380	46	2,1	1,1	344	318,3	118	30
7056-MP	29,2	**280**	420	65	4	1,5	369,2	333,7	133	30
7256-B-MP	58,8	**280**	500	80	5	2	413	368	204	40
F-804601.SKL[2)]	134	**280**	579	108	6	3	460,5	400	234	40
7356-B-MP	134	**280**	580	108	6	3	464,5	402,5	234	40
Z-507343.01.SKL[2)]	13,6	**285**	380	46	2,1	1	342	323	150	40
F-800060.SKL[3)]	14,7	**285**	380	46	2,1	2,1	344,9	318,3	118	30
70860-MP	7,11	**300**	380	25	1,5	1	346,8	334,5	111	30
71860-MP	9,67	**300**	380	38	2,1	1,1	349,1	331	117	30
70960-MP	16,8	**300**	420	37	2,1	1	372	348	112	30
71960-MP	22,3	**300**	420	56	3	1,1	377,1	345,6	132	30
7060-B-MP	41,5	**300**	460	74	4	1,5	398,4	365,6	196	40
F-804853.SKL[2)]	41,4	**300**	460	74	4	1,5	398,4	365,6	196	40
7060-MP	41	**300**	460	74	4	1,5	402,9	360,6	147	30
7260-B-MP	83,8	**300**	540	85	5	2	444,5	397	219	40
7360-B-MP	157	**300**	620	109	7,5	4	493,5	428	247	40
70864-MP	7,6	**320**	400	25	1,5	1	366,7	353,3	116	30
71864-MP	10,3	**320**	400	38	2,1	1,1	368	351	123	30
70964-MP	17,7	**320**	440	37	2,1	1	392	368	128	30
71964-MP	23,6	**320**	440	56	3	1,1	397,1	365,6	138	30
7064-MP	46,9	**320**	480	74	4	1,5	417	383	152	30
7264-B-MP	104	**320**	580	92	5	2	476,5	425	235	40
7364-B-MP	193	**320**	670	112	7,5	4	529,4	467,6	264	40
Z-509091.01.SKL[2)]	23,6	**335**	450	56	2,1	1,5	402,5	382,5	193	40

1) With JP sheet steel cage.
2) With MP cage.
3) With MPA cage.

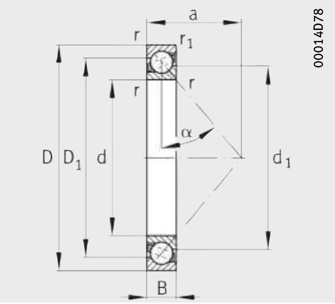


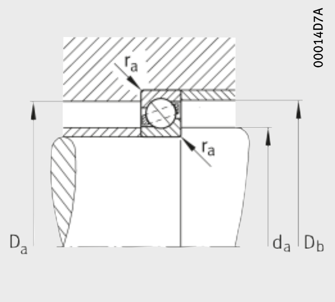
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
286	344	346,8	1	0,6	100	163	0,8	0,39	0,76	0,33	5,2	2 800	–
288,8	341,2	345,4	2	1	163	250	0,8	0,39	0,76	0,33	8	2 800	–
292,4	357,6	364	2,5	1	245	365	0,8	0,39	0,76	0,33	11,2	1 700	–
288,8	371,2	375,4	2	1	190	285	0,8	0,39	0,76	0,33	8,9	2 800	–
290,2	369,8	374	2,1	1	260	400	0,8	0,39	0,76	0,33	12,3	2 800	–
294,6	405,4	413	3	1,5	375	600	0,8	0,39	0,76	0,33	17,2	2 600	–
300	480	489	4	2	500	830	1,14	0,35	0,57	0,26	22,7	2 400	1 350
306	554	566	5	2,5	735	1 270	1,14	0,35	0,57	0,26	37,5	2 000	–
306	554	566	5	2,5	735	1 270	1,14	0,35	0,57	0,26	33	2 000	1 040
295	370	290	2,1	1	196	285	1,14	0,35	0,57	0,26	8,9	2 800	–
290,2	369,8	374	2,1	2,1	260	400	0,8	0,39	0,76	0,33	12,3	2 800	–
307	373	375,4	1,5	1	104	176	0,8	0,39	0,76	0,33	5,4	2 800	–
310,2	369,8	374	2,1	1	204	315	0,8	0,39	0,76	0,33	9,6	2 800	–
310,2	409,8	415,4	2,1	1	245	375	0,8	0,39	0,76	0,33	11,1	2 600	–
312,4	407,6	414	2,5	1	325	530	0,8	0,39	0,76	0,33	15,6	2 600	–
314,6	445,4	453	3	1,5	390	655	1,14	0,35	0,57	0,26	17,7	2 400	1 450
314,6	445,4	453	3	1,5	390	655	1,14	0,35	0,57	0,26	17,7	2 400	–
314,6	445,4	453	3	1,5	430	720	0,8	0,39	0,76	0,33	19,6	2 400	–
320	520	529	4	2	560	965	1,14	0,35	0,57	0,26	26	2 200	1 210
332	588	603	6	3	750	1 370	1,14	0,35	0,57	0,26	35	1 900	940
327	393	395,4	1,5	1	106	186	0,8	0,39	0,76	0,33	5,5	2 600	–
330,2	389,8	394	2,1	1	212	335	0,8	0,39	0,76	0,33	10	2 600	–
330,2	429,8	435,4	2,1	1	245	380	0,8	0,39	0,76	0,33	11,1	2 400	–
332,4	427,6	434	2,5	1	340	570	0,8	0,39	0,76	0,33	16,4	2 400	–
334,6	465,4	473	3	1,5	440	765	0,8	0,39	0,76	0,33	20,2	2 400	–
340	560	569	4	2	610	1 100	1,14	0,35	0,57	0,26	28,5	1 900	1 120
352	638	653	6	3	780	1 500	1,14	0,35	0,57	0,26	36,5	1 800	860
345	440	443	2,1	1,5	255	405	1,14	0,35	0,57	0,26	11	2 400	–

Angular contact ball bearings

Single row





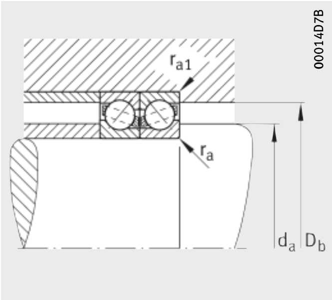
Mounting dimensions

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
70868-MP	8,02	**340**	420	25	1,5	1	386,7	373,3	122	30
71868-MP	10,8	**340**	420	38	2,1	1,1	390,7	370,9	129	30
70968-MP	18,6	**340**	460	37	2,1	1	412	388	134	30
71968-MP	22,7	**340**	460	56	3	1,1	415	385,3	144	30
7068-B-MP	62,8	**340**	520	82	5	2	450,5	413,9	221	40
7068-MP	63	**340**	520	82	5	2	448	412	165	30
7268-B-MP	123	**340**	620	92	6	3	506,5	455	247	40
7368-B-MPB	218	**340**	710	118	7,5	4	557,5	492,2	279	40
70872-MP	8,45	**360**	440	25	1,5	1	406,7	393,3	128	30
71872-MP	11,5	**360**	440	38	2,1	1,1	408	391	134	30
70972-MP	19,6	**360**	480	37	2,1	1	432	408	140	30
71972-MP	23	**360**	480	56	3	1,1	437,1	405,7	149	30
7072-B-MP	61,6	**360**	540	82	5	2	470,5	433,9	230	40
7072-MP	61,1	**360**	540	82	5	2	475,5	428,4	171	30
7272-B-MP	138	**360**	650	95	6	3	534,4	481,6	259	40
7372-B-MPB	280	**360**	750	125	7,5	4	588,5	520,7	295	40
70876-MP	13,8	**380**	480	31	2	1	438,7	421,3	140	30
71876-MP	18,6	**380**	480	46	2,1	1,1	443,6	418,7	147	30
F-804862.SKL[1]	17	**380**	480	50	2,1	1,1	446	416,5	147	30
70976-MP	29	**380**	520	44	3	1,1	464,5	435,6	152	30
Z-509092.01.SKL[2]	39,8	**380**	520	65	2,5	2,5	465,4	438	221	40
71976-MP	41,7	**380**	520	65	4	1,5	468	432	162	30
7076-MP	69,1	**380**	560	82	5	2	488	452	177	30
7276-B-MP	152	**380**	680	95	6	3	557,5	504	270	40
7376-B-MP	314	**380**	780	128	7,5	4	614,8	544,7	307	40
70880-MP	14,7	**400**	500	31	2	1	458,7	441,3	145	30
71880-MP	20,4	**400**	500	46	2,1	1,1	462,4	437,6	153	30
70980-MP	30,3	**400**	540	44	3	1,1	484,5	455,6	158	30
71980-MP	39,4	**400**	540	65	4	1,5	488	452	168	30
7080-MP	83,3	**400**	600	90	5	2	520	480	189	30
7280-B-MPB	188	**400**	720	103	6	3	592,9	533,8	286	40
7380-B-MP	369	**400**	820	136	7,5	4	647	572,7	324	40
Z-509093.01.SKL[2]	47,5	**410**	560	70	3,5	3,5	499,7	470,3	239	40

[1] Full complement.

[2] With MP cage.

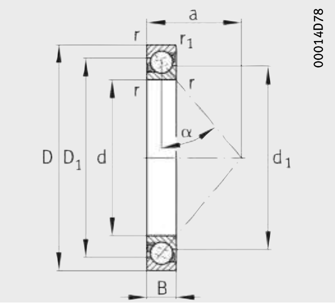


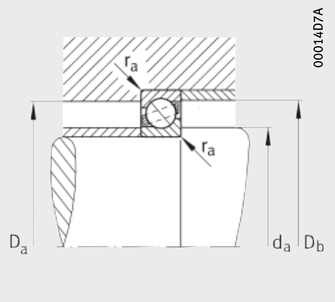
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
347	413	415,4	1,5	1	108	196	0,8	0,39	0,76	0,33	5,6	2 400	–
350,2	409,8	414	2,1	1	212	345	0,8	0,39	0,76	0,33	10,2	2 400	–
350,2	449,8	455,4	2,1	1	250	405	0,8	0,39	0,76	0,33	11,3	2 400	–
352,4	447,6	454	2,5	1	340	570	0,8	0,39	0,76	0,33	18,1	2 400	–
358	502	511,2	4	2	465	850	1,14	0,35	0,57	0,26	22,8	2 000	–
358	502	511,2	4	2	520	930	0,8	0,39	0,76	0,33	27,5	2 000	–
366	594	606	5	2,5	630	1 180	1,14	0,35	0,57	0,26	31,5	1 800	1 000
372	678	693	6	3	865	1 700	1,14	0,35	0,57	0,26	40,5	1 600	790
367	433	435,4	1,5	1	110	204	0,8	0,39	0,76	0,33	5,7	2 400	–
370,2	429,8	434	2,1	1	216	365	0,8	0,39	0,76	0,33	10,3	2 400	–
370,2	469,8	475,4	2,1	1	255	425	0,8	0,39	0,76	0,33	11,6	2 200	–
372,4	467,6	474	2,5	1	345	600	0,8	0,39	0,76	0,33	16,8	2 200	–
378	522	531,2	4	2	475	880	1,14	0,35	0,57	0,26	23,4	1 900	1 130
378	522	531,2	4	2	530	980	0,8	0,39	0,76	0,33	26	1 900	–
386	624	636	5	2,5	695	1 340	1,14	0,35	0,57	0,26	34,5	1 600	920
392	718	733	6	3	900	1 830	1,14	0,35	0,57	0,26	43,5	1 500	740
388,8	471,2	475,4	2	1	166	290	0,8	0,39	0,76	0,33	8	2 000	–
390,2	469,8	474	2,1	1	285	490	0,8	0,39	0,76	0,33	13,5	2 000	–
390,2	469,8	474	2,1	1	360	640	0,8	0,39	0,76	0,33	17,5	1 300	–
392,4	507,6	514	2,5	1	320	560	0,8	0,39	0,76	0,33	15	1 900	–
390	510	510	2,5	2,5	355	630	1,14	0,35	0,57	0,26	16,1	1 900	–
394,6	505,4	513	3	1,5	400	720	0,8	0,39	0,76	0,33	19,6	1 900	–
398	542	551,2	4	2	540	1 040	0,8	0,39	0,76	0,33	25,5	1 900	–
406	654	666	5	2,5	710	1 430	1,14	0,35	0,57	0,26	34,5	1 600	870
412	748	763	6	3	950	1 960	1,14	0,35	0,57	0,26	45	1 400	750
408,8	491,2	495,4	2	1	170	310	0,8	0,39	0,76	0,33	8,3	1 900	–
410,2	489,8	494	2,1	1	290	510	0,8	0,39	0,76	0,33	14,5	1 900	–
412,4	527,6	534	2,5	1	325	585	0,8	0,39	0,76	0,33	15,5	1 900	–
414,6	525,4	533	3	1,5	415	765	0,8	0,39	0,76	0,33	20,3	1 900	–
418	582	591,2	4	2	600	1 180	0,8	0,39	0,76	0,33	29,5	1 800	–
426	694	706	5	2,5	765	1 600	1,14	0,35	0,57	0,26	36,5	1 500	830
432	788	803	6	3	1 020	2 200	1,14	0,35	0,57	0,26	50	1 400	700
423	547	547	3,5	3,5	380	695	1,14	0,35	0,57	0,26	21	1 800	–

Angular contact ball bearings

Single row



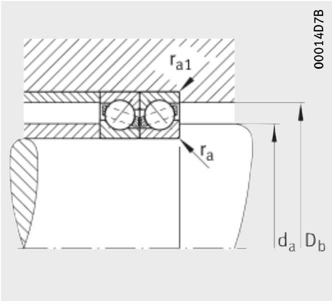


Mounting dimensions

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
70884-MP	15,4	**420**	520	31	2	1	478,7	461,3	151	30
71884-MP	20,3	**420**	520	46	2,1	1,1	483,7	458,4	159	30
70984-MP	31,6	**420**	560	44	3	1,1	504,5	475,6	164	30
71984-MP	41,4	**420**	560	65	4	1,5	508,2	474,6	174	30
7084-MP	86,8	**420**	620	90	5	2	540	500	195	30
7284-B-MPB	228	**420**	760	109	7,5	4	619	560,7	302	40
7384-B-MP	395	**420**	850	136	9,5	5	672	597,7	334	40
70888-MP	16	**440**	540	31	2	1	498,7	481,3	157	30
71888-MP	21,3	**440**	540	46	2,1	1,1	502,4	477,6	164	30
F-803794.SKL[1]	17,3	**440**	540	46	2,1	0,6	502	481	164	30
F-808756.SKL[2]	45,3	**440**	580	70	4	1,5	530,9	493	184	30
70988-MP	42,2	**440**	600	50	4	1,5	538,5	503,5	175	30
Z-509094.01.SKL[2]	56,9	**440**	600	74	3,5	3,5	540	500	255	40
71988-MP	56,9	**440**	600	74	4	1,5	540	500	187	30
7088-MP	102	**440**	650	94	6	3	566,5	523	204	30
7288-B-MP	255	**440**	790	112	7,5	4	645,5	584,2	314	40
7388-B-MP	477	**440**	900	145	9,5	5	709	630,7	350	40
70892-MP	24,3	**460**	580	37	2,1	1,1	531,1	509	169	30
71892-MP	32,2	**460**	580	56	3	1,1	536,9	506	178	30
F-803705.SKL[2]	37,2	**460**	600	50	3	1,1	535,4	507	178	30
70992-MP	44,6	**460**	620	50	4	1,5	558,5	523,5	181	30
71992-MP	53,9	**460**	620	74	4	1,5	560	520	193	30
7092-MP	115	**460**	680	100	6	3	600,1	544,5	214	30
7292-B-MPB	287	**460**	830	118	7,5	4	677,5	612,3	330	40
7392-B-MP	573	**460**	950	155	9,5	5	746	663,2	373	40
Z-510289.01.SKL[2]	68,4	**465**	635	76	3,5	3,5	565,5	533,5	269	40
70896-MP	25,2	**480**	600	37	2,1	1,1	551,1	529	174	30
71896-MP	33,9	**480**	600	56	3	1,1	556,8	526	184	30
70996-MP	54,3	**480**	650	54	4	1,5	582	548	190	30
71996-MP	73,6	**480**	650	78	5	2	586	544,7	202	30
7096-MP	129	**480**	700	100	6	3	613	567	220	30
7296-B-MPB	348	**480**	870	125	7,5	4	710	640,2	346	40
7396-B-MP	618	**480**	980	160	9,5	5	773,5	686,2	386	40

1) With JP sheet steel cage.
2) With MP cage.

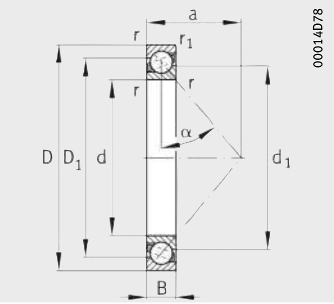


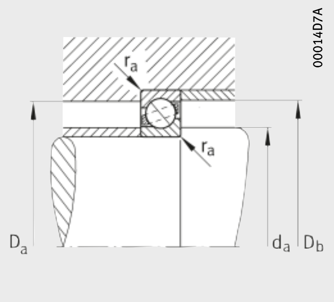
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
428,8	511,2	515,4	2	1	173	320	0,8	0,39	0,76	0,33	8,4	1 900	–
430,2	509,8	514	2,1	1	300	550	0,8	0,39	0,76	0,33	14,2	1 900	–
432,4	547,6	554	2,5	1	335	620	0,8	0,39	0,76	0,33	15,9	1 800	–
434,6	545,4	553	3	1,5	415	780	0,8	0,39	0,76	0,33	20,5	1 800	–
438	602	611,2	4	2	620	1 250	0,8	0,39	0,76	0,33	30	1 600	–
452	728	743	6	3	800	1 730	1,14	0,35	0,57	0,26	38,5	1 400	790
460	810	830	8	4	1 060	2 360	1,14	0,35	0,57	0,26	53	1 300	630
448,8	531,2	535,4	2	1	176	335	0,8	0,39	0,76	0,33	8,6	1 800	–
450,2	529,8	534	2,1	1	300	550	0,8	0,39	0,76	0,33	14,4	1 800	–
450,2	529,8	534	2,1	0,6	345	640	0,8	0,39	0,76	0,33	16,5	1 100	–
454,6	565,4	573	3	1,5	475	930	0,8	0,39	0,76	0,33	23,6	1 600	–
454,6	585,4	593	3	1,5	405	780	0,8	0,39	0,76	0,33	19,4	1 600	–
453	587	587	3,5	3,5	440	865	1,14	0,35	0,57	0,26	23,9	1 600	–
454,6	585,4	593	3	1,5	500	1 000	0,8	0,39	0,76	0,33	24,7	1 600	–
463	627	637,6	5	5	655	1 370	0,8	0,39	0,76	0,33	31,5	1 500	–
472	758	773	6	3	850	1 860	1,14	0,35	0,57	0,26	40,5	1 400	850
480	860	880	8	4	1 160	2 650	1,14	0,35	0,57	0,26	55	1 200	600
470,2	569,8	574	2,1	1	250	465	0,8	0,39	0,76	0,33	11,5	1 600	–
472	568	574	2,5	1	380	735	0,8	0,39	0,76	0,33	18,6	1 600	–
472	568	574	2,5	1	375	720	0,8	0,39	0,76	0,33	17,9	1 600	–
474,6	605,4	613	3	1,5	415	800	0,8	0,39	0,76	0,33	19,5	1 500	–
474,6	605,4	613	3	1,5	500	1 020	0,8	0,39	0,76	0,33	25	1 500	–
483	657	667,6	5	2,5	710	1 500	0,8	0,39	0,76	0,33	37	1 400	–
492	798	813	6	3	930	2 120	1,14	0,35	0,57	0,26	45	1 300	690
500	910	930	8	4	1 250	3 000	1,14	0,35	0,57	0,26	62	1 200	560
478	622	622	3,5	3,5	450	900	1,14	0,35	0,57	0,26	20,9	1 500	–
490,2	589,8	594	2,1	1	255	480	0,8	0,39	0,76	0,33	11,7	1 500	–
492,4	587,6	594	2,5	1	390	765	0,8	0,39	0,76	0,33	19,1	1 500	–
494,6	635,4	643	3	1,5	430	865	0,8	0,39	0,76	0,33	21,1	1 500	–
498	632	641,2	4	2	540	1 100	0,8	0,39	0,76	0,33	26	1 500	–
503	677	687,6	5	2,5	720	1 600	0,8	0,39	0,76	0,33	35	1 400	–
512	838	853	6	3	1 040	2 400	1,14	0,35	0,57	0,26	51	1 200	750
520	940	960	8	4	1 290	3 050	1,14	0,35	0,57	0,26	63	1 100	560

Angular contact ball bearings

Single row





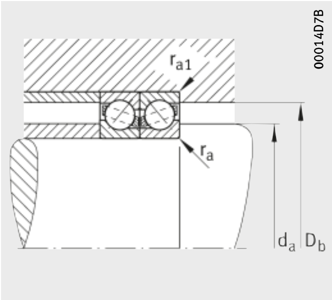
Mounting dimensions

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
708/500-MP	26,2	**500**	620	37	2,1	1,1	571,1	549	190	30
718/500-MP	35,1	**500**	620	56	3	1,1	576,8	546	190	30
709/500-MP	56,1	**500**	670	54	4	1,5	602	568	196	30
719/500-MP	72	**500**	670	78	5	2	606	564,7	208	30
70/500-MP	133	**500**	720	100	6	3	633	587	226	30
72/500-B-MPB	431	**500**	920	136	7,5	4	747	672,7	366	40
73/500-B-MPB	731	**500**	1 030	170	12	6	810,5	719,2	406	40
Z-556716.SKL[1]	14,7	**530**	600	35	2	1	572,5	557,5	181	30
708/530-MP	27,6	**530**	650	37	2,1	1,1	601,1	579	189	30
718/530-MP	37,2	**530**	650	56	3	1,1	606,7	576	198	30
709/530-MP	66,6	**530**	710	57	4	1,5	639	601	208	30
719/530-MP	84,9	**530**	710	82	5	2	645,3	598,7	220	30
70/530-MPB	180	**530**	780	112	6	3	691,3	624,6	245	30
72/530-B-MPB	524	**530**	980	145	9,5	5	794	715,7	389	40
708/560-MP	25,8	**560**	680	37	2,1	1,1	631,1	609	198	30
Z-560752.SKL[1]	28,9	**560**	680	42	3,5	2	631,1	609	200	30
718/560-MP	30,1	**560**	680	56	3	1,1	636,8	606	207	30
709/560-MP	78,1	**560**	750	60	5	2	675	635	219	30
719/560-MP	98,2	**560**	750	85	5	2	681	632,2	232	30
70/560-MPB	207	**560**	820	115	6	3	726,7	658,1	257	30
72/560-B-MPB	595	**560**	1 030	150	9,5	5	836,5	753,7	409	40
708/600-MP	37,7	**600**	730	42	3	1,1	676,7	655,3	213	30
Z-560519.SKL[2]	41,4	**600**	730	45	2,7	2,7	676,7	655,3	213	30
718/600-MP	49,1	**600**	730	60	3	1,1	681,5	651,3	222	30
709/600-MP	92,2	**600**	800	63	5	2	721	679	234	30
719/600-MP	122	**600**	800	90	5	2	727,5	676	247	30
70/600-MPB	232	**600**	870	118	6	3	763	706,5	271	30
72/600-B-MPB	686	**600**	1 090	155	9,5	5	886,5	803,7	432	40

[1] Separable bearing with MP cage.

[2] Separable bearing with MPBS cage.

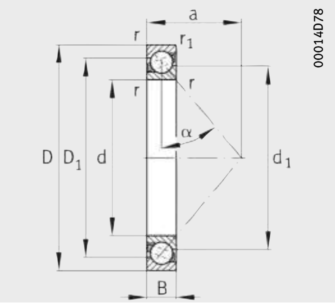


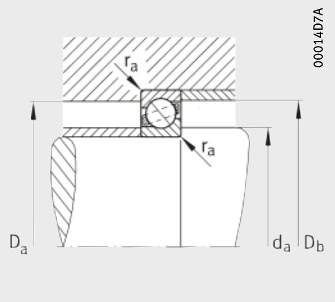
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
510,2	609,8	614	2,1	1	260	500	0,8	0,39	0,76	0,33	12	1 500	–
512,4	607,6	614	2,5	1	390	780	0,8	0,39	0,76	0,33	19,1	1 500	–
514,6	655,4	663	3	1,5	440	900	0,8	0,39	0,76	0,33	21,2	1 400	–
518	652	661,2	4	2	550	1 180	0,8	0,39	0,76	0,33	27	1 400	–
523	697	707,6	5	2,5	735	1 660	0,8	0,39	0,76	0,33	35,5	1 400	–
532	888	903	6	3	1 120	2 700	1,14	0,35	0,57	0,26	57	1 200	700
548	982	1 004	10	5	1 370	3 400	1,14	0,35	0,57	0,26	67	1 100	530
538,8	591,2	595,4	2	1	134	280	0,8	0,39	0,76	0,33	6,6	1 500	–
540,2	639,8	644	2,1	1	265	520	0,8	0,39	0,76	0,33	12,3	1 400	–
542,4	637,6	644	2,5	1	405	830	0,8	0,39	0,76	0,33	19,8	1 400	–
544,6	695,4	703	3	1,5	500	1 080	0,8	0,39	0,76	0,33	24,5	1 400	–
548	692	701,2	4	2	610	1 340	0,8	0,39	0,76	0,33	31	1 400	–
553	757	767,6	5	2,5	850	1 960	0,8	0,39	0,76	0,33	42,5	1 300	–
570	940	960	8	4	1 220	3 050	1,14	0,35	0,57	0,26	60	1 100	670
570,2	669,8	674	2,1	1	270	550	0,8	0,39	0,76	0,33	12,6	1 400	–
574,6	665,4	671,2	3	2	270	550	0,8	0,39	0,76	0,33	15,2	1 400	–
572,4	667,6	674	2,5	1	405	865	0,8	0,39	0,76	0,33	20,1	1 400	–
578	732	741,2	4	2	540	1 200	0,8	0,39	0,76	0,33	26,5	1 300	–
578	732	741,2	4	2	655	1 460	0,8	0,39	0,76	0,33	32,5	1 300	–
583	797	807,6	5	2,5	930	2 280	0,8	0,39	0,76	0,33	47,5	600	–
600	990	1 010	8	4	1 320	3 400	1,14	0,35	0,57	0,26	67	1 000	630
612,4	717,6	724	2,5	1	335	735	0,8	0,39	0,76	0,33	16,2	1 300	–
612,4	717,6	724	3	3	315	670	0,8	0,39	0,76	0,33	14,9	1 300	–
612,4	717,6	724	2,5	1	465	1 040	0,8	0,39	0,76	0,33	22,4	1 300	–
618	782	791,2	4	2	560	1 290	0,8	0,39	0,76	0,33	28	1 200	–
618	782	791,2	4	2	710	1 700	0,8	0,39	0,76	0,33	35,5	1 200	–
623	847	857,6	5	2,5	980	2 400	0,8	0,39	0,76	0,33	48,5	1 100	–
640	1 050	1 070	8	4	1 340	3 600	1,14	0,35	0,57	0,26	68	950	600

Angular contact ball bearings

Single row

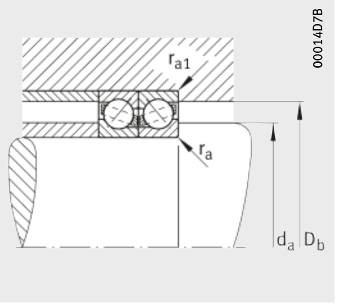




Mounting dimensions

Dimension table (continued) · Dimensions in mm										
Designation	Mass	Dimensions								
	m	d	D	B	r	r_1	D_1	d_1	a	α
	≈kg				min.	min.	≈	≈	≈	°
708/630-MPB	55	**630**	780	48	3	1,1	719,8	687,5	228	30
718/630-MPB	71,7	**630**	780	69	4	1,5	726,4	685,9	238	30
709/630-MP	124	**630**	850	71	5	2	763,5	712,2	249	30
719/630-MP	168	**630**	850	100	6	3	768	701,5	264	30
70/630-MPB	297	**630**	920	128	7,5	4	805,5	742	288	30
72/630-B-MPB	784	**630**	1 150	165	12	6	938,9	849,7	456	40
708/670-MPB	51,6	**670**	820	48	3	1,1	759,8	727,5	239	30
718/670-MPB	76,2	**670**	820	69	4	1,5	766,1	725,9	250	30
709/670-MP	142	**670**	900	73	5	2	809	756,5	263	30
719/670-MPB	184	**670**	900	103	6	3	817	757,2	278	30
70/670-MPB	314	**670**	980	136	7,5	4	869,1	790	306	30
72/670-B-MPB	965	**670**	1 220	175	12	6	993	896,7	484	40
F-801245.SKL[1]	47,6	**680**	810	50	3	1,1	759,8	727,5	239	30
708/710-MPB	62,1	**710**	870	50	4	1,5	805,4	772	253	30
718/710-MPB	93,6	**710**	870	74	4	1,5	811,1	771	265	30
709/710-MP	167	**710**	950	78	5	2	855,5	800	279	30
719/710-MPB	181	**710**	950	106	6	3	861	792	293	30
70/710-MPB	403	**710**	1 030	140	7,5	4	903,5	835	321	30
72/710-B-MPB	1 080	**710**	1 280	180	12	6	1 045	944,7	507	40
708/750-MPB	80,9	**750**	920	54	4	1,5	851,1	816	273	30
718/750-MPB	110	**750**	920	78	5	2	857,5	814,9	280	30
709/750-MP	189	**750**	1 000	80	6	3	901	844	293	30
719/750-MP	216	**750**	1 000	112	6	3	907	836	309	30
70/750-MPB	485	**750**	1 090	150	7,5	4	956	884	341	30
72/750-B-MPB	1 340	**750**	1 360	195	15	7,5	1 107	1 002,7	540	40
708/800-MPB	99,2	**800**	980	57	4	1,5	907,4	869,4	285	30
718/800-MPB	131	**800**	980	82	5	2	914,1	868,5	298	30
709/800-MP	214	**800**	1 060	82	6	3	957	898,2	310	30
719/800-MP	242	**800**	1 060	115	6	3	964	885	326	30
70/800-MPB	547	**800**	1 150	155	7,5	4	1 012	938	339	30

[1] With MPB cage.

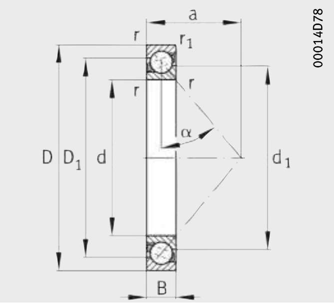


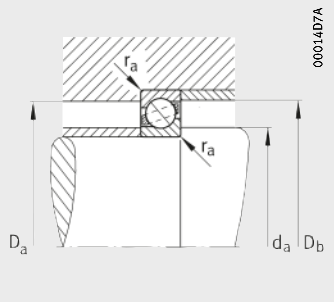
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed	Reference speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G	n_B
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}	min^{-1}
642,4	767,6	774	2,5	1	390	865	0,8	0,39	0,76	0,33	18,4	1 200	–
644,6	765,4	773	3	1,5	540	1 250	0,8	0,39	0,76	0,33	27	1 200	–
648	832	841,2	4	2	670	1 630	0,8	0,39	0,76	0,33	33,5	1 100	–
653	827	837,6	5	2,5	780	1 860	0,8	0,39	0,76	0,33	39	1 100	–
658	892	905,4	6	3	1 080	2 800	0,8	0,39	0,76	0,33	54	1 100	–
678	1 102	1 124	10	5	1 430	4 000	1,14	0,35	0,57	0,26	74	900	530
682	808	814	2,5	1	400	915	0,8	0,39	0,76	0,33	18,9	1 100	–
684,6	805,4	813	3	1,5	560	1 340	0,8	0,39	0,76	0,33	28	1 100	–
688	882	891,2	4	2	695	1 730	0,8	0,39	0,76	0,33	35	1 100	–
693	877	888	5	2,5	850	2 120	0,8	0,39	0,76	0,33	42,5	1 100	–
698	952	965,4	6	3	1 200	3 200	0,8	0,39	0,76	0,33	61	1 000	–
718	1 172	1 194	10	5	1 600	4 550	1,14	0,35	0,57	0,26	83	850	500
692,4	797,6	804	2,5	1	400	915	0,8	0,39	0,76	0,33	18,9	1 100	–
724,6	855,4	863	3	1,5	430	1 020	0,8	0,39	0,76	0,33	20,9	1 000	–
724,6	855,4	863	3	1,5	585	1 460	0,8	0,39	0,76	0,33	29,5	1 000	–
728	932	941,2	4	2	765	1 960	0,8	0,39	0,76	0,33	38	950	–
733	927	937,6	5	2,5	900	2 320	0,8	0,39	0,76	0,33	44,5	950	–
738	1 002	1 015,4	6	3	1 250	3 450	0,8	0,39	0,76	0,33	62	950	–
758	1 232	1 254	10	5	1 700	5 000	1,14	0,35	0,57	0,26	87	800	480
764,6	905,4	913	3	1,5	455	1 120	0,8	0,39	0,76	0,33	22,2	600	–
768	902	911,2	4	2	640	1 630	0,8	0,39	0,76	0,33	31	950	–
773	977	987,6	5	2,5	800	2 120	0,8	0,39	0,76	0,33	42	900	–
773	977	987,6	5	2,5	965	2 600	0,8	0,39	0,76	0,33	49,5	900	–
778	1 062	1 075,4	6	3	1 370	3 900	0,8	0,39	0,76	0,33	70	900	–
808	1 302	1 328	12	6	1 860	5 700	1,14	0,35	0,57	0,26	97	750	450
814,6	965,4	973	3	1,5	510	1 290	0,8	0,39	0,76	0,33	25	900	–
818	962	971,2	4	2	710	1 860	0,8	0,39	0,76	0,33	36	900	–
823	1 037	1 047,6	5	2,5	830	2 280	0,8	0,39	0,76	0,33	43	850	–
823	1 037	1 047,6	5	2,5	1 040	2 850	0,8	0,39	0,76	0,33	54	850	–
828	1 122	1 135,4	6	3	1 460	4 300	0,8	0,39	0,76	0,33	74	850	–

Angular contact ball bearings

Single row



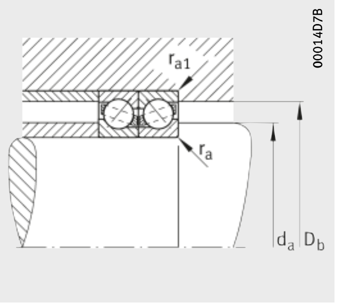


Mounting dimensions

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions							
	m	d	D	B	r	r_1	D_1	a	α
	≈kg				min.	min.	≈	≈	°
708/850-MPB	93,1	**850**	1 030	57	4	1,5	957,4	300	30
718/850-MPB	123	**850**	1 030	82	5	2	964,3	312	30
709/850-MP	244	**850**	1 120	85	6	3	1 013	327	30
719/850-MPB	309	**850**	1 120	118	6	3	1 022	343	30
F-804092.SKL[1]	475	**850**	1 220	118	7,5	7,5	1 072	343	30
70/850-MPB	652	**850**	1 220	165	7,5	4	1 074	381	30
708/900-MPB	123	**900**	1 090	60	5	2	1 013	317	30
718/900-MPB	143	**900**	1 090	85	5	2	1 019,2	330	30
709/900-MP	276	**900**	1 180	88	6	3	1 069,5	344	30
719/900-MP	311	**900**	1 180	122	6	3	1 077	361	30
70/900-MPB	646	**900**	1 280	170	7,5	4	1 129	414	30
708/950-MPB	144	**950**	1 150	63	5	2	1 069	335	30
718/950-MPB	168	**950**	1 150	90	5	2	1 075,5	348	30
709/950-MP	338	**950**	1 250	95	6	3	1 132	365	30
719/950-MP	455	**950**	1 250	132	7,5	4	1 139	384	30
70/950-MPB	882	**950**	1 360	180	7,5	4	1 198,5	423	30
708/1000-MPB	190	**1 000**	1 220	71	5	2	1 135	356	30
718/1000-MPB	255	**1 000**	1 220	100	6	3	1 142,8	370	30
709/1000-MP	411	**1 000**	1 320	103	6	3	1 194	386	30
719/1000-MP	544	**1 000**	1 320	140	7,5	4	1 202	405	30
F-807448.SKL[1]	659	**1 000**	1 420	130	7,5	7,5	1 255,5	414	30
70/1000-MPB	972	**1 000**	1 420	185	7,5	4	1 254	442	30
708/1060-MPB	175	**1 060**	1 280	71	5	2	1 195	373	30
718/1060-MPB	267	**1 060**	1 280	100	6	3	1 198,2	388	30
709/1060-MP	492	**1 060**	1 400	109	7,5	4	1 266	410	30
719/1060-MP	653	**1 060**	1 400	150	7,5	4	1 273	430	30
708/1120-MPB	253	**1 120**	1 360	78	5	2	1 263,5	397	30
718/1120-MPB	312	**1 120**	1 360	106	6	3	1 273,5	411	30
709/1120-MP	515	**1 120**	1 460	109	7,5	4	1 326	427	30
719/1120-MP	686	**1 120**	1 460	150	7,5	4	1 333	447	30

[1] Separable bearing with MPB cage.

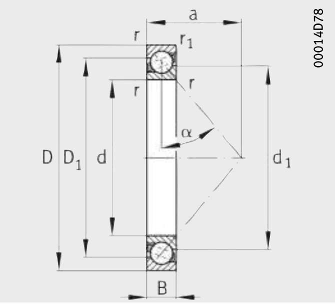


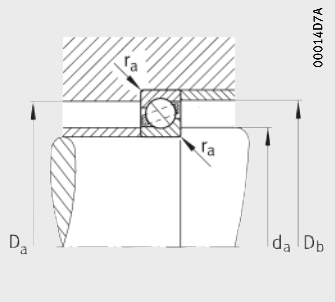
Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed
d_a	D_a	D_b	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	e	X	Y	Y_0	C_{ur}	n_G
min.	max.	max.	max.	max.	kN	kN					kN	min^{-1}
864,6	1 015,4	1 023	3	1,5	520	1 370	0,8	0,39	0,76	0,33	25,5	850
868	1 012	1 021,2	4	2	710	1 930	0,8	0,39	0,76	0,33	36,5	850
873	1 097	1 107,6	5	2,5	880	2 500	0,8	0,39	0,76	0,33	45,5	800
873	1 097	1 107,6	5	2,5	1 100	3 150	0,8	0,39	0,76	0,33	47	800
878	1 192	1 192	6	6	1 120	3 350	0,8	0,39	0,76	0,33	48,5	800
878	1 192	1 205,4	6	3	1 560	4 800	0,8	0,39	0,76	0,33	81	800
918	1 072	1 081,2	4	2	550	1 500	0,8	0,39	0,76	0,33	27	800
918	1 072	1 081,2	4	2	765	2 160	0,8	0,39	0,76	0,33	39	800
923	1 157	1 167,6	5	2,5	965	2 800	0,8	0,39	0,76	0,33	49	750
923	1 157	1 167,6	5	2,5	1 160	3 450	0,8	0,39	0,76	0,33	62	750
928	1 252	1 265,4	6	3	1 600	5 000	0,8	0,39	0,76	0,33	83	750
968	1 132	1 141,2	4	2	585	1 660	0,8	0,39	0,76	0,33	29,5	750
968	1 132	1 141,2	4	2	830	2 400	0,8	0,39	0,76	0,33	42	750
973	1 227	1 237,6	5	2,5	1 060	3 250	0,8	0,39	0,76	0,33	57	700
978	1 222	1 235,4	6	3	1 270	3 900	0,8	0,39	0,76	0,33	67	700
978	1 332	1 345,4	6	3	1 830	6 000	0,8	0,39	0,76	0,33	95	700
1 018	1 202	1 211,2	4	2	680	2 000	0,8	0,39	0,76	0,33	34	700
1 023	1 197	1 207,6	5	2,5	950	2 850	0,8	0,39	0,76	0,33	48,5	700
1 023	1 297	1 307,6	5	2,5	1 120	3 450	0,8	0,39	0,76	0,33	57	700
1 028	1 292	1 305,4	6	3	1 370	4 300	0,8	0,39	0,76	0,33	73	700
1 028	1 392	1 392	6	6	1 400	4 550	0,8	0,39	0,76	0,33	77	700
1 028	1 392	1 405,4	6	3	1 860	6 200	0,8	0,39	0,76	0,33	96	700
1 078	1 262	1 271,2	4	2	695	2 120	0,8	0,39	0,76	0,33	34,5	700
1 083	1 257	1 267,6	5	2,5	965	3 000	0,8	0,39	0,76	0,33	50	700
1 088	1 372	1 385,4	6	3	1 270	4 150	0,8	0,39	0,76	0,33	69	630
1 088	1 372	1 385,4	6	3	1 460	4 750	0,8	0,39	0,76	0,33	76	630
1 138	1 342	1 351,2	4	2	780	2 450	0,8	0,39	0,76	0,33	39	630
1 143	1 337	1 347,6	5	2,5	1 080	3 450	0,8	0,39	0,76	0,33	55	630
1 148	1 432	1 445,4	6	3	1 250	4 150	0,8	0,39	0,76	0,33	68	630
1 148	1 432	1 445,4	6	3	1 500	5 000	0,8	0,39	0,76	0,33	79	630

Angular contact ball bearings

Single row



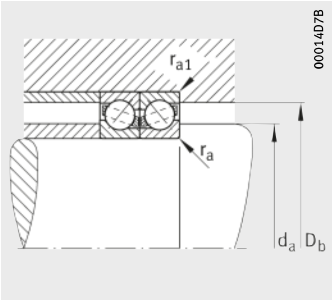


Mounting dimensions

Dimension table (continued) · Dimensions in mm

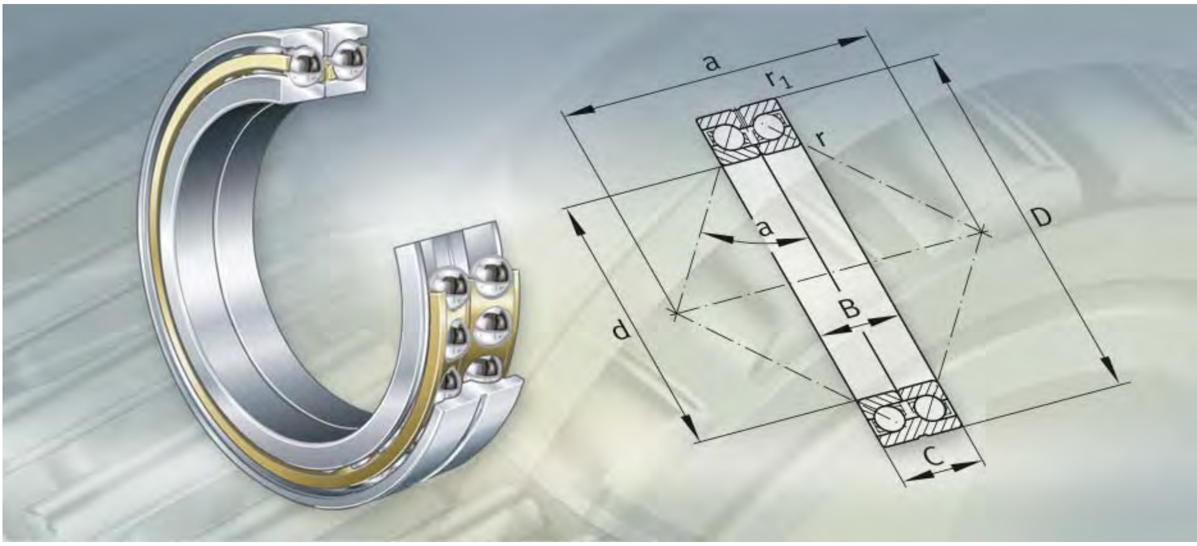
Designation	Mass	Dimensions							
	m	d	D	B	r	r_1	D_1	a	α
	≈kg				min.	min.	≈	≈	°
708/1180-MPB	265	**1 180**	1 420	78	5	2	1 323,5	414	30
718/1180-MPB	346	**1 180**	1 420	106	6	3	1 330,9	428	30
709/1180-MP	608	**1 180**	1 540	115	7,5	4	1 398	450	30
719/1180-MP	816	**1 180**	1 540	160	7,5	4	1 406	473	30
708/1250-MPB	299	**1 250**	1 500	80	6	3	1 399,1	437	30
718/1250-MPB	382	**1 250**	1 500	112	6	3	1 407,2	453	30
709/1250-MP	720	**1 250**	1 630	122	7,5	4	1 480	477	30
719/1250-MP	967	**1 250**	1 630	170	7,5	4	1 488	501	30
Z-563415.SKL[1]	279	**1 300**	1 550	80	3	3	1 452	451	30
708/1320-MPB	393	**1 320**	1 600	88	6	3	1 486,8	465	30
718/1320-MPB	523	**1 320**	1 600	122	6	3	1 496	482	30
709/1320-MP	842	**1 320**	1 720	128	7,5	4	1 562	503	30
719/1320-MP	1 110	**1 320**	1 720	175	7,5	4	1 571	526	30
708/1400-MPB	481	**1 400**	1 700	95	6	3	1 579,5	495	30
718/1400-MPB	644	**1 400**	1 700	132	7,5	4	1 589	513	30
719/1400-MPB	1 230	**1 400**	1 820	185	9,5	5	1 670	557	30
718/1500-MPB	782	**1 500**	1 820	140	7,5	4	1 701,6	549	30
719/1500-MP	1 590	**1 500**	1 950	195	9,5	5	1 784	596	30
718/1600-MPB	1 010	**1 600**	1 950	155	7,5	4	1 820,6	590	30
718/1700-MPB	1 130	**1 700**	2 060	160	7,5	4	1 926,5	623	30
718/1800-MPB	1 300	**1 800**	2 180	165	9,5	5	2 040,7	657	30
718/1900-MPB	1 540	**1 900**	2 300	175	9,5	5	2 152,8	694	30
718/2000-MPB	1 830	**2 000**	2 430	190	9,5	5	2 277,5	734	30

[1] With MPB cage.



Mounting dimensions

Mounting dimensions					Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed
d_a min.	D_a max.	D_b max.	r_a max.	r_{a1} max.	dyn. C_r kN	stat. C_{0r} kN	e	X	Y	Y_0	C_{ur} kN	n_G min^{-1}
1 198	1 402	1 411,2	4	2	800	2 550	0,8	0,39	0,76	0,33	40	630
1 203	1 397	1 407,6	5	2,5	1 100	3 600	0,8	0,39	0,76	0,33	56	630
1 208	1 512	1 525,4	6	3	1 340	4 550	0,8	0,39	0,76	0,33	71	600
1 208	1 512	1 525,4	6	3	1 630	5 700	0,8	0,39	0,76	0,33	89	600
1 273	1 477	1 487,6	5	2,5	830	2 750	0,8	0,39	0,76	0,33	42	600
1 273	1 477	1 487,6	5	2,5	1 180	4 000	0,8	0,39	0,76	0,33	61	600
1 278	1 602	1 615,4	6	3	1 500	5 400	0,8	0,39	0,76	0,33	80	560
1 278	1 602	1 615,4	6	3	1 760	6 400	0,8	0,39	0,76	0,33	95	560
1 312,4	1 537,6	1 537,6	2,5	2,5	720	2 320	0,8	0,39	0,76	0,33	35,5	560
1 343	1 577	1 587,6	5	2,5	950	3 250	0,8	0,39	0,76	0,33	49,5	560
1 343	1 577	1 587,6	5	2,5	1 340	4 750	0,8	0,39	0,76	0,33	72	560
1 348	1 692	1 705,4	6	3	1 560	5 700	0,8	0,39	0,76	0,33	84	530
1 348	1 692	1 705,4	6	3	1 900	6 950	0,8	0,39	0,76	0,33	102	530
1 423	1 677	1 687,6	5	2,5	1 100	3 900	0,8	0,39	0,76	0,33	56	530
1 428	1 672	1 685,4	6	3	1 500	5 500	0,8	0,39	0,76	0,33	80	530
1 434	1 786	1 802	8	4	2 040	7 800	0,8	0,39	0,76	0,33	115	530
1 528	1 792	1 805,4	6	3	1 630	6 300	0,8	0,39	0,76	0,33	89	500
1 534	1 916	1 932	8	4	2 320	9 300	0,8	0,39	0,76	0,33	127	500
1 628	1 922	1 935,4	6	3	1 860	7 500	0,8	0,39	0,76	0,33	102	500
1 728	2 032	2 045,4	6	3	1 900	8 000	0,8	0,39	0,76	0,33	102	480
1 834	2 146	2 162	8	4	2 160	9 300	0,8	0,39	0,76	0,33	118	450
1 934	2 266	2 282	8	4	2 280	10 200	0,8	0,39	0,76	0,33	124	430
2 034	2 396	2 412	8	4	2 400	11 000	0,8	0,39	0,76	0,33	131	380



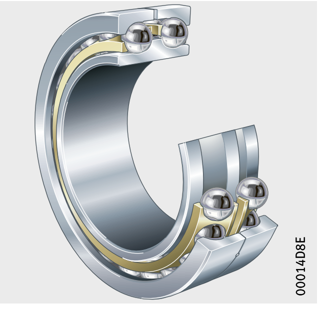
Double row angular contact ball bearings

Double row angular contact ball bearings

Double row

Split outer ring

Z-5..SKL2-01



Split inner ring

Z-5..SKL2-02

Split, extended inner ring

Z-5..SKL2-03

Double row angular contact ball bearings

Features

The double row angular contact ball bearings shown here are self-retaining units with solid inner and outer rings and ball and cage assemblies with cages. Double row angular contact ball bearings are similar in design to a pair of single row angular contact ball bearings in an X arrangement or an O arrangement.

The special bearings with non-standardised main dimensions with the designation Z-5..SKL differ in the design of the bearing rings.

The angular adjustment facility of the double row 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 bearings described here are used as axial bearings.

Bearings with split outer ring

Design 1

- In bearings with a split outer ring and a single-piece inner ring, the rows of balls are in an X arrangement.
- These axial bearings for wire rod roll stands are mounted with radial clearance between the outer ring and chock bore.
  As a result, the angular contact ball bearings support purely axial forces.
- The contact angle $\alpha = 40°$.

Bearings with split inner ring

Design 2

- These bearings with a split inner ring and single-piece outer ring (O arrangement) are also mounted in wire rod roll stands with radial clearance between the outer ring and chock bore.
- The contact angle $\alpha = 40°$.

Bearings with split, extended inner ring

Design 3

- These double row angular contact ball bearings have the same internal construction as the bearings of Design 2. However, the inner rings are wide than the outer ring.
  These bearings are used, for example, as axial bearings for oil film bearings.
- The contact angle $\alpha = 40°$.

Sealing

The double row angular contact ball bearings are not sealed.

Lubrication

The bearings can be lubricated with grease or oil.

Operating temperature

Double row angular contact ball bearings without seals are suitable for operating temperatures from –30 °C to +150 °C.

Cages

The double row angular contact ball bearings have one solid brass cage for each row of balls.

Design and safety guidelines

Equivalent dynamic bearing load

Contact angle 40°

For bearings under dynamic loading, the following applies in the case of pure axial load:

$$P = 0{,}93 \cdot F_a$$

P kN
Equivalent dynamic bearing load
F_a kN
Axial dynamic bearing load.

Equivalent static bearing load

Contact angle 40°

For bearings under static loading, the following applies in the case of pure axial load:

$$P_0 = 0{,}52 \cdot F_{0a}$$

P_0 kN
Equivalent static load
F_{0a} kN
Axial 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, ball bearings with cage must therefore be subjected to a minimum load of the order of $P/C_r > 0{,}01$.

Speeds

For these special bearings, the tables only give limiting speeds n_G.

!

The limiting speed n_G given in the dimension tables must not be exceeded.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The dimension tables give the maximum dimension of the radius r_a and the diameters of the abutment shoulders D_a, d_a.

Accuracy

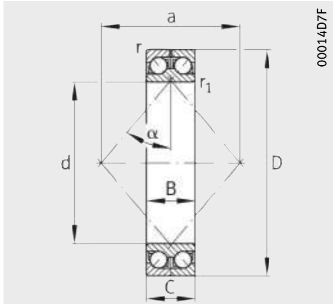
The main dimensions of the bearings are not standardised. The dimensional and running tolerances correspond to tolerance class PN to DIN 620-2 or better. We can provide the tolerances of the individual bearings in response to an enquiry.

Axial internal clearance

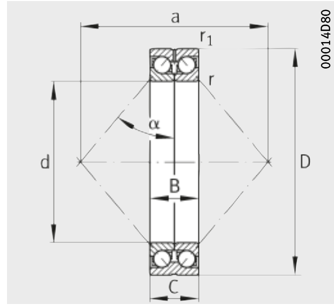
We can provide the axial internal clearance of the double row angular contact ball bearings in response to an enquiry.

Angular contact ball bearings

Double row



Design 1: $\alpha = 40°$

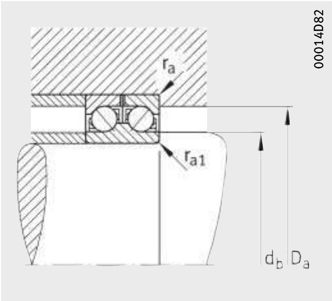


Design 2 and 3: $\alpha = 40°$

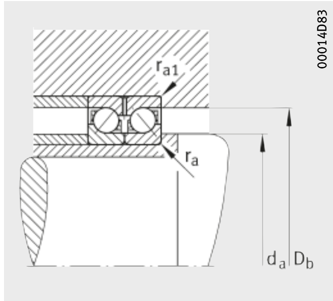
Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions							
		m	d	D	B/C	r	r_1	D_1	d_1	a
		≈kg				min.	min.	≈	≈	≈
Z-508732.01.SKL	2	22	**230**	330	80	2,1	2,1	308,9	271	275
Z-573446.SKL	1	23,9	**230**	330	80	2,1	1,1	308,9	254	195
Z-514481.SKL[1]	3	18,9	**250**	340	76 /70	2,1	1,5	320,5	286	286
Z-508731.01.SKL	2	30,5	**260**	370	92	2,1	2,1	348,5	305	310
Z-505057.SKL	1	61,5	**260**	400	130	4	4	373	290	342
Z-508730.01.SKL	2	32,5	**280**	390	92	2,1	2,1	368,6	324	327

[1] The outer ring is 70 mm wide, the split inner ring is 76 mm wide.



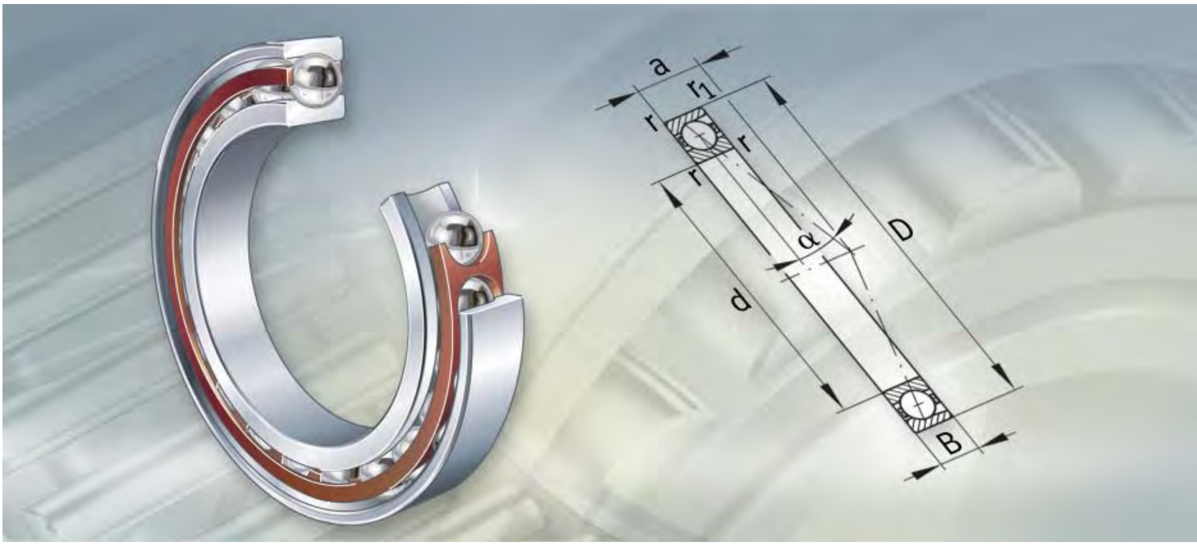
Mounting dimensions
Design 1



Mounting dimensions
Design 2 and 3

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speed
d_a	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
min.	max.	max.	max.	kN	kN	kN	min^{-1}
240	319,5	2,1	2,1	320	530	17,3	1 600
236	319,5	2,1	1	320	530	17,8	1 600
260	333	2,1	1,5	300	510	15,8	1 600
270	359,5	2,1	2,1	390	695	22,2	1 500
277	383	3	3	540	1 020	30	1 400
290	379,5	2,1	2,1	405	750	23,2	1 400

FAG



Spindle bearings

Spindle bearings

Standard spindle bearings

B719, B70, B72

With ceramic balls

HCB719

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 are not separable.

Spindle bearings have restricted tolerances. They are particularly suitable for bearing arrangements with very high requirements for guidance accuracy and high speeds. They have proved extremely suitable for main spindle bearing arrangements in machine tools.

A detailed description of spindle bearings (designs, calculation, lubrication, speeds, fits) is given in Catalogue SP 1, Super Precision Bearings.

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 HCB719 have balls in standard sizes made from ceramic (hybrid bearings).

Sealing

Large spindle bearings are of an open design.

Lubrication

The bearings can be lubricated with grease or oil.

Universal design

Spindle bearings of the universal design can be mounted in any arrangement or combined in various sets without any loss of performance. The position of the contact cone is marked on the cylindrical surface of the outer ring.

Bearings with the suffix UL are designed for slight preload in an X or O arrangement.

! The preload is altered by mounting and the operating conditions.

Ordering data

When ordering, the number of individual bearings must be stated.

Operating temperature

The bearings are suitable for operating temperatures from –30 °C to +100 °C, restricted by the 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 (suffix T). The cage is guided on the outer ring.

Check the chemical resistance of the 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 at high temperatures.

The oil change intervals must be observed.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
C	Contact angle 15°	Standard
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 laminated fabric	
UL	Universal design, for example for mounting in pairs, bearing pair has slight preload in O and X arrangement	

1) For preload values, see Catalogue SP1, Super Precision Bearings.

Design and safety guidelines

Operating life

High precision bearings must guide machine parts with very high precision and support forces at up to very high speeds.

They are selected predominantly from the perspectives of:

- accuracy
- rigidity
- running behaviour.

In order that they can fulfil these tasks for as long as possible, the bearings must run without wear. The precondition for this is the creation of a load-bearing hydrodynamic lubricant film at the contact points of the rolling contact partners.
Under these conditions, rolling bearings will achieve their fatigue life in a large number of applications. If the design is appropriate to the fatigue life, the operating life of the bearing is normally restricted by the lubricant operating life.

The decisive factors for the operating life from the perspective of load are the Hertzian pressures occurring at the contacts and the bearing kinematics. For high performance assemblies, individual design with the aid of special calculation programs is therefore advisable.

Since failure as a result of fatigue plays no part in practice in the case of high precision bearings, calculation of the rating life L_{10} in accordance with DIN ISO 281 is not suitable as a means of determining the operating life.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads. It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies:

Bearings with contact angle 15°

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leq 1{,}09$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 1{,}09$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}46 \cdot F_{0a}$

Bearings with contact angle 25°

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leq 1{,}3$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > 1{,}3$	$P_0 = 0{,}5 \cdot F_{0r} + 0{,}38 \cdot F_{0a}$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
Radial static bearing load.

Static load safety factor

In order to maintain the accuracy of the bearings, a static load safety factor $S_0 > 3$ is required.

$$S_0 = \frac{C_{0r}}{P_0}$$

C_{0r} kN
Basic static load rating, see dimension tables

P_0 kN
Equivalent static load.

If several bearings are present, the external load is distributed over the individual bearings.
In this case, see Catalogue SP 1, Super Precision Bearings.

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.

The speeds stated in the dimension tables are guide values for single bearings under elastic preload and low loads.

The limiting speeds n_G given in the dimension tables are valid for lubrication with grease or for minimal quantity lubrication with oil and must not be exceeded.

For a more detailed description, see Catalogue SP 1, Super Precision Bearings.

Universal bearing sets

Universal bearings of the same sort (same bore and outside diameter) are also available as sets. They can be used as required in an O, X or tandem arrangement, *Figure 1* to *Figure 3*, page 264.

Sets with slight preload have the following designations:

- duplex (2 bearings): suffix DUL
- triplex (3 bearings): suffix TUL
- quadruplex (4 bearings): suffix QUL.

Ordering data

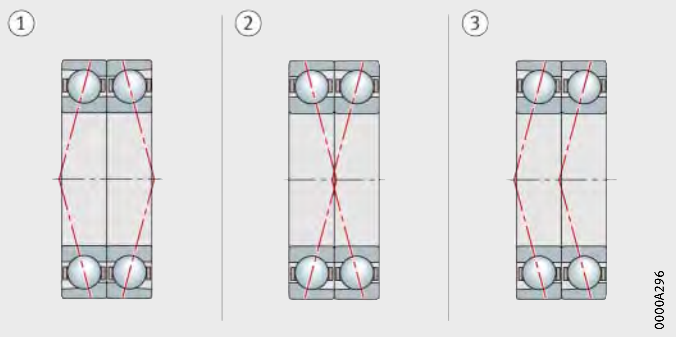
When ordering bearings, the number of sets must be stated, not the number of individual bearings.

Spindle bearings

Ready-to-fit bearing sets

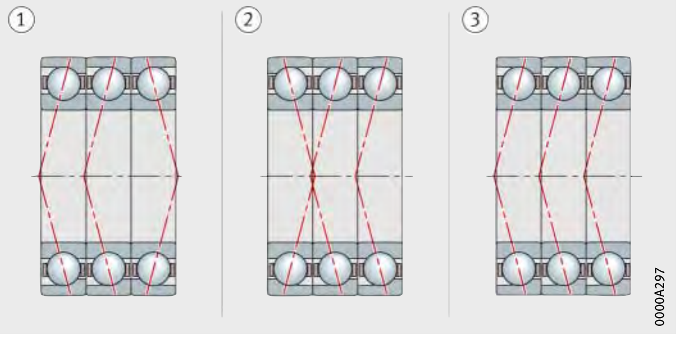
In ready-to-fit bearing sets, the bearings are supplied for use in a specifically defined arrangement.

The bearings must be mounted in the arrangement ordered.



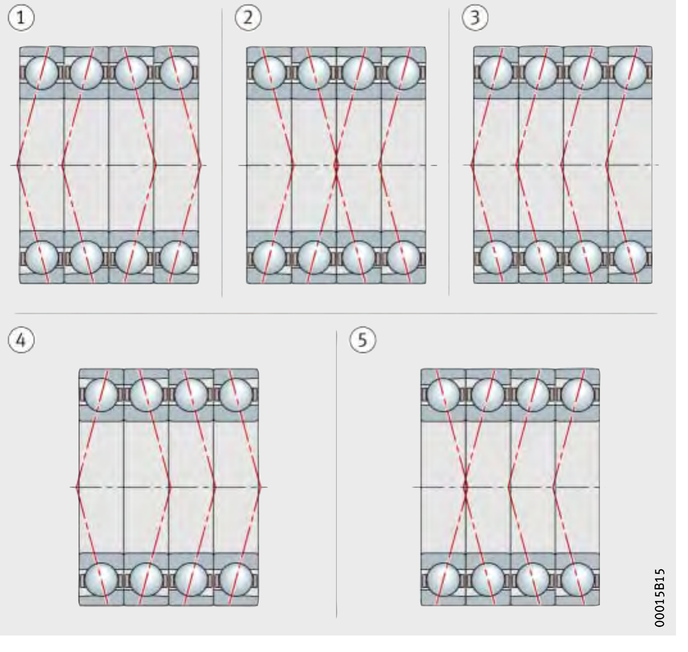
① DBL, O arrangement
② DFL, X arrangement
③ DTL, tandem arrangement

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 B7048-C-T-P4S-DBL
Description: two spindle bearings in O arrangement, slight preload.

Design of bearing arrangements

Shaft and housing tolerances

For spindle bearings, fits are recommended as a function of the speeds, see Catalogue SP 1, Super Precision Bearings.

Mounting dimensions

The bearing tables give the maximum dimensions of the radii r_a and r_{a1} and the diameters of the abutment shoulders D_a and d_a.

Accuracy

The main dimensions of the bearings correspond to DIN 628-1. The dimensional tolerances of the bearings correspond to tolerance class P4, while the running tolerances correspond to tolerance class P2 to DIN 620-2.

The actual value codes 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	Axial runout S_{ia} µm
over	incl.								
150	180	0	–10	0	–250	4	3	4	5
180	250	0	–12	0	–300	5	4	5	5
250	315	0	–15	0	–350	6	5	6	7
315	400	0	–19	0	–400	7	7	7	9
400	500	0	–23	0	–450	8	8	8	11
500	630	0	–26	0	–500	10	9	10	13

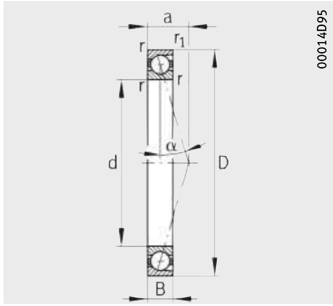
Outer ring tolerances

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	Axial runout S_{ea} µm
over	incl.						
315	400	0	–15	7	8	7	8
400	500	0	–18	7	9	8	10
500	630	0	–22	8	11	9	12
630	800	0	–26	9	13	10	14

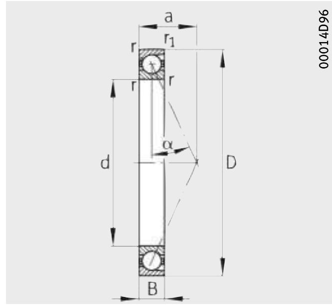
The width deviation Δ_{Cs} is identical to Δ_{Bs} of the corresponding inner ring.

Spindle bearings

With steel balls



B719..-C, B70..-C, B72..-C
α = 15°

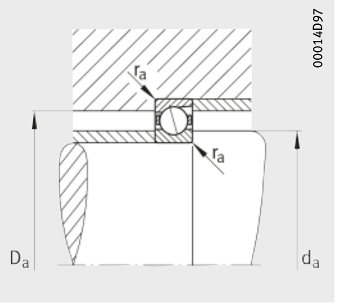


B719..-E, B70..-E, B72..-E
α = 25°

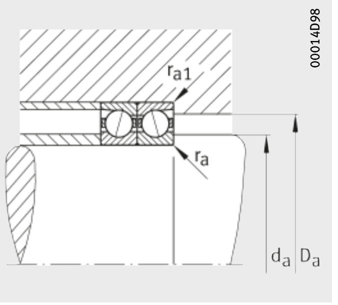
Dimension table · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	r_1	a
	≈kg				min.	min.	≈
B7236-C-T-P4S	16,4	**180**	320	52	4	4	60
B7236-E-T-P4S	16,3	**180**	320	52	4	4	84
B7238-C-T-P4S	20	**190**	340	55	4	4	63
B7238-E-T-P4S	20	**190**	340	55	4	4	89
B7240-C-T-P4S	24,2	**200**	360	58	4	4	67
B7240-E-T-P4S	24,2	**200**	360	58	4	4	94
B7044-C-T-P4S	15,7	**220**	340	56	3	3	66
B7044-E-T-P4S	15,7	**220**	340	56	3	3	93
B7244-C-T-P4S	33,1	**220**	400	65	4	4	74
B7244-E-T-P4S	33,1	**220**	400	65	4	4	105
HCB71948-C-T-P4S1)	5,92	**240**	320	38	2,1	1,1	57
HCB71948-E-T-P4S1)	5,9	**240**	320	38	2,1	1,1	84
B71948-C-T-P4S	7,1	**240**	320	38	2,1	1,1	57
B71948-E-T-P4S	7,08	**240**	320	38	2,1	1,1	84
B7048-C-T-P4S	16,8	**240**	360	56	3	3	68
B7048-E-T-P4S	16,7	**240**	360	56	3	3	98
B71952-C-T-P4S	12	**260**	360	46	2,1	1,1	65
B71952-E-T-P4S	11,9	**260**	360	46	2,1	1,1	95
B71956-C-T-P4S	12,8	**280**	380	46	2,1	1,1	67
B71956-E-T-P4S	12,7	**280**	380	46	2,1	1,1	100
B71960-C-T-P4S	20,1	**300**	420	56	3	1,1	76
B71960-E-T-P4S	20	**300**	420	56	3	1,1	112
B71964-C-T-P4S	21,3	**320**	440	56	3	1,1	79
B71964-E-T-P4S	21,3	**320**	440	56	3	1,1	117
B71968-C-T-P4S	22,4	**340**	460	56	3	1,1	82
B71968-E-T-P4S	22,4	**340**	460	56	3	1,1	121
B71972-C-T-P4S	23,6	**360**	480	56	3	1,1	84
B71972-E-T-P4S	23,6	**360**	480	56	3	1,1	126
B71984-C-T-P4S	36,8	**420**	560	65	4	1,5	98
B71984-E-T-P4S	36,8	**420**	560	65	4	1,5	147
B71992-C-T-P4S	55,1	**460**	620	74	4	1,5	109
B71992-E-T-P4S	55	**460**	620	74	4	1,5	163
B719/500-C-T-P4S	67,9	**500**	670	78	5	2	117
B719/500-E-T-P4S	67,9	**500**	670	78	5	2	175

1) With ceramic balls.

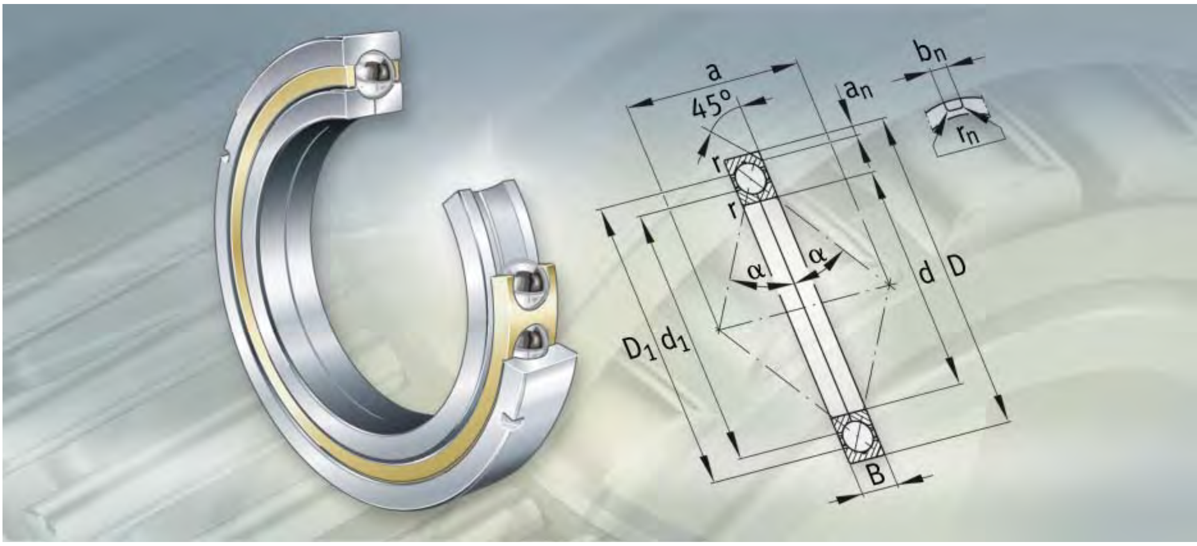


Mounting dimensions



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 kN	stat. C_{0r} kN	C_{ur} kN	n_G grease min^{-1}	n_G oil min^{-1}
213,5	286,5	3	3	305	390	17,6	3 800	5 600
213,5	286,5	3	3	290	365	16,8	3 400	5 000
223,5	306,5	3	3	315	415	18,3	3 400	5 000
223,5	306,5	3	3	300	390	17,4	3 200	4 800
238,5	321,5	3	3	325	440	19	3 200	4 800
238,5	321,5	3	3	310	415	18	3 000	4 500
239	321	2,5	1	325	440	19	3 200	4 800
239	321	2,5	1	310	415	18	3 000	4 500
264	356	3	3	400	560	23,2	2 800	4 300
264	356	3	3	380	540	22,1	2 600	4 000
254	307	1	1	154	215	9,6	4 000	6 000
254	307	1	1	145	200	9	3 600	5 300
254	307	1	1	224	310	13,5	3 200	4 800
254	307	1	1	212	285	12,8	3 000	4 500
260	341	2,5	1	335	465	19,5	3 000	4 500
260	341	2,5	1	315	440	18,5	2 800	4 300
278	342	2,1	1	285	415	17,1	2 800	4 300
278	342	2,1	1	270	390	16,2	2 600	4 000
298	362	2,1	1	300	450	18	2 600	4 000
298	362	2,1	1	280	425	17	2 400	3 800
322	398	1,5	1	360	570	21,8	2 400	3 800
322	398	1,5	1	340	540	20,7	2 200	3 600
342	418	1,5	1	375	620	23,1	2 200	3 600
342	418	1,5	1	355	585	21,9	2 000	3 400
362	438	1,5	1	380	640	23,6	2 200	3 600
362	438	1,5	1	360	610	17,9	1 900	3 200
382	458	1,5	1	390	695	24,8	2 000	3 400
382	458	1,5	1	375	640	23,4	1 800	3 000
444	536	1,5	1	510	980	32,5	1 700	2 800
444	536	1,5	1	475	915	30,5	1 500	2 400
493	587	1,5	1	530	1 080	34,5	1 500	2 400
493	587	1,5	1	500	1 000	32,5	1 400	2 200
538	632	2,5	1	550	1 160	36,5	1 400	2 200
538	632	2,5	1	520	1 080	34,5	1 200	1 900



Four point contact bearings

Four point contact bearings

With retaining slots

QJ2..-N2, QJ3..-N2,
QJ10..-N2, QJ19..-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 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 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.

Four point contact bearings

Sealing

Four point contact bearings are of an open design.

Lubrication

They are not greased and can be lubricated with grease or oil.

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.

Cages

Four point contact bearings with brass cages have the suffix MPA. These window cages are guided on the outer ring.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
C3	Axial internal clearance larger than normal	Special design, available by agreement only
MPA	Solid brass cage	Standard
N2	Two retaining slots in outer ring	

Design and safety guidelines

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies:

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic bearing 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 kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads.
It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies:

$$P_0 = F_{0r} + 0,58 \cdot F_{0a}$$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
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 elements 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.

Four point contact bearings

Speeds

High speeds can be achieved if four point contact bearings are subjected to purely axial load.

ISO 15 312 does not give thermal reference speeds for these bearings.

The dimension tables therefore only state the limiting speeds n_G. These values are for oil lubrication and must not be exceeded. If higher speeds are required, please contact us.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The dimension tables give the maximum dimension of the radius r_a and the diameters of the abutment shoulders D_a and d_a.

Accuracy

The main dimensions of the bearings correspond to DIN 628-4.

The dimensional and running tolerances correspond to tolerance class PN to DIN 620-2.

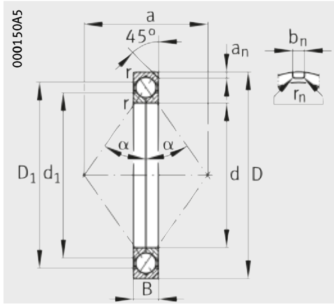
Axial internal clearance

The axial internal clearance corresponds to internal clearance group CN to DIN 628-4.

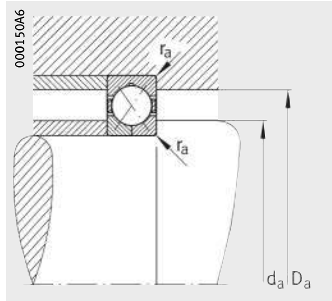
Axial internal clearance

Bore		Axial internal clearance							
d mm		C2 μm		CN μm		C3 μm		C4 μm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
140	180	90	155	135	200	185	250	235	300
180	220	105	175	155	225	210	280	260	330
220	260	120	195	175	250	230	305	290	360
260	300	140	220	200	280	260	340	320	400
300	355	160	240	220	300	280	360	–	–
355	400	180	270	250	330	310	390	–	–
400	450	200	290	270	360	340	430	–	–
450	500	220	310	290	390	370	470	–	–
500	560	240	330	310	420	400	510	–	–

Four point contact bearings



N2, two retaining slots
$\alpha = 35°$

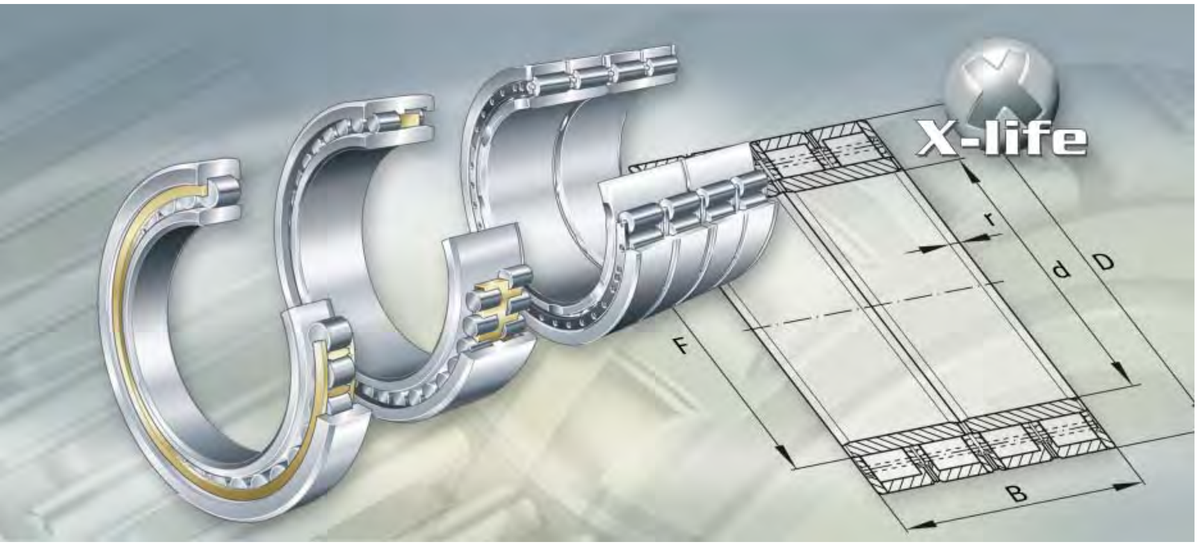


Mounting dimensions

Dimension table · Dimensions in mm

Designation	Mass	Dimensions									
	m	d	D	B	r	D_1	d_1	a	a_n	b_n	r_n
	≈kg				min.	≈	≈	≈			
QJ330-N2-MPA	28	**150**	320	65	4	261	211,3	165	12,7	10,5	2
QJ332-N2-MPA	32,8	**160**	340	68	4	279,9	222,7	175	12,7	10,5	2
QJ334-N2-MPA	38,4	**170**	360	72	4	292	238	186	12,7	10,5	2
QJ236-N2-MPA	19,6	**180**	320	52	4	269	231	175	12,7	10,5	2
QJ336-N2-MPA	44,9	**180**	380	75	4	311	249,1	196	12,7	10,5	2
QJ238-N2-MPA	23,8	**190**	340	55	4	286,3	245,8	186	12,7	10,5	2
QJ338-N2-MPA	52,1	**190**	400	78	5	327	262,5	207	12,7	10,5	2
QJ240-N2-MPA	28	**200**	360	58	4	302	258,6	196	12,7	10,5	2
QJ340-N2-MPA	58,3	**200**	420	80	5	343,5	276,5	217	15	12,5	2,5
QJ1044-N2-MPA	19,5	**220**	340	56	3	298,5	261,4	196	12,7	10,5	2
QJ244-N2-MPA	38,6	**220**	400	65	4	336	284,6	217	12,7	10,5	2
QJ344-N2-MPA	77,1	**220**	460	88	5	378	302	238	15	12,5	2,5
QJ1048-N2-MPA	21,7	**240**	360	56	3	319,6	282,3	210	12,7	10,5	2
QJ248-N2-MPA	53,1	**240**	440	72	4	367	312,5	238	15	12,5	2,5
QJ348-N2-MPA	98,2	**240**	500	95	5	410	330,7	259	15	12,5	2,5
QJ1052-N2-MPA	32,3	**260**	400	65	4	353	309,3	231	12,7	10,5	2
QJ1056-N2-MPA	34,3	**280**	420	65	4	373	329,3	245	15	12,5	2,5
QJ1060-N2-MPA	48,4	**300**	460	74	4	406	356,6	266	15	12,5	2,5
QJ260-N2-MPA	92,4	**300**	540	85	5	455,8	387,3	294	20	15,5	3
QJ1064-N2-MPA	50,7	**320**	480	74	4	424	375,8	280	15	12,5	2,5
QJ264-N2-MPA	119	**320**	580	92	5	486,5	413,3	315	20	15,5	3
QJ272-N2-MPA	155	**360**	650	95	6	543	466,5	354	25	20,5	3
QJ1076-N2-MPA	74,6	**380**	560	82	5	497	443	329	15	12,5	2,5
QJ1984-N2-MPA	48	**420**	560	65	4	512,2	469,2	343	15	12,5	2,5
QJ1084-N2-MPA	103	**420**	620	90	5	550,2	489,8	364	15	12,5	2,5
QJ284-N2-MPA	192	**420**	760	109	7,5	637,8	546,3	413	25	20,5	3
QJ1988-N2-MPA	66,4	**440**	600	74	4	545,6	497	364	15	12,5	2,5
QJ1088-N2-MPA	115	**440**	650	94	6	579,1	514,3	382	20	15,5	3
QJ1992-N2-MPA	68,1	**460**	620	74	4	565,6	517	378	15	12,5	2,5
QJ1096-N2-MPA	139	**480**	700	100	6	625,8	557,7	413	20	15,5	3
QJ10/560-N2-MPA	222	**560**	820	115	6	731	652	483	25	20,5	3

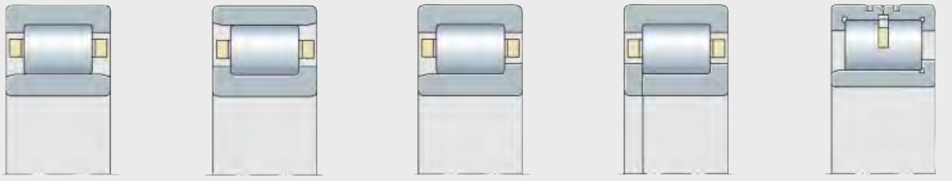
Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
min.	max.	max.	kN	kN	kN	min^{-1}
167	303	3	510	735	25,5	3 800
177	323	3	585	865	29,5	3 600
187	343	3	585	915	24,9	3 200
197	303	3	430	670	18,9	3 600
197	363	3	680	1 080	33	3 000
207	323	3	455	735	24,4	3 200
210	380	4	735	1 250	37	2 800
217	343	3	510	850	22,6	3 000
220	400	4	750	1 270	37	2 800
232,4	327,6	2,5	440	750	22,2	3 000
237	383	3	630	1 120	31	2 800
240	440	4	900	1 660	44,5	2 800
252	348	2,5	450	780	25	2 800
257	423	3	680	1 270	30,5	2 800
260	480	4	1 020	1 960	52	2 600
275	385	3	550	1 020	30,5	2 800
294,6	405,4	3	560	1 080	31,5	2 600
314,6	445,4	3	630	1 250	34	2 400
320	520	4	915	1 930	52	2 200
334,6	465,4	3	640	1 320	33	2 400
340	560	4	1 040	2 320	54	1 900
386	624	5	1 140	2 700	60	1 600
398	542	4	780	1 800	42	1 900
434,6	545,4	3	620	1 400	34	1 800
438	602	4	900	2 160	48	1 600
452	728	6	1 430	3 650	82	1 400
454,6	585,4	3	735	1 760	41,5	1 600
463	627	5	965	2 400	55	1 500
474,6	605,4	3	750	1 800	42	1 500
503	677	5	1 060	2 750	60	1 400
583	797	5	1 320	3 750	77	1 200



Cylindrical roller bearings

Single row, with cage
Double row, with cage
Four-row, with cage
Full complement
Self-aligning
Split

Cylindrical roller bearings

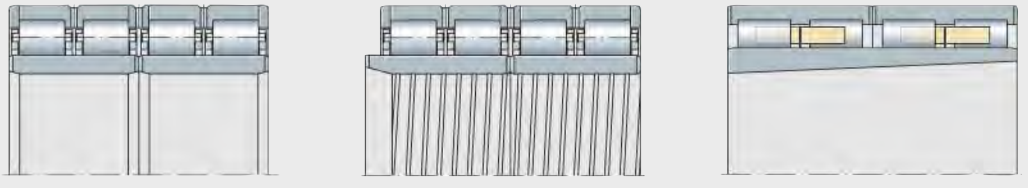


NU | N | NJ | NUP | LSL1923

00014DFF

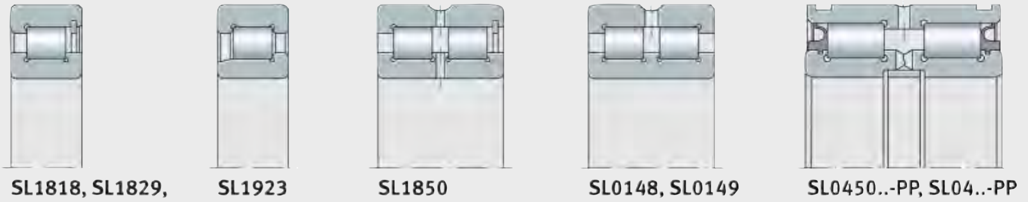
NNU40, NNU48, NNU49 | NNU41 | Z-5..ZL2-01 | NN30..-AS-K-M-SP | NNU49..-S-K-M-SP

00014E00



Z-5..ZL4-01, F-8..ZL4-01 | Z-5..ZL4-02, F-8..ZL4-02 | Z-5..ZL4-03, F-8..ZL4-03

00014E01

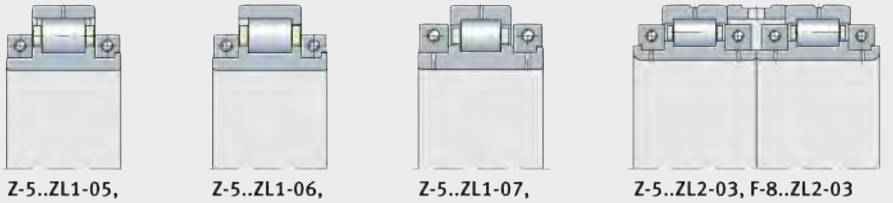


SL1818, SL1829, SL1830, SL1822 | SL1923 | SL1850 | SL0148, SL0149 | SL0450..-PP, SL04..-PP

00014E02

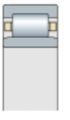
Z-5..ZL2-02, F-8..ZL2-02

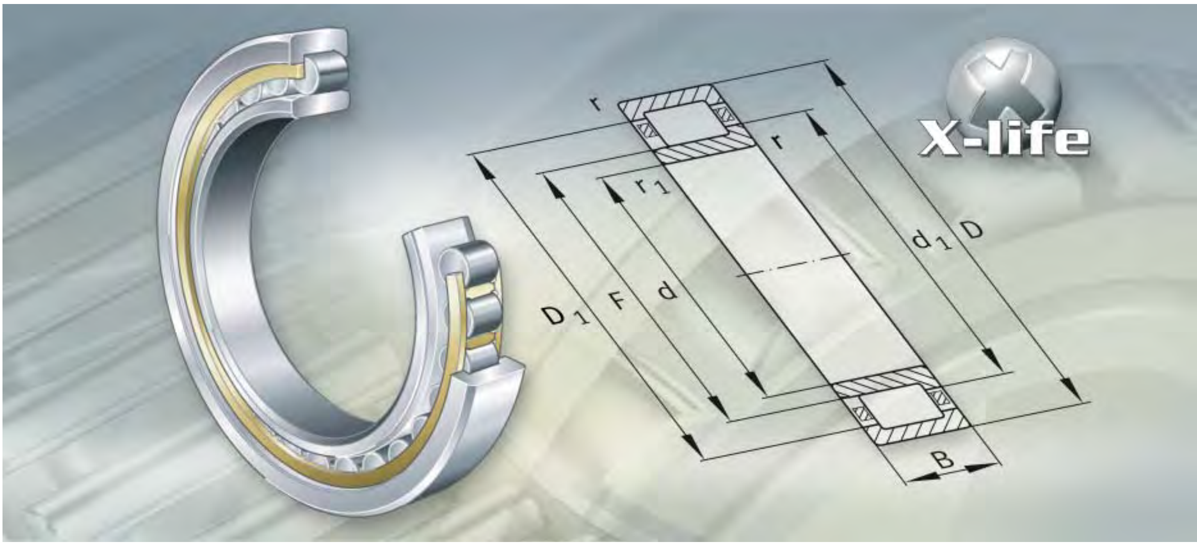
00014E03



Z-5..ZL1-05, F-8..ZL1-05 | Z-5..ZL1-06, F-8..ZL1-06 | Z-5..ZL1-07, F-8..ZL1-07 | Z-5..ZL2-03, F-8..ZL2-03

00014E04





Single row cylindrical roller bearings with cage

Single row cylindrical roller bearings with cage

Product overview Single row cylindrical roller bearings with cage

Non-locating bearings

With cylindrical bore

NU10, NU12, NU18, NU19, NU28, NU29, NU30, NU31, NU38, NU39..-E, NU4, NU2..-E, NU3..-E, NU20..-E, NU22..-E, NU23..-E, Z-5..ZL1-01, F-8..ZL1-01


00014DF0

N2..-E, N3..-E, N10, N18, N28, N29, N4, Z-5..ZL1-02, F-8..ZL1-02


00014DF5

With tapered bore

NU10..-K, NU30..-K


00014DF1

N10..-K-M1-SP, N19..-K-M1-SP


00014DF6

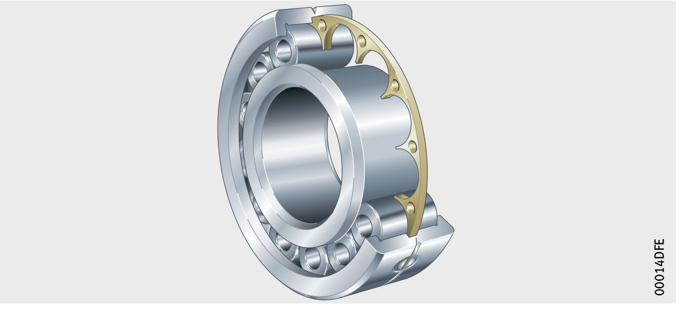
Semi-locating bearings

With cage

NJ2..-E, NJ3..-E, NJ22..-E, NJ23..-E, NJ4, NJ10, NJ18, NJ19, NJ28, NJ29, Z-5..ZL1-03, F-8..ZL1-03

With disc cage

LSL1923



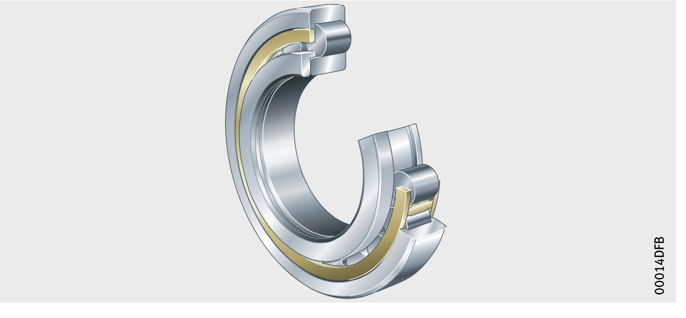
Locating bearings

With rib washer

NUP2..-E, NUP3..-E, NUP20..-E, NUP22..-E, NUP23..-E, NUP10, NUP18, NUP19, NUP28, NUP29, NUP4, Z-5..ZL1-04, F-8..ZL1-04

With L-section ring

NJ2..-E + HJ, NJ3..-E + HJ, NJ22..-E + HJ, NJ23..-E + HJ, NJ4 + HJ, NJ10 + HJ, NJ18 + HJ, NJ19 + HJ, NJ28 + HJ, NJ29 + HJ



Single row 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 than 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 mount and dismount. As a result, both bearing rings can be given a tight fit.

Single row cylindrical roller bearings with cage are available as non-locating, semi-locating and locating bearings.

X-life

Some sizes are supplied in the X-life design. These bearings are indicated in the dimension tables. Bearings of X-life quality have, for example, a lower roughness R_a and a better 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 rating life for the same dimensioning. In certain applications, this means that a smaller bearing arrangement can be designed where necessary.

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.

Special bearings with cylindrical bore

In addition to cylindrical roller bearings with standardised designations and main dimensions, we also supply special bearings. Special bearings of the type NU (Z-5..ZL1-01) are used, for example, in drilling rig equipment. They have chamfers on the inner ring bore and, in some cases, inch dimensions.

Special bearings for high speed tubular stranding machines are of the type N (Z-5..ZL1-02 or F-8..ZL1-02) and have a lubrication groove and three lubrication holes in the outer ring. The robust solid brass cage is guided on the inner ring. In order to reduce the inertia forces, the bearings contain only half as many rollers as normal bearings of the same size. Their load carrying capacity is, however, sufficient for the application. Large bearings have threaded holes for the location of eye bolts for mounting. The bearings for high speed tubular stranding machines have metric main dimensions.

Super precision bearings with tapered bore

Single row cylindrical roller bearings of series N10..-K-M1-SP and N19..-K-M1-SP are super precision bearings for machine tools.
In the case of bearings with a tapered bearing bore (taper 1:12), the radial internal clearance or preload can be set to an optimum value. These bearings are characterised by their high load carrying capacity, high rigidity and excellent accuracy.

Axial displacement

The outer and inner ring can be axially displaced relative to each other from the central position by the value “s”.

Semi-locating bearings

Cylindrical roller bearings NJ and bearings with disc cage LSL1923 are semi-locating bearings. Semi-locating bearings can support axial forces in one direction as well as high radial forces and can thus 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.

Bearings with disc cage

Since they have a larger number of rolling elements and larger rolling elements, bearings of series LSL 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.

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. They must not be installed with two L-section rings (due to the risk of jamming).

Axial displacement

The outer and inner ring can be axially displaced relative to each other in one direction by the value “s”.

Locating bearings

Cylindrical roller bearings NUP and NJ with HJ are locating bearings. Locating bearings can support axial forces in both directions as well as high radial forces and can thus guide shafts axially in both directions.

Bearings with rib washer

The design 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.

Single row cylindrical roller bearings with cage

Bearings with L-section ring

Semi-locating bearings NJ can be combined with an L-section ring HJ to form a locating bearing unit. This design has two ribs on the outer ring, one rib on the inner ring and additionally 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 bearings of series NUP bearings with a loose rib washer is too small to provide a sufficiently high bearing seat. In some applications, they also make it easier to mount and dismount the bearings.

Sealing

The bearings are supplied without seals.

Lubrication

The bearings can be lubricated from the end faces using grease or oil.

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.

Cages

The suffix M1 indicates standard bearings with roller-guided brass cages. Further cage suffixes: see table, page 289.
Please contact us for information on the cage designs for special bearings.

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.

Suffixes

Suffixes for available designs of standard bearings: see table.

Available designs

Suffix[1]	Description	Design
C3	Radial internal clearance larger than normal	Special design, available by agreement only
C4	Radial internal clearance larger than C3	
E	Increased capacity design	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)	
K	Tapered bore, taper 1:12	
M	Solid brass cage, two-piece, roller-guided	Special design, available by agreement only
MA	Solid brass cage, rib-guided on outer ring	
MPA	Solid brass window cage, rib-guided on outer ring	
MP1A	Solid brass cage, single-piece, rib-guided on outer ring	
MP1B	Solid brass cage, single-piece, rib-guided on inner ring	
M1	Solid brass cage, roller-guided	Standard
M1A	Solid brass cage, two-piece, rib-guided on outer ring	Special design, available by agreement only
M1B	Solid brass cage, two-piece, rib-guided on inner ring	
SP	Tolerance class SP	Standard

[1] In the case of non-standardised cylindrical roller bearings, the design (for example radial internal clearance, cage, accuracy) is specified in the designation (Z-5 or F-8). In the case of these bearings, additional suffixes are only used for deviations from the original design.

Single row cylindrical roller bearings with cage

Design and safety guidelines

Permissible skewing

There is no significant reduction in rating life if the misalignment of the inner ring relative to the outer ring does not exceed the following values:

- 4′ in bearings of series 10, 12, 18, 19, 2, 3, 4
- 3′ in bearings of series 20, 22, 23, 28, 29, 30, 31, 38, 39.

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
- tilting of the bearing.

Ribs subjected to load must be supported across their entire height.

The permissible axial load $F_{a\ per}$ must not be exceeded, in order to avoid an unacceptable increase in temperature.

The axial limiting load $F_{a\ max}$ must not be exceeded, in order to avoid impermissible pressures at the contact surfaces.

The ratio F_a/F_r must not exceed the value 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 as a function of the lubrication method, see table, page 291

k_B –
Factor as a function of the bearing series, see table Bearing factor k_B, page 291

d_M mm
Mean bearing diameter (d + D)/2, see dimension table

n min^{-1}
Operating speed.

Factor k_S for the 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 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	Factor k_B
NJ2..-E, NJ22..-E, NUP2..-E, NUP22..-E	15
NJ3..-E, NJ23..-E, NUP3..-E, NUP23..-E	20
NJ4	22

Skewing of the bearing, for example due to shaft deflection, can lead to alternating stresses on the inner ring ribs.
In this case, the axial load must be restricted to F_{as} for bearing tilting of up to max. 2 angular minutes.

$$F_{as} = 20 \cdot d_M{}^{1,42}$$

If even greater tilting is present, special strength analysis is required.

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\,min} = C_{0r}/60$ is necessary.

If $F_{r\,min} < C_{0r}/60$, please contact us.

Single row cylindrical roller bearings with cage

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 load ratio must be taken into consideration.

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic bearing load
$\frac{F_a}{F_r} \leq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = 0{,}92 \cdot F_r + Y \cdot F_a$

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, Y –
Factors, see table.

Factors e and Y

Series	Calculation factors	
	e	Y
NJ2, NUP2, NJ3, NUP3, NJ4	0,2	0,6
NJ22, NUP22, NJ23, NUP23, LSL1923	0,3	0,4

Operating life of high precision bearings

High precision bearings must guide machine parts with high precision and support forces at up to very high speeds.

They are selected predominantly from the perspectives of:

- accuracy
- rigidity
- running behaviour.

In order that they can fulfil these tasks for as long as possible, the bearings must run without wear. The precondition for this is the creation of a load-bearing hydrodynamic lubricant film at the contact points of the rolling contact partners.
Under these conditions, rolling bearings will achieve their fatigue life in a large number of applications. If the design is appropriate to the fatigue life, the operating life of the bearing is normally restricted by the lubricant operating life.

The decisive factors for the operating life from the perspective of load are the Hertzian pressures occurring at the contacts and the bearing kinematics. For high performance assemblies, individual design with the aid of special calculation programs is therefore advisable.

Since failure as a result of fatigue plays no part in practice in the case of high precision bearings, calculation of the rating life L_{10} in accordance with DIN ISO 281 is not suitable as a means of determining the operating life.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0 kN
Equivalent static bearing load

F_{0r} kN
Radial static bearing load.

Static load safety factor of high precision bearings

$$S_0 = \frac{C_{0r}}{P_0}$$

S_0 –
Static load safety factor

C_{0r} kN
Basic static load rating, see dimension tables

P_0 kN
Equivalent static bearing load.

In order to achieve sufficiently smooth running, the static load safety factor for high precision bearings should be $S_0 > 3$.

Single row cylindrical roller bearings with cage

Speeds of high precision bearings

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

The limiting speeds n_G given in the dimension tables for high precision bearings are valid for lubrication with grease or for minimal quantity lubrication with oil and must not be exceeded.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Recommendations for machining of the tapered shaft and housing for high precision bearings, see table, page 398.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by force locking or form fit.

The abutment shoulders (shaft and housing) should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seating point to the abutment shoulder must be designed with rounding to DIN 5418 or an undercut to DIN 509. The minimum values for the chamfer dimensions r in the dimension tables must be observed.

In the case of semi-locating bearings, the bearing rings only require support on one side, on the rib supporting the axial load.

Full support must be provided for ribs transmitting forces in axially loaded bearings.

Accuracy

The dimensional and running tolerances of the bearings with cylindrical bore correspond to tolerance class PN to DIN 620.

Special bearings for tubular stranding machines running at high speeds have increased accuracy to tolerance class P6 or P5.

Super precision bearings with a tapered bore correspond to the more stringent tolerance class SP.

Width tolerances SP

Bore d mm		Width deviation (in relation to bore) Δ_{Bs} µm		Width variation V_{Bs} µm
over	incl.	max.	min.	
180	250	0	−300	5
250	315	0	−350	6
315	400	0	−400	7
400	500	0	−450	8

Inner ring tolerances SP

Bore d mm		Bore deviation Δ_{dmp} µm		Bore deviation $\Delta_{d1\,mp} - \Delta_{dmp}$ µm		Variation V_{dp} µm	Radial runout K_{ia} µm	Axial runout S_d µm	Axial runout S_{ia} µm
over	incl.								
180	250	30	0	9	0	8	8	6	8
250	315	35	0	11	0	9	9	7	10
315	400	40	0	12	0	12	10	9	12
400	500	45	0	14	0	14	12	11	15

Outer ring tolerances SP

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.						
250	315	0	−18	9	11	8	10
315	400	0	−20	10	13	10	13
400	500	0	−23	12	15	11	15
500	630	0	−28	14	17	13	18
630	800	0	−35	18	20	15	22

Single row cylindrical roller bearings with cage

Radial internal clearance

The radial internal clearance of bearings with a cylindrical bore normally corresponds to internal clearance group CN to DIN 620-4. This also applies to special cylindrical roller bearings for stranding machines.

Radial internal clearance (cylindrical bore)

Bore d mm		Radial internal clearance					
		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.
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
710	800	310	470	470	630	630	790
800	900	350	520	520	690	690	860
900	1 000	390	580	580	770	770	960
1 000	1 120	430	640	640	850	850	1 060
1 120	1 250	470	710	710	950	950	1 190
1 250	1 400	530	790	790	1 050	1 050	1 310
1 400	1 600	610	890	890	1 170	1 170	1 450
1 600	1 800	700	1 020	1 020	1 340	1 340	1 660
1 800	2 000	760	1 120	1 120	1 480	1 480	1 840

Bearings with a tapered bore frequently have a radial internal clearance C3 or C4 to DIN 620-4.

Radial internal clearance (tapered bore)

Bore d mm		Radial internal clearance					
		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.
200	225	155	215	200	260	245	305
225	250	170	235	220	285	270	335
250	280	185	255	240	310	295	365
280	315	205	280	265	340	325	400
315	355	225	305	290	370	355	435
355	400	255	345	330	420	405	495
400	450	285	385	370	470	455	555
450	500	315	425	410	520	505	615
500	560	350	470	455	575	560	680

Radial internal clearance of high precision bearings

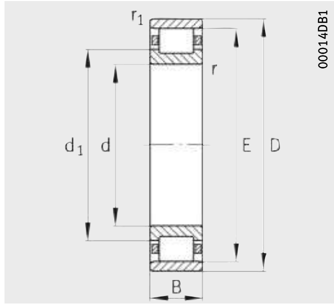
The radial internal clearance of high precision bearings is smaller than the normal internal clearance and corresponds to internal clearance group C1NA.
The internal clearance is not stated in the designation.
The bearing rings are not interchangeable.

Radial internal clearance C1NA (tapered bore)

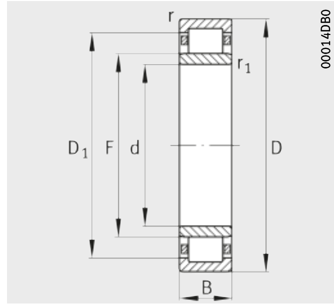
Bore d mm		Radial internal clearance C1NA μm	
over	incl.	min.	max.
225	250	65	100
250	280	75	110
280	315	80	120
315	355	90	135
355	400	100	150
400	450	110	170
450	500	120	190

Cylindrical roller bearings with cage

Single row
Non-locating bearings



Design 1
N

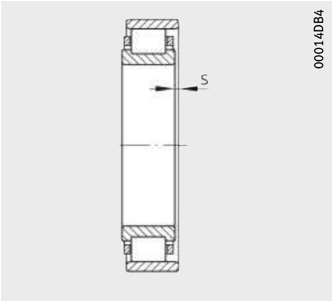


Design 3
NU

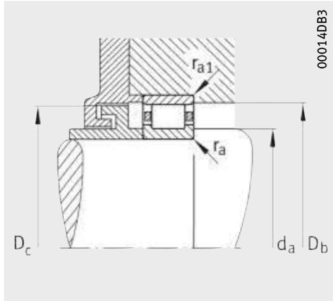
Dimension table · Dimensions in mm

Designation	X-life	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[2)]	E	F	D_1 ≈	d_1 ≈
N426-M1	–	1	40,1	**130**	340	78	5	5	6,2	285	–	–	204,2
NU426-M1	–	3	40,6	**130**	340	78	5	5	6,2	285	185	265,9	–
N428-M1	–	1	46,9	**140**	360	82	5	5	7,6	302	–	–	218,2
NU428-M1	–	3	47,4	**140**	360	82	5	5	7,6	302	198	282,9	–
N330-E-M1	**XL**	1	26,9	**150**	320	65	4	4	5,5	283	–	–	209,5
NU330-E-M1	**XL**	3	27	**150**	320	65	4	4	5,5	283	193	269,8	–
NU330-E-M1A	**XL**	3	27	**150**	320	65	4	4	5,5	283	193	269,8	–
NU330-E-MP1A	**XL**	3	26,5	**150**	320	65	4	4	5,5	283	193	269,8	–
NU330-E-MPA	**XL**	3	27,9	**150**	320	65	4	4	5,5	283	193	269,8	–
NU330-E-N-M1	**XL**	3[1)]	27	**150**	320	65	4	4	5,5	283	193	269,8	–
N2330-E-M1	**XL**	1	43,3	**150**	320	108	4	4	9,7	283	–	–	209,5
N2330-E-MP1B	**XL**	1	42,4	**150**	320	108	4	4	9,7	283	–	–	209,5
NU2330-E-M1	**XL**	3	43,4	**150**	320	108	4	4	9,7	283	193	269,8	–
N430-M1	–	1	53,9	**150**	380	85	5	5	8,1	317	–	–	233,2
NU430-M1	–	3	54,4	**150**	380	85	5	5	8,1	317	213	297,9	–
N332-E-M1	–	1	32,6	**160**	340	68	4	4	5,5	300	–	–	221,6
NU332-E-M1	–	3	31,8	**160**	340	68	4	4	5,6	300	204	286	–
NU332-E-M1A	–	3	31,8	**160**	340	68	4	4	5,6	300	204	286	–
NU332-E-MP1A	–	3	32	**160**	340	68	4	4	5,6	300	204	286	–
N2332-E-M1	–	1	51,4	**160**	340	114	4	4	9,9	300	–	–	221,6
N2332-E-M1B	–	1	51,8	**160**	340	114	4	4	9,9	300	–	–	221,6
NU2332-E-M1	–	3	51,5	**160**	340	114	4	4	9,9	300	204	286	–
N432-M1	–	1	61,5	**160**	400	88	5	5	8,3	334	–	–	247,2
NU432-M1	–	3	61,9	**160**	400	88	5	5	8,3	334	226	314,9	–
NU334-E-MPA	–	3	38,4	**170**	360	72	4	4	6	318	218	301,6	–
N334-E-M1	–	1	37,9	**170**	360	72	4	4	5,9	318	–	–	237
NU334-E-M1	–	3	38	**170**	360	72	4	4	6	318	218	301,6	–
N2334-EX-M1	–	1	61	**170**	360	120	4	4	10,2	320	–	–	235,7
N2334-EX-MP1B	–	1	59,9	**170**	360	120	4	4	10,2	320	–	–	235,7
NU2334-EX-M1	–	3	61,4	**170**	360	120	4	4	10,2	320	216	303	–
N434-M1	–	1	70,4	**170**	420	92	5	5	8,7	351	–	–	261,2
NU434-M1	–	3	71,1	**170**	420	92	5	5	8,7	351	239	329,9	–

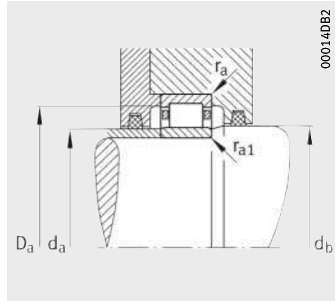
1) With retaining slot in outer ring.



2) Axial displacement “s” for N and NU



Mounting dimensions for N

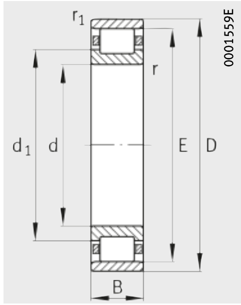


Mounting dimensions for NU

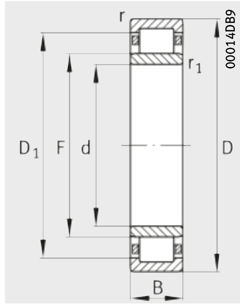
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
154	–	–	316	287	283	4	4	865	1 020	114	3 200	1 900
154	183	187	316	–	–	4	4	865	1 020	95	3 200	1 900
164	–	–	336	304	300	4	4	930	1 120	123	3 000	1 800
164	195	200	336	–	–	4	4	930	1 120	103	3 000	1 800
167	–	–	303	285	281	3	3	900	930	126	3 600	1 940
167	190	195	303	–	–	3	3	900	930	103	3 600	1 940
167	190	195	303	–	–	3	3	900	930	103	3 600	1 940
167	190	195	303	–	–	3	3	900	930	93	3 600	2 000
167	190	195	303	–	–	3	3	900	930	103	3 600	1 940
167	190	195	303	–	–	3	3	900	930	103	3 600	2 000
167	–	–	303	285	281	3	3	1 380	1 600	226	3 200	1 500
167	–	–	303	285	281	3	3	1 380	1 600	226	3 200	1 500
167	190	195	303	–	–	3	3	1 380	1 600	226	3 200	1 460
174	–	–	356	319	315	4	4	980	1 220	132	2 800	1 600
174	210	216	356	–	–	4	4	980	1 220	111	2 800	1 600
177	–	–	323	302	298	3	3	865	1 060	114	3 000	1 770
177	200	211	323	–	–	3	3	865	1 060	96	3 000	1 770
177	200	211	323	–	–	3	3	865	1 060	96	3 000	1 770
177	200	211	323	–	–	3	3	865	1 060	81	3 000	1 800
177	–	–	323	302	298	3	3	1 320	1 830	204	3 000	1 300
177	–	–	323	302	298	3	3	1 320	1 830	204	3 000	1 300
177	200	211	323	–	–	3	3	1 320	1 830	204	3 000	1 340
184	–	–	376	336	332	4	4	1 060	1 320	142	2 800	1 500
184	223	230	376	–	–	4	4	1 060	1 320	118	2 800	1 500
187	215	221	343	–	–	3	3	915	1 140	98	3 000	1 670
187	–	–	343	320	316	3	3	965	1 220	132	3 000	1 610
187	215	221	343	–	–	3	3	965	1 220	105	3 000	1 610
187	–	–	343	322	318	3	3	1 500	2 080	231	2 800	1 200
187	–	–	343	322	318	3	3	1 500	2 080	231	2 800	1 200
187	214	218	343	–	–	3	3	1 500	2 080	231	2 800	1 210
194	–	–	396	353	349	4	4	1 120	1 400	151	2 800	1 500
194	236	243	396	–	–	4	4	1 120	1 400	126	2 800	1 500

Cylindrical roller bearings with cage

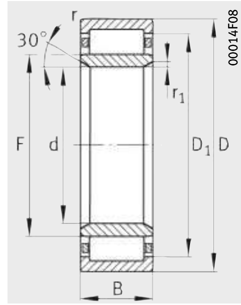
Single row
Non-locating
bearings



Design 1
N



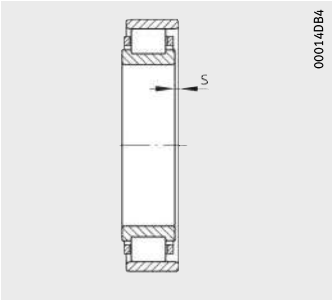
Design 3
NU



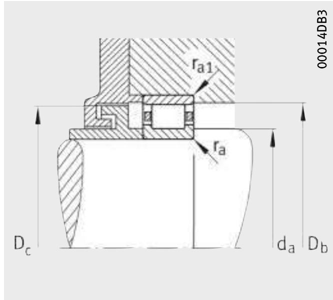
Design 4
NU

Dimension table (continued) · Dimensions in mm

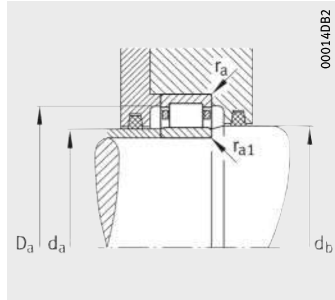
Designation	X-life	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[1)]	E	F	D_1 ≈	d_1 ≈
N236-E-M1	**XL**	1	18,9	**180**	320	52	4	4	4,7	289	–	–	230,2
NU236-E-M1	**XL**	3	18,9	**180**	320	52	4	4	4,7	289	217	278,6	–
NU236-E-M1A	**XL**	3	18,9	**180**	320	52	4	4	4,7	289	217	278,6	–
NU236-E-MP1A	**XL**	3	18,9	**180**	320	52	4	4	4,7	289	217	278,6	–
NU1236-M1	–	3	22,2	**180**	320	62	4	4	4,7	293	213	279,8	–
NU2236-E-M1	**XL**	3	30,7	**180**	320	86	4	4	7,2	291	215	280	–
NU2236-E-M1A	**XL**	3	31,3	**180**	320	86	4	4	7,2	291	215	280	–
N336-E-MP1B	–	1	42,9	**180**	380	75	4	4	6,1	335	–	–	250,5
NU336-E-M1	–	3	43,9	**180**	380	75	4	4	6,1	335	231	319,8	–
NU336-E-M1A	–	3	43,9	**180**	380	75	4	4	6,1	335	231	319,8	–
NU336-E-MP1A	–	3	43,9	**180**	380	75	4	4	6,1	335	231	319,8	–
NU336-E-MPA	–	3	43,9	**180**	380	75	4	4	6,1	335	231	319,8	–
N2336-EX-M1	–	1	71,3	**180**	380	126	4	4	10,5	339	–	–	248
N2336-EX-MP1B	–	1	69,7	**180**	380	126	4	4	10,5	339	–	–	248
NU2336-EX-M1	–	3	71,8	**180**	380	126	4	4	10,5	339	227	320,8	–
NU436-M1	–	3	80,9	**180**	440	95	6	6	8,9	370	250	346,9	–
NU3138-M1	–	3	34,4	**190**	320	104	3	3	9,2	294	222	282,1	–
N238-E-M1	–	1	22,8	**190**	340	55	4	4	4,7	306	–	–	244
N238-E-M1B	–	1	23	**190**	340	55	4	4	4,7	306	–	–	244
NU238-E-M1	–	3	22,8	**190**	340	55	4	4	4,7	306	230	295	–
NU238-E-M1-C3	–	3	22,8	**190**	340	55	4	4	4,7	306	230	295	–
NU238-E-M1A	–	3	22,8	**190**	340	55	4	4	4,7	306	230	295	–
NU238-E-MP1A	–	3	22,2	**190**	340	55	4	4	4,7	306	230	295	–
NU238-E-MPA	–	3	22,2	**190**	340	55	4	4	4,7	306	230	295	–
NU1238-M1	–	3	26,6	**190**	340	65	4	4	4,8	310	226	296,2	–
NU2238-E-M1	–	3	37,1	**190**	340	92	4	4	8	308	228	296,4	–
NU2238-E-M1A	–	3	37,9	**190**	340	92	4	4	8	308	228	296,4	–
Z-549128.ZL	–	4	45,5	**190**	340	114	3	8	7,6	313,1	229,1	299,2	–
N338-E-M1	–	1	50,5	**190**	400	78	5	5	6,3	353	–	–	265,4
NU338-E-M1	–	3	50,6	**190**	400	78	5	5	6,3	353	245	336	–
NU338-E-M1A	–	3	50,6	**190**	400	78	5	5	6,3	353	245	336	–
N2338-EX-M1	–	1	82,5	**190**	400	132	5	5	11	360	–	–	262,5
N2338-EX-MP1B	–	1	80,9	**190**	400	132	5	5	11	360	–	–	262,5
NU2338-EX-M1	–	3	83,1	**190**	400	132	5	5	11	360	240	340,5	–
NU438-M1	–	3	90,6	**190**	460	98	6	6	9,4	385	265	361,9	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

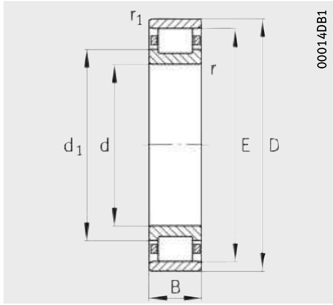


Mounting dimensions for NU

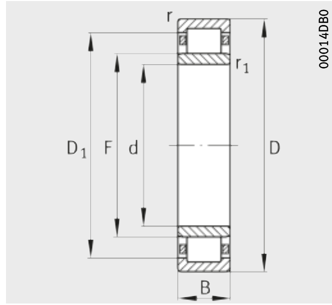
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
197	–	–	303	292	286	3	3	730	830	112	3 600	1 850
197	214	221	303	–	–	3	3	730	830	93	3 600	1 850
197	214	221	303	–	–	3	3	730	830	93	3 600	1 850
197	214	221	303	–	–	3	3	730	830	85	3 600	1 850
197	210	216	303	–	–	3	–	830	910	100	3 200	2 000
197	214	221	303	–	–	3	3	1 180	1 490	209	3 200	1 380
197	214	221	303	–	–	3	3	1 180	1 490	209	3 200	1 380
197	–	–	363	338	332	3	3	1 040	1 320	141	2 800	1 500
197	228	234	363	–	–	3	3	1 040	1 320	112	2 800	1 500
197	228	234	363	–	–	3	3	1 040	1 320	112	2 800	1 500
197	228	234	363	–	–	3	3	1 040	1 320	87	2 800	1 500
197	228	234	363	–	–	3	3	1 040	1 320	87	2 800	1 500
197	–	–	363	342	336	3	3	1 660	2 320	260	2 800	1 100
197	–	–	363	342	336	3	3	1 660	2 320	260	2 800	1 100
197	225	229	363	–	–	3	3	1 660	2 320	260	2 800	1 120
210	247	254	410	–	–	5	5	1 290	1 630	141	2 600	1 300
204	219	225	306	–	–	2,5	2,5	1 060	1 660	181	2 400	–
207	–	–	323	309	303	3	3	680	930	100	3 200	1 720
207	–	–	323	309	303	3	3	680	930	100	3 200	1 700
207	227	234	323	–	–	3	3	680	930	85	3 200	1 720
207	227	234	323	–	–	3	3	680	930	85	3 200	1 720
207	227	234	323	–	–	3	3	680	930	85	3 200	1 720
207	227	234	323	–	–	3	3	680	930	72	3 200	1 700
207	227	234	323	–	–	3	3	680	930	72	3 200	1 700
207	223	230	323	–	–	3	3	765	1 020	109	3 000	1 800
207	225	232	323	–	–	3	3	1 100	1 660	184	3 000	1 290
207	225	232	323	–	–	3	3	1 100	1 660	184	3 000	1 290
218	227	234	326	–	–	3	7	1 320	2 040	218	2 200	–
210	–	–	380	356	350	4	4	1 120	1 430	151	2 800	1 400
210	242	248	380	–	–	4	4	1 120	1 430	120	2 800	1 400
210	242	248	380	–	–	4	4	1 120	1 430	120	2 800	1 400
210	–	–	380	363	357	4	4	1 900	2 650	285	2 600	1 000
210	–	–	380	363	357	4	4	1 900	2 650	285	2 600	1 000
210	237,8	242,2	380	–	–	4	4	1 900	2 650	285	2 600	1 010
220	262	269	430	–	–	5	5	1 340	1 760	152	2 600	1 200

Cylindrical roller bearings with cage

Single row
Non-locating bearings



Design 1
N

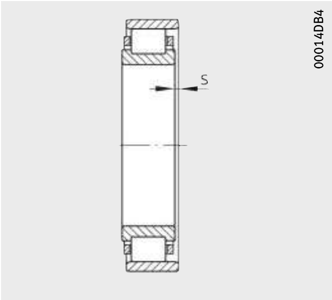


Design 3
NU

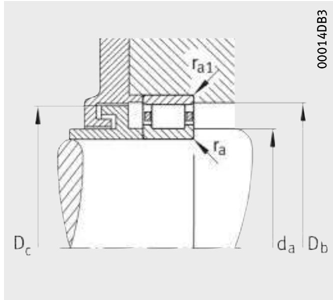
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions									
		m	d	D	B	r	r_1	s[2]	E	F	D_1	d_1
		≈kg				min.	min.				≈	≈
NU3140-M1	3	42,4	**200**	340	112	3	3	10	313	233	300,2	–
N240-E-M1	1	27,2	**200**	360	58	4	4	4,8	323	–	–	257,6
NU240-E-M1	3	27,2	**200**	360	58	4	4	4,8	323	243	311,5	–
NU240-E-M1-C3	3	27,2	**200**	360	58	4	4	4,8	323	243	311,5	–
NU240-E-M1A	3	27,2	**200**	360	58	4	4	4,8	323	243	311,5	–
NU1240-M1	3	32,3	**200**	360	70	4	4	5	328	238	313,1	–
N2240-E-M1	1	44,7	**200**	360	98	4	4	8,2	325	–	–	256,3
N2240-E-MP1B	1	43,9	**200**	360	98	4	4	8,2	325	–	–	256,3
N2240-E-N-M1	1[1]	44,7	**200**	360	98	4	4	8,2	325	–	–	256,3
N2240-E-N-MP1B	1[1]	43,9	**200**	360	98	4	4	8,2	325	–	–	256,3
NU2240-E-M1	3	44,7	**200**	360	98	4	4	8,2	325	241	312,9	–
NU2240-E-M1A	3	45,7	**200**	360	98	4	4	8,2	325	241	312,9	–
NU2240-E-MPA	3	44,4	**200**	360	98	4	4	8,2	325	241	312,9	–
N340-E-M1	1	57	**200**	420	80	5	5	6,3	370	–	–	279
NU340-E-M1	3	57,3	**200**	420	80	5	5	6,3	370	258	351,8	–
NU340-E-M1A	3	57,3	**200**	420	80	5	5	6,3	370	258	351,8	–
NU340-E-MP1A	3	57	**200**	420	80	5	5	6,3	370	258	351,8	–
NU2340-EX-M1	3	95,6	**200**	420	138	5	5	11,3	377	253	356,9	–
NU440-M1	3	103	**200**	480	102	6	6	9,4	404	276	378,9	–

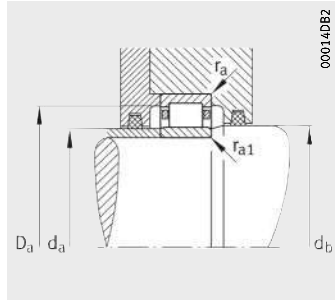
[1] With retaining slot in outer ring.



[2)] Axial displacement “s” for N and NU



Mounting dimensions for N

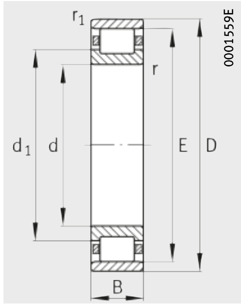


Mounting dimensions for NU

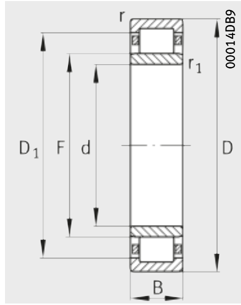
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
214	230	236	326	–	–	2,5	2,5	1 290	2 080	230	2 800	1 500
217	–	–	343	326	320	3	3	750	1 040	110	3 000	1 600
217	240	247	343	–	–	3	3	750	1 040	94	3 000	1 600
217	240	247	343	–	–	3	3	750	1 040	94	3 000	1 600
217	240	247	343	–	–	3	3	750	1 040	94	3 000	1 600
217	235	241	343	–	–	3	3	880	1 160	122	2 800	1 700
217	–	–	343	328	322	3	3	1 220	1 860	205	2 800	1 200
217	–	–	343	328	322	3	3	1 220	1 860	205	2 800	1 200
217	–	–	343	328	322	3	3	1 220	1 860	205	2 800	1 200
217	–	–	343	328	322	3	3	1 220	1 860	205	2 800	1 200
217	240	247	343	–	–	3	3	1 220	1 860	206	2 800	1 180
217	240	247	343	–	–	3	3	1 220	1 860	206	2 800	1 180
217	240	247	343	–	–	3	3	1 220	1 860	206	2 800	1 200
220	–	–	400	373	367	4	4	1 180	1 530	161	2 600	1 320
220	255	261	400	–	–	4	4	1 180	1 530	128	2 600	1 320
220	255	261	400	–	–	4	4	1 180	1 530	128	2 600	1 320
220	255	261	400	–	–	4	4	1 180	1 530	99	2 600	1 300
220	250,7	255,3	400	–	–	4	4	2 040	2 900	310	2 400	940
230	273	280	450	–	–	5	5	1 460	1 860	159	2 400	1 200

Cylindrical roller bearings with cage

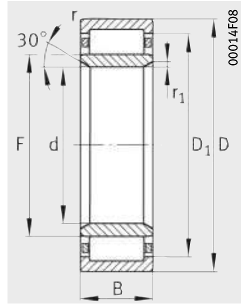
Single row
Non-locating bearings



Design 1
N



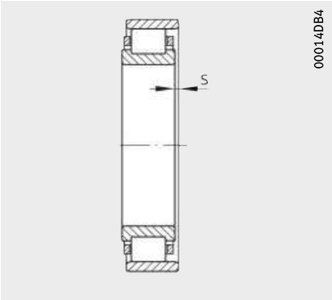
Design 3
NU, cylindrical or tapered bore



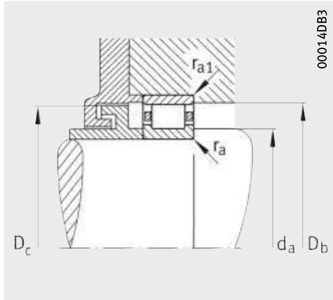
Design 4
NU

Dimension table (continued) · Dimensions in mm

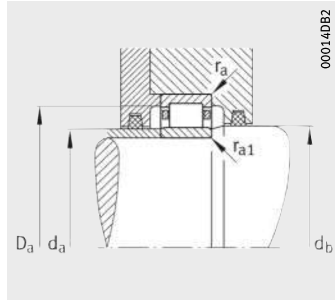
Designation	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[1]	E	F	D_1 ≈	d_1 ≈
N1044-M1	1	20,4	**220**	340	56	3	3	6,2	310	–	–	261,7
N1044-M1B	1	18,8	**220**	340	56	3	3	6,2	310	–	–	261,7
NU1044-K-M1	3	18,3	**220**	340	56	3	–	6,2	310	250	298,9	–
NU1044-K-M1A	3	18,7	**220**	340	56	3	–	6,2	310	250	298,9	–
NU1044-M1	3	20,5	**220**	340	56	3	3	6,2	310	250	298,9	–
NU1044-M1-C3	3	20,5	**220**	340	56	3	3	6,2	310	250	298,9	–
NU1044-M1A	3	19	**220**	340	56	3	3	6,2	310	250	298,9	–
NU1044-MP1A	3	18,2	**220**	340	56	3	3	6,2	310	250	298,9	–
NU2044-E-M1	3	25,1	**220**	340	72	3	3	4	314	250	302,8	–
NU3044-M1	3	30,9	**220**	340	90	3	3	2,5	310	250	298,9	–
Z-546293.ZL	3	37,2	**220**	350	98	3	3	6,7	323	247	310,4	–
NU3144-M1	3	52,6	**220**	370	120	4	4	10,2	340	256	326,1	–
N244-E-M1	1	38,2	**220**	400	65	4	4	5,5	358	–	–	285,2
NU244-E-M1	3	38,1	**220**	400	65	4	4	5,5	358	268	344,9	–
NU244-E-M1A	3	38,1	**220**	400	65	4	4	5,5	358	268	344,9	–
NU244-E-MP1A	3	38,3	**220**	400	65	4	4	5,5	358	268	344,9	–
NU1244-M1	3	45,2	**220**	400	78	4	4	5,7	365	261	348	–
NU2244-EX-M1	3	61,6	**220**	400	108	4	4	8,4	367	259	349,4	–
NU2244-EX-M1A	3	62,8	**220**	400	108	4	4	8,4	367	259	349,4	–
NU2244-EX-MP1A	3	60,4	**220**	400	108	4	4	8,4	367	259	349,4	–
Z-548409.ZL	4	75,1	**220**	400	133	3	9,5	–	366,1	266,1	349,6	–
N344-E-M1	1	75,5	**220**	460	88	5	5	7	406	–	–	305,1
NU344-E-M1	3	75,5	**220**	460	88	5	5	7	406	282	386	–
NU344-E-M1A	3	75,5	**220**	460	88	5	5	7	406	282	386	–
NU2344-EX-M1	3	121	**220**	460	145	5	5	11,9	413	277	391,2	–
NU444-M1	3	150	**220**	540	115	6	6	10	455	305	426,1	–



1) Axial displacement “s” for N and NU



Mounting dimensions for N

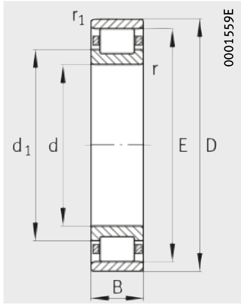


Mounting dimensions for NU

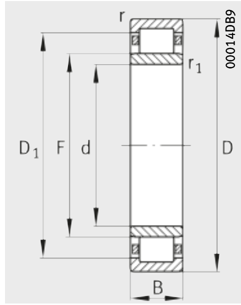
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
232	–	–	328	313	307	2,5	2,5	510	765	80	3 200	2 000
232	–	–	328	313	307	2,5	2,5	510	765	80	3 200	2 000
232	248	254	328	–	–	2,5	–	510	765	69	3 200	2 040
232	248	254	328	–	–	2,5	–	510	765	69	3 200	2 000
232	248	254	328	–	–	2,5	2,5	510	765	69	3 200	2 040
232	248	254	328	–	–	2,5	2,5	510	765	69	3 200	2 040
232	248	254	328	–	–	2,5	2,5	510	765	69	3 200	2 040
232	248	254	328	–	–	2,5	2,5	510	765	60	3 200	2 040
232	247	253	328	–	–	2,5	2,5	880	1 460	161	3 000	1 500
232	246	254	328	–	–	2,5	2,5	965	1 730	191	3 000	1 400
232	243	251	338	–	–	2,5	2,5	1 250	2 080	231	2 800	–
237	253	259	353	–	–	3	3	1 460	2 400	265	2 800	1 300
237	–	–	383	361	355	3	3	950	1 320	135	2 800	1 400
237	265	271	383	–	–	3	3	950	1 320	109	2 800	1 380
237	265	271	383	–	–	3	3	950	1 320	109	2 800	1 380
237	265	271	383	–	–	3	3	950	1 320	87	2 800	1 400
237	257	264	383	–	–	3	3	1 080	1 430	150	2 800	1 500
237	256,7	261,3	383	–	–	3	3	1 630	2 360	250	2 600	1 000
237	256,7	261,3	383	–	–	3	3	1 630	2 360	250	2 600	1 000
237	256,7	261,3	383	–	–	3	3	1 630	2 360	250	2 600	1 000
260	263	269	386	–	–	2,5	8	1 900	3 000	320	2 600	1 100
240	–	–	440	409	403	4	4	1 430	1 900	192	2 400	1 100
240	279	285	440	–	–	4	4	1 430	1 900	152	2 400	1 140
240	279	285	440	–	–	4	4	1 430	1 900	152	2 400	1 140
240	274,7	279,3	440	–	–	4	4	2 360	3 350	340	2 200	830
250	302	309	510	–	–	5	5	1 960	2 550	209	2 200	950

Cylindrical roller bearings with cage

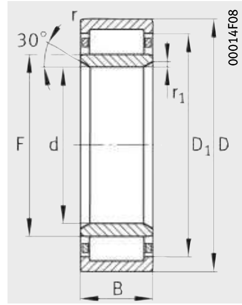
Single row
Non-locating
bearings



Design 1
N



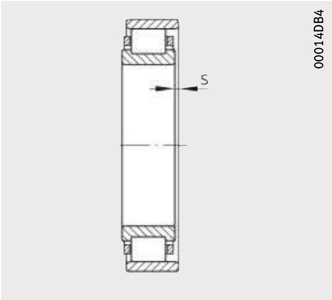
Design 3
NU, cylindrical or tapered bore



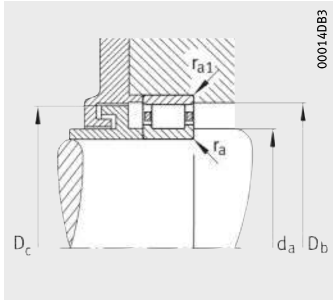
Design 4
NU

Dimension table (continued) · Dimensions in mm

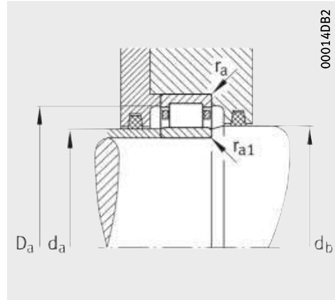
Designation	Design	Mass	Dimensions									
		m	d	D	B	r	r_1	s[1]	E	F	D_1	d_1
		≈kg				min.	min.				≈	≈
NU1948-M1	3	8,37	**240**	320	38	2,1	1,5	4,6	299	261	292,6	–
NU3948-E-M1	3	13,6	**240**	320	60	2,1	1,5	3,2	302	260	295	–
NU3948-E-MP1A	3	13,5	**240**	320	60	2,1	1,5	5,3	302	260	295	–
N1048-M1	1	19,8	**240**	360	56	3	3	6,4	330	–	–	281,6
N1048-M1B	1	20	**240**	360	56	3	3	6,4	330	–	–	281,6
NU1048-K-M1	3	20	**240**	360	56	3	–	6,4	330	270	318,9	–
NU1048-M1	3	19,9	**240**	360	56	3	3	6,4	330	270	318,9	–
NU1048-M1-C3	3	19,9	**240**	360	56	3	3	6,4	330	270	318,9	–
NU1048-M1A	3	20,2	**240**	360	56	3	3	6,4	330	270	318,9	–
NU1048-MP1A	3	19,2	**240**	360	56	3	3	6,4	330	270	318,9	–
NU2048-E-M1	3	26,6	**240**	360	72	3	3	1,9	334	270	322,8	–
NU3048-M1	3	33,6	**240**	360	92	3	3	9,8	330	270	318,9	–
NU3148-M1	3	64,8	**240**	400	128	4	4	12	368	278	353,2	–
N248-E-M1	1	51,5	**240**	440	72	4	4	6	393	–	–	312
NU248-E-M1	3	51,8	**240**	440	72	4	4	6	393	293	376,6	–
NU248-E-M1A	3	51,8	**240**	440	72	4	4	6	393	293	376,6	–
NU1248-M1	3	60,4	**240**	440	85	4	4	6,5	399	287	380,8	–
NU2248-EX-M1	3	82,8	**240**	440	120	4	4	10,2	399	287	380,7	–
NU2248-EX-M1A	3	84,3	**240**	440	120	4	4	10,2	399	287	380,7	–
NU2248-EX-MPA	3	83,3	**240**	440	120	4	4	10,2	399	287	380,7	–
Z-548410.ZL	4	102	**240**	440	146	3	9,5	–	401,4	291,4	383,4	–
NU348-E-M1	3	95,7	**240**	500	95	5	5	7,4	442	306	421,2	–
NU2348-EX-M1	3	151	**240**	500	155	5	5	13,3	447	303	424	–
NU448-M1	3	176	**240**	580	122	6	6	10,9	490	330	459,1	–
Z-544518.ZL	3	54,1	**241**	375	127	10	4	–	342,5	282,5	332,6	–
Z-549124.ZL	3	59,7	**250**	410	111	4	4	–	378	282	362,3	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

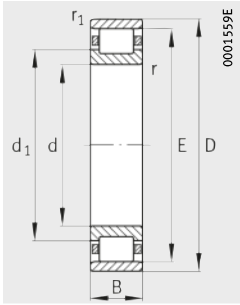


Mounting dimensions for NU

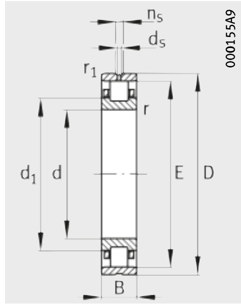
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
248	258	264	309	–	–	2	1,5	330	490	44	3 800	–
248	257	263	309	–	–	2	1,5	700	1 200	130	3 200	1 400
248	257	263	309	–	–	2	1,5	700	1 200	130	3 200	1 400
252	–	–	348	333	327	2,5	2,5	540	850	86	3 000	1 800
252	–	–	348	333	327	2,5	2,5	540	850	86	3 000	1 800
252	268	275	348	–	–	2,5	–	540	850	64	3 000	1 800
252	268	275	348	–	–	2,5	2,5	540	850	74	3 000	1 850
252	268	275	348	–	–	2,5	2,5	540	850	74	3 000	1 850
252	268	275	348	–	–	2,5	2,5	540	850	74	3 000	1 850
252	268	275	348	–	–	2,5	2,5	540	850	64	3 000	1 850
252	269	275	348	–	–	2,5	2,5	915	1 600	172	2 800	1 400
252	266	274	348	–	–	2,5	2,5	1 000	1 900	205	2 800	1 300
257	275	281	383	–	–	3	3	1 660	2 800	295	2 600	1 100
257	–	–	423	396	390	3	3	1 140	1 600	163	2 600	1 220
257	290	296	423	–	–	3	3	1 140	1 600	132	2 600	1 220
257	290	296	423	–	–	3	3	1 140	1 600	132	2 600	1 220
257	284,5	289,5	423	–	–	3	3	1 290	1 760	183	2 400	1 300
257	284,5	289,5	423	–	–	3	3	1 830	2 800	295	2 400	900
257	284,5	289,5	423	–	–	3	3	1 830	2 800	295	2 400	900
257	284,5	289,5	423	–	–	3	3	1 830	2 800	295	2 400	900
280	288	294	426	–	–	2,5	8	2 240	3 600	380	2 400	1 000
260	303	309	480	–	–	4	4	1 730	2 280	176	2 200	1 000
260	300,5	305,5	480	–	–	4	4	2 600	3 750	375	2 000	750
270	327	334	550	–	–	5	5	2 240	2 900	198	1 900	850
258	279	285	340	–	–	8	3	1 400	2 900	215	1 800	–
267	279	285	393	–	–	3	3	1 630	2 600	270	2 600	1 100

Cylindrical roller bearings with cage

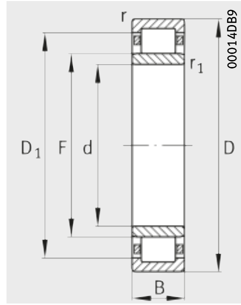
Single row
Non-locating
bearings



Design 1
N



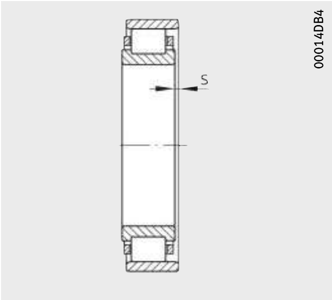
Design 2
N with lubrication groove and holes



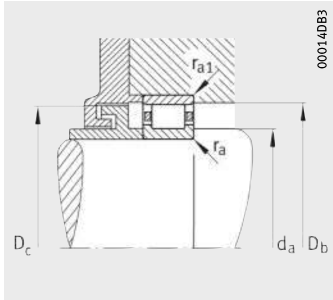
Design 3
NU, cylindrical or tapered bore

Dimension table (continued) · Dimensions in mm

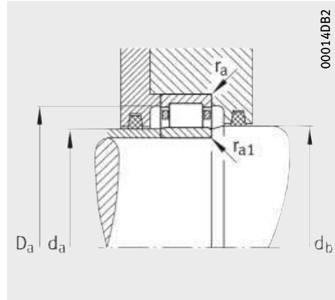
Designation	De-sign	Mass	Dimensions											
		m	d	D	B	r	r_1	s[1)]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
Z-541924.ZL	2	4,62	**260**	320	28	2	1,1	5	306	–	–	284	2	6,5
NU1852-M1	3	4,83	**260**	320	28	2	1,1	3,2	307	275	300,6	–	–	–
NU3852-M1	3	7,9	**260**	320	45	2	1,1	4,6	307	275	300,6	–	–	–
NU1952-M1	3	14,2	**260**	360	46	2,1	1,5	5,3	334	286	324,4	–	–	–
NU3952-E-M1	3	23,1	**260**	360	75	2,1	1,5	4,3	338	286	329,3	–	–	–
N1052-M1	1	29,4	**260**	400	65	4	4	7,2	364	–	–	309,1	–	–
N1052-M1B	1	29,9	**260**	400	65	4	4	7,2	364	–	–	309,1	–	–
NU1052-K-M1	3	29,2	**260**	400	65	4	–	7,2	364	296	351,3	–	–	–
NU1052-M1	3	29,7	**260**	400	65	4	4	7,2	364	296	351,3	–	–	–
NU1052-M1-C3	3	29,7	**260**	400	65	4	4	7,2	364	296	351,3	–	–	–
NU1052-M1A	3	29,9	**260**	400	65	4	4	7,2	364	296	351,3	–	–	–
NU1052-MP1A	3	29	**260**	400	65	4	4	7,2	364	296	351,3	–	–	–
NU2052-E-M1	3	39,5	**260**	400	82	4	4	6,2	370	294	356,3	–	–	–
NU3052-M1	3	49,3	**260**	400	104	4	4	9,7	364	296	351,3	–	–	–
NU3152-M1	3	89,7	**260**	440	144	4	4	13,5	404	304	388,2	–	–	–
NU252-E-M1	3	68,4	**260**	480	80	5	5	6,2	429	317	410,8	–	–	–
NU252-E-M1A	3	68,4	**260**	480	80	5	5	6,2	429	317	410,8	–	–	–
NU1252-M1	3	77	**260**	480	90	5	5	6,7	433	313	413,6	–	–	–
NU2252-E-M1	3	109	**260**	480	130	5	5	10,5	433	313	413,6	–	–	–
NU2252-E-M1A	3	111	**260**	480	130	5	5	10,5	433	313	413,6	–	–	–
NU2252-E-MP1A	3	108	**260**	480	130	5	5	10,5	433	313	413,6	–	–	–
NU352-E-M1	3	121	**260**	540	102	6	6	10	477	337	454,6	–	–	–
NU2352-EX-M1	3	189	**260**	540	165	6	6	13,7	484	324	458,4	–	–	–
Z-547407.ZL	1	12,8	**279**	368	44	4	4	4	348	–	–	306,1	–	–
NU1856-M1	3	7,1	**280**	350	33	2	1,1	4	333	299	327,1	–	–	–
NU1956-M1	3	15	**280**	380	46	2,1	1,5	5,2	354	306	345,4	–	–	–
NU3956-E-M1	3	24,8	**280**	380	75	2,1	1,5	6,6	358	306	349,3	–	–	–
N1056-M1	1	31,3	**280**	420	65	4	4	7,2	384	–	–	329,1	–	–
N1056-M1B	1	31,3	**280**	420	65	4	4	7,2	384	–	–	329,1	–	–
NU1056-M1	3	31,4	**280**	420	65	4	4	7,2	384	316	371,3	–	–	–
NU1056-M1-C3	3	31,4	**280**	420	65	4	4	7,2	384	316	371,3	–	–	–
NU1056-M1A	3	31,7	**280**	420	65	4	4	7,2	384	316	371,3	–	–	–
NU1056-MP1A	3	30,9	**280**	420	65	4	4	7,2	384	316	371,3	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

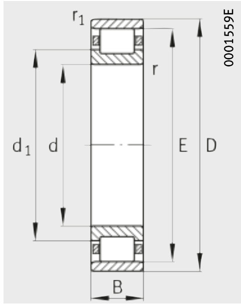


Mounting dimensions for NU

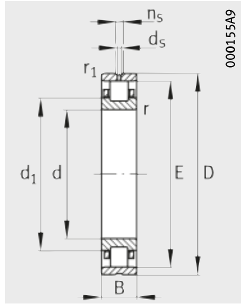
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
269	–	–	311	310	302	2	1,1	106	176	13,5	3 800	–
269	272	278	311	–	–	2	1	270	440	39	3 600	–
269	272	278	311	–	–	2	1	485	930	100	3 200	1 300
268	283	289	349	–	–	2	1,5	425	735	64	3 000	–
268	283	289	349	–	–	2	1,5	830	1 660	179	2 800	1 200
275	–	–	385	366,5	361,5	3	3	655	1 020	104	2 800	1 700
275	–	–	385	366,5	361,5	3	3	655	1 020	104	2 800	1 700
275	292	300	385	–	–	3	–	655	1 020	90	2 800	1 690
275	292	300	385	–	–	3	3	655	1 020	90	2 800	1 690
275	292	300	385	–	–	3	3	655	1 020	90	2 800	1 690
275	292	300	385	–	–	3	3	655	1 020	90	2 800	1 690
275	292	300	385	–	–	3	3	655	1 020	77	2 800	1 690
275	291	297	385	–	–	3	3	1 200	2 080	217	2 600	1 200
275	292	300	385	–	–	3	3	1 270	2 400	255	2 800	1 100
277	301	307	423	–	–	3	3	2 040	3 400	355	2 400	1 000
280	314	320	460	–	–	4	4	1 340	1 900	154	2 400	1 110
280	314	320	460	–	–	4	4	1 340	1 900	154	2 400	1 110
280	310	316	460	–	–	4	4	1 460	2 040	204	2 200	1 100
280	310	316	460	–	–	4	4	2 160	3 350	345	2 200	780
280	310	316	460	–	–	4	4	2 160	3 350	345	2 200	780
280	310	316	460	–	–	4	4	2 160	3 350	345	2 200	800
286	334,3	339,7	514	–	–	5	5	1 900	2 600	198	2 000	900
286	321,3	326,7	514	–	–	5	5	3 100	4 500	435	1 800	660
294	–	–	353	351	345	3	3	490	850	87	2 800	–
289	296	302	341	–	–	2	1	255	500	43	3 200	–
288	303	309	369	–	–	2	1,5	440	800	68	2 800	–
288	303	309	369	–	–	2	1,5	865	1 760	188	2 800	1 100
295	–	–	405	386	382	3	3	680	1 100	112	2 800	1 500
295	–	–	405	386	382	3	3	680	1 100	112	2 800	1 500
295	312	321	405	–	–	3	3	680	1 100	96	2 800	1 550
295	312	321	405	–	–	3	3	680	1 100	96	2 800	1 550
295	312	321	405	–	–	3	3	680	1 100	96	2 800	1 550
295	312	321	405	–	–	3	3	695	1 140	86	2 800	1 530

Cylindrical roller bearings with cage

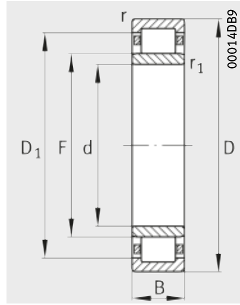
Single row
Non-locating
bearings



Design 1
N



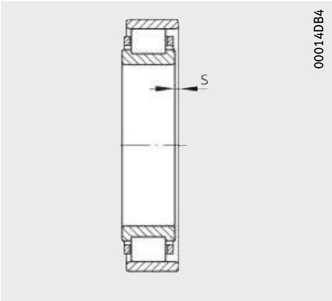
Design 2
N with lubrication groove and holes



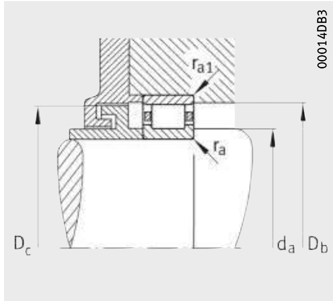
Design 3
NU

Dimension table (continued) · Dimensions in mm

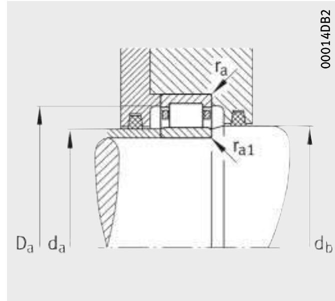
Designation	Design	Mass	Dimensions											
		m ≈kg	d	D	B	r min.	r_1 min.	s[1]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
NU2056-E-M1	3	41,8	**280**	420	82	4	4	6,2	390	314	376,3	–	–	–
NU3056-M1	3	53,2	**280**	420	106	4	4	9,8	384	316	371,3	–	–	–
NU3156-M1	3	96,6	**280**	460	146	5	5	14	424	324	407,6	–	–	–
NU256-E-M1	3	72,1	**280**	500	80	5	5	6,3	449	337	430,8	–	–	–
NU256-E-M1A	3	72,1	**280**	500	80	5	5	6,3	449	337	430,8	–	–	–
NU1256-M1	3	81,2	**280**	500	90	5	5	6,7	453	333	434	–	–	–
NU2256-E-M1	3	114	**280**	500	130	5	5	10,5	453	333	436	–	–	–
NU2256-E-M1A	3	118	**280**	500	130	5	5	10,5	453	333	436	–	–	–
NU2256-E-MP1A	3	113	**280**	500	130	5	5	10,5	453	333	436	–	–	–
NU356-E-M1	3	147	**280**	580	108	6	6	8,7	512	362	488	–	–	–
NU2356-EX-M1	3	234	**280**	580	175	6	6	13,8	521	351	493,8	–	–	–
Z-527791.ZL	2	9,65	**300**	380	38	2,1	2,1	7	362	–	–	329,9	3,2	9,5
NU1860-M1	3	9,96	**300**	380	38	2,1	1,5	4,3	362	322	355,2	–	–	–
N2860-M1	1	12,8	**300**	380	48	2,1	1,5	5,3	362	–	–	328,7	–	–
NU2860-M1	3	12,9	**300**	380	48	2,1	1,5	5,3	362	322	355,2	–	–	–
NU3860-M1	3	16,4	**300**	380	60	2,1	1,5	6	362	322	355,2	–	–	–
NU1960-M1	3	23,7	**300**	420	56	3	3	6,5	390	330	378	–	–	–
NU3960-E-M1	3	38,6	**300**	420	90	3	3	7,5	394	330	383,3	–	–	–
NU3960-E-M1A	3	38,6	**300**	420	90	3	3	7,5	394	330	383,3	–	–	–
N1060-M1	1	44,3	**300**	460	74	4	4	7,9	420	–	–	355,7	–	–
NU1060-M1	3	44,6	**300**	460	74	4	4	7,9	420	340	405,2	–	–	–
NU1060-M1-C3	3	44,6	**300**	460	74	4	4	7,9	420	340	405,2	–	–	–
NU1060-M1A	3	44,6	**300**	460	74	4	4	7,9	420	340	405,2	–	–	–
NU1060-MP1A	3	43,5	**300**	460	74	4	4	7,9	420	340	405,2	–	–	–
NU3060-M1	3	74	**300**	460	118	4	4	10,5	420	340	405,2	–	–	–
NU3160-M1	3	126	**300**	500	160	5	5	4,2	460	348	442,4	–	–	–
NU260-E-M1	3	90,4	**300**	540	85	5	5	6,9	484	364	464,6	–	–	–
NU260-E-M1A	3	90,4	**300**	540	85	5	5	6,9	484	364	464,6	–	–	–
NU1260-M1	3	103	**300**	540	98	5	5	7,2	487	359	466,4	–	–	–
NU2260-EX-MPA	3	147	**300**	540	140	5	5	12,2	495	355	472,6	–	–	–
NU2260-EX-M1	3	143	**300**	540	140	5	5	12,2	495	355	472,6	–	–	–
NU2260-EX-M1A	3	143	**300**	540	140	5	5	12,2	495	355	472,6	–	–	–
NU360-E-M1	3	171	**300**	620	109	7,5	7,5	8,9	542	392	518	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

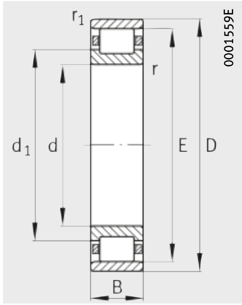


Mounting dimensions for NU

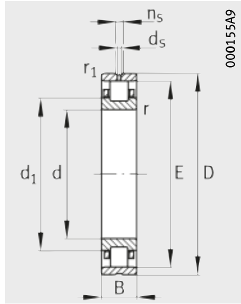
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
295	311	317	405	–	–	3	3	1 220	2 160	224	2 600	1 100
295	312	320	405	–	–	3	3	1 340	2 600	275	2 600	1 000
300	321	327	440	–	–	4	4	2 080	3 650	370	2 200	950
300	334	340	480	–	–	4	4	1 400	2 000	163	2 200	1 020
300	334	340	480	–	–	4	4	1 400	2 000	163	2 200	1 020
300	330	336	480	–	–	4	4	1 530	2 200	215	2 200	1 000
300	330	336	480	–	–	4	4	2 280	3 600	360	2 000	720
300	330	336	480	–	–	4	4	2 280	3 600	360	2 000	720
300	330	336	480	–	–	4	4	2 280	3 600	360	2 000	700
306	359	366	554	–	–	5	5	2 160	3 050	224	1 900	790
306	348	354	554	–	–	5	5	3 550	5 200	495	1 600	590
310	–	–	370	366	358	2,1	2,1	204	325	25	2 800	–
310	319	325	370	–	–	2	1,5	335	640	55	2 800	–
310	–	–	370	366	358	2	1,5	475	1 000	101	2 800	1 200
310	319	325	370	–	–	2	1,5	475	1 000	101	2 800	1 200
310	319	325	370	–	–	2	1,5	610	1 400	143	2 800	1 100
312	327	333	408	–	–	2,5	2,5	600	1 020	87	2 800	–
312	327	333	408	–	–	2,5	2,5	1 180	2 360	242	2 600	950
312	327	333	408	–	–	2,5	2,5	1 180	2 360	242	2 600	950
315	–	–	445	422	418	3	3	900	1 430	139	2 400	1 400
315	336	345	445	–	–	3	3	900	1 430	120	2 400	1 390
315	336	345	445	–	–	3	3	900	1 430	120	2 400	1 390
315	336	345	445	–	–	3	3	900	1 430	120	2 400	1 390
315	336	345	445	–	–	3	3	900	1 430	105	2 400	1 390
315	336	344	445	–	–	3	3	1 700	3 250	335	2 400	900
320	345	351	480	–	–	4	4	2 500	4 300	435	2 000	850
320	359	367	520	–	–	4	4	1 600	2 320	182	2 000	920
320	359	367	520	–	–	4	4	1 600	2 320	182	2 000	920
320	–	–	520	491	483	4	4	1 730	2 500	242	2 000	950
320	352	358	520	–	–	4	4	2 550	3 900	375	1 200	670
320	352	358	520	–	–	4	4	2 700	4 150	395	1 900	650
320	352	358	520	–	–	4	4	2 700	4 150	395	1 900	650
332	389	395	588	–	–	6	6	2 280	3 250	238	1 800	750

Cylindrical roller bearings with cage

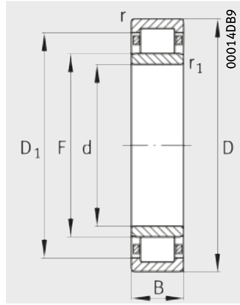
Single row
Non-locating
bearings



Design 1
N



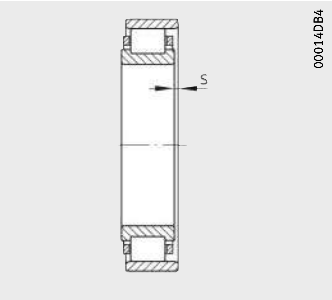
Design 2
N with lubrication
groove and holes



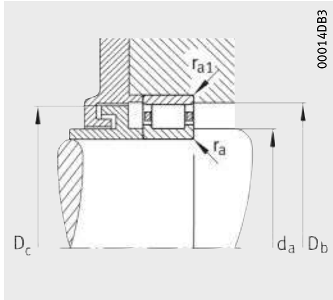
Design 3
NU

Dimension table (continued) · Dimensions in mm

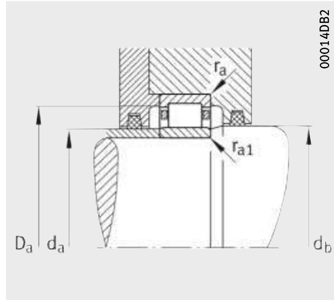
Designation	De-sign	Mass	Dimensions											
		m	d	D	B	r	r_1	s[1)]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
Z-527454.ZL	2	10,2	**320**	400	38	2	2	7	381	–	–	349	3,2	9,5
NU1864-M1	3	10,8	**320**	400	38	2,1	1,5	4,3	381	341	373,8	–	–	–
NU3864-M1	3	17,5	**320**	400	60	2,1	1,5	6	381	341	373,8	–	–	–
NU1964-M1	3	25,1	**320**	440	56	3	3	6,2	410	350	398	–	–	–
NU2964-M1	3	33,2	**320**	440	72	3	3	7	410	350	398	–	–	–
NU3964-E-M1	3	41,5	**320**	440	90	3	3	4,7	414	350	403,3	–	–	–
N1064-M1	1	46,5	**320**	480	74	4	4	8	440	–	–	375,4	–	–
NU1064-M1	3	46,9	**320**	480	74	4	4	8	440	360	425,1	–	–	–
NU1064-M1-C3	3	46,9	**320**	480	74	4	4	8	440	360	425,1	–	–	–
NU1064-M1A	3	46,9	**320**	480	74	4	4	8	440	360	425,1	–	–	–
NU1064-MP1A	3	45,8	**320**	480	74	4	4	8	440	360	425,1	–	–	–
NU3064-M1	3	79,3	**320**	480	121	4	4	11,5	440	360	425,1	–	–	–
NU3164-M1	3	168	**320**	540	176	5	5	12	496	368	475,4	–	–	–
NU264-EX-M1	3	113	**320**	580	92	5	5	7,5	520	392	499,4	–	–	–
NU264-EX-M1A	3	113	**320**	580	92	5	5	7,5	520	392	499,4	–	–	–
NU1264-M1	3	130	**320**	580	105	5	5	7,3	523	383	500,6	–	–	–
NU2264-EX-M1	3	180	**320**	580	150	5	5	11,9	530	380	506	–	–	–
NU2264-EX-M1A	3	184	**320**	580	150	5	5	11,9	530	380	506	–	–	–
NU364-E-M1	3	214	**320**	670	112	7,5	7,5	8,9	580	420	554	–	–	–
NU2364-E-M1	3	356	**320**	670	200	7,5	7,5	16	602	402	570	–	–	–
Z-527455.ZL	2	10,6	**340**	420	38	2,1	2,1	7	401,5	–	–	369,3	3,2	9,5
NU1868-M1	3	11,3	**340**	420	38	2,1	1,5	4,3	401,5	361,5	394,7	–	–	–
NU3868-M1	3	18,4	**340**	420	60	2,1	1,5	6	401,5	361,5	394,7	–	–	–
NU1968-M1	3	27,2	**340**	460	56	3	3	6,5	430	370	418	–	–	–
NU2968-M1	3	34,6	**340**	460	72	3	3	7	430	370	418	–	–	–
NU3968-E-M1	3	43,8	**340**	460	90	3	3	4,7	434	370	423,3	–	–	–
NU1068-MPA	3	65,1	**340**	520	82	5	5	8,9	475	385	458,2	–	–	–
N1068-M1	1	62,8	**340**	520	82	5	5	8,9	475	–	–	402,2	–	–
NU1068-M1	3	63,2	**340**	520	82	5	5	8,9	475	385	458,2	–	–	–
NU1068-M1-C3	3	63,2	**340**	520	82	5	5	8,9	475	385	458,2	–	–	–
NU1068-M1A	3	63,2	**340**	520	82	5	5	8,9	475	385	458,2	–	–	–
NU3168-M1A	3	209	**340**	580	190	5	5	17,3	527	399	507,2	–	–	–
NU268-E-M1	3	133	**340**	620	92	6	6	7,4	547	419	526,4	–	–	–
NU1268-M1	3	165	**340**	620	118	6	6	8,3	558	408	534	–	–	–
NU2268-E-M1	3	229	**340**	620	165	6	6	13,3	558	408	534	–	–	–



1) Axial displacement “s” for N and NU



Mounting dimensions for N

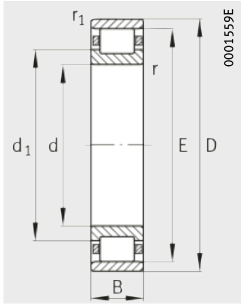


Mounting dimensions for NU

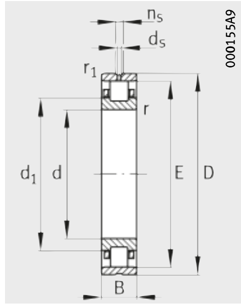
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
329	–	–	391	385	377	2	2	212	360	27	2 800	–
330	338	344	390	–	–	2	1,5	345	695	58	2 800	–
330	338	344	390	–	–	2	1,5	630	1 500	151	2 800	1 000
332	346	354	428	–	–	2,5	2,5	620	1 100	91	2 600	–
332	346	354	428	–	–	2,5	2,5	915	1 800	181	2 400	1 100
332	346	354	428	–	–	2,5	2,5	1 220	2 550	255	2 400	900
335	–	–	465	443	437	3	3	915	1 500	144	2 400	1 300
335	356	365	465	–	–	3	3	915	1 500	124	2 400	1 300
335	356	365	465	–	–	3	3	915	1 500	124	2 400	1 300
335	356	365	465	–	–	3	3	915	1 500	124	2 400	1 300
335	356	365	465	–	–	3	3	915	1 500	108	2 400	1 300
335	356	364	465	–	–	3	3	1 760	3 450	345	2 200	850
340	364	372	520	–	–	4	4	3 250	5 600	550	1 900	700
340	388,5	395,5	560	–	–	4	4	1 800	2 700	204	1 900	830
340	388,5	395,5	560	–	–	4	4	1 800	2 700	204	1 900	830
340	380	386	560	–	–	4	4	2 080	3 000	280	1 900	850
340	376,5	383,5	560	–	–	4	4	3 150	4 900	460	1 600	570
340	376,5	383,5	560	–	–	4	4	3 150	4 900	460	1 600	560
352	416	424	638	–	–	6	6	2 550	3 750	265	1 600	650
352	398	405	638	–	–	6	6	4 550	6 800	620	1 400	480
350	–	–	410	405	398	2,1	2,1	212	360	26,5	2 800	–
350	358	365	410	–	–	2,1	1,5	360	735	61	2 800	–
350	358	365	410	–	–	2	1,5	640	1 560	156	2 600	950
352	366	374	448	–	–	2,5	2,5	640	1 160	96	2 600	–
352	366	374	448	–	–	2,5	2,5	950	1 930	190	2 400	950
352	366	374	448	–	–	2,5	2,5	1 250	2 600	260	2 400	850
357	381	390	503	–	–	4	4	1 080	1 760	141	2 200	1 200
357	–	–	503	478,5	471,5	4	4	1 120	1 830	169	2 200	1 200
357	381	390	503	–	–	4	4	1 120	1 830	147	2 200	1 190
357	381	390	503	–	–	4	4	1 120	1 830	147	2 200	1 190
357	381	390	503	–	–	4	4	1 120	1 830	147	2 200	1 190
360	395	403	560	–	–	4	4	3 200	5 600	540	1 800	700
366	415	423	594	–	–	5	5	1 930	3 000	225	1 800	750
366	404	412	594	–	–	5	5	2 360	3 450	315	1 800	800
366	404	412	594	–	–	5	5	3 450	5 700	540	1 500	520

Cylindrical roller bearings with cage

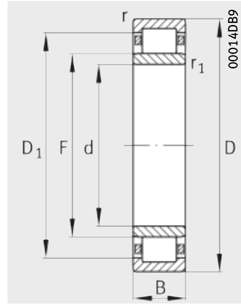
Single row
Non-locating bearings



Design 1
N



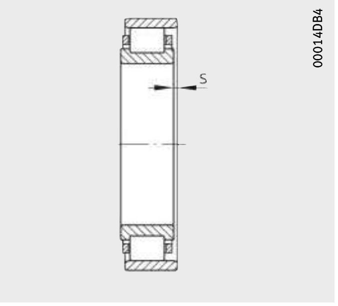
Design 2
N with lubrication groove and holes



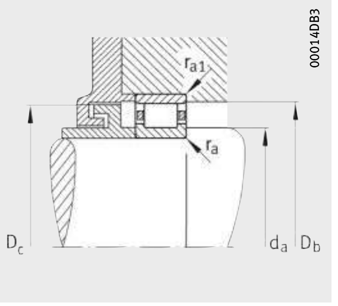
Design 3
NU

Dimension table (continued) · Dimensions in mm

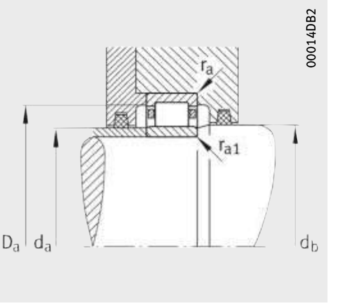
Designation	Design	Mass	Dimensions											
		m	d	D	B	r	r_1	s[1)]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
NU2268-E-M1A	3	233	**340**	620	165	6	6	13,3	558	408	534	–	–	–
NU368-E-M1	3	247	**340**	710	118	7,5	7,5	9,7	614,4	450,4	588	–	–	–
NU2368-E-M1	3	419	**340**	710	212	7,5	7,5	15,5	635	425	601,4	–	–	–
Z-527456.ZL	2	11,2	**360**	440	38	2,1	2,1	7	421,5	–	–	389,4	3,2	9,5
NU1872-M1	3	12	**360**	440	38	2,1	1,5	4,3	421,5	381,5	414,7	–	–	–
NU3872-M1	3	19,4	**360**	440	60	2,1	1,5	6	421,5	381,5	414,7	–	–	–
NU1972-M1	3	27,7	**360**	480	56	3	3	6,2	450	390	438,5	–	–	–
NU2972-M1	3	37,2	**360**	480	72	3	3	4	450	390	440	–	–	–
NU3972-E-M1	3	45,6	**360**	480	90	3	3	4,7	454	390	443,3	–	–	–
N1072-M1	1	65,3	**360**	540	82	5	5	8,9	495	–	–	421,6	–	–
NU1072-M1	3	65,9	**360**	540	82	5	5	8,9	495	405	478,1	–	–	–
NU1072-M1-C3	3	65,9	**360**	540	82	5	5	8,9	495	405	478,1	–	–	–
NU1072-M1A	3	65,9	**360**	540	82	5	5	8,9	495	405	478,1	–	–	–
NU1072-MP1A	3	64,2	**360**	540	82	5	5	8,9	495	405	478,1	–	–	–
NU1072-MPA	3	64,2	**360**	540	82	5	5	8,9	495	405	478,1	–	–	–
NU3072-M1	3	112	**360**	540	134	5	5	11,5	495	405	478,1	–	–	–
NU3172-M1	3	220	**360**	600	192	5	5	19	548	420	527	–	–	–
NU272-E-M1	3	149	**360**	650	95	6	6	9,5	579	451	558,5	–	–	–
NU272-E-M1A	3	151	**360**	650	95	6	6	9,5	579	451	558,5	–	–	–
NU1272-M1	3	187	**360**	650	122	6	6	8,2	589	429	563,5	–	–	–
NU2272-E-M1	3	254	**360**	650	170	6	6	15	588	428	562	–	–	–
NU2272-E-M1A	3	258	**360**	650	170	6	6	15	588	428	562	–	–	–
NU2372-E-M1	3	498	**360**	750	224	7,5	7,5	19	665	445	630	–	–	–
NU2372-E-M1A	3	498	**360**	750	224	7,5	7,5	19	665	445	630	–	–	–
Z-526718.ZL	2	18,8	**380**	480	46	2,1	2,1	8,5	455,5	–	–	415,5	3,2	9,5
N1876-M1	1	19,1	**380**	480	46	2,1	2,1	5,3	455,5	–	–	415,5	–	–
NU1876-M1	3	19,2	**380**	480	46	2,1	2,1	5,3	455,5	407,5	447,4	–	–	–
N2876-M1	1	25,3	**380**	480	60	2,1	2,1	6,9	455,5	–	–	415,5	–	–
NU2876-M1	3	25,4	**380**	480	60	2,1	2,1	6,9	455,5	407,5	447,4	–	–	–
NU3876-M1	3	32,5	**380**	480	75	2,1	2,1	7,8	455,5	407,5	447,4	–	–	–
NU1976-M1	3	40,7	**380**	520	65	4	4	6	484	416	472,7	–	–	–
N2976-M1	3	52,5	**380**	520	82	4	4	7,2	486	–	–	425,9	–	–
NU2976-M1	3	52,9	**380**	520	82	4	4	7,2	486	414	471,6	–	–	–
NU2976-MP1A	3	52,3	**380**	520	82	4	4	7,2	486	414	471,6	–	–	–
NU3976-E-M1	3	67	**380**	520	106	4	4	8,7	490	414	474,8	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

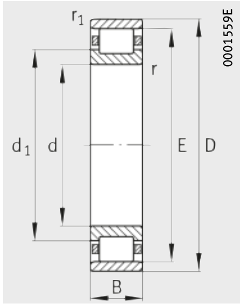


Mounting dimensions for NU

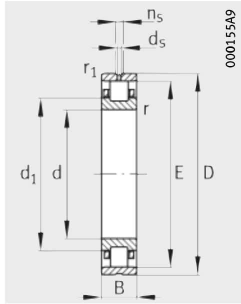
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
366	404	412	594	–	–	5	5	3 450	5 700	540	1 500	520
372	447	454	678	–	–	6	6	2 750	4 150	290	1 500	600
372	421,5	428,5	678	–	–	6	6	5 000	7 350	660	1 400	450
370	–	–	430	425	418	2,1	2,1	220	390	28	2 600	–
370	378	385	430	–	–	2	1,5	365	765	62	2 600	–
370	378	385	430	–	–	2	1,5	670	1 660	163	2 400	900
372	386	394	468	–	–	2,5	2,5	655	1 220	100	2 400	–
372	386	394	468	–	–	2,5	2,5	980	2 040	199	2 200	900
372	386	394	468	–	–	2,5	2,5	1 290	2 800	275	2 200	800
378	–	–	523	499	491	4	4	1 140	1 900	175	2 400	1 300
377	400	410	523	–	–	4	4	1 140	1 900	151	2 200	1 110
377	400	410	523	–	–	4	4	1 140	1 900	151	2 200	1 110
377	400	410	523	–	–	4	4	1 140	1 900	151	2 200	1 110
377	400	410	523	–	–	4	4	1 140	1 900	133	2 200	1 110
377	400	410	523	–	–	4	4	1 140	1 900	133	2 200	1 110
377	400	410	523	–	–	4	4	2 200	4 400	420	2 000	670
380	416	424	580	–	–	4	4	3 350	6 000	570	1 600	630
386	447	455	624	–	–	5	5	2 000	3 150	234	1 600	700
386	447	455	624	–	–	5	5	2 000	3 150	234	1 600	700
386	425	433	624	–	–	5	5	2 700	4 000	345	1 600	700
386	424	432	624	–	–	5	5	3 600	5 700	520	1 400	510
386	424	432	624	–	–	5	5	3 600	5 700	520	1 400	510
392	441	449	718	–	–	6	6	5 500	8 300	730	1 300	400
392	441	449	718	–	–	6	6	5 500	8 300	730	1 300	400
390	–	–	470	460	451	2,1	2,1	285	480	34,5	2 400	–
390	–	–	470	460	451	2	2	490	1 000	91	2 400	–
390	404	411	470	–	–	2	2	490	1 000	81	2 400	–
390	–	–	470	460	451	2	2	695	1 560	148	2 200	900
390	404	411	470	–	–	2	2	695	1 560	148	2 200	900
390	404	411	470	–	–	2	2	900	2 160	208	2 200	800
395	412	420	505	–	–	3	3	815	1 500	124	2 200	–
395	–	–	505	490	482	3	3	1 320	2 700	255	2 000	800
395	410	418	505	–	–	3	3	1 320	2 700	260	2 000	800
395	410	418	505	–	–	3	3	1 320	2 700	260	2 000	800
395	410	418	505	–	–	3	3	1 700	3 550	340	2 000	700

Cylindrical roller bearings with cage

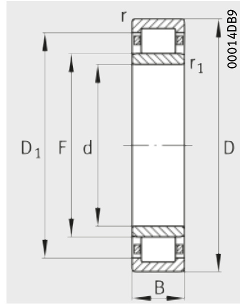
Single row
Non-locating
bearings



Design 1
N



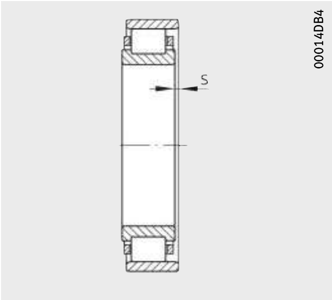
Design 2
N with lubrication groove and holes



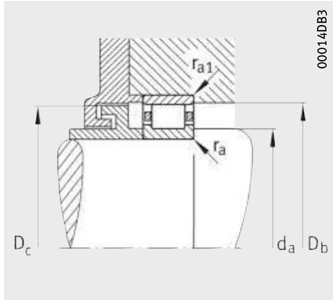
Design 3
NU, cylindrical or tapered bore

Dimension table (continued) · Dimensions in mm

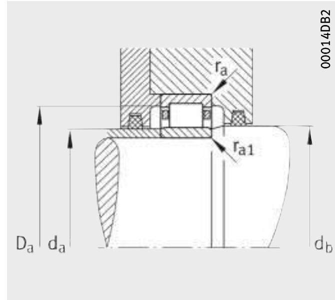
Designation	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[1]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
N1076-M1	1	67,2	**380**	560	82	5	5	9	515	–	–	441,6	–	–
N1076-M1B	1	67,6	**380**	560	82	5	5	9	515	–	–	441,6	–	–
NU1076-M1	3	69,1	**380**	560	82	5	5	9	515	425	498,1	–	–	–
NU1076-M1-C3	3	69,1	**380**	560	82	5	5	9	515	425	498,1	–	–	–
NU1076-M1A	3	69,1	**380**	560	82	5	5	9	515	425	498,1	–	–	–
NU3076-M1	3	117	**380**	560	135	5	5	12,5	515	425	498,1	–	–	–
NU3176-M1	3	231	**380**	620	194	5	5	19,5	568	440	547	–	–	–
NU276-E-M1	3	162	**380**	680	95	6	6	8	622	494	601	–	–	–
NU1276-M1	3	211	**380**	680	132	6	6	9,5	619	449	592	–	–	–
NU2276-E-M1	3	288	**380**	680	175	6	6	13,8	615	451	588,8	–	–	–
NU2276-E-M1A	3	293	**380**	680	175	6	6	13,8	615	451	588,8	–	–	–
Z-527457.ZL	2	19,4	**400**	500	46	2,1	2,1	8	476	–	–	437,4	3,2	9,5
NU1880-M1	3	20,3	**400**	500	46	2,1	2,1	5,3	476	428	468	–	–	–
NU3880-M1	3	34	**400**	500	75	2,1	2,1	7,8	476	428	468	–	–	–
NU1980-M1	3	41,9	**400**	540	65	4	4	7,2	504	436	492,7	–	–	–
NU2980-M1	3	55,3	**400**	540	82	4	4	7,2	506	434	494	–	–	–
NU3980-E-M1	3	70,3	**400**	540	106	4	4	8,7	510	434	497,5	–	–	–
N1080-M1	1	87,9	**400**	600	90	5	5	9,5	550	–	–	469	–	–
NU1080-K-M1	3	88,5	**400**	600	90	5	–	9,5	550	450	531,5	–	–	–
NU1080-M1	3	90,1	**400**	600	90	5	5	9,5	550	450	531,5	–	–	–
NU1080-M1-C3	3	90,1	**400**	600	90	5	5	9,5	550	450	531,5	–	–	–
NU1080-M1A	3	90,6	**400**	600	90	5	5	9,5	550	450	531,5	–	–	–
NU3080-M1	3	153	**400**	600	148	5	5	12,8	550	450	531,5	–	–	–
NU3180-M1	3	260	**400**	650	200	6	6	18	600	460	577,5	–	–	–
NU1280-M1	3	258	**400**	720	140	6	6	9,8	654	474	625	–	–	–
NU2280-E-M1	3	342	**400**	720	185	6	6	15,4	661	471	630,5	–	–	–
NU2280-E-M1A	3	346	**400**	720	185	6	6	15,4	661	471	630,5	–	–	–
Z-547075.01.ZL	1	32,2	**406**	502	76	4	2,5	–	482,7	–	–	437,6	–	–
Z-547459.ZL	1	33,7	**406**	502	76	4	4	–	482,7	–	–	437,6	–	–
Z-527458.ZL	2	21	**420**	520	46	2,1	2,1	8,5	496	–	–	457,5	3,2	12,2
NU1884-M1	3	20,9	**420**	520	46	2,1	2,1	5,3	496	448	488	–	–	–
NU3884-M1	3	35,5	**420**	520	75	2,1	2,1	7,8	496	448	488	–	–	–
NU1984-M1	3	44,2	**420**	560	65	4	4	7,2	524	456	510,4	–	–	–



[1] Axial displacement “s”
for N and NU



Mounting dimensions
for N

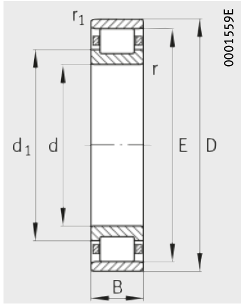


Mounting dimensions
for NU

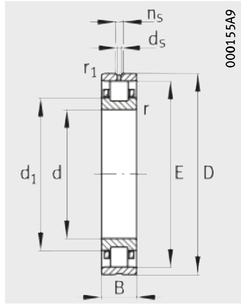
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
398	–	–	543	519	511	4	4	1 180	2 000	180	2 400	1 250
398	–	–	543	519	511	4	4	1 180	2 000	180	2 400	1 250
397	420	430	543	–	–	4	4	1 180	2 000	156	2 000	1 050
397	420	430	543	–	–	4	4	1 180	2 000	156	2 000	1 050
397	420	430	543	–	–	4	4	1 180	2 000	156	2 000	1 050
397	420	430	543	–	–	4	4	2 240	4 550	435	1 900	670
400	436	444	600	–	–	4	4	3 450	6 300	600	1 600	600
406	556	564	654	–	–	5	5	2 120	3 450	255	1 500	610
406	445	453	654	–	–	5	5	2 850	4 150	370	1 500	700
406	446	456	654	–	–	5	5	4 050	6 700	610	1 400	450
406	446	456	654	–	–	5	5	4 050	6 700	610	1 400	450
410	–	–	490	480	472	2,1	2,1	300	530	37	2 400	–
410	424	431	490	–	–	2,1	2,1	520	1 100	88	2 400	–
410	424	431	490	–	–	2	2	930	2 280	219	2 200	750
415	432	440	525	–	–	3	3	800	1 500	123	2 200	–
415	430	438	525	–	–	3	3	1 340	2 750	265	2 000	750
415	430	438	525	–	–	3	3	1 760	3 750	360	1 900	670
417	–	–	583	554	546	4	4	1 370	2 320	212	1 900	950
417	445	455	583	–	–	4	–	1 370	2 320	177	1 900	980
417	445	455	583	–	–	4	4	1 370	2 320	177	1 900	980
417	445	455	583	–	–	4	4	1 370	2 320	177	1 900	980
417	445	455	583	–	–	4	4	1 370	2 320	177	1 900	980
417	445	455	583	–	–	4	4	2 650	5 400	510	1 800	600
426	456	464	624	–	–	5	5	4 050	7 500	690	1 400	530
426	470	478	694	–	–	5	5	3 050	4 400	385	1 400	670
426	467	475	694	–	–	5	5	5 600	7 600	670	1 300	850
426	467	475	694	–	–	5	5	5 600	7 600	670	1 300	410
421	–	–	490	486	478	3	2,1	1 160	2 750	231	2 200	670
421	–	–	490	486	478	3	3	1 160	2 750	231	2 200	670
430	–	–	510	500	492	2,1	2,1	315	570	39,5	2 200	–
430	444	451	510	–	–	2	2	530	1 140	90	2 200	–
430	444	451	510	–	–	2	2	950	2 400	226	2 000	700
435	452	460	545	–	–	3	3	830	1 600	129	2 000	–

Cylindrical roller bearings with cage

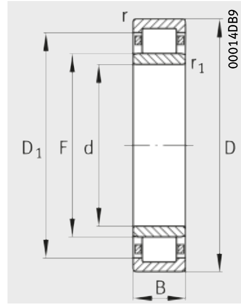
Single row
Non-locating
bearings



Design 1
N



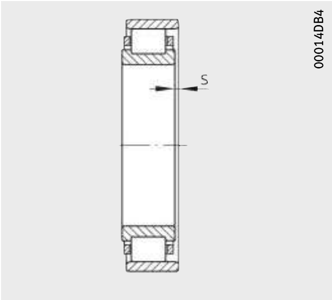
Design 2
N with lubrication groove and holes



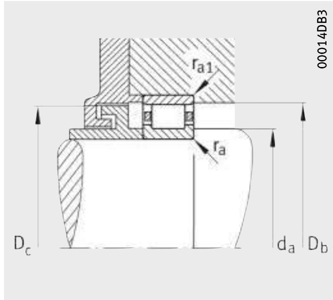
Design 3
NU, cylindrical or tapered bore

Dimension table (continued) · Dimensions in mm

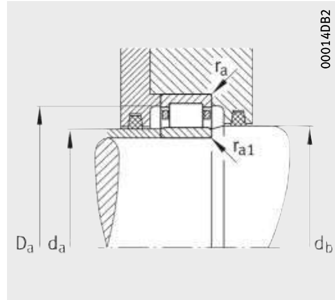
Designation	Design	Mass m	Dimensions d	D	B	r	r_1	s[1]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
NU2984-M1	3	58,6	**420**	560	82	4	4	6	526	454	511,6	–	–	–
NU3984-E-M1	3	73	**420**	560	106	4	4	5,7	530	454	517,5	–	–	–
N1084-M1	1	92,2	**420**	620	90	5	5	9,6	570	–	–	489	–	–
NU1084-M1	3	92,9	**420**	620	90	5	5	9,6	570	470	551,5	–	–	–
NU1084-M1A	3	94,2	**420**	620	90	5	5	9,6	570	470	551,5	–	–	–
NU3084-M1	3	162	**420**	620	150	5	5	13,5	570	470	551,5	–	–	–
NU3084-M1A	3	162	**420**	620	150	5	5	13,5	570	470	551,5	–	–	–
NU3184-M1	3	352	**420**	700	224	6	6	19	645	485	619,5	–	–	–
NU1284-M1	3	314	**420**	760	150	7,5	7,5	9,8	694	494	662	–	–	–
NU2284-E-M1	3	398	**420**	760	195	7,5	7,5	16,8	690	494	658	–	–	–
NU2284-E-M1A	3	406	**420**	760	195	7,5	7,5	16,8	690	494	658	–	–	–
Z-531636.ZL	2	19	**440**	540	40	2,1	2,1	6,5	514	–	–	478,6	3,2	9,5
Z-527459.ZL	2	22	**440**	540	46	2,1	2,1	8,5	516	–	–	477,4	3,2	12,2
N1888-M1B	1	22,3	**440**	540	46	2,1	2,1	5,3	516	–	–	476	–	–
NU1888-M1	3	22,2	**440**	540	46	2,1	2,1	5,3	516	468	508	–	–	–
NU3888-M1	3	37	**440**	540	75	2,1	2,1	7,8	516	468	508	–	–	–
NU1988-M1	3	60,5	**440**	600	74	4	4	8,9	558	482	545,5	–	–	–
N2988-M1B	1	81	**440**	600	95	4	4	8,7	560	–	–	493,3	–	–
NU2988-M1	3	81	**440**	600	95	4	4	8,7	560	480	545,6	–	–	–
NU3988-E-M1	3	99,2	**440**	600	118	4	4	9,7	564	480	550	–	–	–
N1088-M1	1	107	**440**	650	94	6	6	9,8	597	–	–	513,5	–	–
NU1088-M1	3	107	**440**	650	94	6	6	9,8	597	493	577,6	–	–	–
NU1088-M1A	3	109	**440**	650	94	6	6	9,8	597	493	577,6	–	–	–
NU1088-MPA	3	113	**440**	650	94	6	6	9,8	597	493	577,6	–	–	–
NU3088-K-M1A	3	181	**440**	650	157	6	–	3,2	597	493	577,6	–	–	–
NU3188-M1	3	367	**440**	720	226	6	6	19,1	665	505	640	–	–	–
NU1288-M	3	345	**440**	790	155	7,5	7,5	9,8	724	514	690	–	–	–
NU2288-E-M1	3	438	**440**	790	200	7,5	7,5	17,5	718	518	686	–	–	–
NU2288-E-M1A	3	449	**440**	790	200	7,5	7,5	17,5	718	518	686	–	–	–
Z-527460.ZL	2	32,1	**460**	580	56	3	3	10	550	–	–	505	3,2	12,2
NU1892-M1	3	34,1	**460**	580	56	3	3	6,6	550	494	540,5	–	–	–
NU3892-M1	3	56,4	**460**	580	90	3	3	10	550	494	540,5	–	–	–
NU1992-M1	3	63,1	**460**	620	74	4	4	8,4	578	502	562,8	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

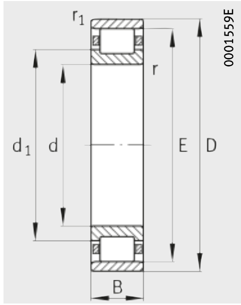


Mounting dimensions for NU

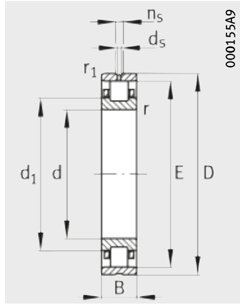
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
435	450	458	545	–	–	3	3	1 370	2 900	275	1 900	700
435	450	458	545	–	–	3	3	1 760	3 900	370	1 900	630
437	–	–	603	574	566	4	4	1 400	2 450	219	1 800	900
437	465	475	603	–	–	4	4	1 400	2 450	183	1 800	920
437	465	475	603	–	–	4	4	1 400	2 450	183	1 800	920
437	465	475	603	–	–	4	4	2 700	5 600	530	1 600	560
437	465	475	603	–	–	4	4	2 700	5 600	530	1 600	560
446	480	490	674	–	–	5	5	4 900	8 800	790	1 400	480
452	490	498	728	–	–	6	6	3 900	5 700	490	1 400	560
452	489	499	728	–	–	6	6	5 000	8 150	710	1 200	380
452	489	499	728	–	–	6	6	5 000	8 150	710	1 200	380
450	–	–	530	519	509	2,1	2,1	290	550	37	2 200	–
450	–	–	530	521	511	2,1	2,1	335	620	42	2 200	–
450	–	–	530	521	511	2	2	540	1 200	104	2 200	–
450	464	471	530	–	–	2	2	540	1 200	93	2 200	–
450	464	471	530	–	–	2	2	965	2 500	232	2 000	670
455	478	486	585	–	–	3	3	1 000	1 900	149	1 900	–
455	–	–	585	565	555	3	3	1 630	3 450	320	1 800	670
455	476	484	585	–	–	3	3	1 630	3 450	320	1 800	670
455	476	484	585	–	–	3	3	2 120	4 650	430	1 600	560
463	–	–	627	601	593	5	5	1 560	2 750	244	1 600	850
463	488	498	627	–	–	5	5	1 560	2 750	203	1 600	860
463	488	498	627	–	–	5	5	1 560	2 750	203	1 600	860
463	488	498	627	–	–	5	5	1 560	2 750	203	1 600	860
463	488	498	627	–	–	5	–	3 000	6 400	590	1 500	500
466	500	510	694	–	–	5	5	5 100	9 300	830	1 400	450
472	509	519	758	–	–	6	6	4 050	6 000	500	1 300	530
472	514	523	758	–	–	6	6	5 100	8 300	710	1 200	380
472	514	523	758	–	–	6	6	5 100	8 300	710	1 200	380
472	–	–	568	555	545	2,5	2,5	400	710	48	2 000	–
472	490	497	568	–	–	2,5	2,5	670	1 430	109	2 000	–
472	490	497	568	–	–	2,5	2,5	1 200	3 050	280	1 800	630
475	498	506	605	–	–	3	3	1 020	1 960	135	1 800	–

Cylindrical roller bearings with cage

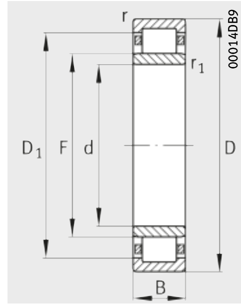
Single row
Non-locating bearings



Design 1
N



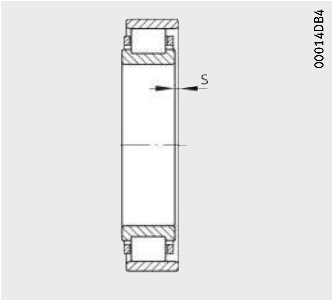
Design 2
N with lubrication groove and holes



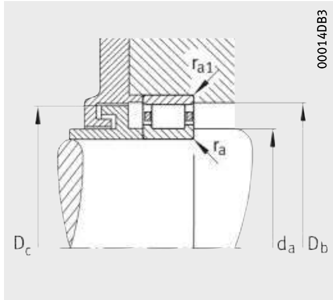
Design 3
NU, cylindrical or tapered bore

Dimension table (continued) · Dimensions in mm

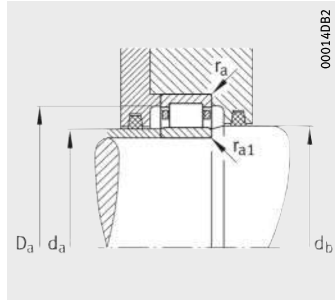
Designation	Design	Mass	Dimensions											
		m	d	D	B	r	r_1	s[1)]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
NU2992-M1	3	84	**460**	620	95	4	4	8,7	580	500	564	–	–	–
NU3992-E-M1	3	104	**460**	620	118	4	4	6,2	584	500	570	–	–	–
NU1092-K-M1	3	122	**460**	680	100	6	–	11,2	624	516	603,9	–	–	–
NU1092-K-M1A	3	124	**460**	680	100	6	–	11,2	624	516	603,9	–	–	–
NU1092-M1	3	125	**460**	680	100	6	6	11,2	624	516	603,9	–	–	–
NU1092-M1A	3	126	**460**	680	100	6	6	11,2	624	516	603,9	–	–	–
NU3092-K-M1A	3	206	**460**	680	163	6	–	14,4	624	516	603,9	–	–	–
NU3192-M1A	3	436	**460**	760	240	7,5	7,5	20	701	531	674	–	–	–
NU1292-M1	3	401	**460**	830	165	7,5	7,5	14,1	759	539	724	–	–	–
NU2292-E-M1	3	511	**460**	830	212	7,5	7,5	20	756	544	722	–	–	–
NU2292-E-M1A	3	521	**460**	830	212	7,5	7,5	20	756	544	722	–	–	–
NU2292-E-MPA	3	513	**460**	830	212	7,5	7,5	20	756	544	722	–	–	–
Z-527461.ZL	2	34,6	**480**	600	56	3	3	10	570	–	–	525	3,2	12,2
NU1896-M1	3	35,2	**480**	600	56	3	3	6,6	570	514	560,5	–	–	–
NU3896-M1	3	57,8	**480**	600	90	3	3	10	570	514	560,5	–	–	–
NU1996-M1	3	74,2	**480**	650	78	5	5	8,8	605	525	589	–	–	–
NU2996-M1	3	98,8	**480**	650	100	5	5	6,3	607	523	593	–	–	–
NU3996-E-M1	3	125	**480**	650	128	5	5	6,7	613	523	598	–	–	–
N1096-M1	1	128	**480**	700	100	6	6	10,7	644	–	–	556,4	–	–
NU1096-M1	3	129	**480**	700	100	6	6	10,7	644	536	623,9	–	–	–
NU1096-M1A	3	132	**480**	700	100	6	6	10,7	644	536	623,9	–	–	–
NU3096-M1	3	219	**480**	700	165	6	6	15	644	536	623,9	–	–	–
NU3196-M1	3	483	**480**	790	248	7,5	7,5	22	726	556	698,8	–	–	–
NU1296-M1	3	468	**480**	870	170	7,5	7,5	10,5	794	564	757	–	–	–
Z-537024.ZL	2	29,6	**500**	620	45	3	3	7	587	–	–	547	3,2	9,5
Z-527462.ZL	2	35	**500**	620	56	3	3	10	590	–	–	545	3,2	12,2
N18/500-M1	1	36,1	**500**	620	56	3	3	6,6	590	–	–	543,5	–	–
NU18/500-M1	3	36,9	**500**	620	56	3	3	6,6	590	534	580	–	–	–
N28/500-M1	1	48,2	**500**	620	72	3	3	8	590	–	–	543,5	–	–
NU28/500-M1	3	48,5	**500**	620	72	3	3	8	590	534	580	–	–	–
NU28/500-M1A	3	49,1	**500**	620	72	3	3	8	590	534	580	–	–	–
NU38/500-M1	3	60,5	**500**	620	90	3	3	10	590	534	580	–	–	–
NU19/500-M1	3	76,8	**500**	670	78	5	5	8,8	625	545	609	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

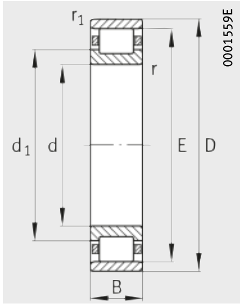


Mounting dimensions for NU

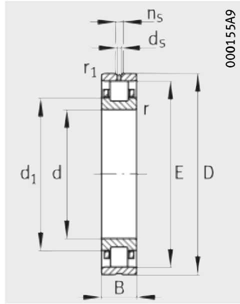
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
475	496	504	605	–	–	3	3	1 660	3 600	330	1 600	630
475	496	504	605	–	–	3	3	2 160	4 800	440	1 600	530
483	510	522	657	–	–	5	–	1 660	3 000	218	1 600	800
483	510	522	657	–	–	5	–	1 660	3 000	218	1 600	800
483	510	522	657	–	–	5	5	1 660	3 000	218	1 600	830
483	510	522	657	–	–	5	5	1 660	3 000	218	1 600	830
483	511	521	657	–	–	5	–	3 250	6 950	630	1 400	480
492	526	536	728	–	–	6	6	5 600	10 400	920	1 300	430
492	534	544	798	–	–	6	6	4 650	6 950	580	1 200	500
492	540	549	798	–	–	6	6	5 600	9 150	770	1 100	360
492	540	549	798	–	–	6	6	5 600	9 150	770	1 100	355
492	540	549	798	–	–	6	6	5 600	9 150	770	1 100	360
492	–	–	588	575	565	2,5	2,5	415	765	52	1 900	–
492	510	517	588	–	–	2,5	2,5	680	1 460	113	1 900	–
492	510	517	588	–	–	2,5	2,5	1 220	3 100	285	1 800	600
497	521	529	633	–	–	4	4	1 140	2 240	172	1 800	–
497	519	527	633	–	–	4	4	1 900	4 150	380	1 500	560
497	519	527	633	–	–	4	4	2 450	5 500	495	1 500	500
503	–	–	677	648,5	639,5	5	5	1 700	3 100	270	1 500	800
503	530	542	677	–	–	5	5	1 700	3 100	225	1 500	780
503	530	542	677	–	–	5	5	1 700	3 100	225	1 500	780
503	531	541	677	–	–	5	5	3 350	7 200	650	1 400	450
512	551	561	758	–	–	6	6	5 850	11 000	970	1 200	400
512	559	569	838	–	–	6	6	5 100	7 650	630	1 100	450
512	–	–	608	593	581	2,5	2,5	360	695	47	1 900	–
512	–	–	608	596	584	2,5	2,5	440	830	55	1 800	–
512	–	–	608	596	584	2,5	2,5	695	1 530	130	1 800	–
512	530	538	608	–	–	2,5	2,5	695	1 530	116	1 800	–
512	–	–	608	596	584	2,5	2,5	1 020	2 500	222	1 600	630
512	530	538	608	–	–	2,5	2,5	1 020	2 500	222	1 600	630
512	530	538	608	–	–	2,5	2,5	1 020	2 500	222	1 600	630
512	530	538	608	–	–	2,5	2,5	1 250	3 250	290	1 600	560
517	541	549	653	–	–	4	4	1 160	2 320	176	1 600	–

Cylindrical roller bearings with cage

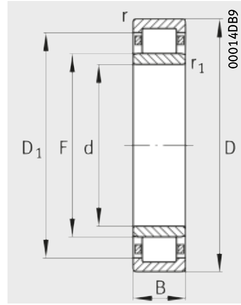
Single row
Non-locating bearings



Design 1
N



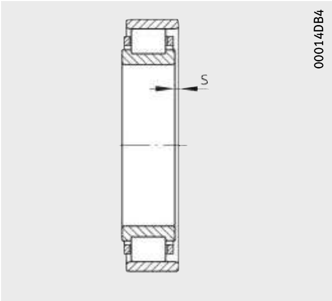
Design 2
N with lubrication groove and holes



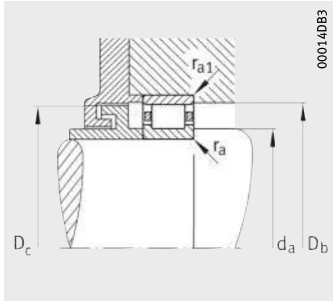
Design 3
NU, cylindrical or tapered bore

Dimension table (continued) · Dimensions in mm

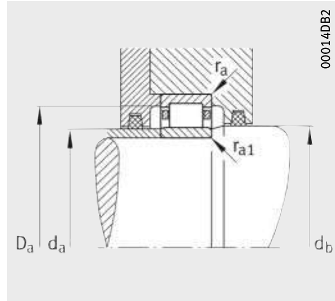
Designation	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈	d_s	n_s
NU29/500-M1	3	103	**500**	670	100	5	5	6,3	627	543	613	–	–	–
NU39/500-E-M1	3	128	**500**	670	128	5	5	11	633	543	618	–	–	–
N10/500-M1	1	132	**500**	720	100	6	6	10,7	664	–	–	576,4	–	–
NU10/500-M1	3	133	**500**	720	100	6	6	10,7	664	556	643,9	–	–	–
NU10/500-M1A	3	135	**500**	720	100	6	6	10,7	664	556	643,9	–	–	–
NU20/500-E-M1	3	177	**500**	720	128	6	6	7	673	553	655,5	–	–	–
NU30/500-M1	3	230	**500**	720	167	6	6	10,8	664	556	643,9	–	–	–
NU31/500-M1	3	575	**500**	830	264	7,5	7,5	23,5	761	581	732	–	–	–
NU12/500-M1	3	568	**500**	920	185	7,5	7,5	16	839	589	799	–	–	–
NU12/500-M1A	3	568	**500**	920	185	7,5	7,5	16	839	589	799	–	–	–
NU22/500-E-M1	3	728	**500**	920	243	7,5	7,5	17	824	604	789	–	–	–
Z-527247.ZL	2	31	**530**	650	45	3	3	3,2	620	–	–	575	3,2	9,5
Z-527272.ZL	2	36,6	**530**	650	56	3	3	10	620	–	–	573,5	3,2	12,2
NU18/530-M1	3	38,5	**530**	650	56	3	3	6,6	620	564	610,5	–	–	–
NU28/530-M1	3	50,7	**530**	650	72	3	3	8	620	564	610,5	–	–	–
NU38/530-M1	3	64,1	**530**	650	90	3	3	10	620	564	610,5	–	–	–
NU19/530-M1	3	89,9	**530**	710	82	5	5	9,3	662	578	645,2	–	–	–
NU29/530-M1	3	123	**530**	710	106	5	5	8,5	665	575	647	–	–	–
NU10/530-M1	3	190	**530**	780	112	6	6	10,2	719	591	696	–	–	–
NU10/530-M1A	3	193	**530**	780	112	6	6	10,2	719	591	696	–	–	–
NU20/530-E-M1	3	250	**530**	780	145	6	6	8	724	594	703,1	–	–	–
NU30/530-K-M1A	3	311	**530**	780	185	6	–	16,8	719	591	696	–	–	–
NU30/530-M1A	3	315	**530**	780	185	6	6	15,5	719	591	696	–	–	–
NU31/530-M1	3	665	**530**	870	272	7,5	7,5	22	801	611	770,6	–	–	–
NU12/530-M1	3	702	**530**	980	200	9,5	9,5	11,7	894	624	851	–	–	–
Z-540208.ZL	2	33	**560**	680	45	3	3	7	647	–	–	606,8	3,2	9,5
Z-526722.ZL	2	40,5	**560**	680	56	3	3	10	650	–	–	605	3,2	9,5
NU18/560-M1	3	40,5	**560**	680	56	3	3	6,6	650	594	640	–	–	–
NU38/560-M1	3	67,3	**560**	680	90	3	3	10	650	594	640	–	–	–
NU19/560-M1	3	105	**560**	750	85	5	5	9,6	700	610	682	–	–	–
NU29/560-M1	3	143	**560**	750	112	5	5	6,5	703	607	687,5	–	–	–
NU10/560-K-M1	3	209	**560**	820	115	6	–	9,8	754	626	731	–	–	–
NU10/560-M1	3	213	**560**	820	115	6	6	9,8	754	626	731	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

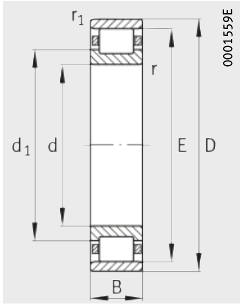


Mounting dimensions for NU

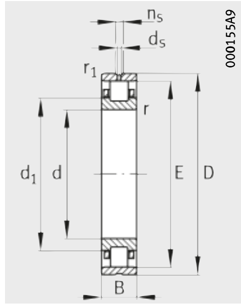
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
517	539	547	653	–	–	4	4	1 930	4 300	385	1 500	560
517	539	547	653	–	–	4	4	2 500	5 700	510	1 400	480
523	–	–	697	669	659	5	5	1 760	3 200	275	1 500	750
523	550	562	697	–	–	5	5	1 760	3 200	232	1 500	750
523	550	562	697	–	–	5	5	1 760	3 200	232	1 500	750
523	548	558	697	–	–	5	5	3 000	6 000	530	1 400	480
523	551	561	697	–	–	5	5	3 400	7 500	670	1 400	430
532	576	586	798	–	–	6	6	6 550	12 500	1 070	1 100	360
532	584	594	888	–	–	6	6	5 700	8 500	680	1 100	430
532	584	594	888	–	–	6	6	5 700	8 500	680	1 100	430
532	600	608	888	–	–	6	6	7 100	12 500	1 030	1 000	290
542	–	–	638	626	614	2,5	2,5	455	880	58	1 800	–
542	–	–	638	626	614	2,5	2,5	455	880	58	1 800	–
542	560	568	638	–	–	2,5	2,5	720	1 660	123	1 800	–
542	560	568	638	–	–	2,5	2,5	1 060	2 700	236	1 500	600
542	560	568	638	–	–	2,5	2,5	1 290	3 450	310	1 500	530
547	574	582	693	–	–	4	4	1 290	2 650	197	1 500	–
547	571	579	693	–	–	4	4	2 200	4 900	425	1 400	500
553	585	597	757	–	–	5	5	2 500	4 550	320	1 300	640
553	585	597	757	–	–	5	5	2 500	4 550	320	1 300	640
553	589	599	757	–	–	5	5	3 550	7 200	610	1 300	450
553	586	596	757	–	–	5	–	4 300	9 150	810	1 300	380
553	586	596	757	–	–	5	5	4 300	9 150	810	1 300	380
562	605	616	838	–	–	6	6	7 200	14 000	1 180	1 100	320
570	619	629	940	–	–	8	8	6 300	9 300	730	1 000	400
572	–	–	668	653	641	2,5	2,5	375	750	48,5	1 600	–
572	–	–	668	656	644	2,5	2,5	475	950	61	1 600	–
572	590	598	668	–	–	2,5	2,5	735	1 700	124	1 600	–
572	590	598	668	–	–	2,5	2,5	1 290	3 550	310	1 500	500
577	606	614	733	–	–	4	4	1 460	3 000	215	1 400	–
577	603	611	733	–	–	4	4	2 450	5 500	475	1 400	450
583	620	632	797	–	–	5	–	2 700	5 100	355	1 200	590
583	620	632	797	–	–	5	5	2 700	5 100	355	1 200	590

Cylindrical roller bearings with cage

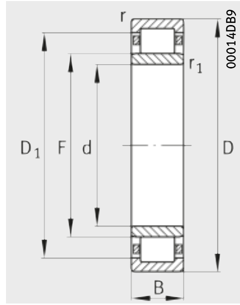
Single row
Non-locating
bearings



Design 1
N



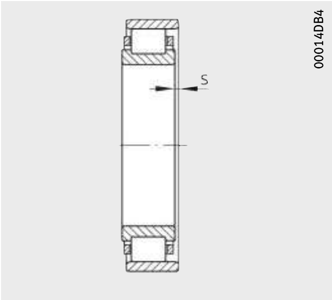
Design 2
N with lubrication
groove and holes



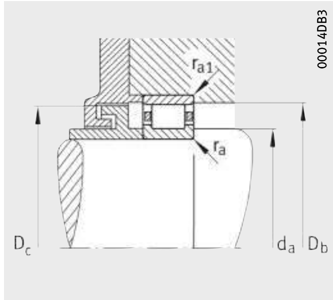
Design 3
NU

Dimension table (continued) · Dimensions in mm

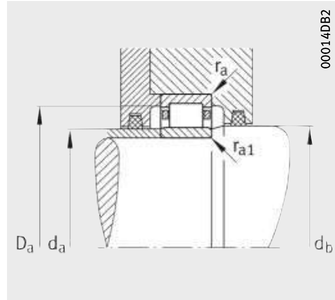
Designation	Design	Mass m ≈kg	d	D	B	r min.	r_1 min.	$s^{1)}$	E	F	D_1 ≈	d_1 ≈	d_s	n_s
NU10/560-M1A	3	222	**560**	820	115	6	6	9,8	754	626	731	–	–	–
NU20/560-E-M1	3	281	**560**	820	150	6	6	12	762	626	741	–	–	–
NU30/560-M1	3	362	**560**	820	195	6	6	16,8	754	626	731	–	–	–
NU31/560-M1	3	756	**560**	920	280	7,5	7,5	22,5	846	646	814	–	–	–
NU12/560-M1	3	778	**560**	1 030	206	9,5	9,5	11,9	939	659	894	–	–	–
NU12/560-M1A	3	778	**560**	1 030	206	9,5	9,5	11,9	939	659	894	–	–	–
NU22/560-E-M	3	1 040	**560**	1 030	272	9,5	9,5	21,9	939	659	894	–	–	–
NU22/560-E-M1A	3	1 070	**560**	1 030	272	9,5	9,5	21,9	939	659	894	–	–	–
Z-503867.ZL	3	64,6	**585**	750	60	3	3	–	693	637	682,4	–	–	–
Z-527273.ZL	2	52,3	**600**	730	60	3	3	12,2	697	–	–	658,4	3,2	12,2
N18/600-M1	1	50,4	**600**	730	60	3	3	7	697	–	–	647	–	–
NU18/600-M1	3	50,6	**600**	730	60	3	3	7	697	637	687	–	–	–
NU28/600-M1	3	67,4	**600**	730	78	3	3	9,5	697	637	687	–	–	–
NU38/600-M1	3	85,1	**600**	730	98	3	3	11	697	637	687	–	–	–
NU19/600-M1	3	125	**600**	800	90	5	5	9,9	748	652	730,7	–	–	–
NU29/600-E-M1	3	172	**600**	800	118	5	5	8,4	757	649	739	–	–	–
NU29/600-E-M1A	3	172	**600**	800	118	5	5	8,4	757	649	739	–	–	–
NU29/600-E-MP1A	3	169	**600**	800	118	5	5	8,4	757	649	739	–	–	–
N10/600-M1	1	240	**600**	870	118	6	6	10,6	803	–	–	693,5	–	–
N10/600-M1B	1	241	**600**	870	118	6	6	10,6	803	–	–	693,5	–	–
NU10/600-M1	3	241	**600**	870	118	6	6	10,6	803	667	776	–	–	–
NU10/600-M1A	3	243	**600**	870	118	6	6	10,6	803	667	776	–	–	–
NU30/600-MP1A	3	400	**600**	870	200	6	6	16	803	667	776	–	–	–
NU31/600-M1	3	898	**600**	980	300	7,5	7,5	25,5	902	692	868,5	–	–	–
NU12/600-M1	3	918	**600**	1 090	212	9,5	9,5	12	994	704	947,5	–	–	–
Z-547406.ZL	1	116	**622**	775	108	5	5	–	743,5	–	–	670,5	–	–
Z-537025.ZL	2	58,1	**630**	780	56	4	4	9	737	–	–	688,5	3,2	12,2
Z-527274.ZL	2	68,6	**630**	780	69	4	4	12,5	744	–	–	686	3,2	12,2
NU18/630-M1	3	71,8	**630**	780	69	4	4	8,4	744	672	732	–	–	–
N28/630-M1	1	94,5	**630**	780	88	4	4	8,7	744	–	–	684	–	–
NU28/630-M1	3	94,8	**630**	780	88	4	4	8,7	744	672	732	–	–	–
NU28/630-M1A	3	96,5	**630**	780	88	4	4	8,7	744	672	732	–	–	–
NU38/630-M1	3	118	**630**	780	112	4	4	11,2	744	672	732	–	–	–
NU19/630-M1	3	163	**630**	850	100	6	6	8,5	792	688	771	–	–	–
NU29/630-E-M1	3	211	**630**	850	128	6	6	10,3	803	683	784	–	–	–



[1] Axial displacement “s” for N and NU



Mounting dimensions for N

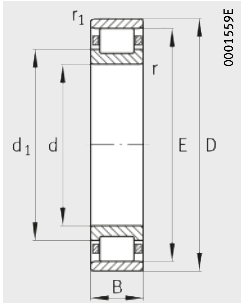


Mounting dimensions for NU

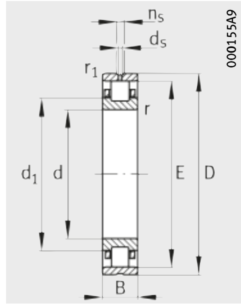
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
583	620	632	797	–	–	5	5	2 700	5 100	355	1 200	590
583	620,5	631,5	797	–	–	5	5	3 900	7 800	660	1 200	400
583	621	631	797	–	–	5	5	4 500	10 000	860	1 200	360
592	641	646	888	–	–	6	6	8 000	15 300	1 280	1 000	300
600	654	664	990	–	–	8	8	7 100	10 800	830	950	360
600	654	664	990	–	–	8	8	7 100	10 800	830	950	360
600	654	664	990	–	–	8	8	9 500	15 600	1 240	850	240
600	654	664	990	–	–	8	8	9 500	15 600	1 240	850	240
597	632	642	738	–	–	2,5	2,5	750	1 800	135	1 500	530
612	–	–	718	703	691	2,5	2,5	405	900	55	1 500	670
612	–	–	718	703	691	2,5	2,5	850	2 000	162	1 500	–
612	632	642	718	–	–	2,5	2,5	850	2 000	144	1 500	–
612	632	642	718	–	–	2,5	2,5	1 250	3 350	280	1 400	500
612	632	642	718	–	–	2,5	2,5	1 530	4 250	365	1 400	450
617	647	657	783	–	–	4	4	1 700	3 450	249	1 400	–
617	645	655	783	–	–	4	4	3 000	6 700	570	1 200	400
617	645	655	783	–	–	4	4	3 000	6 700	570	1 200	400
617	645	655	783	–	–	4	4	3 000	6 700	570	1 200	400
623	–	–	847	809	797	5	5	2 850	5 400	440	1 100	530
623	–	–	847	809	797	5	5	2 850	5 400	440	1 100	530
623	661	673	847	–	–	5	5	2 850	5 400	365	1 100	550
623	661	673	847	–	–	5	5	2 850	5 400	365	1 100	550
623	642	672	847	–	–	5	5	4 900	11 000	920	1 100	320
632	687	697	948	–	–	6	6	8 650	17 000	1 390	950	280
640	704	714	1 050	–	–	8	8	7 800	12 500	940	900	320
637	–	–	760	750	738	4	4	2 400	5 700	425	1 300	380
645	–	–	765	743	730	3	3	530	1 100	68	1 400	–
645	–	–	765	750	738	3	3	655	1 250	80	1 400	–
645	667	677	765	–	–	3	3	1 140	2 600	189	1 400	–
645	–	–	765	751	737	3	3	1 700	4 400	370	1 300	430
645	667	677	765	–	–	3	3	1 700	4 400	370	1 300	430
645	667	677	765	–	–	3	3	1 700	4 400	370	1 300	430
645	667	677	765	–	–	3	3	2 040	5 500	470	1 300	400
653	683	693	827	–	–	5	5	1 900	3 900	280	1 300	–
653	678	688	827	–	–	5	5	3 350	7 350	505	1 100	360

Cylindrical roller bearings with cage

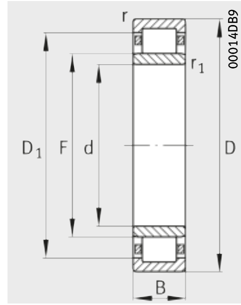
Single row
Non-locating bearings



Design 1
N



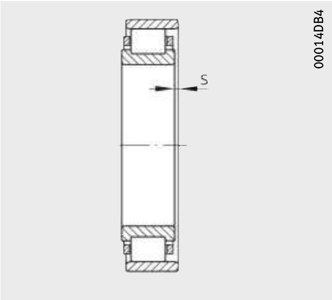
Design 2
N with lubrication groove and holes



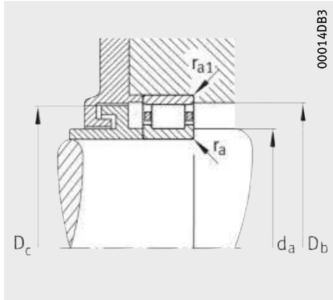
Design 3
NU

Dimension table (continued) · Dimensions in mm

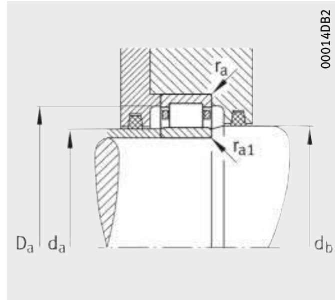
Designation	Design	Mass m ≈kg	d	D	B	r min.	r_1 min.	s[1)]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
N10/630-M1	1	292	**630**	920	128	7,5	7,5	11,7	850	–	–	728	–	–
NU30/630-M1	3	486	**630**	920	212	7,5	7,5	17,4	850	700	826,2	–	–	–
NU31/630-M	3	1 050	**630**	1 030	315	7,5	7,5	27,3	947	727	911,8	–	–	–
NU12/630-M1	3	1 100	**630**	1 150	230	15	15	20	1 020	760	978	–	–	–
Z-527249.ZL	2	60,1	**640**	790	56	4	4	8,5	750	–	–	698,3	3,2	12,2
Z-537238.ZL	2	60,7	**670**	820	56	4	4	9	778	–	–	729,5	6,3	12,2
Z-527463.ZL	2	70,3	**670**	820	69	4	4	12,5	784	–	–	725,9	3,2	12,2
NU18/670-M1	3	75,9	**670**	820	69	4	4	7,8	784	712	772	–	–	–
N28/670-M1	1	100	**670**	820	88	4	4	8,7	784	–	–	724	–	–
NU28/670-M1	3	100	**670**	820	88	4	4	8,7	784	712	772	–	–	–
NU28/670-M1A	3	101	**670**	820	88	4	4	8,7	784	712	772	–	–	–
NU38/670-M1	3	123	**670**	820	112	4	4	11,2	784	712	772	–	–	–
NU19/670-M1	3	186	**670**	900	103	6	6	11,3	839	731	817	–	–	–
NU29/670-M1	3	257	**670**	900	136	6	6	7,5	841	729	819	–	–	–
N10/670-M1	1	348	**670**	980	136	7,5	7,5	12,7	905	–	–	774,5	–	–
NU30/670-M1	3	620	**670**	980	230	7,5	7,5	20,6	905	745	876,2	–	–	–
NU12/670-M	3	1 300	**670**	1 220	243	12	12	13,4	1 115	785	1 062	–	–	–
Z-527275.ZL	2	86,8	**710**	870	74	4	4	12	833	–	–	768,4	3,2	12,2
N18/710-M1	1	91,5	**710**	870	74	4	4	7,9	833	–	–	766,5	–	–
NU18/710-M1	3	91,7	**710**	870	74	4	4	7,9	833	753	820	–	–	–
NU19/710-M1	3	213	**710**	950	106	6	6	9,3	886	774	867,7	–	–	–
NU29/710-M1	3	289	**710**	950	140	6	6	11,7	890	770	866	–	–	–
NU29/710-M1A	3	289	**710**	950	140	6	6	11,7	890	770	866	–	–	–
N10/710-M1	1	401	**710**	1 030	140	7,5	7,5	12,6	950	–	–	819,5	–	–
NU10/710-M1	3	400	**710**	1 030	140	7,5	7,5	12,6	950	790	924,5	–	–	–
NU10/710-M1A	3	406	**710**	1 030	140	7,5	7,5	12,6	950	790	924,5	–	–	–
NU30/710-M1	3	673	**710**	1 030	236	7,5	7,5	22,3	950	790	924,5	–	–	–
Z-527250.ZL	2	79	**720**	880	62	4	4	9	839	–	–	780,9	3,2	12,2
Z-536020.ZL	2	95	**750**	920	68	5	5	12	875	–	–	817	3,2	12,2
Z-526719.ZL	2	106	**750**	920	78	5	5	15	879	–	–	812,2	3,2	12,2
NU18/750-M1	3	108	**750**	920	78	5	5	8,8	879	799	866	–	–	–
NU38/750-M1	3	182	**750**	920	128	5	5	14	879	799	866	–	–	–
NU19/750-M1	3	245	**750**	1 000	112	6	6	12,1	935	815	911	–	–	–
NU29/750-M1	3	329	**750**	1 000	145	6	6	8	940	810	919	–	–	–
N10/750-M1	1	481	**750**	1 090	150	7,5	7,5	13,6	1 005	–	–	866	–	–



[1] Axial displacement “s”
for N and NU



Mounting dimensions
for N

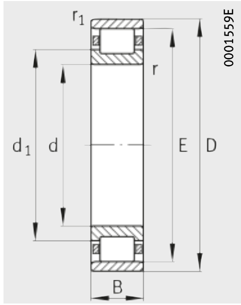


Mounting dimensions
for NU

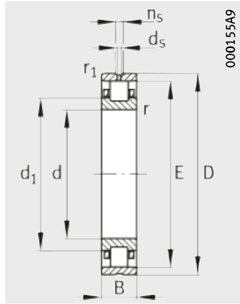
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
658	–	–	892	856	844	6	6	3 250	6 200	495	1 100	500
658	695	705	892	–	–	6	6	5 700	12 500	1 030	1 100	300
662	722	732	998	–	–	6	6	9 150	18 000	1 430	900	260
684	740	745	1 096	–	–	12	12	7 800	13 200	1 000	800	300
655	–	–	775	756	744	3	3	610	1 250	78	1 400	–
685	–	–	805	784	772	3	3	530	1 100	67	1 400	–
685	–	–	805	790	778	3	3	680	1 370	85	1 400	–
685	707	717	805	–	–	3	3	1 180	2 750	197	1 400	–
685	–	–	805	791	777	3	3	1 760	4 650	385	1 200	400
685	707	717	805	–	–	3	3	1 760	4 650	385	1 200	400
685	707	717	805	–	–	3	3	1 760	4 650	385	1 200	400
685	707	717	805	–	–	3	3	2 120	5 850	320	1 200	360
693	726	736	877	–	–	5	5	2 040	4 250	300	1 200	–
693	724	734	877	–	–	5	5	3 450	8 150	690	1 100	340
698	–	–	952	911	899	6	6	3 750	7 100	540	950	450
698	740	750	952	–	–	6	6	6 550	14 600	1 180	950	260
718	780	790	1 172	–	–	10	10	9 150	14 300	1 050	800	280
725	–	–	855	840	826	3	3	800	1 560	124	1 200	–
725	–	–	855	840	826	3	3	1 400	3 250	260	1 200	–
725	748	758	855	–	–	3	3	1 400	3 250	230	1 200	–
733	769	779	927	–	–	5	5	2 240	4 750	300	1 100	–
733	765	775	927	–	–	5	5	3 750	8 800	710	1 000	320
733	765	775	927	–	–	5	5	3 750	8 800	710	1 000	320
738	–	–	1 002	957	943	6	6	4 050	8 000	620	950	430
738	784	796	1 002	–	–	6	6	4 050	8 000	510	950	425
738	784	796	1 002	–	–	6	6	4 050	8 000	510	950	425
738	785	795	1 002	–	–	6	6	6 800	15 600	1 250	950	240
735	–	–	865	846	832	3	3	800	1 700	104	1 200	–
767	–	–	903	882	868	4	4	735	1 560	94	1 100	–
767	–	–	903	886	872	4	4	850	1 700	102	1 100	–
767	794	804	903	–	–	4	4	1 430	3 450	213	1 100	–
767	794	804	903	–	–	4	4	2 550	7 350	590	1 100	320
773	810	820	977	–	–	5	5	2 500	5 300	365	1 100	–
773	805	815	977	–	–	5	5	4 150	9 650	770	950	300
778	–	–	1 062	1 012	998	6	6	4 500	9 000	680	850	400

Cylindrical roller bearings with cage

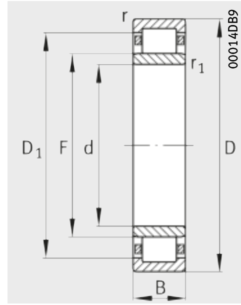
Single row
Non-locating
bearings



Design 1
N



Design 2
N with lubrication groove and holes

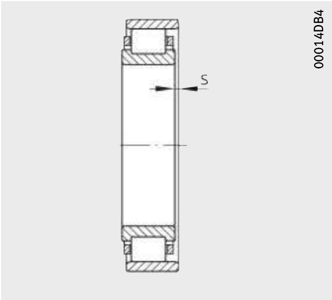


Design 3
NU

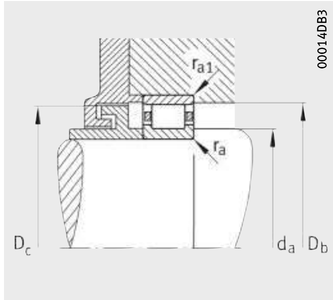
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[2)]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
NU10/750-M1	3	480	**750**	1 090	150	7,5	7,5	13,6	1 005	835	978	–	–	–
NU10/750-M1A	3	495	**750**	1 090	150	7,5	7,5	13,6	1 005	835	978	–	–	–
NU30/750-M1	3	808	**750**	1 090	250	7,5	7,5	20,5	1 005	835	978	–	–	–
Z-527276.ZL	2[1)]	113	**800**	980	82	5	5	15	939	–	–	866,2	3,2	12,2
NU18/800-M1	3	129	**800**	980	82	5	5	8,9	939	849	923	–	–	–
NU38/800-M1	3	220	**800**	980	136	5	5	14	939	849	923	–	–	–
NU19/800-M1	3	276	**800**	1 060	115	6	6	12,8	990	870	968,4	–	–	–
NU29/800-M1	3	378	**800**	1 060	150	6	6	13,3	995	865	969	–	–	–
N10/800-M1	1	556	**800**	1 150	155	7,5	7,5	13,6	1 065	–	–	918	–	–
NU10/800-M1	3	557	**800**	1 150	155	7,5	7,5	13,6	1 065	885	1 036	–	–	–
NU10/800-M1A	3	557	**800**	1 150	155	7,5	7,5	13,6	1 065	885	1 036	–	–	–
NU30/800-M1	3	912	**800**	1 150	258	7,5	7,5	22,5	1 065	885	1 036	–	–	–
Z-527251.ZL	2	101	**820**	990	72	5	5	7,3	951	–	–	883,2	3,2	12,2
Z-526720.ZL	2[1)]	130	**850**	1 030	82	5	5	15	989	–	–	916,2	3,2	15
NU18/850-M1	3	137	**850**	1 030	82	5	5	9	985	895	970	–	–	–
NU28/650-M1	3	185	**850**	1 030	106	5	5	9,3	985	895	970	–	–	–
NU28/650-M1A	3	186	**850**	1 030	106	5	5	9,3	985	895	970	–	–	–
NU38/850-M1	3	232	**850**	1 030	136	5	5	14	985	895	970	–	–	–
NU19/850-M1	3	315	**850**	1 120	118	6	6	12,6	1 049	921	1 024,1	–	–	–
NU29/850-M1	3	427	**850**	1 120	155	6	6	8,6	1 053	917	1 031,5	–	–	–
N10/850-M1	1	658	**850**	1 220	165	7,5	7,5	13,5	1 125	–	–	978	–	–
NU10/850-M1	3	659	**850**	1 220	165	7,5	7,5	13,5	1 125	945	1 096,2	–	–	–
NU30/850-M	3	1 080	**850**	1 220	272	7,5	7,5	26	1 125	945	1 096,2	–	–	–
Z-527464.ZL	2[1)]	146	**900**	1 090	85	5	5	15	1 047	–	–	969,3	3,2	15
NU18/900-M1	3	159	**900**	1 090	85	5	5	11,8	1 047	951	1 031	–	–	–
NU38/900-M1	3	269	**900**	1 090	140	5	5	13,5	1 047	951	1 031	–	–	–
NU19/900-M1	3	354	**900**	1 180	122	6	6	9,8	1 108	972	1 086,2	–	–	–
NU29/900-M1	3	499	**900**	1 180	165	6	6	13,3	1 110	970	1 088	–	–	–
N10/900-M1	1	720	**900**	1 280	170	7,5	7,5	13,5	1 190	–	–	1 026	–	–
NU10/900-M1	3	728	**900**	1 280	170	7,5	7,5	13,5	1 190	990	1 158	–	–	–
NU30/900-M1	3	1 190	**900**	1 280	280	7,5	7,5	23	1 190	990	1 158	–	–	–

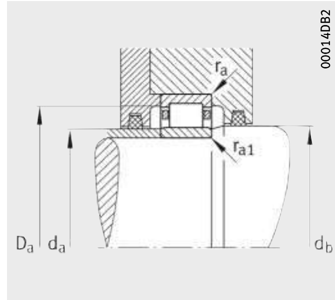
1) With thread M8 for eye bolts on the end faces.



[2)] Axial displacement “s”
for N and NU



Mounting dimensions
for N

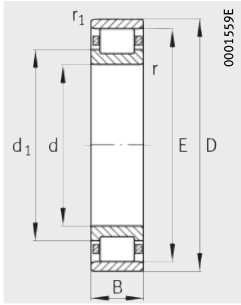


Mounting dimensions
for NU

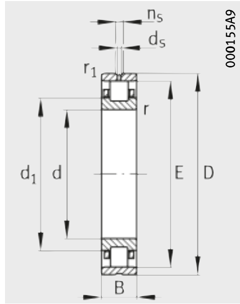
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
778	829	841	1 062	–	–	6	6	4 500	9 000	570	850	400
778	829	841	1 062	–	–	6	6	4 500	9 000	570	850	400
778	830	840	1 062	–	–	6	6	7 650	17 600	1 380	850	220
817	–	–	963	946	932	4	4	1 020	2 000	118	1 100	450
817	844	854	963	–	–	4	4	1 760	4 150	280	1 100	–
817	844	854	963	–	–	4	4	3 100	8 800	690	1 000	280
823	865	875	1 037	–	–	5	5	2 600	5 700	390	1 000	–
823	860	870	1 037	–	–	5	5	4 250	10 000	780	900	280
828	–	–	1 122	1 072	1 058	6	6	5 000	10 000	750	800	360
828	879	891	1 122	–	–	6	6	5 000	10 000	630	800	365
828	879	891	1 122	–	–	6	6	5 000	10 000	630	800	365
828	880	890	1 122	–	–	6	6	8 500	19 600	1 530	800	200
837	–	–	973	858	844	4	4	915	1 900	111	1 100	–
867	–	–	1 013	896	882	4	4	1 060	2 160	126	1 000	–
867	894	904	1 013	–	–	4	4	1 800	4 400	295	1 000	–
867	890	900	1 013	–	–	4	4	2 750	7 650	590	950	280
867	890	900	1 013	–	–	4	4	2 750	7 650	590	950	280
867	894	904	1 013	–	–	4	4	3 200	9 300	720	950	260
873	916	926	1 097	–	–	5	5	2 900	6 400	430	950	–
873	912	922	1 097	–	–	5	5	4 750	11 600	890	850	260
878	–	–	1 192	1 132	1 118	6	6	5 600	11 800	880	750	320
878	938	952	1 192	–	–	6	6	5 600	11 800	730	750	325
878	940	950	1 192	–	–	6	6	8 500	20 400	1 540	750	190
917	–	–	1 073	1 054	1 040	4	4	1 140	2 320	132	950	–
917	946	956	1 073	–	–	4	4	2 040	5 100	330	950	–
917	946	956	1 073	–	–	4	4	3 600	10 600	810	850	220
923	967	977	1 157	–	–	5	5	3 250	7 350	470	900	–
923	965	975	1 157	–	–	5	5	5 400	13 400	1 010	800	220
928	–	–	1 252	1 198	1 182	6	6	6 400	13 400	960	700	300
928	983	997	1 252	–	–	6	6	6 400	13 400	800	700	295
928	985	995	1 252	–	–	6	6	10 200	24 000	1 770	700	170

Cylindrical roller bearings with cage

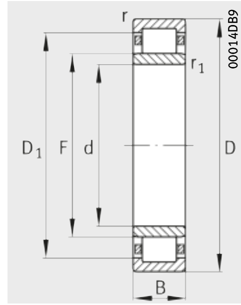
Single row
Non-locating bearings



Design 1
N



Design 2
N with lubrication groove and holes

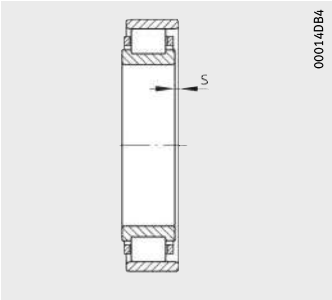


Design 3
NU

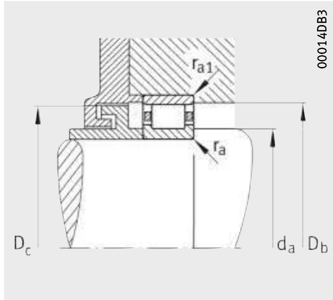
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	d	D	B	r min.	r_1 min.	s[2)]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
F-803618.ZL	2[1)]	185	**950**	1 150	90	5	5	20,5	1 094	–	–	1 029,4	3,2	15
Z-527465.ZL	2[1)]	171	**950**	1 150	90	5	5	15,5	1 104	–	–	1 024	3,2	15
NU18/950-M1	3	187	**950**	1 150	90	5	5	9,5	1 104	1 004	1 088	–	–	–
NU38/950-M1	3	318	**950**	1 150	150	5	5	15	1 104	1 004	1 088	–	–	–
NU19/950-M1	3	435	**950**	1 250	132	7,5	7,5	13,9	1 175	1 025	1 151	–	–	–
NU29/950-M1	3	596	**950**	1 250	175	7,5	7,5	14,5	1 175	1 025	1 151	–	–	–
N10/950-M1	1	898	**950**	1 360	180	7,5	7,5	13,5	1 255	–	–	1 091	–	–
NU10/950-M1	3	899	**950**	1 360	180	7,5	7,5	13,5	1 255	1 055	1 223	–	–	–
NU30/950-M	3	1 490	**950**	1 360	300	7,5	7,5	28	1 255	1 055	1 223	–	–	–
NU31/950-M	3	3 080	**950**	1 500	438	12	12	–	1 361	1 089	1 317	–	–	–
Z-527466.ZL	2[1)]	198	**1 000**	1 210	92	6	6	16	1 155	–	–	1 075	4,8	15
NU18/1000-M1	3	242	**1 000**	1 220	100	6	6	10,3	1 170	1 058	1 150	–	–	–
NU28/1000-M	3	324	**1 000**	1 220	128	6	6	11	1 170	1 058	1 150	–	–	–
NU28/1000-MA	3	326	**1 000**	1 220	128	6	6	11	1 170	1 058	1 150	–	–	–
NU38/1000-M	3	411	**1 000**	1 220	165	6	6	16,3	1 170	1 058	1 150	–	–	–
Z-507276.ZL	3	423	**1 000**	1 290	130	7,5	7,5	11,3	1 215	1 075	1 187	–	–	–
NU19/1000-M1	3	527	**1 000**	1 320	140	7,5	7,5	10,5	1 240	1 080	1 214,4	–	–	–
NU29/1000-M1	3	708	**1 000**	1 320	185	7,5	7,5	16,3	1 240	1 080	1 215	–	–	–
N10/1000-M1	1	1 010	**1 000**	1 420	185	7,5	7,5	14,5	1 315	–	–	1 143	–	–
NU10/1000-M1	3	1 010	**1 000**	1 420	185	7,5	7,5	14,5	1 315	1 105	1 281	–	–	–
NU20/1000-E-M1	3	1 300	**1 000**	1 420	243	7,5	7,5	11,5	1 330	1 100	1 293	–	–	–
NU30/1000-M1	3	1 640	**1 000**	1 420	308	7,5	7,5	28	1 315	1 105	1 281	–	–	–
Z-539392.ZL	2	203	**1 030**	1 240	92	6	6	15	1 185	–	–	1 104	4,8	15
Z-539393.ZL	2	257	**1 030**	1 250	100	6	6	–	1 190	–	–	1 109	–	–
Z-526747.ZL	2[1)]	211	**1 060**	1 270	92	6	6	16	1 215	–	–	1 134	4,8	9,5
Z-535549.ZL	2	240	**1 060**	1 280	100	6	6	12,5	1 220	–	–	1 139	4,8	9,5
NU18/1060-M1	3	259	**1 060**	1 280	100	6	6	10,3	1 230	1 118	1 210	–	–	–
NU28/1060-M	3	341	**1 060**	1 280	128	6	6	11	1 230	1 118	1 210	–	–	–
NU38/1060-M	3	431	**1 060**	1 280	165	6	6	16,3	1 230	1 118	1 210	–	–	–
NU19/1060-M1	3	630	**1 060**	1 400	150	7,5	7,5	11,5	1 312	1 148	1 285,8	–	–	–
NU29/1060-M1	3	830	**1 060**	1 400	195	7,5	7,5	16,2	1 315	1 145	1 288	–	–	–
N10/1060-M1	1	1 150	**1 060**	1 500	195	9,5	9,5	14,5	1 390	–	–	1 210	–	–
NU10/1060-M1	3	1 150	**1 060**	1 500	195	9,5	9,5	14,5	1 390	1 170	1 355	–	–	–

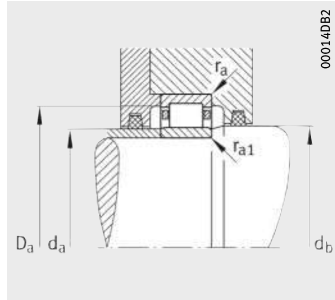
[1)] With thread M8 for eye bolts on the end faces.



2) Axial displacement “s” for N and NU



Mounting dimensions for N

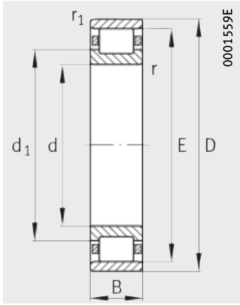


Mounting dimensions for NU

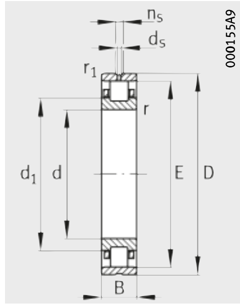
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
967	–	–	1 133	1 102	1 086	4	4	880	1 960	118	900	–
967	–	–	1 133	1 112	1 096	4	4	1 200	2 450	141	900	–
967	999	1 009	1 133	–	–	4	4	2 200	5 500	340	900	–
967	999	1 009	1 133	–	–	4	4	3 900	11 600	880	800	220
978	1 020	1 030	1 222	–	–	6	6	3 800	8 500	540	800	–
978	1 020	1 030	1 222	–	–	6	6	5 850	14 600	1 090	750	220
978	–	–	1 332	1 263	1 247	6	6	7 200	15 600	1 110	700	260
978	1 048	1 062	1 332	–	–	6	6	7 200	15 600	920	700	265
978	1 050	1 060	1 332	–	–	6	6	11 400	28 000	2 070	700	150
992	1 083	1 095	1 458	–	–	10	10	16 300	36 500	2 500	430	–
1 023	–	–	1 187	1 163	1 147	5	5	1 250	2 650	151	850	–
1 023	1 053	1 063	1 197	–	–	5	5	2 450	5 850	390	850	–
1 023	1 053	1 063	1 197	–	–	5	5	3 650	10 000	760	750	220
1 023	1 053	1 063	1 197	–	–	5	5	3 650	10 000	760	750	220
1 023	1 053	1 063	1 197	–	–	5	5	4 400	12 700	960	750	200
1 028	1 070	1 080	1 262	–	–	6	6	3 550	8 150	520	800	–
1 028	1 075	1 085	1 292	–	–	6	6	4 400	9 800	600	750	–
1 028	1 075	1 085	1 292	–	–	6	6	6 550	16 300	1 170	700	200
1 028	–	–	1 392	1 323	1 307	6	6	7 500	16 300	1 150	630	260
1 028	1 098	1 112	1 392	–	–	6	6	7 500	16 300	960	630	255
1 028	1 095	1 105	1 392	–	–	6	6	10 600	23 600	1 700	630	170
1 028	1 100	1 110	1 392	–	–	6	6	12 500	31 000	2 250	630	140
1 053	–	–	1 217	1 193	1 177	5	5	1 250	2 650	149	850	–
1 053	–	–	1 227	1 198	1 182	5	5	2 080	5 300	380	850	260
1 083	–	–	1 247	1 223	1 207	5	5	1 320	2 850	159	800	–
1 083	–	–	1 257	1 228	1 212	5	5	1 320	2 850	159	800	–
1 083	1 113	1 123	1 257	–	–	5	5	2 550	6 400	415	800	–
1 083	1 113	1 123	1 257	–	–	5	5	3 800	10 600	790	700	220
1 083	1 113	1 123	1 257	–	–	5	5	4 550	13 400	1 000	700	190
1 088	1 143	1 153	1 372	–	–	6	6	4 650	10 600	650	700	–
1 088	1 140	1 150	1 372	–	–	6	6	7 350	18 600	1 330	700	180
1 094	–	–	1 466	1 398	1 382	8	8	8 500	18 600	1 300	600	220
1 094	1 163	1 177	1 466	–	–	8	8	8 500	18 600	1 080	600	231

Cylindrical roller bearings with cage

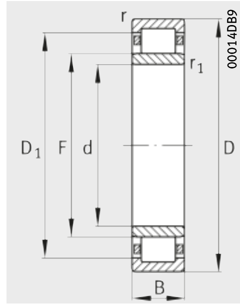
Single row
Non-locating
bearings



Design 1
N



Design 2
N with lubrication groove and holes

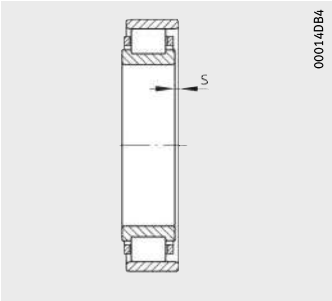


Design 3
NU

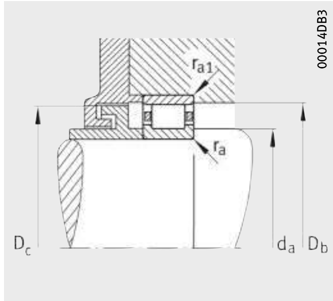
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	B	r min.	r_1 min.	s[3]	E	F	D_1 ≈	d_1 ≈	d_s	n_s
NU20/1060-E-M1	3	1 480	**1 060**	1 500	250	9,5	9,5	11,5	1 405	1 165	1 367	–	–	–
NU30/1060-M1	3	1 920	**1 060**	1 500	325	9,5	9,5	29,8	1 390	1 170	1 355	–	–	–
F-808288.ZL	3	118	**1 110**	1 240	85	6	2	5	1 205	1 145	1 195	–	–	–
Z-527467.ZL	2[1]	239	**1 120**	1 340	94	6	6	17	1 280	–	–	1 199	4,8	9,5
Z-535550.ZL	2	284	**1 120**	1 360	104	6	6	20	1 290	–	–	1 209	4,8	9,5
NU18/1120-M1	3	312	**1 120**	1 360	106	6	6	11	1 305	1 185	1 286	–	–	–
NU38/1120-M	3	547	**1 120**	1 360	180	6	6	18	1 305	1 185	1 286	–	–	–
NU19/1120-M1	3	665	**1 120**	1 460	150	7,5	7,5	11,5	1 372	1 208	1 346	–	–	–
NU29/1120-M1	3	887	**1 120**	1 460	195	7,5	7,5	13,8	1 375	1 205	1 347,8	–	–	–
N10/1120-M1	1	1 300	**1 120**	1 580	200	9,5	9,5	16	1 465	–	–	1 276	–	–
NU10/1120-M1	3	1 300	**1 120**	1 580	200	9,5	9,5	16	1 465	1 235	1 428	–	–	–
NU20/1120-E-M1	3	1 710	**1 120**	1 580	265	9,5	9,5	13	1 480	1 230	1 440	–	–	–
NU30/1120-M1	3	2 260	**1 120**	1 580	345	9,5	9,5	32,3	1 465	1 235	1 428	–	–	–
Z-527468.ZL	2[1]	245	**1 180**	1 400	94	6	6	17	1 342	–	–	1 257,8	4,8	9,5
NU18/1180-M1	3	329	**1 180**	1 420	106	6	6	11	1 365	1 245	1 346	–	–	–
NU38/1180-M	3	569	**1 180**	1 420	180	6	6	18	1 365	1 245	1 346	–	–	–
NU19/1180-M1	3	789	**1 180**	1 540	160	7,5	7,5	12,5	1 445	1 275	1 418	–	–	–
NU29/1180-M1	3	1 060	**1 180**	1 540	206	7,5	7,5	16,5	1 450	1 270	1 421	–	–	–
NU39/1180-E-M1	3	1 350	**1 180**	1 540	272	7,5	7,5	13,9	1 460	1 270	1 432	–	–	–
N10/1180-M1	1	1 520	**1 180**	1 660	212	9,5	9,5	17	1 540	–	–	1 343	–	–
NU10/1180-M1	3	1 520	**1 180**	1 660	212	9,5	9,5	17	1 540	1 300	1 502	–	–	–
NU20/1180-E-M1	3	1 940	**1 180**	1 660	272	9,5	9,5	13	1 555	1 295	1 513	–	–	–
NU30/1180-M	3	2 520	**1 180**	1 660	355	9,5	9,5	32,3	1 540	1 300	1 502	–	–	–
Z-527469.ZL	2[2]	278	**1 250**	1 480	95	6	6	17	1 417	–	–	1 333	4,8	15
Z-566705.ZL	2	337	**1 250**	1 500	106	6	6	15	1 444	–	–	1 340	4,8	15
NU18/1250-M1	3	390	**1 250**	1 500	112	6	6	11,4	1 444	1 316	1 423,3	–	–	–
NU38/1250-M	3	654	**1 250**	1 500	185	6	6	17,3	1 444	1 316	1 423,3	–	–	–
NU19/1250-M1	3	938	**1 250**	1 630	170	7,5	7,5	13	1 530	1 350	1 501,2	–	–	–
NU29/1250-M1	3	1 260	**1 250**	1 630	218	7,5	7,5	10,3	1 535	1 345	1 505	–	–	–
NU39/1250-E-M1	3	1 570	**1 250**	1 630	280	7,5	7,5	13,6	1 545	1 345	1 516	–	–	–
N10/1250-M1	1	1 710	**1 250**	1 750	218	9,5	9,5	18,5	1 625	–	–	1 419	–	–
NU10/1250-M1	3	1 710	**1 250**	1 750	218	9,5	9,5	18,5	1 625	1 375	1 585	–	–	–

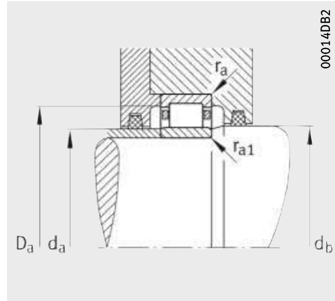
1) With thread M8 for eye bolts on the end faces.
2) With thread M10 for eye bolts on the end faces.



3) Axial displacement “s” for N and NU



Mounting dimensions for N

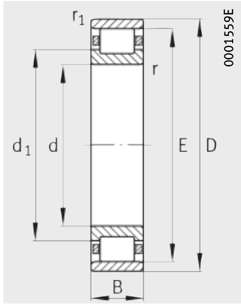


Mounting dimensions for NU

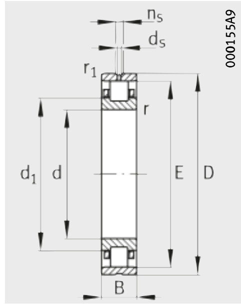
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 094	1 160	1 170	1 466	–	–	8	8	11 600	26 500	1 830	600	150
1 094	1 165	1 175	1 466	–	–	8	8	13 200	32 500	2 280	430	–
1 119	1 140	1 150	1 217	–	–	5	2	1 120	3 450	241	850	–
1 143	–	–	1 317	1 288	1 272	5	5	1 370	3 050	168	750	–
1 143	–	–	1 337	1 298	1 282	5	5	1 370	3 050	167	750	–
1 143	1 180	1 190	1 337	–	–	5	5	2 850	7 100	450	750	–
1 143	1 180	1 190	1 337	–	–	5	5	5 100	15 000	1 090	700	180
1 148	1 203	1 213	1 432	–	–	6	6	4 750	11 200	680	700	–
1 148	1 200	1 210	1 432	–	–	6	6	7 500	19 600	1 380	630	170
1 154	–	–	1 546	1 474	1 456	8	8	9 000	20 000	1 380	560	220
1 154	1 228	1 242	1 546	–	–	8	8	9 000	20 000	1 150	560	215
1 154	1 225	1 235	1 546	–	–	8	8	12 000	27 500	1 870	560	150
1 154	1 230	1 240	1 546	–	–	8	8	14 600	37 500	2 550	400	–
1 203	–	–	1 377	1 351	1 333	5	5	1 460	3 350	180	750	–
1 203	1 240	1 250	1 397	–	–	5	5	3 000	7 800	485	700	–
1 203	1 240	1 250	1 397	–	–	5	5	5 400	16 300	1 180	630	160
1 208	1 270	1 280	1 512	–	–	6	6	5 100	12 000	720	700	–
1 208	1 265	1 275	1 512	–	–	6	6	8 500	22 000	1 550	600	150
1 208	1 265	1 275	1 512	–	–	6	6	10 600	28 500	1 790	600	130
1 214	–	–	1 626	1 549	1 531	8	8	10 000	22 800	1 500	560	200
1 214	1 293	1 307	1 626	–	–	8	8	10 000	22 800	1 260	560	199
1 214	1 290	1 300	1 626	–	–	8	8	13 400	31 000	2 100	530	130
1 214	1 295	1 305	1 626	–	–	8	8	14 600	36 500	2 420	380	–
1 273	–	–	1 457	1 426	1 408	5	5	1 500	3 550	189	700	–
1 273	–	–	1 477	1 453	1 435	5	5	2 120	4 650	255	700	–
1 273	1 311	1 321	1 477	–	–	5	5	3 350	8 650	530	700	–
1 273	1 311	1 321	1 477	–	–	5	5	6 100	18 600	1 320	600	140
1 278	1 345	1 355	1 602	–	–	6	6	5 700	13 700	820	630	–
1 278	1 340	1 350	1 602	–	–	6	6	9 650	25 500	1 760	560	140
1 278	1 340	1 350	1 602	–	–	6	6	11 800	32 500	2 220	560	110
1 284	–	–	1 716	1 634	1 616	8	8	10 600	24 500	1 590	530	180
1 284	1 368	1 382	1 716	–	–	8	8	10 600	24 500	1 340	530	186

Cylindrical roller bearings with cage

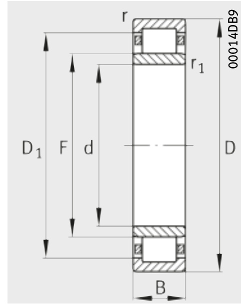
Single row
Non-locating
bearings



Design 1
N



Design 2
N with lubrication groove and holes

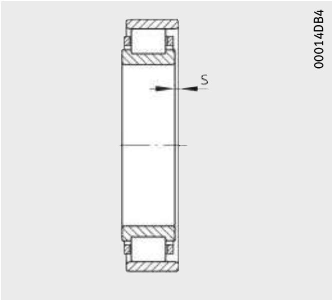


Design 3
NU

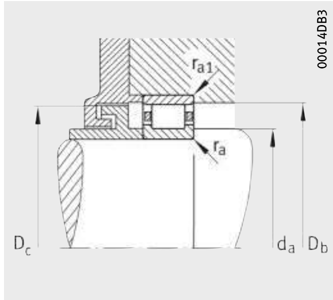
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions											
		m	d	D	B	r	r_1	s[2]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
NU20/1250-E-M1	3	2 270	**1 250**	1 750	290	9,5	9,5	13,5	1 635	1 375	1 593	–	–	–
NU30/1250-M	3	2 940	**1 250**	1 750	375	9,5	9,5	35,3	1 625	1 375	1 585	–	–	–
Z-529599.ZL	2[1]	301	**1 320**	1 550	95	6	6	17	1 487	–	–	1 403	4,8	15
Z-526748.ZL	2	478	**1 320**	1 600	122	6	6	10	1 533	–	–	1 422	9,5	17,7
NU18/1320-M1	3	497	**1 320**	1 600	122	6	6	12,8	1 533	1 397	1 511	–	–	–
NU38/1320-M	3	854	**1 320**	1 600	206	6	6	20,5	1 533	1 397	1 511	–	–	–
NU19/1320-M1	3	1 080	**1 320**	1 720	175	7,5	7,5	13	1 615	1 425	1 584,6	–	–	–
NU29/1320-M1	3	1 470	**1 320**	1 720	230	7,5	7,5	17,6	1 620	1 420	1 588	–	–	–
NU39/1320-E-M1	3	1 850	**1 320**	1 720	300	7,5	7,5	14,9	1 630	1 420	1 600	–	–	–
N10/1320-M1	1	2 040	**1 320**	1 850	230	12	12	19	1 715	–	–	1 501	–	–
NU10/1320-M1	3	2 030	**1 320**	1 850	230	12	12	19	1 715	1 455	1 673	–	–	–
NU20/1320-E-M1	3	2 650	**1 320**	1 850	300	12	12	14	1 725	1 455	1 682	–	–	–
NU30/1320-M	3	3 520	**1 320**	1 850	400	12	12	39	1 715	1 455	1 673	–	–	–
Z-527470.ZL	2[1]	362	**1 400**	1 650	100	7,5	7,5	18	1 577	–	–	1 493	4,8	15
NU18/1400-M1	3	625	**1 400**	1 700	132	7,5	7,5	13,4	1 630	1 480	1 606	–	–	–
NU38/1400-M	3	1 050	**1 400**	1 700	224	7,5	7,5	21,5	1 630	1 480	1 606	–	–	–
NU19/1400-M1	3	1 270	**1 400**	1 820	185	9,5	9,5	14	1 710	1 510	1 678	–	–	–
NU29/1400-M	3	1 710	**1 400**	1 820	243	9,5	9,5	18,8	1 715	1 505	1 681	–	–	–
NU39/1400-E-M1	3	2 170	**1 400**	1 820	315	9,5	9,5	15,5	1 726	1 506	1 694	–	–	–
N10/1400-M1	1	2 350	**1 400**	1 950	243	12	12	19,5	1 810	–	–	1 587	–	–
NU10/1400-M1	3	2 350	**1 400**	1 950	243	12	12	19,5	1 810	1 540	1 767	–	–	–
NU20/1400-E-M1	3	3 010	**1 400**	1 950	315	12	12	26,4	1 820	1 540	1 775	–	–	–
NU30/1400-M	3	3 970	**1 400**	1 950	412	12	12	39,5	1 810	1 540	1 767	–	–	–
Z-529600.ZL	2[1]	433	**1 500**	1 760	105	7,5	7,5	20	1 682	–	–	1 598	8	15
NU18/1500-M1	3	750	**1 500**	1 820	140	7,5	7,5	14,5	1 745	1 585	1 719	–	–	–
NU38/1500-M	3	1 300	**1 500**	1 820	243	7,5	7,5	23,8	1 745	1 585	1 719	–	–	–
NU29/1500-M	3	2 110	**1 500**	1 950	258	9,5	9,5	12	1 835	1 615	1 800	–	–	–
NU39/1500-E-M	3	2 640	**1 500**	1 950	335	9,5	9,5	15,5	1 851	1 611	1 817	–	–	–

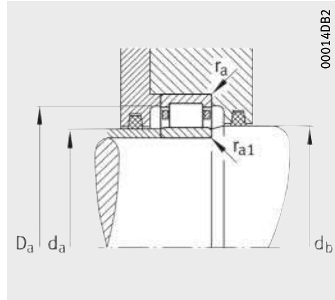
[1] With thread M10 for eye bolts on the end faces.



[2)] Axial displacement “s” for N and NU



Mounting dimensions for N

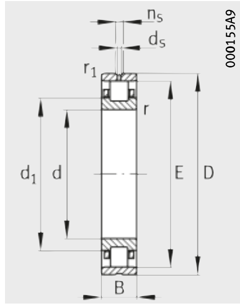


Mounting dimensions for NU

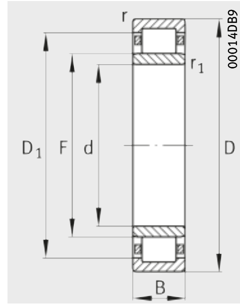
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 284	1 370	1 380	1 716	–	–	8	8	13 700	32 500	2 190	530	130
1 284	1 370	1 380	1 716	–	–	8	8	16 300	41 500	2 700	360	–
1 243	–	–	1 527	1 496	1 478	5	5	1 560	3 750	197	700	–
1 243	–	–	1 577	1 542	1 524	5	5	2 600	6 000	315	630	–
1 243	1 392	1 402	1 577	–	–	5	5	3 800	10 200	600	630	–
1 243	1 392	1 402	1 577	–	–	5	5	6 800	21 200	1 450	560	130
1 348	1 420	1 430	1 692	–	–	6	6	6 400	15 600	910	600	–
1 348	1 415	1 425	1 692	–	–	6	6	10 600	29 000	1 930	530	120
1 348	1 415	1 425	1 692	–	–	6	6	12 900	36 000	2 420	530	110
1 362	–	–	1 808	1 724	1 706	10	10	11 800	27 000	1 750	500	170
1 362	1 448	1 462	1 808	–	–	10	10	11 800	27 000	1 480	500	171
1 362	1 450	1 460	1 808	–	–	10	10	15 600	38 000	2 500	500	110
1 362	1 450	1 460	1 808	–	–	10	10	18 300	48 000	3 100	340	–
1 428	–	–	1 622	1 586	1 568	6	6	1 600	4 000	206	630	–
1 428	1 475	1 485	1 672	–	–	6	6	4 550	12 000	700	600	–
1 428	1 475	1 485	1 672	–	–	6	6	8 150	25 500	1 710	530	120
1 434	1 505	1 515	1 786	–	–	8	8	7 200	17 600	1 000	560	–
1 434	1 500	1 510	1 786	–	–	8	8	11 400	30 500	2 020	500	120
1 434	1 501	1 511	1 786	–	–	8	8	14 300	40 500	2 700	500	95
1 442	–	–	1 908	1 819	1 801	10	10	13 200	31 000	1 980	480	150
1 442	1 533	1 547	1 908	–	–	10	10	13 200	31 000	1 670	480	155
1 442	1 535	1 545	1 908	–	–	10	10	16 600	40 500	2 600	480	110
1 442	1 535	1 545	1 908	–	–	10	10	19 300	51 000	3 250	340	–
1 528	–	–	1 732	1 691	1 673	6	6	1 630	4 150	214	600	–
1 528	1 580	1 590	1 792	–	–	6	6	5 200	14 000	780	560	–
1 528	1 580	1 590	1 792	–	–	6	6	9 150	29 000	1 890	500	110
1 534	1 610	1 620	1 916	–	–	8	8	12 700	34 500	2 250	480	110
1 534	1 606	1 616	1 916	–	–	8	8	16 000	45 000	2 850	480	90

Cylindrical roller bearings with cage

Single row
Non-locating bearings



Design 2
N with lubrication groove and holes

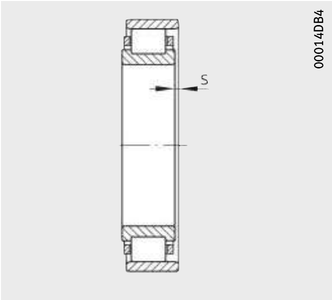


Design 3
NU

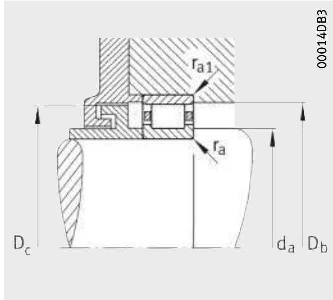
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions											
		m	d	D	B	r	r_1	s[3)]	E	F	D_1	d_1	d_s	n_s
		≈kg				min.	min.				≈	≈		
Z-529601.ZL	2[1)]	553	**1 600**	1 890	110	7,5	7,5	21	1 799	–	–	1 711	4,8	15
NU28/1600-MA	3	1 270	**1 600**	1 950	200	7,5	7,5	20	1 870	1 690	1 841	–	–	–
NU38/1600-M	3	1 670	**1 600**	1 950	265	7,5	7,5	24,3	1 870	1 690	1 841	–	–	–
NU29/1600-M	3	2 310	**1 600**	2 060	265	9,5	9,5	12,3	1 945	1 715	1 908	–	–	–
Z-529602.ZL	2[1)]	631	**1 700**	2 000	115	7,5	7,5	22	1 906	–	–	1 815	4,8	15
NU38/1700-M	3	1 860	**1 700**	2 060	272	7,5	7,5	23,5	1 980	1 790	1 950	–	–	–
NU29/1700-M	3	2 730	**1 700**	2 180	280	9,5	9,5	12,9	2 060	1 820	2 022	–	–	–
Z-529603.ZL	2[1)]	717	**1 800**	2 110	120	9,5	9,5	23	2 015	–	–	1 918	8	15
NU38/1800-M	3	2 210	**1 800**	2 180	290	9,5	9,5	25,5	2 095	1 895	2 063	–	–	–
NU29/1800-M	3	3 110	**1 800**	2 300	290	12	12	14	2 175	1 925	2 135	–	–	–
Z-529604.ZL	2[2)]	829	**1 900**	2 230	125	9,5	9,5	23	2 129	–	–	2 025	8	15
NU38/1900-M	3	2 560	**1 900**	2 300	300	9,5	9,5	26	2 210	2 000	2 176	–	–	–
NU29/1900-M	3	3 700	**1 900**	2 430	308	12	12	14,4	2 300	2 030	2 257	–	–	–
Z-529605.ZL	2[2)]	977	**2 000**	2 350	130	9,5	9,5	24	2 243	–	–	2 132	8	15
NU38/2000-M	3	3 130	**2 000**	2 430	325	9,5	9,5	29,8	2 330	2 110	2 295	–	–	–
Z-540513.ZL	3	627	**2 550**	2 780	100	4	4	14,5	2 710	2 626	2 696	–	–	–

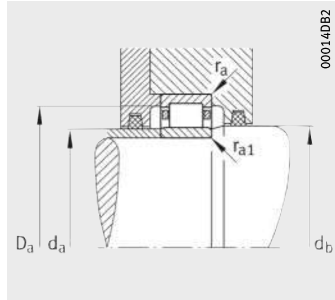
1) With thread M12 for eye bolts on the end faces.
2) With thread M16 for eye bolts on the end faces.



[3] Axial displacement “s” for N and NU



Mounting dimensions for N

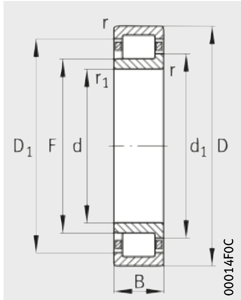


Mounting dimensions for NU

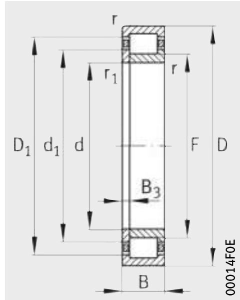
Mounting dimensions								Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_b	D_a	D_b	D_c	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.	max.	min.	max.	min.	max.	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 628	–	–	1 862	1 808	1 790	6	6	1 830	4 750	239	560	–
1 628	1 685	1 695	1 922	–	–	6	6	8 300	24 000	1 540	480	120
1 628	1 685	1 695	1 922	–	–	6	6	11 000	34 000	2 200	480	95
1 634	1 710	1 720	2 026	–	–	8	8	13 400	37 500	2 380	480	100
1 728	–	–	1 972	1 916	1 896	6	6	1 930	5 000	255	530	–
1 728	1 785	1 795	2 032	–	–	6	6	12 200	38 000	2 460	480	85
1 734	1 815	1 825	2 146	–	–	8	8	15 000	42 500	2 600	450	90
1 834	–	–	2 076	2 025	2 005	8	8	2 200	5 850	290	500	–
1 834	1 890	1 900	2 146	–	–	8	8	13 400	42 500	2 650	450	80
1 842	1 920	1 930	2 258	–	–	10	10	16 000	46 500	2 800	430	80
1 934	–	–	2 196	2 139	2 119	8	8	2 500	6 700	325	480	–
1 934	1 995	2 005	2 266	–	–	8	8	15 000	48 000	2 950	430	70
1 942	2 025	2 035	2 388	–	–	10	10	18 300	52 000	3 150	430	75
2 034	–	–	2 316	2 253	2 233	8	8	2 800	7 500	360	480	–
2 034	2 105	2 115	2 396	–	–	8	8	16 600	54 000	3 250	430	67
2 565	–	–	2 765	–	–	3	3	2 750	11 600	470	380	–

Cylindrical roller bearings with cage

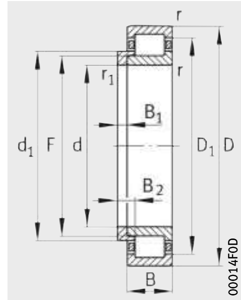
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

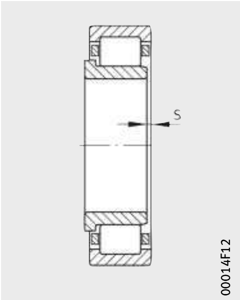


Design 1
NJ and HJ
Locating bearing

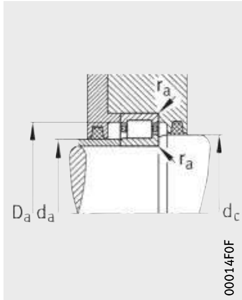
Dimension table · Dimensions in mm

Designation			Design	Mass m		Dimensions								
Bearing	X-life	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈
NJ426-M1	–	–	1	41,2	–	**130**	340	78	5	5	6,2	185	265,9	204,2
NJ426-M1	–	**HJ426**	1	41,2	12,2	**130**	340	78	5	5	–	185	265,9	204,2
NUP426-M1	–	–	1	41,9	–	**130**	340	78	5	5	–	185	265,9	204,2
NJ428-M1	–	–	1	48,2	–	**140**	360	82	5	5	7,6	198	282,9	218,2
NJ428-M1	–	**HJ428**	1	48,2	3,79	**140**	360	82	5	5	–	198	282,9	218,2
NUP428-M1	–	–	1	49	–	**140**	360	82	5	5	–	198	282,9	218,2
NJ330-E-M1	**XL**	–	1	27,4	–	**150**	320	65	4	4	5,5	193	269,8	209,5
NJ330-E-M1	**XL**	**HJ330-E**	1	27,4	2,33	**150**	320	65	4	4	–	193	269,8	209,5
NJ330-E-M1A	**XL**	–	1	27,4	–	**150**	320	65	4	4	5,5	193	269,8	209,5
NJ330-E-M1A	**XL**	**HJ330-E**	1	27,4	2,33	**150**	320	65	4	4	–	193	269,8	209,5
NJ330-E-MP1A	**XL**	–	1	26,9	–	**150**	320	65	4	4	5,5	193	269,8	209,5
NJ330-E-MP1A	**XL**	**HJ330-E**	1	26,9	2,33	**150**	320	65	4	4	–	193	269,8	209,5
NJ330-E-MPA	**XL**	–	1	28,3	–	**150**	320	65	4	4	5,5	193	269,8	209,5
NJ330-E-MPA	**XL**	**HJ330-E**	1	28,3	2,33	**150**	320	65	4	4	–	193	269,8	209,5
NUP330-E-M1	**XL**	–	1	27,8	–	**150**	320	65	4	4	–	193	269,8	209,5
NUP330-E-M1A	**XL**	–	1	27,8	–	**150**	320	65	4	4	–	193	269,8	209,5
NUP330-E-MP1A	**XL**	–	1	27,3	–	**150**	320	65	4	4	–	193	269,8	209,5
NUP330-E-MPA	**XL**	–	1	28,7	–	**150**	320	65	4	4	–	193	269,8	209,5
NJ2330-E-M1	**XL**	–	1	44,1	–	**150**	320	108	4	4	9,7	193	269,8	209,5
NJ2330-E-M1	**XL**	**HJ2330-E**	1	44,1	2,55	**150**	320	108	4	4	–	193	269,8	209,5
NJ2330-E-M1A	**XL**	–	1	44,1	–	**150**	320	108	4	4	9,7	193	269,8	209,5
NJ2330-E-M1A	**XL**	**HJ2330-E**	1	44,1	2,55	**150**	320	108	4	4	–	193	269,8	209,5
NJ2330-E-MP1A	**XL**	–	1	43,9	–	**150**	320	108	4	4	9,7	193	269,8	209,5
NJ2330-E-MP1A	**XL**	**HJ2330-E**	1	43,9	2,55	**150**	320	108	4	4	–	193	269,8	209,5
NUP2330-E-M1	**XL**	–	1	44,8	–	**150**	320	108	4	4	–	193	269,8	209,5
NUP2330-E-M1A	**XL**	–	1	44,8	–	**150**	320	108	4	4	–	193	269,8	209,5
NJ430-M1	–	–	1	55,3	–	**150**	380	85	5	5	8,1	213	297,9	233,2
NJ430-M1	–	**HJ430**	1	55,3	4,76	**150**	380	85	5	5	–	213	297,9	233,2
NUP430-M1	–	–	1	56,3	–	**150**	380	85	5	5	–	213	297,9	233,2
NJ332-E-M1	–	–	1	32,3	–	**160**	340	68	4	4	5,6	204	286	221,6
NJ332-E-M1	–	**HJ332-E**	1	32,3	2,58	**160**	340	68	4	4	–	204	286	221,6
NJ332-E-M1A	–	–	1	32,3	–	**160**	340	68	4	4	5,6	204	286	221,6

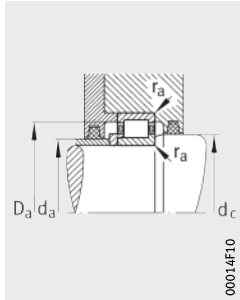
[1)] Under axial load, observe the dimensions D_1 and d_1.



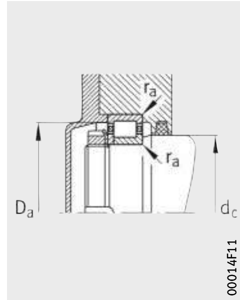
2) Axial displacement "s" for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

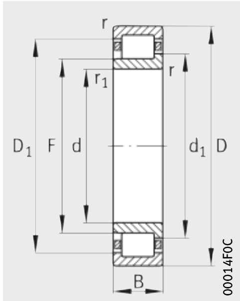


Mounting dimensions for NUP

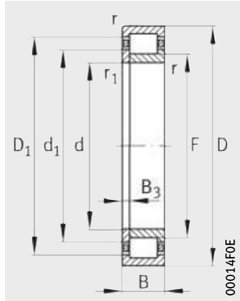
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	154	183	208	316	4	4	865	1 020	114	3 200	1 900
18	32	–	154	183	208	316	4	4	865	1 020	114	3 200	1 900
–	–	14	154	183	208	316	4	4	865	1 020	114	3 200	1 900
–	–	–	164	195	222	336	4	4	930	1 120	123	3 000	1 800
18	33	–	164	195	222	336	4	4	930	1 120	123	3 000	1 800
–	–	15	164	195	222	336	4	4	930	1 120	123	3 000	1 800
–	–	–	167	190	213	303	3	3	900	930	126	3 600	1 940
15	25	–	167	190	213	303	3	3	900	930	126	3 600	1 940
–	–	–	167	190	213	303	3	3	900	930	126	3 600	1 940
15	25	–	167	190	213	303	3	3	900	930	126	3 600	1 940
–	–	–	167	190	213	303	3	3	900	930	126	3 600	2 000
15	25	–	167	190	213	303	3	3	900	930	126	3 600	2 000
–	–	–	167	190	213	303	3	3	900	930	126	3 600	2 000
15	25	–	167	190	213	303	3	3	900	930	126	3 600	2 000
–	–	10	167	190	213	303	3	3	900	930	126	3 600	1 940
–	–	10	167	190	213	303	3	3	900	930	126	3 600	1 940
–	–	10	167	190	213	303	3	3	900	930	126	3 600	2 000
–	–	10	167	190	213	303	3	3	900	930	126	3 600	2 000
–	–	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
15	31,5	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
–	–	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
15	31,5	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
–	–	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
15	31,5	–	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
–	–	16,5	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
–	–	16,5	167	190	213	303	3	3	1 380	1 600	226	3 200	1 460
–	–	–	174	210	237	356	4	4	980	1 220	132	2 800	1 600
20	36,5	–	174	210	237	356	4	4	980	1 220	132	2 800	1 600
–	–	16,5	174	210	237	356	4	4	980	1 220	132	2 800	1 600
–	–	–	177	200	228	323	3	3	865	1 060	114	3 000	1 770
15	25	–	177	200	228	323	3	3	865	1 060	114	3 000	1 770
–	–	–	177	200	228	323	3	3	865	1 060	114	3 000	1 770

Cylindrical roller bearings with cage

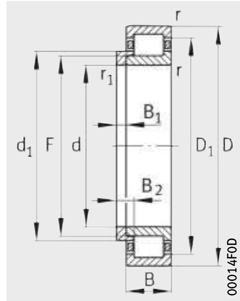
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

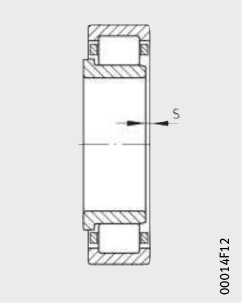


Design 1
NJ and HJ
Locating bearing

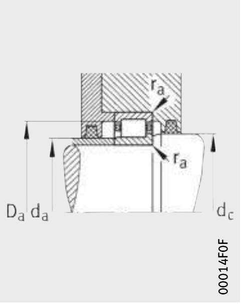
Dimension table (continued) · Dimensions in mm

Designation			Design	Mass m		Dimensions								
Bearing	X-life	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈
NJ332-E-M1A	–	**HJ332-E**	1	32,3	2,58	**160**	340	68	4	4	–	204	286	221,6
NUP332-E-M1	–	–	1	32,7	–	**160**	340	68	4	4	–	204	286	221,6
NUP332-E-M1A	–	–	1	32,7	–	**160**	340	68	4	4	–	204	286	221,6
NUP332-E-MP1A	–	–	1	33	–	**160**	340	68	4	4	–	204	286	221,6
NJ2332-E-M1	–	–	1	52,3	–	**160**	340	114	4	4	9,9	204	286	221,6
NJ2332-E-M1	–	**HJ2332-E**	1	52,3	2,85	**160**	340	114	4	4	–	204	286	221,6
NJ2332-E-M1A	–	–	1	52,3	–	**160**	340	114	4	4	9,9	204	286	221,6
NJ2332-E-M1A	–	**HJ2332-E**	1	52,3	2,85	**160**	340	114	4	4	–	204	286	221,6
NJ2332-E-MP1A	–	–	1	54,1	–	**160**	340	114	4	4	9,9	204	286	221,6
NJ2332-E-MP1A	–	**HJ2332-E**	1	54,1	2,85	**160**	340	114	4	4	–	204	286	221,6
NJ2332-E-MPA	–	–	1	54,9	–	**160**	340	114	4	4	9,9	204	286	221,6
NJ2332-E-MPA	–	**HJ2332-E**	1	54,9	2,85	**160**	340	114	4	4	–	204	286	221,6
NUP2332-E-M1	–	–	1	53,2	–	**160**	340	114	4	4	–	204	286	221,6
NUP2332-E-M1A	–	–	1	53,2	–	**160**	340	114	4	4	–	204	286	221,6
NUP2332-E-MPA	–	–	1	55,7	–	**160**	340	114	4	4	–	204	286	221,6
NJ432-M1	–	–	1	63	–	**160**	400	88	5	5	8,3	226	314,9	247,2
NJ432-M1	–	**HJ432**	1	63	5,33	**160**	400	88	5	5	–	226	314,9	247,2
NUP432-M1	–	–	1	64,1	–	**160**	400	88	5	5	–	226	314,9	247,2
NJ334-E-MPA	–	–	1	39	–	**170**	360	72	4	4	6	218	301,6	237
NJ334-E-MPA	–	**HJ334-E**	1	39	3,21	**170**	360	72	4	4	–	218	301,6	237
NUP334-E-MPA	–	–	1	39,6	–	**170**	360	72	4	4	–	218	301,6	237
NJ334-E-M1	–	–	1	38,6	–	**170**	360	72	4	4	6	218	301,6	237
NJ334-E-M1	–	**HJ334-E**	1	38,6	3,21	**170**	360	72	4	4	–	218	301,6	237
NUP334-E-M1	–	–	1	39,2	–	**170**	360	72	4	4	–	218	301,6	237
NJ2334-EX-M1	–	–	1	62,3	–	**170**	360	120	4	4	10,2	216	303	235,7
NJ2334-EX-M1	–	**HJ2334-EX**	1	62,3	3,5	**170**	360	120	4	4	–	216	303	235,7
NJ2334-EX-M1A	–	–	1	62,3	–	**170**	360	120	4	4	10,2	216	303	235,7
NJ2334-EX-M1A	–	**HJ2334-EX**	1	62,3	3,5	**170**	360	120	4	4	–	216	303	235,7
NJ2334-EX-MP1A	–	–	1	61,4	–	**170**	360	120	4	4	10,2	216	303	235,7
NJ2334-EX-MP1A	–	**HJ2334-EX**	1	61,4	3,5	**170**	360	120	4	4	–	216	303	235,7
NUP2334-EX-M1	–	–	1	62,9	–	**170**	360	120	4	4	–	216	303	235,7
NUP2334-EX-MP1A	–	–	1	62,3	–	**170**	360	120	4	4	–	216	303	235,7
NJ434-M1	–	–	1	72,3	–	**170**	420	92	5	5	8,7	239	329,9	261,2
NJ434-M1	–	**HJ434**	1	72,3	5,97	**170**	420	92	5	5	–	239	329,9	261,2
NUP434-M1	–	–	1	73,7	–	**170**	420	92	5	5	–	239	329,9	261,2

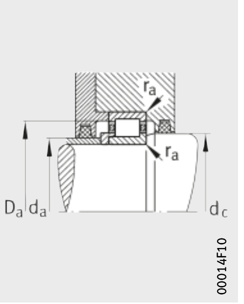
[1)] Under axial load, observe the dimensions D_1 and d_1.



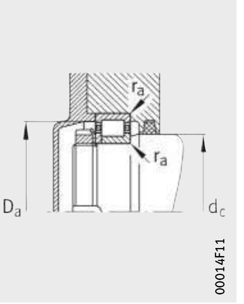
2) Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

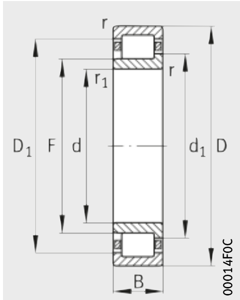


Mounting dimensions for NUP

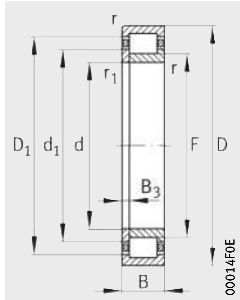
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
15	25	–	177	200	228	323	3	3	865	1 060	114	3 000	1 770
–	–	10	177	200	228	323	3	3	865	1 060	114	3 000	1 770
–	–	10	177	200	228	323	3	3	865	1 060	114	3 000	1 770
–	–	10	177	200	228	323	3	3	865	1 060	114	3 000	1 800
–	–	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 340
15	32	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 340
–	–	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 340
15	32	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 340
–	–	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
15	32	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
–	–	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
15	32	–	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
–	–	17	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
–	–	17	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
–	–	17	177	200	228	323	3	3	1 320	1 830	204	3 000	1 300
–	–	–	184	223	252	376	4	4	1 060	1 320	142	2 800	1 500
20	37	–	184	223	252	376	4	4	1 060	1 320	142	2 800	1 500
–	–	17	184	223	252	376	4	4	1 060	1 320	142	2 800	1 500
–	–	–	187	215	240	343	3	3	915	1 140	123	3 000	1 700
16	27	–	187	215	240	343	3	3	915	1 140	123	3 000	1 700
–	–	11	187	215	240	343	3	3	915	1 140	123	3 000	1 700
–	–	–	187	215	240	343	3	3	965	1 220	132	3 000	1 610
16	27	–	187	215	240	343	3	3	965	1 220	132	3 000	1 610
16	33,5	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
–	–	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
16	33,5	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
–	–	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
16	33,5	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
–	–	17,5	187	214	238,3	343	3	3	1 500	2 080	231	2 800	1 200
16	33,5	–	187	214	238,3	343	3	3	1 500	2 080	230	2 800	1 210
–	–	17,5	187	214	238,3	343	3	3	1 500	2 080	231	2 800	1 200
–	–	17,5	187	214	238,3	343	3	3	1 500	2 080	231	2 800	1 200
–	–	–	194	236	266	396	4	4	1 120	1 400	151	2 800	1 500
20	38	–	194	236	266	396	4	4	1 120	1 400	151	2 800	1 500
–	–	18	194	236	266	396	4	4	1 120	1 400	151	2 800	1 500

Cylindrical roller bearings with cage

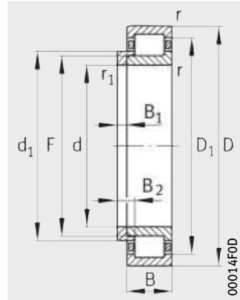
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

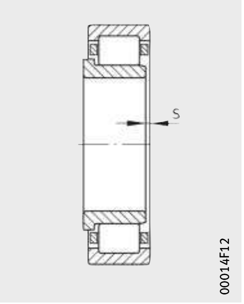


Design 1
NJ and HJ
Locating bearing

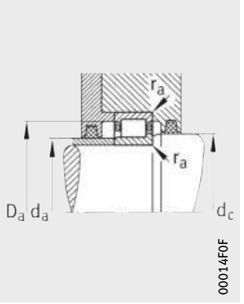
Dimension table (continued) · Dimensions in mm

Designation			Design	Mass m		Dimensions								
Bearing	X-life	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2]	F	D_1 ≈	d_1 ≈
NJ236-E-M1	**XL**	–	1	19,2	–	**180**	320	52	4	4	4,7	217	278,6	230,2
NJ236-E-M1	**XL**	**HJ236-E**	1	19,2	1,76	**180**	320	52	4	4	–	217	278,6	230,2
NJ236-E-M1A	**XL**	–	1	19,2	–	**180**	320	52	4	4	4,7	217	278,6	230,2
NJ236-E-M1A	**XL**	**HJ236-E**	1	19,2	1,76	**180**	320	52	4	4	–	217	278,6	230,2
NJ236-E-MP1A	**XL**	–	1	19,1	–	**180**	320	52	4	4	4,7	217	278,6	230,2
NJ236-E-MP1A	**XL**	**HJ236-E**	1	19,1	1,76	**180**	320	52	4	4	–	217	278,6	230,2
NUP236-E-M1	**XL**	–	1	17,3	–	**180**	320	52	4	4	–	217	278,6	230,2
NUP236-E-M1A	**XL**	–	1	17,3	–	**180**	320	52	4	4	–	217	278,6	230,2
NUP236-E-MP1A	**XL**	–	1	19,4	–	**180**	320	52	4	4	–	217	278,6	230,2
NUP236-E-MPA	**XL**	–	1	19,4	–	**180**	320	52	4	4	–	217	278,6	230,2
NJ2236-E-M1	**XL**	–	1	31,1	–	**180**	320	86	4	4	7,2	215	280	229
NJ2236-E-M1	**XL**	**HJ2236-E**	1	31,1	1,87	**180**	320	86	4	4	–	215	280	229
NUP2236-E-M1	**XL**	–	1	31,6	–	**180**	320	86	4	4	–	215	280	229
NUP2236-E-M1A	**XL**	–	1	31,6	–	**180**	320	86	4	4	–	215	280	229
NUP2236-E-MP1A	**XL**	–	1	31,6	–	**180**	320	86	4	4	–	215	280	229
NUP2236-E-MPA	**XL**	–	1	31,3	–	**180**	320	86	4	4	–	215	280	229
NJ336-E-M1	–	–	1	44,6	–	**180**	380	75	4	4	6,1	231	319,8	250,5
NJ336-E-M1	–	**HJ336-E**	1	44,6	3,77	**180**	380	75	4	4	–	231	319,8	250,5
NJ336-E-M1A	–	–	1	44,6	–	**180**	380	75	4	4	6,1	231	319,8	250,5
NJ336-E-M1A	–	**HJ336-E**	1	44,6	3,77	**180**	380	75	4	4	–	231	319,8	250,5
NJ336-E-MP1A	–	–	1	44,6	–	**180**	380	75	4	4	6,1	231	319,8	250,5
NJ336-E-MP1A	–	**HJ336-E**	1	44,6	3,77	**180**	380	75	4	4	–	231	319,8	250,5
NUP336-E-M1	–	–	1	45,3	–	**180**	380	75	4	4	–	231	319,8	250,5
NUP336-E-M1A	–	–	1	45,3	–	**180**	380	75	4	4	–	231	319,8	250,5
NUP336-E-MPA	–	–	1	45,3	–	**180**	380	75	4	4	–	231	319,8	250,5
NJ2336-EX-M1	–	–	1	72,9	–	**180**	380	126	4	4	10,5	227	320,8	248
NJ2336-EX-M1	–	**HJ2336-EX**	1	72,9	4,05	**180**	380	126	4	4	–	227	320,8	248
NJ2336-EX-M1A	–	–	1	72,9	–	**180**	380	126	4	4	10,5	227	320,8	248
NJ2336-EX-M1A	–	**HJ2336-EX**	1	72,9	4,05	**180**	380	126	4	4	–	227	320,8	248
NJ2336-EX-MP1A	–	–	1	72	–	**180**	380	126	4	4	10,5	227	320,8	248
NJ2336-EX-MP1A	–	**HJ2336-EX**	1	72	4,05	**180**	380	126	4	4	–	227	320,8	248
NUP2336-EX-M1	–	–	1	74	–	**180**	380	126	4	4	–	227	320,8	248
NUP2336-EX-M1A	–	–	1	74	–	**180**	380	126	4	4	–	227	320,8	248
NUP2336-EX-MP1A	–	–	1	73,1	–	**180**	380	126	4	4	–	227	320,8	248
NUP2336-EX-MPA	–	–	1	73,1	–	**180**	380	126	4	4	–	227	320,8	248

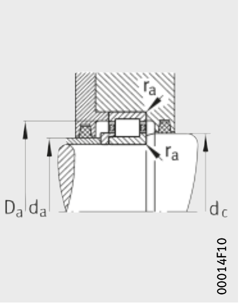
[1] Under axial load, observe the dimensions D_1 and d_1.



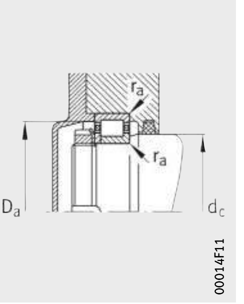
[2)] Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

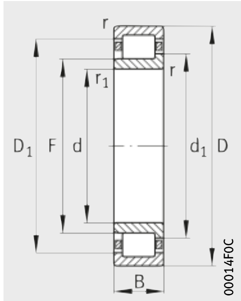


Mounting dimensions for NUP

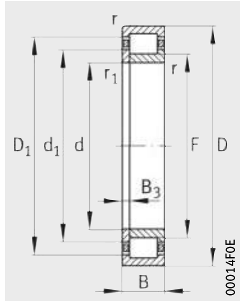
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1)]	max.	min.	max.[1)]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	197	214	233	303	3	3	730	830	112	3 600	1 850
12	20	–	197	214	233	303	3	3	730	830	112	3 600	1 850
–	–	–	197	214	233	303	3	3	730	830	112	3 600	1 850
12	20	–	197	214	233	303	3	3	730	830	112	3 600	1 850
–	–	–	197	214	233	303	3	3	730	830	112	3 600	1 900
12	20	–	197	214	233	303	3	3	730	830	112	3 600	1 900
–	–	8	197	214	233	303	3	3	730	830	112	3 600	1 850
–	–	8	197	214	233	303	3	3	730	830	112	3 600	1 850
–	–	8	197	214	233	303	3	3	730	830	112	3 600	1 900
–	–	8	197	214	233	303	3	3	730	830	112	3 600	1 900
–	–	–	197	214	233	303	3	3	1 180	1 490	208	3 200	1 380
12	24	–	197	214	233	303	3	3	1 180	1 490	208	3 200	1 380
–	–	12	197	214	233	303	3	3	1 180	1 490	208	3 200	1 380
–	–	12	197	214	233	303	3	3	1 180	1 490	208	3 200	1 380
–	–	12	197	214	233	303	3	3	1 180	1 490	208	3 200	1 400
–	–	12	197	214	233	303	3	3	1 180	1 490	208	3 200	1 400
–	–	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
17	28,5	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
17	28,5	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
17	28,5	–	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	11,5	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	11,5	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	11,5	197	228	254	363	3	3	1 040	1 320	141	2 800	1 500
–	–	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 120
17	35	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 120
–	–	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 120
17	35	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 120
–	–	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 100
17	35	–	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 100
–	–	18	197	225	250,6	363	3	3	1 660	2 320	260	2 800	1 100
–	–	18	197	225	25 0,6	363	3	3	1 660	2 320	260	2 800	1 100
–	–	18	197	225	25 0,6	363	3	3	1 660	2 320	260	2 800	1 100
–	–	18	197	225	25 0,6	363	3	3	1 660	2 320	260	2 800	1 100

Cylindrical roller bearings with cage

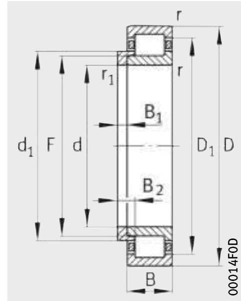
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

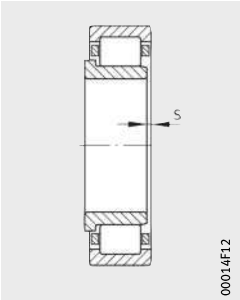


Design 1
NJ and HJ
Locating bearing

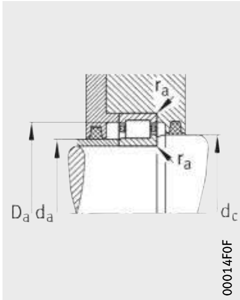
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	$s^{2)}$	F	D_1 ≈	d_1 ≈
NJ238-E-M1	–	1	23,2	–	**190**	340	55	4	4	4,7	230	295	244
NJ238-E-M1	**HJ238-E**	1	23,2	2,17	**190**	340	55	4	4	–	230	295	244
NJ238-E-M1A	–	1	23,2	–	**190**	340	55	4	4	4,7	230	295	244
NJ238-E-M1A	**HJ238-E**	1	23,2	2,17	**190**	340	55	4	4	–	230	295	244
NUP238-E-M1	–	1	23,5	–	**190**	340	55	4	4	–	230	295	244
NJ2238-E-M1	–	1	37,7	–	**190**	340	92	4	4	8	228	296,4	242,7
NJ2238-E-M1	**HJ2238-E**	1	37,7	2,31	**190**	340	92	4	4	–	228	296,4	242,7
NUP2238-E-M1	–	1	38,3	–	**190**	340	92	4	4	–	228	296,4	242,7
NUP2238-E-M1A	–	1	38,3	–	**190**	340	92	4	4	–	228	296,4	242,7
NJ338-E-M1	–	1	51,4	–	**190**	400	78	5	5	6,3	245	336	265,4
NJ338-E-M1A	–	1	51,4	–	**190**	400	78	5	5	6,3	245	336	265,4
NUP338-E-M1	–	1	52,2	–	**190**	400	78	5	5	–	245	336	265,4
NUP338-E-M1A	–	1	52,2	–	**190**	400	78	5	5	–	245	336	265,4
NJ2338-EX-M1	–	1	84,4	–	**190**	400	132	5	5	11	240	340,5	262,5
NJ2338-EX-M1	**HJ2338-EX**	1	84,4	4,8	**190**	400	132	5	5	–	240	340,5	262,5
NJ2338-EX-MP1A	–	1	86,3	–	**190**	400	132	5	5	11	240	340,5	262,5
NJ2338-EX-MP1A	**HJ2338-EX**	1	86,3	4,8	**190**	400	132	5	5	–	240	340,5	262,5
NUP2338-EX-M1	–	1	85,7	–	**190**	400	132	5	5	–	240	340,5	262,5
NJ438-M1	–	1	71,2	–	**190**	460	98	6	6	9,4	165	361,9	289,2
NJ438-M1	**HJ438**	1	71,2	8,14	**190**	460	98	6	6	–	165	361,9	289,2
NJ240-E-M1	–	1	27,5	–	**200**	360	58	4	4	4,8	243	311,5	257,6
NJ240-E-M1	**HJ240-E**	1	27,5	2,62	**200**	360	58	4	4	–	243	311,5	257,6
NJ240-E-M1A	–	1	27,5	–	**200**	360	58	4	4	4,8	243	311,5	257,6
NJ240-E-M1A	**HJ240-E**	1	27,5	2,62	**200**	360	58	4	4	–	243	311,5	257,6
NJ240-E-MP1A	–	1	27,5	–	**200**	360	58	4	4	4,8	243	311,5	257,6
NJ240-E-MP1A	**HJ240-E**	1	27,5	2,62	**200**	360	58	4	4	–	243	311,5	257,6
NUP240-E-M1	–	1	28	–	**200**	360	58	4	4	–	243	311,5	257,6
NUP240-E-M1A	–	1	28	–	**200**	360	58	4	4	–	243	311,5	257,6
NUP240-E-MPA	–	1	27,9	–	**200**	360	58	4	4	–	243	311,5	257,6
NJ2240-E-M1	–	1	45,3	–	**200**	360	98	4	4	8,2	241	312,9	256,3
NJ2240-E-M1	**HJ2240-E**	1	45,3	2,78	**200**	360	98	4	4	–	241	312,9	256,3
NJ2240-E-M1A	–	1	45,3	–	**200**	360	98	4	4	8,2	241	312,9	256,3
NJ2240-E-M1A	**HJ2240-E**	1	45,3	2,78	**200**	360	98	4	4	–	241	312,9	256,3
NUP2240-E-M1	–	1	46	–	**200**	360	98	4	4	–	241	312,9	256,3
NUP2240-E-M1A	–	1	46	–	**200**	360	98	4	4	–	241	312,9	256,3

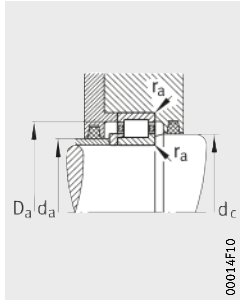
1) Under axial load, observe the dimensions D_1 and d_1.



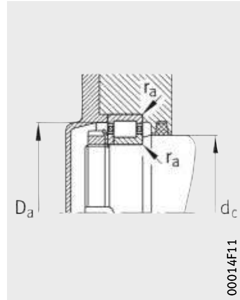
[2] Axial displacement "s" for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

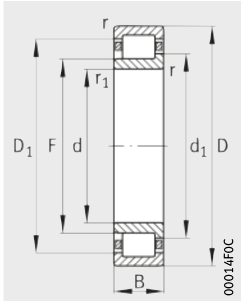


Mounting dimensions for NUP

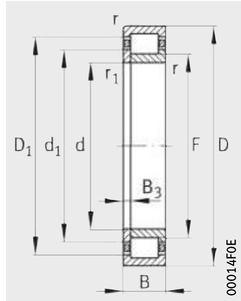
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	207	227	247	323	3	3	680	930	100	3 200	1 720
13	21,5	–	207	227	247	323	3	3	680	930	100	3 200	1 720
–	–	–	207	227	247	323	3	3	680	930	100	3 200	1 720
13	21,5	–	207	227	247	323	3	3	680	930	100	3 200	1 720
–	–	8,5	207	227	247	323	3	3	680	930	100	3 200	1 720
–	–	–	207	227	247	323	3	3	1 100	1 660	184	3 000	1 290
13	26,5	–	207	227	247	323	3	3	1 100	1 660	184	3 000	1 290
–	–	13,5	207	227	247	323	3	3	1 100	1 660	183	3 000	1 290
–	–	13,5	207	227	247	323	3	3	1 100	1 660	183	3 000	1 290
–	–	–	210	242	269	380	4	4	1 120	1 430	151	2 800	1 400
–	–	–	210	242	269	380	4	4	1 120	1 430	151	2 800	1 400
–	–	12	210	242	269	380	4	4	1 120	1 430	151	2 800	1 400
–	–	12	210	242	269	380	4	4	1 120	1 430	151	2 800	1 400
–	–	–	210	237,8	265,3	380	4	4	1 900	2 650	285	2 600	1 010
18	36,5	–	210	237,8	265,3	380	4	4	1 900	2 650	285	2 600	1 010
–	–	–	210	237,8	265,3	380	4	4	1 900	2 650	285	2 600	1 000
18	36,5	–	210	237,8	265,3	380	4	4	1 900	2 650	285	2 600	1 000
–	–	18,8	210	237,8	265,3	380	4	4	1 900	2 650	285	2 600	1 000
–	–	–	220	262	294	430	5	5	1 340	1 760	181	2 600	1 200
23	42	–	220	262	294	430	5	5	1 340	1 760	181	2 600	1 200
–	–	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
14	23	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
14	23	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
14	23	–	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	9	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	9	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	9	217	240	261	343	3	3	750	1 040	110	3 000	1 600
–	–	–	217	240	261	343	3	3	1 220	1 860	206	2 800	1 180
14	28	–	217	240	261	343	3	3	1 220	1 860	206	2 800	1 180
–	–	–	217	240	261	343	3	3	1 220	1 860	206	2 800	1 180
14	28	–	217	240	261	343	3	3	1 220	1 860	206	2 800	1 180
–	–	14	217	240	261	343	3	3	1 220	1 860	205	2 800	1 200
–	–	14	217	240	261	343	3	3	1 220	1 860	205	2 800	1 200

Cylindrical roller bearings with cage

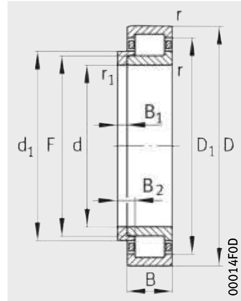
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

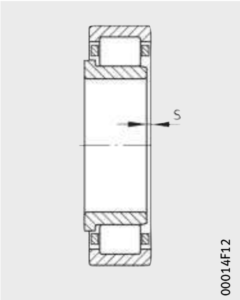


Design 1
NJ and HJ
Locating bearing

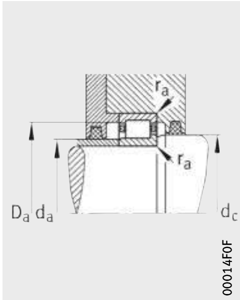
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2]	F	D_1 ≈	d_1 ≈
NUP2240-E-MP1A	–	1	45,6	–	**200**	360	98	4	4	–	241	312,9	256,3
NUP2240-E-MPA	–	1	45,6	–	**200**	360	98	4	4	–	241	312,9	256,3
NJ340-E-M1	–	1	58,1	–	**200**	420	80	5	5	6,3	258	351,8	279
NJ340-E-M1	**HJ340-E**	1	58,1	4,94	**200**	420	80	5	5	–	258	351,8	279
NJ340-E-M1A	–	1	58,1	–	**200**	420	80	5	5	6,3	258	351,8	279
NJ340-E-M1A	**HJ340-E**	1	58,1	4,94	**200**	420	80	5	5	–	258	351,8	279
NUP340-E-M1	–	1	59	–	**200**	420	80	5	5	–	258	351,8	279
NUP340-E-M1A	–	1	59	–	**200**	420	80	5	5	–	258	351,8	279
NJ2340-EX-M1	–	1	97,2	–	**200**	420	138	5	5	11,3	253	356,9	276,1
NJ2340-EX-M1	**HJ2340-EX**	1	97,2	5,28	**200**	420	138	5	5	–	253	356,9	276,1
NJ2340-EX-M1A	–	1	97,2	–	**200**	420	138	5	5	11,3	253	356,9	276,1
NJ2340-EX-M1A	**HJ2340-EX**	1	97,2	5,28	**200**	420	138	5	5	–	253	356,9	276,1
NUP2340-EX-M1	–	1	98,7	–	**200**	420	138	5	5	–	253	356,9	276,1
NUP2340-EX-M1A	–	1	98,7	–	**200**	420	138	5	5	–	253	356,9	276,1
NUP2340-EX-MP1A	–	1	97	–	**200**	420	138	5	5	–	253	356,9	276,1
NJ440-M1	–	1	104	–	**200**	480	102	6	6	9,4	276	378,9	301,1
NJ440-M1	**HJ440**	1	104	9,02	**200**	480	102	6	6	–	276	378,9	301,1
NJ1044-M1	–	1	20,9	–	**220**	340	56	3	3	6,2	250	298,9	261,7
NJ1044-M1	**HJ1044**	1	20,9	2,13	**220**	340	56	3	3	–	250	298,9	261,7
NJ1044-M1A	–	1	20,9	–	**220**	340	56	3	3	6,2	250	298,9	261,7
NJ1044-M1A	**HJ1044**	1	20,9	2,13	**220**	340	56	3	3	–	250	298,9	261,7
NJ244-E-M1	–	1	38,7	–	**220**	400	65	4	4	5,5	268	344,9	285,2
NJ244-E-M1	**HJ244-E**	1	38,7	3,55	**220**	400	65	4	4	–	268	344,9	285,2
NUP244-E-M1	–	1	39,3	–	**220**	400	65	4	4	–	268	344,9	285,2
NUP244-E-M1A	–	1	39,3	–	**220**	400	65	4	4	–	268	344,9	285,2
NJ2244-EX-M1	–	1	62,5	–	**220**	400	108	4	4	8,4	259	349,4	279,4
NJ2244-EX-M1	**HJ2244-EX**	1	62,5	3,58	**220**	400	108	4	4	–	259	349,4	279,4
NJ2244-EX-M1A	–	1	62,5	–	**220**	400	108	4	4	8,4	259	349,4	279,4
NJ2244-EX-M1A	**HJ2244-EX**	1	62,5	3,58	**220**	400	108	4	4	–	259	349,4	279,4
NJ2244-EX-MP1A	–	1	61,3	–	**220**	400	108	4	4	8,4	259	349,4	279,4
NJ2244-EX-MP1A	**HJ2244-EX**	1	61,3	3,58	**220**	400	108	4	4	–	259	349,4	279,4
NUP2244-EX-M1	–	1	63,4	–	**220**	400	108	4	4	–	259	349,4	279,4
NUP2244-EX-M1A	–	1	63,4	–	**220**	400	108	4	4	–	259	349,4	279,4
NUP2244-EX-MP1A	–	1	62,2	–	**220**	400	108	4	4	–	259	349,4	279,4
NJ344-E-M1	–	1	76,6	–	**220**	460	88	5	5	7	282	386	305,1

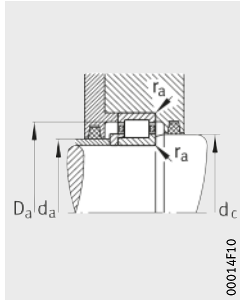
1) Under axial load, observe the dimensions D_1 and d_1.



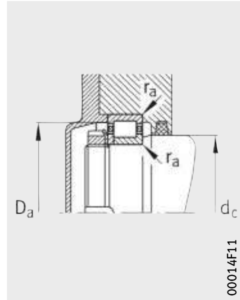
2) Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

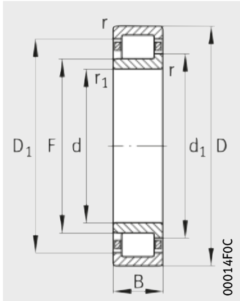


Mounting dimensions for NUP

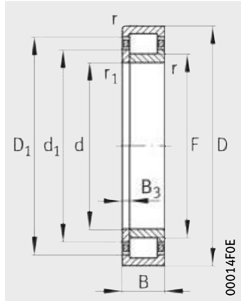
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	14	217	240	261	343	3	3	1 220	1 860	205	2 800	1 200
–	–	14	217	240	261	343	3	3	1 220	1 860	205	2 800	1 200
–	–	–	220	255	282	400	4	4	1 180	1 530	161	2 600	1 320
18	30	–	220	255	282	400	4	4	1 180	1 530	161	2 600	1 320
–	–	–	220	255	282	400	4	4	1 180	1 530	161	2 600	1 320
18	30	–	220	255	282	400	4	4	1 180	1 530	161	2 600	1 320
–	–	12	220	255	282	400	4	4	1 180	1 530	161	2 600	1 300
–	–	12	220	255	282	400	4	4	1 180	1 530	161	2 600	1 300
–	–	–	220	250,7	279	400	4	4	2 040	2 900	310	2 400	940
18	37	–	220	250,7	279	400	4	4	2 040	2 900	310	2 400	940
–	–	–	220	250,7	279	400	4	4	2 040	2 900	310	2 400	940
18	37	–	220	250,7	279	400	4	4	2 040	2 900	310	2 400	940
–	–	19	220	250,7	279	400	4	4	2 040	2 900	310	2 400	950
–	–	19	220	250,7	279	400	4	4	2 040	2 900	310	2 400	950
–	–	19	220	250,7	279	400	4	4	2 040	2 900	310	2 400	950
–	–	–	230	273	306	450	5	5	1 460	1 860	190	2 400	1 200
24	43	–	230	273	306	450	5	5	1 460	1 860	190	2 400	1 200
–	–	–	232	248	265	328	2,5	2,5	510	765	80	3 200	2 000
14	27	–	232	248	265	328	2,5	2,5	510	765	80	3 200	2 000
–	–	–	232	248	265	328	2,5	2,5	510	765	80	3 200	2 000
14	27	–	232	248	265	328	2,5	2,5	510	765	80	3 200	2 000
–	–	–	237	265	288	383	3	3	950	1 320	134	2 800	1 380
15	25	–	237	265	288	383	3	3	950	1 320	134	2 800	1 380
–	–	10	237	265	288	383	3	3	950	1 320	135	2 800	1 380
–	–	10	237	265	288	383	3	3	950	1 320	135	2 800	1 380
–	–	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
15	29	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
15	29	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
15	29	–	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	14	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	14	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	14	237	256,7	282,3	383	3	3	1 630	2 360	250	2 600	1 000
–	–	–	240	279	308	440	4	4	1 430	1 900	192	2 400	1 140

Cylindrical roller bearings with cage

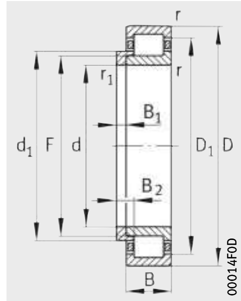
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

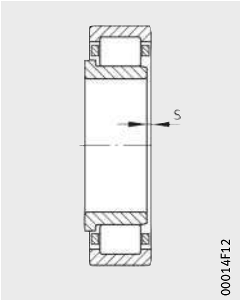


Design 1
NJ and HJ
Locating bearing

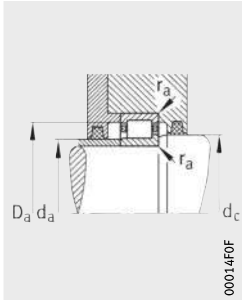
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2]	F	D_1 ≈	d_1 ≈
NUP344-E-M1	–	1	77,7	–	**220**	460	88	5	5	–	282	386	305,1
NJ2344-EX-M1	–	1	122	–	**220**	460	145	5	5	11,9	277	391,2	302,2
NJ2344-EX-M1	**HJ2344-EX**	1	122	6,93	**220**	460	145	5	5	–	277	391,2	302,2
NUP2344-EX-M1	–	1	124	–	**220**	460	145	5	5	–	277	391,2	302,2
NUP2344-EX-M1A	–	1	124	–	**220**	460	145	5	5	–	277	391,2	302,2
NJ444-M1	–	1	153	–	**220**	540	115	6	6	10	305	426,1	335,1
NJ444-M1	**HJ444**	1	153	12,4	**220**	540	115	6	6	–	305	426,1	335,1
NJ1948-MP1A	–	1	8,9	–	**240**	320	38	2,1	1,5	4,6	261	292,6	267,4
NJ1948-MP1A	**HJ1948**	1	8,9	1,2	**240**	320	38	2,1	1,5	–	261	292,6	267,4
NJ1048-M1	–	1	20,4	–	**240**	360	56	3	3	6,4	270	318,9	281,6
NJ1048-M1	**HJ1048**	1	20,4	2,29	**240**	360	56	3	3	–	270	318,9	281,6
NJ1048-M1A	–	1	20,4	–	**240**	360	56	3	3	6,4	270	318,9	281,6
NJ1048-M1A	**HJ1048**	1	20,4	2,29	**240**	360	56	3	3	–	270	318,9	281,6
NJ248-E-M1	–	1	52,5	–	**240**	440	72	4	4	6	293	376,6	312
NJ248-E-M1	**HJ248-E**	1	52,5	4,6	**240**	440	72	4	4	–	293	376,6	312
NUP248-E-M1	–	1	53,3	–	**240**	440	72	4	4	–	293	376,6	312
NUP248-E-M1A	–	1	53,3	–	**240**	440	72	4	4	–	293	376,6	312
NJ2248-EX-M1	–	1	84,2	–	**240**	440	120	4	4	10,2	287	380,7	308
NJ2248-EX-M1	**HJ2248-EX**	1	84,2	4,9	**240**	440	120	4	4	–	287	380,7	308
NJ2248-EX-M1A	–	1	84,2	–	**240**	440	120	4	4	10,2	287	380,7	308
NJ2248-EX-M1A	**HJ2248-EX**	1	84,2	4,9	**240**	440	120	4	4	–	287	380,7	308
NUP2248-EX-M1	–	1	85,6	–	**240**	440	120	4	4	–	287	380,7	308
NUP2248-EX-M1A	–	1	85,6	–	**240**	440	120	4	4	–	287	380,7	308
NJ348-E-M1	–	1	97	–	**240**	500	95	5	5	7,4	306	421,2	331,3
NJ348-E-M1	**HJ348-E**	1	97	8,3	**240**	500	95	5	5	–	306	421,2	331,3
NJ2348-EX-M1	–	1	154	–	**240**	500	155	5	5	13,3	303	424	329,6
NJ2348-EX-M1	**HJ2348-EX**	1	154	9,04	**240**	500	155	5	5	–	303	424	329,6
NUP2348-EX-M1	–	1	154	–	**240**	500	155	5	5	–	303	424	329,6
NJ448-M1	–	1	176	–	**240**	580	122	6	6	10,9	330	459,1	363,1
NJ448-M1	**HJ448**	1	176	15,6	**240**	580	122	6	6	–	330	459,1	363,1
NJ2852-M1	–	1	6,42	–	**260**	320	36	2	1,1	3,8	275	300,6	281,5
NUP2852-M1	–	1	6,51	–	**260**	320	36	2	1,1	–	275	300,6	280,6

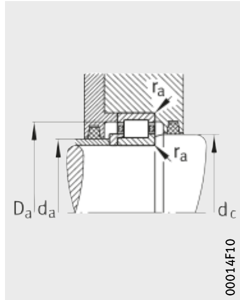
[1] Under axial load, observe the dimensions D_1 and d_1.



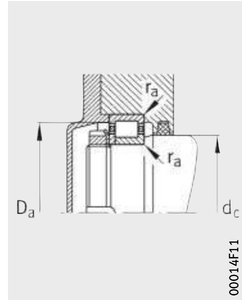
2) Axial displacement "s" for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

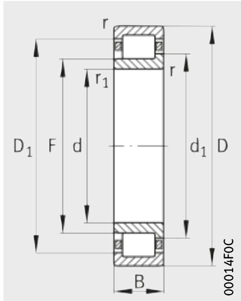


Mounting dimensions for NUP

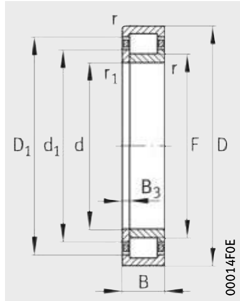
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	13	240	279	308	440	4	4	1 430	1 900	192	2 400	1 100
–	–	–	240	276	306	440	4	4	2 360	3 350	340	2 200	830
20	40	–	240	276	306	440	4	4	2 360	3 350	340	2 200	830
–	–	20	240	274,7	305,1	440	4	4	2 360	3 350	340	2 200	830
–	–	20	240	274,7	305,1	440	4	4	2 360	3 350	340	2 200	830
–	–	–	250	302	340	510	5	5	1 960	2 550	249	2 200	950
26	46	–	250	302	340	510	5	5	1 960	2 550	249	2 200	950
–	–	–	248	258	272	309	2	1,5	330	490	50	3 800	–
12	21,5	–	248	258	272	309	2	1,5	330	490	50	3 800	–
–	–	–	252	268	285	348	2,5	2,5	540	850	74	3 000	1 800
14	27	–	252	268	285	348	2,5	2,5	540	850	74	3 000	1 800
–	–	–	252	268	285	348	2,5	2,5	540	850	64	3 000	1 800
14	27	–	252	268	285	348	2,5	2,5	540	850	64	3 000	1 800
–	–	–	257	290	315	423	3	3	1 140	1 600	163	2 600	1 220
16	27	–	257	290	315	423	3	3	1 140	1 600	163	2 600	1 220
–	–	11	257	290	315	423	3	3	1 140	1 600	163	2 600	1 200
–	–	11	257	290	315	423	3	3	1 140	1 600	163	2 600	1 200
–	–	–	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
16	33,5	–	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
–	–	–	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
16	33,5	–	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
–	–	17,5	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
–	–	17,5	257	284,5	311,1	423	3	3	1 830	2 800	290	2 400	900
–	–	–	260	303	335	480	4	4	1 730	2 280	221	2 200	1 000
22	35,5	–	260	303	335	480	4	4	1 730	2 280	221	2 200	1 000
–	–	–	260	300,5	332,7	480	4	4	2 600	3 750	375	2 000	750
22	44,5	–	260	300,5	332,7	480	4	4	2 600	3 750	375	2 000	750
–	–	22,5	260	300,5	332,7	480	4	4	2 600	3 750	375	2 000	750
–	–	–	270	327	368	550	5	5	2 240	2 900	275	1 900	850
28	49	–	270	327	368	550	5	5	2 240	2 900	275	1 900	850
–	–	–	269	272	284	311	2	1	380	690	72	3 200	1 400
–	–	6	269	272	284	311	2	1	380	690	72	3 200	1 400

Cylindrical roller bearings with cage

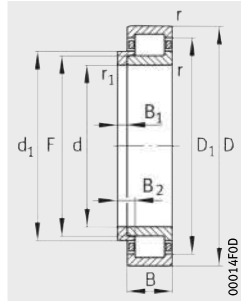
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

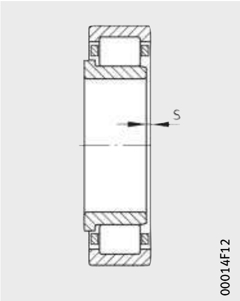


Design 1
NJ and HJ
Locating bearing

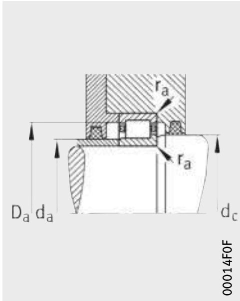
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2]	F	D_1 ≈	d_1 ≈
NJ1952-M1	–	1	14,2	–	**260**	360	46	2,1	1,5	5,3	286	324,4	–
NJ1952-M1	**HJ1952**	1	14,2	1,9	**260**	360	46	2,1	1,5	–	286	324,4	–
NJ1952-M1A	–	1	14,2	–	**260**	360	46	2,1	1,5	5,3	286	324,4	–
NJ1952-M1A	**HJ1952**	1	14,2	1,9	**260**	360	46	2,1	1,5	–	286	324,4	–
NJ1952-MPA	–	1	14,5	–	**260**	360	46	2,1	1,5	5,3	286	324,4	294
NJ1952-MPA	**HJ1952**	1	14,5	1,9	**260**	360	46	2,1	1,5	–	286	324,4	294
NJ1052-M1	–	1	30,4	–	**260**	400	65	4	4	7,2	296	351,3	309,1
NJ1052-M1	**HJ1052**	1	30,4	3,36	**260**	400	65	4	4	–	296	351,3	309,1
NJ1052-M1A	–	1	30,4	–	**260**	400	65	4	4	7,2	296	351,3	309,1
NJ1052-M1A	**HJ1052**	1	30,4	3,36	**260**	400	65	4	4	–	296	351,3	309,1
NJ1052-MP1A	–	1	29	–	**260**	400	65	4	4	7,2	296	351,3	309,1
NJ1052-MP1A	**HJ1052**	1	29	3,36	**260**	400	65	4	4	–	296	351,3	309,1
NUP1052-M1	–	1	31,2	–	**260**	400	65	4	4	–	296	351,3	309,1
NUP1052-M1A	–	1	31,5	–	**260**	400	65	4	4	–	296	351,3	309,1
NUP2052-E-M1	–	1	40,5	–	**260**	400	82	4	4	–	294	356,3	308
NUP2052-E-M1A	–	1	40,5	–	**260**	400	82	4	4	–	294	356,3	308
NJ252-E-M1	–	1	69,4	–	**260**	480	80	5	5	6,2	317	410,8	336,9
NJ252-E-M1	**HJ252-E**	1	69,4	5,92	**260**	480	80	5	5	–	317	410,8	336,9
NJ252-E-M1A	–	1	69,4	–	**260**	480	80	5	5	6,2	317	410,8	336,9
NJ252-E-M1A	**HJ252-E**	1	69,4	5,92	**260**	480	80	5	5	–	317	410,8	336,9
NJ2252-E-M1	–	1	110	–	**260**	480	130	5	5	10,5	313	413,6	335,6
NJ2252-E-M1	**HJ2252-E**	1	110	6,44	**260**	480	130	5	5	–	313	413,6	335,6
NJ2252-E-M1A	–	1	110	–	**260**	480	130	5	5	10,5	313	413,6	335,6
NJ2252-E-M1A	**HJ2252-E**	1	110	6,44	**260**	480	130	5	5	–	313	413,6	335,6
NUP2252-E-M1	–	1	112	–	**260**	480	130	5	5	–	313	413,6	335,6
NUP2252-E-M1A	–	1	112	–	**260**	480	130	5	5	–	313	413,6	335,6
NJ352-E-M1	–	1	122	–	**260**	540	102	6	6	10	337	454,6	362,9
NJ2352-EX-M1	–	1	192	–	**260**	540	165	6	6	13,7	324	458,4	353,5
NJ2352-EX-M1	**HJ2352-EX**	1	192	11	**260**	540	165	6	6	–	324	458,4	353,5
NJ2352-EX-M1A	–	1	192	–	**260**	540	165	6	6	13,7	324	458,4	353,5
NJ2352-EX-M1A	**HJ2352-EX**	1	192	11	**260**	540	165	6	6	–	324	458,4	353,5
NJ2352-EX-MPA	–	1	194	–	**260**	540	165	6	6	13,7	324	458,4	353,5
NJ2352-EX-MPA	**HJ2352-EX**	1	194	11	**260**	540	165	6	6	–	324	458,4	353,5
NUP2352-EX-M1	–	1	206	–	**260**	540	165	6	6	–	324	458,4	353,5
NUP2352-EX-M1A	–	1	206	–	**260**	540	165	6	6	–	324	458,4	353,5

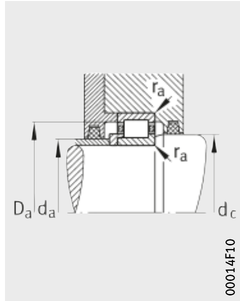
[1] Under axial load, observe the dimensions D_1 and d_1.



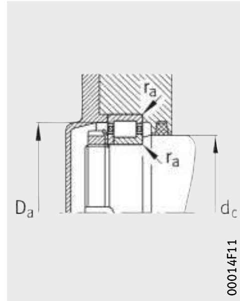
2) Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

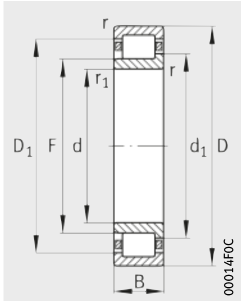


Mounting dimensions for NUP

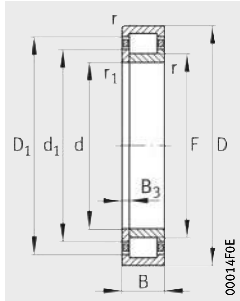
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	268	283	299	349	2	2	425	735	56	3 000	–
14	25	–	268	283	299	349	2	2	425	735	56	3 000	–
–	–	–	268	283	299	349	2	2	425	735	56	3 000	–
14	25	–	268	283	299	349	2	2	425	735	56	3 000	–
–	–	–	268	283	299	349	2	2	425	735	73	3 000	–
14	25	–	268	283	299	349	2	2	425	735	73	3 000	–
–	–	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
16	31,5	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
–	–	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
16	31,5	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
–	–	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
16	31,5	–	275	292	312	385	3	3	655	1 020	105	2 800	1 700
–	–	15,5	275	292	312	385	3	3	655	1 020	104	2 800	1 700
–	–	15,5	275	292	312	385	3	3	655	1 020	104	2 800	1 700
–	–	10	275	291	314	385	3	3	1 200	2 080	216	2 600	1 200
–	–	10	275	291	314	385	3	3	1 200	2 080	216	2 600	1 200
–	–	–	280	314	341	460	4	4	1 340	1 900	191	2 400	1 110
18	30	–	280	314	341	460	4	4	1 340	1 900	191	2 400	1 110
–	–	–	280	314	341	460	4	4	1 340	1 900	191	2 400	1 110
18	30	–	280	314	341	460	4	4	1 340	1 900	191	2 400	1 110
–	–	–	280	310	339	460	4	4	2 160	3 350	340	2 200	780
18	35,5	–	280	310	339	460	4	4	2 160	3 350	340	2 200	780
–	–	–	280	310	339	460	4	4	2 160	3 350	340	2 200	780
18	35,5	–	280	310	339	460	4	4	2 160	3 350	340	2 200	780
–	–	17,5	280	310	339	460	4	4	2 160	3 350	340	2 200	800
–	–	17,5	280	310	339	460	4	4	2 160	3 350	340	2 200	800
–	–	–	286	334,3	366,2	514	5	5	1 900	2 600	249	2 000	900
–	–	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
24	46,5	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
–	–	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
24	46,5	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
–	–	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
24	46,5	–	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
–	–	22,5	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670
–	–	22,5	286	321,3	356,8	514	5	5	3 100	4 500	435	1 800	670

Cylindrical roller bearings with cage

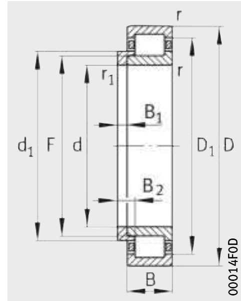
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

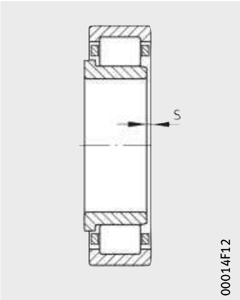


Design 1
NJ and HJ
Locating bearing

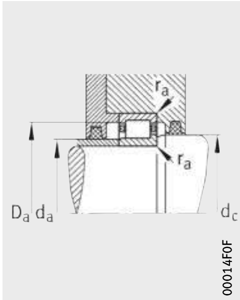
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈
NJ1856-M1	–	1	7,26	–	**280**	350	33	2	1,1	4	299	327,1	304,8
NJ1856-M1	**HJ1856**	1	7,26	1,04	**280**	350	33	2	1,1	–	299	327,1	304,8
NJ2856-M1	–	1	9,22	–	**280**	350	42	2	2	5,3	299	327,1	304,8
NUP2856-M1	–	1	9,43	–	**280**	350	42	2	2	–	299	327,1	304,8
NJ1956-M1	–	1	15,3	–	**280**	380	46	2,1	1,5	5,2	306	345,4	314
NJ1956-M1	**HJ1956**	1	15,3	2,16	**280**	380	46	2,1	1,5	–	306	345,4	314
NJ1956-M1A	–	1	15,3	–	**280**	380	46	2,1	1,5	5,2	306	345,4	314
NJ1956-M1A	**HJ1956**	1	15,3	2,16	**280**	380	46	2,1	1,5	–	306	345,4	314
NJ2956-M1	–	1	20,5	–	**280**	380	60	2,1	1,5	6,9	306	346	314
NJ1056-M1	–	1	32,2	–	**280**	420	65	4	4	7,2	316	371,3	329,1
NJ1056-M1	**HJ1056**	1	32,2	3,59	**280**	420	65	4	4	–	316	371,3	329,1
NJ1056-M1A	–	1	32,2	–	**280**	420	65	4	4	7,2	316	371,3	329,1
NJ1056-M1A	**HJ1056**	1	32,2	3,59	**280**	420	65	4	4	–	316	371,3	329,1
NJ1056-MP1A	–	1	31,7	–	**280**	420	65	4	4	7,2	316	371,3	329,1
NJ1056-MP1A	**HJ1056**	1	32,2	3,59	**280**	420	65	4	4	–	316	371,3	329,1
NUP2056-E-M1	–	1	42,9	–	**280**	420	82	4	4	–	314	376,3	328
NUP2056-E-M1A	–	1	42,9	–	**280**	420	82	4	4	–	314	376,3	328
NJ256-E-M1	–	1	73,2	–	**280**	500	80	5	5	6,3	337	430,8	358,2
NJ256-E-M1	**HJ256-E**	1	73,2	6,51	**280**	500	80	5	5	–	337	430,8	358,2
NJ256-E-M1A	–	1	73,2	–	**280**	500	80	5	5	6,3	337	430,8	358,2
NJ256-E-M1A	**HJ256-E**	1	73,2	6,51	**280**	500	80	5	5	–	337	430,8	358,2
NUP256-E-M1	–	1	74,3	–	**280**	500	80	5	5	–	337	430,8	358,2
NUP256-E-M1A	–	1	74,3	–	**280**	500	80	5	5	–	337	430,8	358,2
NJ2256-E-M1	–	1	116	–	**280**	500	130	5	5	10,5	333	436	355,6
NJ2256-E-M1	**HJ2256-E**	1	116	6,85	**280**	500	130	5	5	–	333	436	355,6
NJ2256-E-M1A	–	1	116	–	**280**	500	130	5	5	10,5	333	436	355,6
NJ2256-E-M1A	**HJ2256-E**	1	116	6,85	**280**	500	130	5	5	–	333	436	355,6
NUP2256-E-M1	–	1	117	–	**280**	500	130	5	5	–	333	436	355,6
NUP2256-E-M1A	–	1	117	–	**280**	500	130	5	5	–	333	436	355,6
NJ356-E-M1	–	1	149	–	**280**	580	108	6	6	8,7	362	488	389,8
NJ356-E-M1	**HJ356-E**	1	149	13,7	**280**	580	108	6	6	–	362	488	389,8
NJ2356-EX-M1	–	1	237	–	**280**	580	175	6	6	13	351	493,8	382,3
NJ2356-EX-M1	**HJ2356-EX**	1	237	13,8	**280**	580	175	6	6	–	351	493,8	382,3

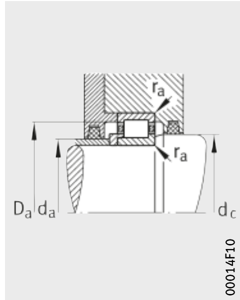
1) Under axial load, observe the dimensions D_1 and d_1.



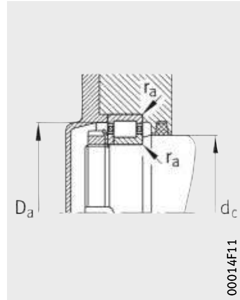
[2)] Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

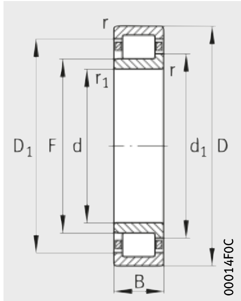


Mounting dimensions for NUP

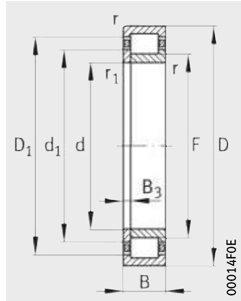
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1)]	max.	min.	max.[1)]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	289	296	308	341	2	1	255	500	48,5	3 200	–
10	18	–	289	296	308	341	2	1	255	500	48,5	3 200	–
–	–	–	289	296	308	341	2	1	345	735	74	3 000	1 400
–	–	9	289	296	308	341	2	1	345	735	75	3 000	1 400
–	–	–	288	303	319	369	2	1,5	440	800	78	2 800	–
15	26	–	288	303	319	369	2	1,5	440	800	78	2 800	–
–	–	–	288	303	319	369	2	1,5	440	800	78	2 800	–
15	26	–	288	303	319	369	2	1,5	440	800	78	2 800	–
–	–	–	288	303	319	370	2	1,5	620	1 220	126	2 800	1 300
–	–	–	295	312	333	405	3	3	680	1 100	112	2 800	1 500
16	31,5	–	295	312	333	405	3	3	680	1 100	112	2 800	1 500
–	–	–	295	312	333	405	3	3	680	1 100	112	2 800	1 500
16	31,5	–	295	312	333	405	3	3	680	1 100	112	2 800	1 500
–	–	–	295	312	333	405	3	3	695	1 140	116	2 800	1 500
16	31,5	–	295	312	333	405	3	3	680	1 100	112	2 800	1 500
–	–	10	295	311	334	405	3	3	1 220	2 160	223	2 600	1 100
–	–	10	295	311	334	405	3	3	1 220	2 160	223	2 600	1 100
–	–	–	300	334	362	480	4	4	1 400	2 000	201	2 200	1 020
18	30	–	300	334	362	480	4	4	1 400	2 000	201	2 200	1 020
–	–	–	300	334	362	480	4	4	1 400	2 000	201	2 200	1 020
18	30	–	300	334	362	480	4	4	1 400	2 000	201	2 200	1 020
–	–	12	300	334	362	480	4	4	1 400	2 000	200	2 200	1 000
–	–	12	300	334	362	480	4	4	1 400	2 000	200	2 200	1 000
–	–	–	300	330	359	480	4	4	2 280	3 600	360	2 000	720
18	35,5	–	300	330	359	480	4	4	2 280	3 600	360	2 000	720
–	–	–	300	330	359	480	4	4	2 280	3 600	360	2 000	720
18	35,5	–	300	330	359	480	4	4	2 280	3 600	360	2 000	720
–	–	17,5	300	330	359	480	4	4	2 280	3 600	360	2 000	700
–	–	17,5	300	330	359	480	4	4	2 280	3 600	360	2 000	700
–	–	–	306	359	393,4	554	5	5	2 160	3 050	285	1 900	790
26	42,5	–	306	359	393,4	554	5	5	2 160	3 050	285	1 900	790
–	–	–	306	348	385,9	554	5	5	3 550	5 200	495	1 600	600
26	48,5	–	306	348	385,9	554	5	5	3 550	5 200	495	1 600	600

Cylindrical roller bearings with cage

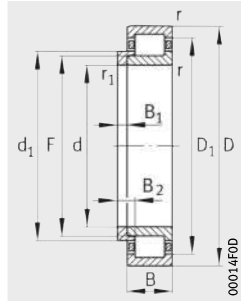
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

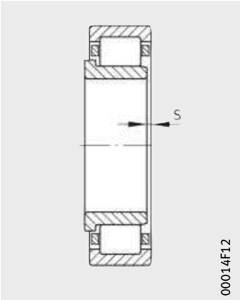


Design 1
NJ and HJ
Locating bearing

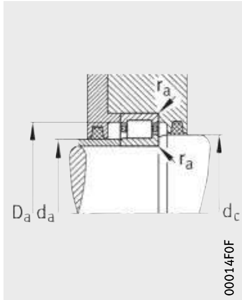
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions								
Bearing	L-section ring		Bearing	L-section ring	d	D	B	r	r_1	s[2)]	F	D_1	d_1
			≈kg	≈kg				min.	min.			≈	≈
NJ1860-M1	–	1	10,2	–	**300**	380	38	2,1	1,5	4,3	322	355,2	328,7
NJ1860-M1	**HJ1860**	1	10,2	1,54	**300**	380	38	2,1	1,5	–	322	355,2	328,7
NJ1860-MPA	–	1	10	–	**300**	380	38	2,1	1,5	4,3	322	355,2	328,7
NJ1860-MPA	**HJ1860**	1	10	1,54	**300**	380	38	2,1	1,5	–	322	355,2	328,7
NJ2860-M1	–	1	13,1	–	**300**	380	48	2,1	1,5	5,3	322	355,2	328,7
NUP2860-M1	–	1	13,4	–	**300**	380	48	2,1	1,5	–	322	355,2	328,7
NJ1960-M1	–	1	24,2	–	**300**	420	56	3	3	6,5	330	378	340
NJ1960-M1	**HJ1960**	1	24,2	3,29	**300**	420	56	3	3	–	330	378	340
NJ1960-M1A	–	1	24,2	–	**300**	420	56	3	3	6,5	330	378	340
NJ1960-M1A	**HJ1960**	1	24,2	3,29	**300**	420	56	3	3	–	330	378	340
NJ1060-M1	–	1	45,7	–	**300**	460	74	4	4	11,9	340	405,2	355,7
NJ1060-M1	**HJ1060**	1	45,7	5,17	**300**	460	74	4	4	–	340	405,2	355,7
NJ1060-M1A	–	1	45,7	–	**300**	460	74	4	4	11,9	340	405,2	355,7
NJ1060-M1A	**HJ1060**	1	45,7	5,17	**300**	460	74	4	4	–	340	405,2	355,7
NJ1060-MP1A	–	1	44,6	–	**300**	460	74	4	4	11,9	340	405,2	355,7
NJ1060-MP1A	**HJ1060**	1	44,6	5,17	**300**	460	74	4	4	–	340	405,2	355,7
NUP2060-E-M1	–	1	61,5	–	**300**	460	95	4	4	–	341	409,9	356,3
NUP2060-E-M1A	–	1	61,5	–	**300**	460	95	4	4	–	341	409,9	356,3
NJ260-E-M1	–	1	91,6	–	**300**	540	85	5	5	6,9	364	464,6	385,6
NJ260-E-M1	**HJ260-E**	1	91,6	8,31	**300**	540	85	5	5	–	364	464,6	385,6
NJ260-E-M1A	–	1	91,6	–	**300**	540	85	5	5	6,9	364	464,6	385,6
NJ260-E-M1A	**HJ260-E**	1	91,6	8,31	**300**	540	85	5	5	–	364	464,6	385,6
NUP260-E-M1	–	1	92,8	–	**300**	540	85	5	5	–	364	464,6	385,6
NUP260-E-M1A	–	1	92,8	–	**300**	540	85	5	5	–	364	464,6	385,6
NJ2260-EX-M1	–	1	146	–	**300**	540	140	5	5	12,2	355	472,6	380,9
NJ2260-EX-M1	**HJ2260-E**	1	146	9,8	**300**	540	140	5	5	–	355	472,6	380,9
NUP2260-EX-M1	–	1	148	–	**300**	540	140	5	5	–	355	472,6	380,9
NJ1864-M1	–	1	11	–	**320**	400	38	2,1	1,5	4,3	341	373,8	347,7
NJ1864-M1	**HJ1864**	1	11	1,59	**320**	400	38	2,1	1,5	–	341	373,8	347,7
NJ1864-MP1A	–	1	10,8	–	**320**	400	38	2,1	1,5	4,3	341	373,8	347,7
NJ1864-MP1A	**HJ1864**	1	10,8	1,59	**320**	400	38	2,1	1,5	–	341	373,8	347,7
NUP1864-M1	–	1	11,3	–	**320**	400	38	2,1	1,5	–	341	373,8	347,7
NJ2864-M1	–	1	14,3	–	**320**	400	48	2,1	1,5	5,3	341	373,8	347,7
NUP2864-M1	–	1	14,6	–	**320**	400	48	2,1	1,5	–	341	373,8	347,7
NJ1964-M1	–	1	25,6	–	**320**	440	56	3	3	6,2	350	398	360

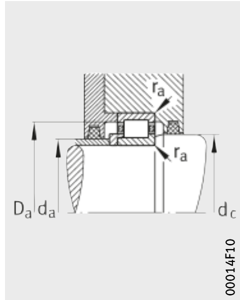
1) Under axial load, observe the dimensions D_1 and d_1.



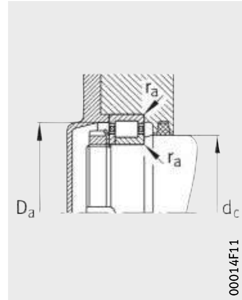
[2] Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

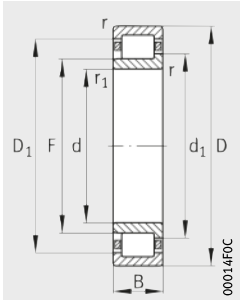


Mounting dimensions for NUP

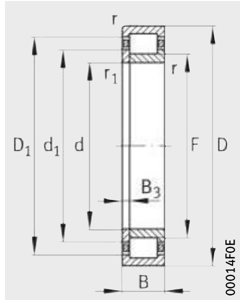
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	310	319	332	370	2	1,5	335	640	62	2 800	–
12	21	–	310	319	332	370	2	1,5	335	640	62	2 800	–
–	–	–	310	319	332	370	2	1,5	335	640	62	2 800	–
12	21	–	310	319	332	370	2	1,5	335	640	62	2 800	–
–	–	–	310	319	332	370	2	1,5	475	1 000	101	2 800	1 200
–	–	9	310	319	332	370	2	1,5	475	1 000	101	2 800	1 200
–	–	–	312	327	345	408	2,5	2,5	600	1 020	99	2 800	–
18	31	–	312	327	345	408	2,5	2,5	600	1 020	99	2 800	–
–	–	–	312	327	345	408	2,5	2,5	600	1 020	99	2 800	–
18	31	–	312	327	345	408	2,5	2,5	600	1 020	99	2 800	–
–	–	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
19	36	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
–	–	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
19	36	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
–	–	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
19	36	–	315	336	359	445	3	3	900	1 430	139	2 400	1 400
–	–	12,5	315	338	363	445	3	3	1 500	2 700	275	2 200	950
–	–	12,5	315	338	363	445	3	3	1 500	2 700	275	2 200	950
–	–	–	320	359	390	520	4	4	1 600	2 320	225	2 000	920
20	32,5	–	320	359	390	520	4	4	1 600	2 320	225	2 000	920
–	–	–	320	359	390	520	4	4	1 600	2 320	225	2 000	920
20	32,5	–	320	359	390	520	4	4	1 600	2 320	225	2 000	920
–	–	12,5	320	359	390	520	4	4	1 600	2 320	224	2 000	950
–	–	12,5	320	359	390	520	4	4	1 600	2 320	224	2 000	950
–	–	–	320	352	384,7	520	4	4	2 700	4 150	395	1 900	630
20	40	–	320	352	384,7	520	4	4	2 700	4 150	395	1 900	630
–	–	20	320	352	384,7	520	4	4	2 700	4 150	395	1 900	630
–	–	–	330	338	352	390	2	1,5	345	695	66	2 800	–
12	21	–	330	338	352	390	2	1,5	345	695	66	2 800	–
–	–	–	330	338	352	390	2	1,5	345	695	66	2 800	–
12	21	–	330	338	352	390	2	1,5	345	695	66	2 800	–
–	–	9	330	338	352	390	2	1,5	345	695	66	2 800	–
–	–	–	330	338	352	390	2	1,5	490	1 080	107	2 800	1 100
–	–	9	330	338	352	390	2	1,5	490	1 080	107	2 800	1 100
–	–	–	332	346	365	428	2,5	2,5	620	1 100	104	2 600	–

Cylindrical roller bearings with cage

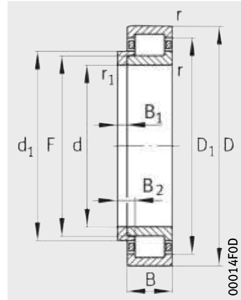
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

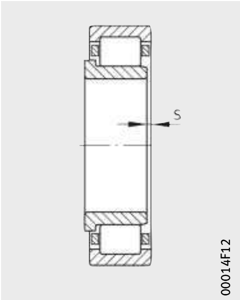


Design 1
NJ and HJ
Locating bearing

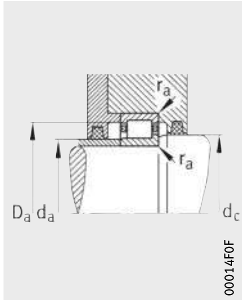
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈
NJ1964-M1	**HJ1964**	1	25,6	3,5	**320**	440	56	3	3	–	350	398	360
NJ1964-M1A	–	1	25,6	–	**320**	440	56	3	3	6,2	350	398	360
NJ1964-M1A	**HJ1964**	1	25,6	3,5	**320**	440	56	3	3	–	350	398	360
NJ1064-M1	–	1	48,1	–	**320**	480	74	4	4	8	360	425,1	375,4
NJ1064-M1	**HJ1064**	1	48,1	5,48	**320**	480	74	4	4	–	360	425,1	375,4
NJ1064-M1A	–	1	48,1	–	**320**	480	74	4	4	8	360	425,1	375,4
NJ1064-M1A	**HJ1064**	1	48,1	5,48	**320**	480	74	4	4	–	360	425,1	375,4
NJ1064-MP1A	–	1	47	–	**320**	480	74	4	4	8	360	425,1	375,4
NJ1064-MP1A	**HJ1064**	1	47	5,48	**320**	480	74	4	4	–	360	425,1	375,4
NUP1064-M1	–	1	49,3	–	**320**	480	74	4	4	–	360	425,1	375,4
NJ264-EX-M1	–	1	115	–	**320**	580	92	5	5	7,5	392	499,4	415,8
NJ264-EX-M1	**HJ264-E**	1	115	10,1	**320**	580	92	5	5	–	392	499,4	415,8
NJ264-EX-M1A	–	1	115	–	**320**	580	92	5	5	7,5	392	499,4	415,8
NJ264-EX-M1A	**HJ264-E**	1	115	10,1	**320**	580	92	5	5	–	392	499,4	415,8
NUP264-EX-M1	–	1	117	–	**320**	580	92	5	5	–	392	499,4	415,8
NUP264-EX-M1A	–	1	117	–	**320**	580	92	5	5	–	392	499,4	415,8
NJ2264-EX-M1	–	1	183	–	**320**	580	150	5	5	11,9	380	506	407,8
NJ2264-EX-M1	**HJ2264-EX**	1	183	10,8	**320**	580	150	5	5	–	380	506	407,8
NUP2264-EX-M1	–	1	237	–	**320**	580	150	5	5	–	380	506	407,8
NJ364-E-M1	–	1	216	–	**320**	670	112	7,5	7,5	8,9	420	554	450
NJ1868-M1	–	1	11,6	–	**340**	420	38	2,1	1,5	4,3	361,5	394,7	368,2
NJ1868-M1	**HJ1868**	1	11,6	1,71	**340**	420	38	2,1	1,5	–	361,5	394,7	368,2
NJ1868-M1A	–	1	11,6	–	**340**	420	38	2,1	1,5	4,3	361,5	394,7	368,2
NJ1868-M1A	**HJ1868**	1	11,6	1,71	**340**	420	38	2,1	1,5	–	361,5	394,7	368,2
NJ2868-M1	–	1	15,3	–	**340**	420	48	2,1	1,5	5,3	361,5	394,7	368,2
NUP2868-M1	–	1	15,6	–	**340**	420	48	2,1	1,5	–	361,5	394,7	368,2
NJ1968-E-M1	–	1	26,9	–	**340**	460	56	3	3	5,7	370	423,3	380,7
NJ1968-E-M1	**HJ1968-E**	1	26,9	4,09	**340**	460	56	3	3	–	370	423,3	380,7
NJ1968-E-M1A	–	1	26,9	–	**340**	460	56	3	3	5,7	370	423,3	380,7
NJ1968-E-M1A	**HJ1968-E**	1	26,9	4,09	**340**	460	56	3	3	–	370	423,3	380,7
NUP1968-E-MP1A	–	1	27,1	–	**340**	460	56	3	3	–	370	423,3	380,7
NJ2968-M1	–	1	35,1	–	**340**	460	72	3	3	7	370	418	380
NJ2968-M1	**HJ2968**	1	35,1	4,02	**340**	460	72	3	3	–	370	418	380
NJ2968-M1A	–	1	35,1	–	**340**	460	72	3	3	7	370	418	380
NJ2968-M1A	**HJ2968**	1	35,1	4,02	**340**	460	72	3	3	–	370	418	380

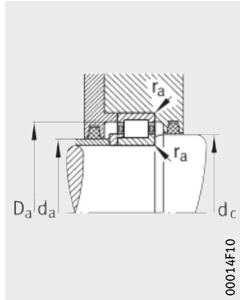
[1)] Under axial load, observe the dimensions D_1 and d_1.



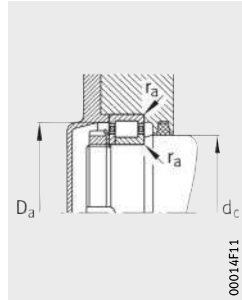
[2] Axial displacement "s" for NJ



Mounting dimensions for NJ

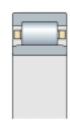


Mounting dimensions for NJ and HJ



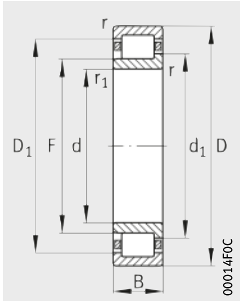
Mounting dimensions for NUP

			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	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
18	31	–	332	346	365	428	2,5	2,5	620	1 100	104	2 600	–
–	–	–	332	346	365	428	2,5	2,5	620	1 100	104	2 600	–
18	31	–	332	346	365	428	2,5	2,5	620	1 100	104	2 600	–
–	–	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
19	36	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
–	–	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
19	36	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
–	–	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
19	36	–	335	356	380	465	3	3	915	1 500	143	2 400	1 300
–	–	17	335	356	380	465	3	3	915	1 500	144	2 400	1 300
–	–	–	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
21	35	–	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
–	–	–	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
21	35	–	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
–	–	14	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
–	–	14	340	388,5	419,6	560	4	4	1 800	2 700	255	1 900	850
–	–	–	340	376,5	411,7	560	4	4	3 150	4 900	460	1 600	570
21	41	–	340	376,5	411,7	560	4	4	3 150	4 900	460	1 600	570
–	–	20	340	376,5	411,7	560	4	4	3 150	4 900	460	1 600	560
–	–	–	352	415	455	638	6	6	2 550	3 750	330	1 600	650
–	–	–	350	358	373	410	2,1	2,1	360	735	69	2 800	–
12	21	–	350	358	373	410	2,1	2,1	360	735	69	2 800	–
–	–	–	350	358	373	410	2,1	2,1	360	735	69	2 800	–
12	21	–	350	358	373	410	2,1	2,1	360	735	69	2 800	–
–	–	–	350	358	372	410	2	1,5	510	1 140	112	2 600	1 100
–	–	9	350	358	372	410	2	1,5	510	1 140	112	2 600	1 100
–	–	–	352	366	385,4	446	2,5	2,5	695	1 250	118	2 400	–
20	32	–	352	366	385,4	446	2,5	2,5	695	1 250	118	2 400	–
–	–	–	352	366	385,4	446	2,5	2,5	695	1 250	118	2 400	–
20	32	–	352	366	385,4	446	2,5	2,5	695	1 250	118	2 400	–
–	–	12	352	366	385,4	446	2,5	2,5	695	1 250	118	2 400	–
–	–	–	352	366	385	448	2,5	2,5	950	1 930	190	2 400	950
20	32	–	352	366	385	448	2,5	2,5	950	1 930	190	2 400	950
–	–	–	352	366	385	448	2,5	2,5	950	1 930	190	2 400	950
20	32	–	352	366	385	448	2,5	2,5	950	1 930	190	2 400	950

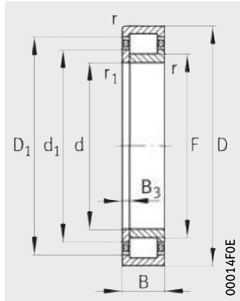


Cylindrical roller bearings with cage

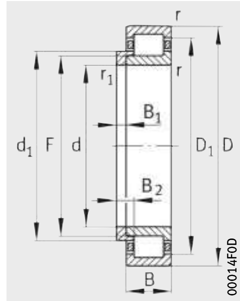
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

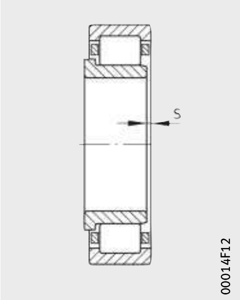


Design 1
NJ and HJ
Locating bearing

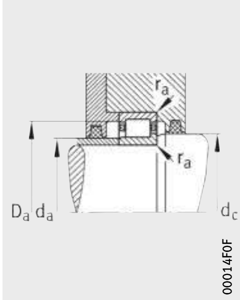
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈
NJ1068-MPA	–	1	66,6	–	**340**	520	82	5	5	8,9	385	458,2	402,2
NJ1068-MPA	**HJ1068**	1	66,6	7,22	**340**	520	82	5	5	–	385	458,2	402,2
NJ1068-M1	–	1	64,7	–	**340**	520	82	5	5	8,9	385	458,2	402,2
NJ1068-M1	**HJ1068**	1	64,7	7,22	**340**	520	82	5	5	–	385	458,2	402,2
NJ1068-M1A	–	1	64,7	–	**340**	520	82	5	5	8,9	385	458,2	402,2
NJ1068-M1A	**HJ1068**	1	64,7	7,22	**340**	520	82	5	5	–	385	458,2	402,2
NJ268-E-M1	–	1	135	–	**340**	620	92	6	6	7,4	419	526,4	442,9
NJ268-E-M1	**HJ268-E**	1	135	12,5	**340**	620	92	6	6	–	419	526,4	442,9
NJ1872-M1	–	1	17,9	–	**360**	440	38	2,1	1,5	4,3	421	414,7	388,2
NJ1872-M1	**HJ1872**	1	17,9	1,8	**360**	440	38	2,1	1,5	–	421	414,7	388,2
NJ2872-M1	–	1	15,7	–	**360**	440	48	2,1	1,5	5,4	381,5	414,7	388,2
NUP2872-M1	–	1	16	–	**360**	440	48	2,1	1,5	–	381,5	414,7	388,2
NJ1972-M1	–	1	28,3	–	**360**	480	56	3	3	6,2	390	438,5	400
NJ1972-M1	**HJ1972**	1	28,3	4,28	**360**	480	56	3	3	–	390	438,5	400
NJ1972-M1A	–	1	28,3	–	**360**	480	56	3	3	6,2	390	438,5	400
NJ1972-M1A	**HJ1972**	1	28,3	4,28	**360**	480	56	3	3	–	390	438,5	400
NUP1972-M1A	–	1	29	–	**360**	480	56	3	3	–	390	438,5	400
NJ1072-M1	–	1	67,5	–	**360**	540	82	5	5	8,9	405	478,1	421,6
NJ1072-M1	**HJ1072**	1	67,5	7,38	**360**	540	82	5	5	–	405	478,1	421,6
NJ1072-M1A	–	1	67,5	–	**360**	540	82	5	5	8,9	405	478,1	421,6
NJ1072-M1A	**HJ1072**	1	67,5	7,38	**360**	540	82	5	5	–	405	478,1	421,6
NJ1072-MP1A	–	1	65,8	–	**360**	540	82	5	5	8,9	405	478,1	421,6
NJ1072-MP1A	**HJ1072**	1	65,8	7,38	**360**	540	82	5	5	–	405	478,1	421,6
NUP1072-M1	–	1	69,1	–	**360**	540	82	5	5	–	405	478,1	421,6
NUP2072-E-M1	–	1	91,5	–	**360**	540	106	5	5	–	405	483,8	422,7
NUP2072-E-M1A	–	1	91,5	–	**360**	540	106	5	5	–	405	483,8	422,7
NUP2072-E-MP1A	–	1	90	–	**360**	540	106	5	5	–	405	483,8	422,7
NUP2072-E-MPA	–	1	90	–	**360**	540	106	5	5	–	405	483,8	422,7
NJ272-E-M1	–	1	151	–	**360**	650	95	6	6	9,5	451	558,5	475
NJ272-E-M1	**HJ272-E**	1	151	14,9	**360**	650	95	6	6	–	451	558,5	475
NJ2272-E-M1	–	1	258	–	**360**	650	170	6	6	15	428	562	457,5

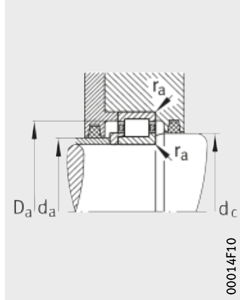
1) Under axial load, observe the dimensions D_1 and d_1.



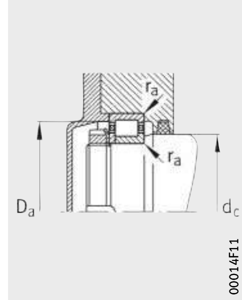
2) Axial displacement "s" for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

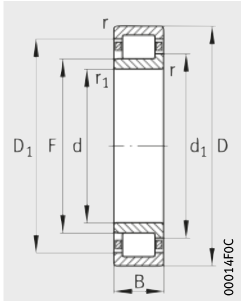


Mounting dimensions for NUP

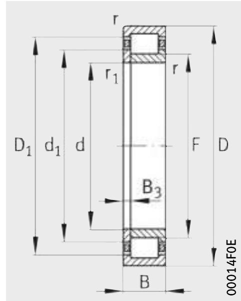
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	357	381	407	503	4	4	1 080	1 760	163	2 200	1 200
21	39,5	–	357	381	407	503	4	4	1 080	1 760	163	2 200	1 200
–	–	–	357	381	407	503	4	4	1 120	1 830	169	2 200	1 200
21	39,5	–	357	381	407	503	4	4	1 120	1 830	169	2 200	1 200
–	–	–	357	381	407	503	4	4	1 120	1 830	169	2 200	1 200
21	39,5	–	357	381	407	503	4	4	1 120	1 830	169	2 200	1 200
–	–	–	366	415	447	594	5	5	1 930	3 000	280	1 800	750
22	36	–	366	415	447	594	5	5	1 930	3 000	280	1 800	750
–	–	–	370	378	393	430	2	1,5	365	765	71	2 600	–
12	21	–	370	378	393	430	2	1,5	365	765	71	2 600	–
–	–	–	370	378	392	430	2	1,5	530	1 220	118	2 400	950
–	–	9	370	378	392	430	2	1,5	530	1 220	118	2 400	950
–	–	–	372	386	405	468	2,5	2,5	655	1 220	114	2 400	–
20	33	–	372	386	405	468	2,5	2,5	655	1 220	114	2 400	–
–	–	–	372	386	405	468	2,5	2,5	655	1 220	114	2 400	–
20	33	–	372	386	405	468	2,5	2,5	655	1 220	114	2 400	–
–	–	13	372	386	405	468	2,5	2,5	655	1 220	115	2 400	–
–	–	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
21	39,5	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
–	–	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
21	39,5	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
–	–	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
21	39,5	–	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
–	–	18,5	377	400	427	523	4	4	1 140	1 900	175	2 200	1 100
–	–	13	377	401	427	523	4	4	2 000	3 750	355	1 900	750
–	–	13	377	401	427	523	4	4	2 000	3 750	355	1 900	750
–	–	13	377	401	427	523	4	4	2 000	3 750	355	1 900	750
–	–	13	377	401	427	523	4	4	2 000	3 750	355	1 900	750
–	–	–	386	447	479	624	5	5	2 000	3 150	290	1 600	700
22	37,5	–	386	447	479	624	5	5	2 000	3 150	290	1 600	700
–	–	–	386	424	462	624	5	5	3 600	5 700	520	1 400	500

Cylindrical roller bearings with cage

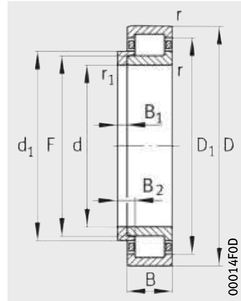
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

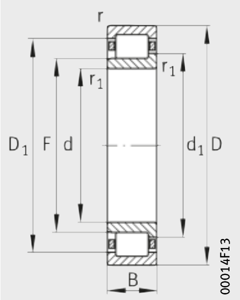


Design 1
NJ and HJ
Locating bearing

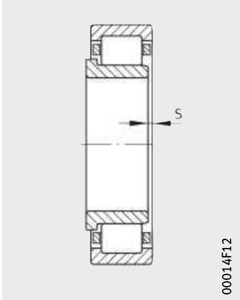
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions								
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2]	F	D_1 ≈	d_1 ≈
NJ1876-M1	–	1	19,6	–	**380**	480	46	2,1	2,1	5,3	407,5	447,4	415,5
NJ1876-M1	**HJ1876**	1	19,6	2,82	**380**	480	46	2,1	2,1	–	407,5	447,4	415,5
NJ1876-MP1A	–	1	19,6	–	**380**	480	46	2,1	2,1	5,3	407,5	447,4	415,5
NJ1876-MP1A	**HJ1876**	1	19,6	2,82	**380**	480	46	2,1	2,1	–	407,5	447,4	415,5
NUP1876-M1	–	1	20,1	–	**380**	480	46	2,1	2,1	–	407,5	447,4	415,5
NJ2876-M1	–	1	25,9	–	**380**	480	60	2,1	2,1	6,9	407,5	447,4	415,5
NJ2876-M1A	–	1	25,9	–	**380**	480	60	2,1	2,1	6,9	407,5	447,4	415,5
NUP2876-M1	–	1	26,4	–	**380**	480	60	2,1	2,1	–	407,5	447,4	415,5
NUP2876-M1A	–	1	26,4	–	**380**	480	60	2,1	2,1	–	407,5	447,4	415,5
NJ2976-M1	–	1	53,8	–	**380**	520	82	4	4	7,2	414	471,6	425,9
NUP2976-M1	–	1	54,5	–	**380**	520	82	4	4	–	414	471,6	425,9
NJ1076-M1	–	1	70,7	–	**380**	560	82	5	5	9	425	498,1	441,6
NJ1076-M1	**HJ1076**	1	70,7	7,86	**380**	560	82	5	5	–	425	498,1	441,6
NJ1076-M1A	–	1	70,7	–	**380**	560	82	5	5	9	425	498,1	441,6
NJ1076-M1A	**HJ1076**	1	70,7	7,86	**380**	560	82	5	5	–	425	498,1	441,6
NJ1076-MP1A	–	1	68,7	–	**380**	560	82	5	5	9	425	498,1	441,6
NJ1076-MP1A	**HJ1076**	1	68,7	7,86	**380**	560	82	5	5	–	425	498,1	441,6
NJ2276-E-M1	–	1	292	–	**380**	680	175	6	6	13,8	451	588,8	481
NJ2276-E-M1	**HJ2276-E**	1	292	17,3	**380**	680	175	6	6	–	451	588,8	481
Z-544425.ZL	–	2 NJ	37,4	–	**381**	508	63,5	5	3	–	407	469,3	421,8
NJ1880-M1	–	1	20,8	–	**400**	500	46	2,1	2,1	5,3	428	468	436
NJ1880-M1	**HJ1880**	1	20,8	3,18	**400**	500	46	2,1	2,1	–	428	468	436
NUP2880-M1	–	1	28,4	–	**400**	500	60	2,1	2,1	–	428	468	436
NJ1980-M1	–	1	42,9	–	**400**	540	65	4	4	7,2	436	492,7	447,3
NJ1980-M1	**HJ1980**	1	42,9	6,22	**400**	540	65	4	4	–	436	492,7	447,3
NJ1980-M1A	–	1	42,9	–	**400**	540	65	4	4	7,2	436	492,7	447,3
NJ1980-M1A	**HJ1980**	1	42,9	6,22	**400**	540	65	4	4	–	436	492,7	447,3
NJ2980-M1	–	1	56,1	–	**400**	540	82	4	4	7,2	434	494	445,9
NJ2980-MP1A	–	1	54,9	–	**400**	540	82	4	4	7,2	434	494	445,9
NJ1080-M1	–	1	92,2	–	**400**	600	90	5	5	9,5	450	531,5	469
NJ1080-M1	**HJ1080**	1	92,2	10,3	**400**	600	90	5	5	–	450	531,5	469
NJ1080-M1A	–	1	92,2	–	**400**	600	90	5	5	9,5	450	531,5	469
NJ1080-M1A	**HJ1080**	1	92,2	10,3	**400**	600	90	5	5	–	450	531,5	469
NUP1080-M1	–	1	94,4	–	**400**	600	90	5	5	–	450	531,5	469
NUP2080-E-M1	–	1	126	–	**400**	600	118	5	5	–	450	533,6	469,7

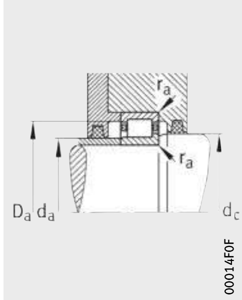
[1] Under axial load, observe the dimensions D_1 and d_1.



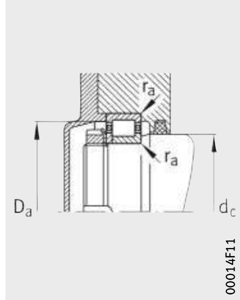
Design 2
NJ
Semi-locating bearing



2) Axial displacement “s” for NJ



Mounting dimensions
for NJ
for NJ and HJ, page 363

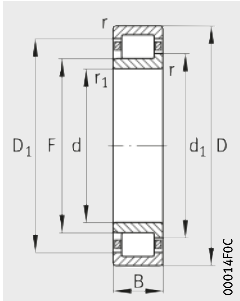


Mounting dimensions
for NUP

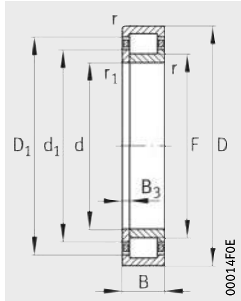
			Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
			min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
–	–	–	390	404	420	470	2	2	490	1 000	91	2 400	–
14	25	–	390	404	420	470	2	2	490	1 000	91	2 400	–
–	–	–	390	404	420	470	2	2	490	1 000	91	2 400	–
14	25	–	390	404	420	470	2	2	490	1 000	91	2 400	–
–	–	11	390	404	420	470	2	2	490	1 000	91	2 400	–
–	–	–	390	404	420	470	2	2	695	1 560	148	2 200	900
–	–	–	390	404	420	470	2	2	695	1 560	148	2 200	900
–	–	12	390	404	420	470	2	2	695	1 560	148	2 200	900
–	–	12	390	404	420	470	2	2	695	1 560	148	2 200	900
–	–	–	395	410	432	505	3	3	1 320	2 700	255	2 000	800
–	–	12	395	410	432	505	3	3	1 320	2 700	255	2 000	800
–	–	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
21	39,5	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
–	–	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
21	39,5	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
–	–	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
21	39,5	–	397	420	447	543	4	4	1 180	2 000	180	2 000	1 000
–	–	–	406	446	484	654	5	5	4 050	6 700	610	1 400	450
25	50	–	406	446	484	654	5	5	4 050	6 700	610	1 400	450
–	–	–	393	403	427	491	4	2,5	1 020	1 860	150	2 000	800
–	–	–	410	424	441	490	2,1	2,1	520	1 100	98	2 400	–
15	26	–	410	424	441	490	2,1	2,1	520	1 100	98	2 400	–
–	–	12	410	424	441	490	2	2	735	1 700	159	2 200	850
–	–	–	415	432	453	525	3	3	800	1 500	141	2 200	–
22	37,5	–	415	432	453	525	3	3	800	1 500	141	2 200	–
–	–	–	415	432	453	525	3	3	800	1 500	141	2 200	–
22	37,5	–	415	432	453	525	3	3	800	1 500	141	2 200	–
–	–	–	415	430	452	525	3	3	1 340	2 750	265	2 000	750
–	–	–	415	430	452	525	3	3	1 340	2 750	265	2 000	750
–	–	–	417	445	474	583	4	4	1 370	2 320	212	1 900	950
23	43	–	417	445	474	583	4	4	1 370	2 320	212	1 900	950
–	–	–	417	445	474	583	4	4	1 370	2 320	212	1 900	950
23	43	–	417	445	474	583	4	4	1 370	2 320	212	1 900	950
–	–	20	417	445	474	583	4	4	1 370	2 320	212	1 900	950
–	–	16,5	417	446	476	583	4	4	2 280	4 400	415	1 800	670

Cylindrical roller bearings with cage

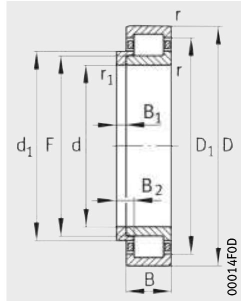
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

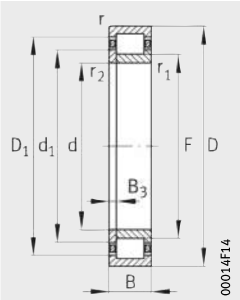


Design 1
NJ and HJ
Locating bearing

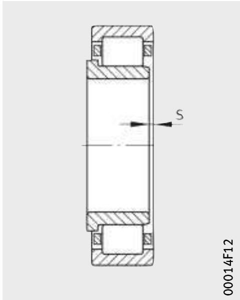
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2]	F	D_1 ≈
NUP2080-E-M1A	–	1	126	–	**400**	600	118	5	5	–	450	533,6
NJ2280-E-M1	–	1	342	–	**400**	720	105	6	6	15	471	630,5
Z-545999.ZL	–	2 NUP	29,6	–	**404,6**	508	60,325	5	5	–	427,2	477,2
NJ1884-MPA	–	1	22,5	–	**420**	520	46	2,1	2,1	5,3	448	488
NJ1884-MPA	**HJ1884**	1	22,5	3,33	**420**	520	46	2,1	2,1	–	448	488
NJ1884-M1	–	1	21,4	–	**420**	520	46	2,1	2,1	5,3	448	488
NJ1884-M1	**HJ1884**	1	21,4	3,33	**420**	520	46	2,1	2,1	–	448	488
NJ1884-M1A	–	1	21,4	–	**420**	520	46	2,1	2,1	5,3	448	488
NJ1884-M1A	**HJ1884**	1	21,4	3,33	**420**	520	46	2,1	2,1	–	448	488
NJ2884-M1	–	1	25,1	–	**420**	520	60	2,1	2,1	6,9	448	488
NUP2884-M1	–	1	27,8	–	**420**	520	60	2,1	2,1	–	448	488
NJ1984-M1	–	1	45,2	–	**420**	560	65	4	4	7,2	456	510,4
NJ1984-M1	**HJ1984**	1	45,2	6,51	**420**	560	65	4	4	–	456	510,4
NJ1984-M1A	–	1	45,2	–	**420**	560	65	4	4	7,2	456	510,4
NJ1984-M1A	**HJ1984**	1	45,2	6,51	**420**	560	65	4	4	–	456	510,4
NJ2984-M1	–	1	59,4	–	**420**	560	82	4	4	6	454	511,6
NJ2984-M1A	–	1	59,4	–	**420**	560	82	4	4	6	454	511,6
NUP2984-M1	–	1	60,6	–	**420**	560	82	4	4	–	454	511,6
NJ1084-M1	–	1	95,1	–	**420**	620	90	5	5	15	470	551,5
NJ1084-M1	**HJ1084**	1	95,1	10,7	**420**	620	90	5	5	–	470	551,5
NJ1084-M1A	–	1	95,1	–	**420**	620	90	5	5	15	470	551,5
NJ1084-M1A	**HJ1084**	1	95,1	10,7	**420**	620	90	5	5	–	470	551,5
Z-544003.ZL	–	2 NUP	49,9	–	**431,762**	558,825	73,025	4	7,5/4	–	456,7	510
NJ1888-M1	–	1	22,7	–	**440**	540	46	2,1	2,1	5,3	468	508
NJ1888-M1	**HJ1888**	1	22,7	3,48	**440**	540	46	2,1	2,1	–	468	508
NJ1888-M1A	–	1	22,7	–	**440**	540	46	2,1	2,1	5,3	468	508
NJ1888-M1A	**HJ1888**	1	22,7	3,48	**440**	540	46	2,1	2,1	–	468	508
NJ2888-M1	–	1	30	–	**440**	540	60	2,1	2,1	6,9	468	508
NJ2888-M1A	–	1	30	–	**440**	540	60	2,1	2,1	6,9	468	508
NUP2888-M1	–	1	30,6	–	**440**	540	60	2,1	2,1	–	468	508
NUP2888-M1A	–	1	30,6	–	**440**	540	60	2,1	2,1	–	468	508
NUP2888-MP1A	–	1	29,8	–	**440**	540	60	2,1	2,1	–	468	508
NJ2988-M1	–	1	82,2	–	**440**	600	95	4	4	8,7	480	545,6
NJ2988-M1	**HJ2988**	1	82,2	8,38	**440**	600	95	4	4	–	480	545,6
NJ2988-M1A	–	1	82,2	–	**440**	600	95	4	4	8,7	480	545,6

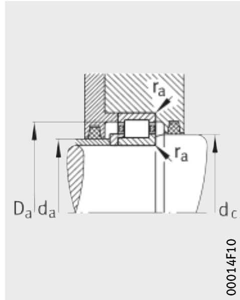
[1] Under axial load, observe the dimensions D_1 and d_1.



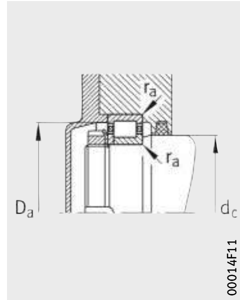
Design 2
NUP
Locating bearing



2) Axial displacement “s” for NJ



Mounting dimensions for NJ and HJ
for NJ, page 361

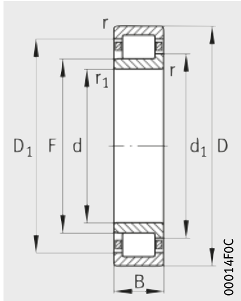


Mounting dimensions for NUP

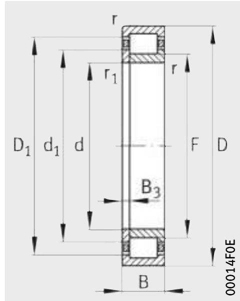
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
469,7	–	–	16,5	417	446	476	583	4	4	2 280	4 400	415	1 800	670
–	–	–	–	426	467	508	694	5	5	5 600	7 600	670	1 300	850
438,8	–	–	9,2	–	–	–	–	4	4	915	1 930	157	2 000	750
456	–	–	–	430	444	461	510	2	2	520	1 100	97	2 200	–
456	15	26	–	430	444	461	510	2	2	520	1 100	97	2 200	–
456	–	–	–	430	444	461	510	2	2	530	1 140	101	2 200	–
456	15	26	–	430	444	461	510	2	2	530	1 140	101	2 200	–
456	–	–	–	430	444	461	510	2	2	530	1 140	101	2 200	–
456	15	26	–	430	444	461	510	2	2	530	1 140	101	2 200	–
456	–	–	–	430	444	461	510	2	2	750	1 760	164	2 000	800
456	–	–	12	430	444	461	510	2	2	750	1 760	164	2 000	800
467,3	–	–	–	435	452	473	545	3	3	830	1 600	148	2 000	–
467,3	22	37,5	–	435	452	473	545	3	3	830	1 600	148	2 000	–
467,3	–	–	–	435	452	473	545	3	3	830	1 600	148	2 000	–
467,3	22	37,5	–	435	452	473	545	3	3	830	1 600	148	2 000	–
465,9	–	–	–	435	450	472	545	3	3	1 370	2 900	275	1 900	700
465,9	–	–	–	435	450	472	545	3	3	1 370	2 900	275	1 900	700
465,9	–	–	12	435	450	472	545	3	3	1 370	2 900	275	1 900	700
489	–	–	–	437	465	494	603	4	4	1 400	2 450	219	1 800	900
489	23	43	–	437	465	494	603	4	4	1 400	2 450	219	1 800	900
489	–	–	–	437	465	494	603	4	4	1 400	2 450	219	1 800	900
489	23	43	–	437	465	494	603	4	4	1 400	2 450	219	1 800	900
469,1	–	–	10,5	–	–	–	–	3	6/3	1 180	2 600	241	1 900	630
476	–	–	–	450	464	481	530	2	2	540	1 200	104	2 200	–
476	15	26	–	450	464	481	530	2	2	540	1 200	104	2 200	–
476	–	–	–	450	464	481	530	2	2	540	1 200	104	2 200	–
476	15	26	–	450	464	481	530	2	2	540	1 200	104	2 200	–
476	–	–	–	450	464	481	530	2	2	765	1 830	168	2 000	750
476	–	–	–	450	464	481	530	2	2	765	1 830	168	2 000	750
476	–	–	12	450	464	481	530	2	2	765	1 830	168	2 000	750
476	–	–	12	450	464	481	530	2	2	765	1 830	168	2 000	750
476	–	–	12	450	464	481	530	2	2	765	1 830	168	2 000	750
493,3	–	–	–	455	476	500	585	3	3	1 630	3 450	320	1 800	670
493,3	24	39	–	455	476	500	585	3	3	1 630	3 450	320	1 800	670
493,3	–	–	–	455	476	500	585	3	3	1 630	3 450	320	1 800	670

Cylindrical roller bearings with cage

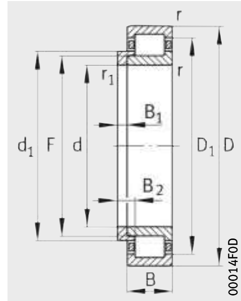
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

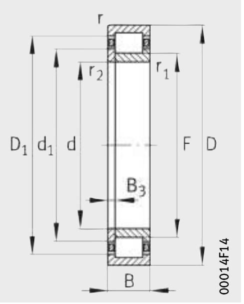


Design 1
NJ and HJ
Locating bearing

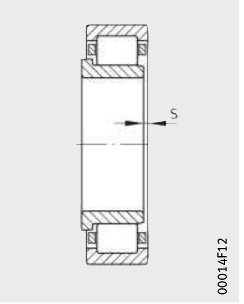
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2)]	F	D_1 ≈
NJ2988-M1A	**HJ2988**	1	82,2	8,38	**440**	600	95	4	4	–	480	545,6
NUP2988-M1	–	1	83,4	–	**440**	600	95	4	4	–	480	545,6
NJ1088-M1	–	1	110	–	**440**	650	94	6	6	9,8	493	577,6
NJ1088-M1	**HJ1088**	1	110	12,6	**440**	650	94	6	6	–	493	577,6
NJ1088-M1A	–	1	110	–	**440**	650	94	6	6	9,8	493	577,6
NJ1088-M1A	**HJ1088**	1	110	12,6	**440**	650	94	6	6	–	493	577,6
NJ1892-M1	–	1	34,9	–	**460**	580	56	3	3	6,6	494	540,5
NJ1892-M1	**HJ1892**	1	34,9	5,33	**460**	580	56	3	3	–	494	540,5
NJ1892-M1A	–	1	34,9	–	**460**	580	56	3	3	6,6	494	540,5
NJ1892-M1A	**HJ1892**	1	34,9	5,33	**460**	580	56	3	3	–	494	540,5
NJ2892-M1	–	1	46,6	–	**460**	580	72	3	3	8	494	540,5
NJ2892-M1A	–	1	46,6	–	**460**	580	72	3	3	8	494	540,5
NUP2892-M1	–	1	47,4	–	**460**	580	72	3	3	–	494	540,5
NUP2892-M1A	–	1	47,4	–	**460**	580	72	3	3	–	494	540,5
NJ1992-M1	–	1	64,4	–	**460**	620	74	4	4	8,4	502	562,8
NJ1992-M1	**HJ1992**	1	64,4	9,03	**460**	620	74	4	4	–	502	562,8
NJ1992-M1A	–	1	64,4	–	**460**	620	74	4	4	8,4	502	562,8
NJ1992-M1A	**HJ1992**	1	64,4	9,03	**460**	620	74	4	4	–	502	562,8
NUP1992-M1	–	1	66	–	**460**	620	74	4	4	–	502	562,8
NJ2992-M1	–	1	85,2	–	**460**	620	95	4	4	8,7	500	564
NJ2992-M1	**HJ2992**	1	85,2	8,73	**460**	620	95	4	4	–	500	564
NUP2992-M1	–	1	86,5	–	**460**	620	95	4	4	–	500	564
NJ1092-M1	–	1	128	–	**460**	680	100	6	6	11,2	516	603,9
NJ1092-M1	**HJ1092**	1	128	14,2	**460**	680	100	6	6	–	516	603,9
NJ1092-M1A	–	1	128	–	**460**	680	100	6	6	11,2	516	603,9
NJ1092-M1A	**HJ1092**	1	128	14,2	**460**	680	100	6	6	–	516	603,9
NUP1092-M1	–	1	131	–	**460**	680	100	6	6	–	516	603,9
Z-539186.ZL	–	2 NUP	46,8	–	**469,9**	571,5	82,55	4	4	–	494,5	536

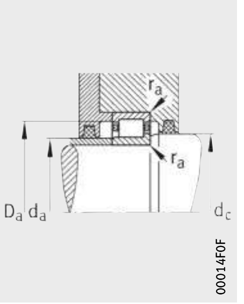
1) Under axial load, observe the dimensions D_1 and d_1.



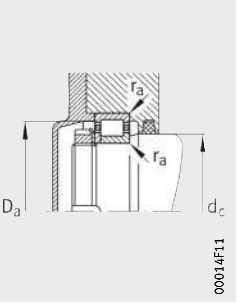
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions
for NJ
for NJ and HJ, page 367

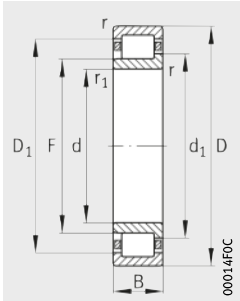


Mounting dimensions
for NUP

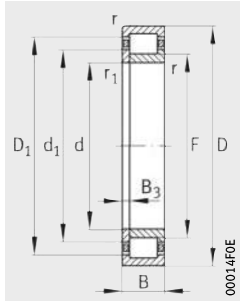
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
493,3	24	39	–	455	476	500	585	3	3	1 630	3 450	320	1 800	670
493,3	–	–	15	455	476	500	585	3	3	1 630	3 450	320	1 800	670
513,5	–	–	–	463	488	518	627	5	5	1 560	2 750	244	1 600	850
513,5	24	45	–	463	488	518	627	5	5	1 560	2 750	244	1 600	850
513,5	–	–	–	463	488	518	627	5	5	1 560	2 750	244	1 600	850
513,5	24	45	–	463	488	518	627	5	5	1 560	2 750	244	1 600	850
503,5	–	–	–	472	490	508	568	2,5	2,5	670	1 430	125	2 000	–
503,5	18	32	–	472	490	508	568	2,5	2,5	670	1 430	125	2 000	–
503,5	–	–	–	472	490	508	568	2,5	2,5	670	1 430	125	2 000	–
503,5	18	32	–	472	490	508	568	2,5	2,5	670	1 430	125	2 000	–
503,5	–	–	–	472	490	508	568	2,5	2,5	980	2 360	213	1 800	700
503,5	–	–	–	472	490	508	568	2,5	2,5	980	2 360	213	1 800	700
503,5	–	–	14	472	490	508	568	2,5	2,5	980	2 360	213	1 800	700
503,5	–	–	14	472	490	508	568	2,5	2,5	980	2 360	213	1 800	700
514,5	–	–	–	475	498	520	605	3	3	1 020	1 960	173	1 800	–
514,5	24	42	–	475	498	520	605	3	3	1 020	1 960	173	1 800	–
514,5	–	–	–	475	498	520	605	3	3	1 020	1 960	173	1 800	–
514,5	24	42	–	475	498	520	605	3	3	1 020	1 960	173	1 800	–
514,5	–	–	18	475	498	520	605	3	3	1 020	1 960	173	1 800	–
513,3	–	–	–	475	496	520	605	3	3	1 660	3 600	325	1 600	630
513,3	24	39	–	475	496	520	605	3	3	1 660	3 600	325	1 600	630
513,3	–	–	15	475	496	520	605	3	3	1 660	3 600	325	1 600	630
536,4	–	–	–	483	510	541	657	5	5	1 660	3 000	260	1 600	800
536,4	25	48	–	483	510	541	657	5	5	1 660	3 000	260	1 600	800
536,4	–	–	–	483	510	541	657	5	5	1 660	3 000	260	1 600	800
536,4	25	48	–	483	510	541	657	5	5	1 660	3 000	260	1 600	800
536,4	–	–	23	483	510	541	657	5	5	1 660	3 000	260	1 600	800
505	–	–	10,3	–	–	–	–	3	3	1 250	3 350	275	1 900	560

Cylindrical roller bearings with cage

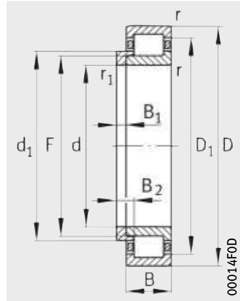
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

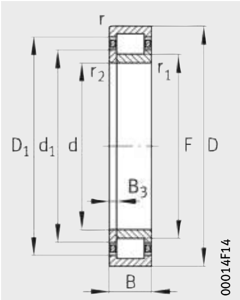


Design 1
NJ and HJ
Locating bearing

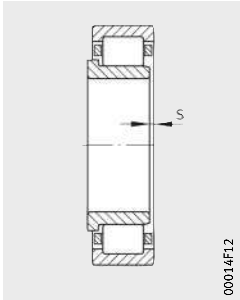
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	$s^{2)}$	F	D_1 ≈
NJ1896-M1	–	1	36	–	**480**	600	56	3	3	6,6	514	560,5
NJ1896-M1	**HJ1896**	1	36	5,43	**480**	600	56	3	3	–	514	560,5
NJ1896-M1A	–	1	36	–	**480**	600	56	3	3	6,6	514	560,5
NJ1896-M1A	**HJ1896**	1	36	5,43	**480**	600	56	3	3	–	514	560,5
NJ2896-M1	–	1	47,2	–	**480**	600	72	3	3	7,9	514	560,5
NJ2896-M1	**HJ2896**	1	47,2	5,55	**480**	600	72	3	3	–	514	560,5
NUP2896-M1	–	1	48,1	–	**480**	600	72	3	3	–	514	560,5
NJ1996-M1	–	1	76	–	**480**	650	78	5	5	6,8	525	589
NJ1996-M1	**HJ1996**	1	76	9,96	**480**	650	78	5	5	–	525	589
NJ2996-M1	–	1	98,8	–	**480**	650	100	5	5	6,3	523	593
NJ2996-M1A	–	1	98,8	–	**480**	650	100	5	5	6,3	523	593
NJ1096-M1	–	1	132	–	**480**	700	100	6	6	10,7	536	623,9
NJ1096-M1	**HJ1096**	1	132	14,8	**480**	700	100	6	6	–	536	623,9
NJ1096-M1A	–	1	132	–	**480**	700	100	6	6	10,7	536	623,9
NJ1096-M1A	**HJ1096**	1	132	14,8	**480**	700	100	6	6	–	536	623,9
NJ18/500-M1	–	1	37,8	–	**500**	620	56	3	3	6,6	534	580
NJ18/500-M1	**HJ18/500**	1	37,8	5,78	**500**	620	56	3	3	–	534	580
NJ18/500-M1A	–	1	37,8	–	**500**	620	56	3	3	6,6	534	580
NJ18/500-M1A	**HJ18/500**	1	37,8	5,78	**500**	620	56	3	3	–	534	580
NJ28/500-M1	–	1	49,3	–	**500**	620	72	3	3	8	534	580
NUP28/500-M1	–	1	50,3	–	**500**	620	72	3	3	–	534	580
NJ19/500-M1	–	1	78,4	–	**500**	670	78	5	5	8,8	545	609
NJ19/500-M1	**HJ19/500**	1	78,4	10,5	**500**	670	78	5	5	–	545	609
NUP19/500-M1	–	1	80,2	–	**500**	670	78	5	5	–	545	609
NUP19/500-M1A	–	1	80,2	–	**500**	670	78	5	5	–	545	609
NJ10/500-M1	–	1	137	–	**500**	720	100	6	6	10,7	556	643,9
NJ10/500-M1	**HJ10/500**	1	137	15,6	**500**	720	100	6	6	–	556	643,9
NJ10/500-M1A	–	1	137	–	**500**	720	100	6	6	10,7	556	643,9
NJ10/500-M1A	**HJ10/500**	1	137	15,6	**500**	720	100	6	6	–	556	643,9
Z-539187.ZL	–	2 NUP	48,2	–	**508**	609,6	82,55	4	4	–	529	579
Z-544258.ZL	–	2 NUP	48,6	–	**508**	609,6	82,55	5,1	5,1	–	528,8	579
Z-544514.ZL	–	2 NUP	53,7	–	**508**	622,3	79,575	6	6/4	–	532	588,7
Z-544760.ZL	–	2 NUP	59,7	–	**508**	635	76,2	4	7,5/4	–	544,9	587,6
Z-544002.ZL	–	2 NUP	63,7	–	**508,1**	622,3	95,25	6	6	–	529	589

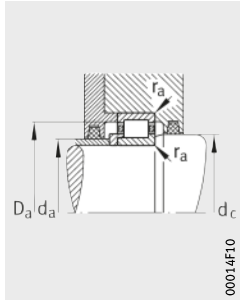
1) Under axial load, observe the dimensions D_1 and d_1.



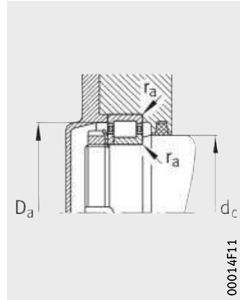
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions
for NJ and HJ
for NJ, page 369

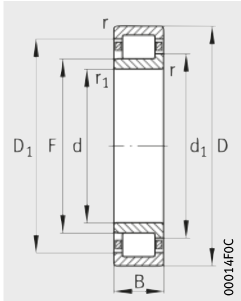


Mounting dimensions
for NUP

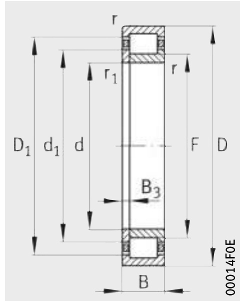
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
523,5	–	–	–	492	510	528	588	2,5	2,5	680	1 460	126	1 900	–
523,5	18	32	–	492	510	528	588	2,5	2,5	680	1 460	126	1 900	–
523,5	–	–	–	492	510	528	588	2,5	2,5	680	1 460	126	1 900	–
523,5	18	32	–	492	510	528	588	2,5	2,5	680	1 460	126	1 900	–
523,5	–	–	–	492	510	528	588	2,5	2,5	1 000	2 400	215	1 800	670
523,5	18	32	–	492	510	528	588	2,5	2,5	1 000	2 400	215	1 800	670
523,5	–	–	14	492	510	528	588	2,5	2,5	1 000	2 400	216	1 800	670
540	–	–	–	497	521	545	633	4	4	1 140	2 240	196	1 800	–
540	24	43	–	497	521	545	633	4	4	1 140	2 240	196	1 800	–
539	–	–	–	497	519	544	633	4	4	1 900	4 150	380	1 500	560
539	–	–	–	497	519	544	633	4	4	1 900	4 150	380	1 500	560
556,4	–	–	–	503	530	562	677	5	5	1 700	3 100	270	1 500	800
556,4	25	48	–	503	530	562	677	5	5	1 700	3 100	270	1 500	800
556,4	–	–	–	503	530	562	677	5	5	1 700	3 100	270	1 500	800
556,4	25	48	–	503	530	562	677	5	5	1 700	3 100	270	1 500	800
543,5	–	–	–	512	530	549	608	2,5	2,5	695	1 530	130	1 800	–
543,5	18	32	–	512	530	549	608	2,5	2,5	695	1 530	130	1 800	–
543,5	–	–	–	512	530	549	608	2,5	2,5	695	1 530	130	1 800	–
543,5	18	32	–	512	530	549	608	2,5	2,5	695	1 530	130	1 800	–
543,5	–	–	–	512	530	549	608	2,5	2,5	1 020	2 500	222	1 600	630
543,5	–	–	14	512	530	549	608	2,5	2,5	1 020	2 500	222	1 600	630
558,2	–	–	–	517	541	565	653	4	4	1 160	2 320	200	1 600	–
558,2	24	43	–	517	541	565	653	4	4	1 160	2 320	200	1 600	–
558,2	–	–	19	517	541	565	653	4	4	1 160	2 320	200	1 600	–
558,2	–	–	19	517	541	565	653	4	4	1 160	2 320	200	1 600	–
576,4	–	–	–	523	550	582	697	5	5	1 760	3 200	275	1 500	750
576,4	25	48	–	523	550	582	697	5	5	1 760	3 200	275	1 500	750
576,4	–	–	–	523	550	582	697	5	5	1 760	3 200	275	1 500	750
576,4	25	48	–	523	550	582	697	5	5	1 760	3 200	275	1 500	750
540,5	–	–	11,3	–	–	–	–	3	3	1 290	3 250	255	1 000	–
540,8	–	–	11,3	–	–	–	–	4	4	1 340	3 450	270	1 600	530
545,1	–	–	12,2	–	–	–	–	5	5/3	1 370	3 150	250	1 600	530
555	–	–	12,1	–	–	–	–	3	6/3	1 140	3 050	244	1 600	530
542,8	–	–	11,6	–	–	–	–	5	5	1 760	4 250	275	1 600	–

Cylindrical roller bearings with cage

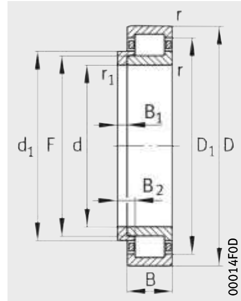
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

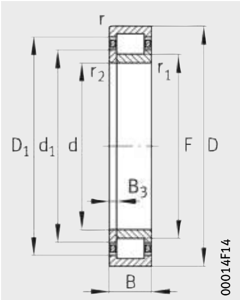


Design 1
NJ and HJ
Locating bearing

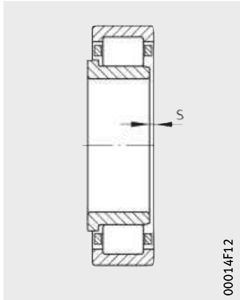
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2)]	F	D_1 ≈
NJ18/530-M1	–	1	39,3	–	**530**	650	56	3	3	8,5	564	610,5
NJ18/530-M1	**HJ18/530**	1	39,3	6,11	**530**	650	56	3	3	–	564	610,5
NJ18/530-M1A	–	1	39,3	–	**530**	650	56	3	3	8,5	564	610,5
NJ18/530-M1A	**HJ18/530**	1	39,3	6,11	**530**	650	56	3	3	–	564	610,5
NJ28/530-M1	–	1	51,6	–	**530**	650	72	3	3	8	564	610,5
NJ28/530-M1A	–	1	51,6	–	**530**	650	72	3	3	8	564	610,5
NUP28/530-M1	–	1	52,6	–	**530**	650	72	3	3	–	564	610,5
NUP28/530-M1A	–	1	52,6	–	**530**	650	72	3	3	–	564	610,5
NJ19/530-M1	–	1	91,9	–	**530**	710	82	5	5	9,3	578	645,2
NJ19/530-M1	**HJ19/530**	1	91,9	12,4	**530**	710	82	5	5	–	578	645,2
NJ10/530-M1	–	1	193	–	**530**	780	112	6	6	10,2	591	696
NJ10/530-M1	**HJ10/530**	1	193	19,1	**530**	780	112	6	6	–	591	696
NJ10/530-M1A	–	1	193	–	**530**	780	112	6	6	10,2	591	696
NJ10/530-M1A	**HJ10/530**	1	193	19,1	**530**	780	112	6	6	–	591	696
Z-544001.ZL	–	2 NUP	101	–	**533,4**	685,8	101,6	3	6/3	–	570	636,5
Z-544515.ZL	–	2 NUP	66,5	–	**546,1**	660,4	92,08	5	5	–	571	627,6
Z-544759.ZL	–	2 NUP	81,4	–	**558,8**	685,8	100,013	5,5	5,5	–	584,3	648
Z-545998.ZL	–	2 NUP	114	–	**558,8**	711,2	111,125	3	6/3	–	595	661,8
NJ18/560-M1	–	1	41,5	–	**560**	680	56	3	3	6,6	594	640
NJ18/560-M1	**HJ18/560**	1	41,5	6,44	**560**	680	56	3	3	–	594	640
NJ18/560-M1A	–	1	41,5	–	**560**	680	56	3	3	6,6	594	640
NJ18/560-M1A	**HJ18/560**	1	41,5	6,44	**560**	680	56	3	3	–	594	640
NJ28/560-M1A	–	1	54,4	–	**560**	680	72	3	3	8	594	640
NUP28/560-M1	–	1	55,5	–	**560**	680	72	3	3	–	594	640
NJ19/560-M1	–	1	107	–	**560**	750	85	5	5	9,6	610	682
NJ19/560-M1	**HJ19/560**	1	107	14,3	**560**	750	85	5	5	–	610	682
NJ19/560-M1A	–	1	107	–	**560**	750	85	5	5	9,6	610	682
NJ19/560-M1A	**HJ19/560**	1	107	14,3	**560**	750	85	5	5	–	610	682
NJ29/560-M1	–	1	143	–	**560**	750	112	5	5	6,5	607	687,5
NJ10/560-M1	–	1	216	–	**560**	820	115	6	6	9,8	626	731
NJ10/560-M1	**HJ10/560**	1	216	23,5	**560**	820	115	6	6	–	626	731
NJ10/560-M1A	–	1	216	–	**560**	820	115	6	6	9,8	626	731
NJ10/560-M1A	**HJ10/560**	1	216	23,5	**560**	820	115	6	6	–	626	731
Z-544513.ZL	–	2 NUP	108	–	**569,9**	723,9	101,6	6	6	–	622	685,5

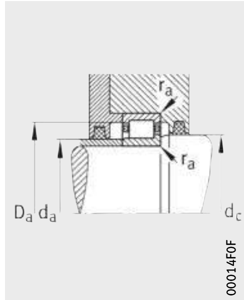
[1)] Under axial load, observe the dimensions D_1 and d_1.



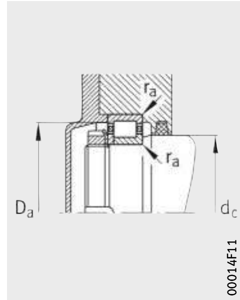
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions for NJ
for NJ and HJ, page 371

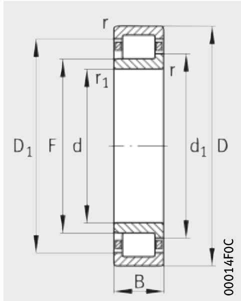


Mounting dimensions for NUP

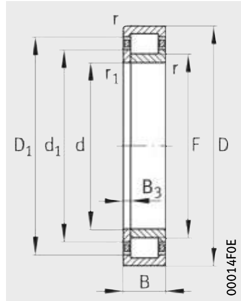
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
573,5	–	–	–	542	560	579	638	2,5	2,5	720	1 660	138	1 800	–
573,5	18	32	–	542	560	579	638	2,5	2,5	720	1 660	138	1 800	–
573,5	–	–	–	542	560	579	638	2,5	2,5	720	1 660	138	1 800	–
573,5	18	32	–	542	560	579	638	2,5	2,5	720	1 660	138	1 800	–
573,5	–	–	–	542	560	579	638	2,5	2,5	1 060	2 700	237	1 500	600
573,5	–	–	–	542	560	579	638	2,5	2,5	1 060	2 700	237	1 500	600
573,5	–	–	14	542	560	579	638	2,5	2,5	1 060	2 700	236	1 500	600
573,5	–	–	14	542	560	579	638	2,5	2,5	1 060	2 700	236	1 500	600
592	–	–	–	547	574	599	693	4	4	1 290	2 650	224	1 500	–
592	25	45	–	547	574	599	693	4	4	1 290	2 650	224	1 500	–
615	–	–	–	553	585	621	757	5	5	2 500	4 550	390	1 300	630
615	26	48	–	553	585	621	757	5	5	2 500	4 550	390	1 300	630
615	–	–	–	553	585	621	757	5	5	2 500	4 550	390	1 300	630
615	26	48	–	553	585	621	757	5	5	2 500	4 550	390	1 300	630
585,4	–	–	13,3	–	–	–	–	2,5	5/2,5	2 040	4 800	375	1 400	450
584,5	–	–	12	–	–	–	–	4	4	1 700	4 400	345	1 500	450
599	–	–	14	–	–	–	–	4	4	1 930	4 750	415	1 400	–
610,3	–	–	15,6	–	–	–	–	2,5	5/2,5	2 200	5 400	415	1 400	430
603,5	–	–	–	572	590	609	668	2,5	2,5	735	1 700	139	1 600	–
603,5	18	32	–	572	590	609	668	2,5	2,5	735	1 700	139	1 600	–
603,5	–	–	–	572	590	609	668	2,5	2,5	735	1 700	139	1 600	–
603,5	18	32	–	572	590	609	668	2,5	2,5	735	1 700	139	1 600	–
603,5	–	–	–	572	590	609	668	2,5	2,5	1 060	2 750	238	1 500	560
603,5	–	–	14	572	590	609	668	2,5	2,5	1 060	2 750	238	1 500	560
625	–	–	–	577	606	632	733	4	4	1 460	3 000	244	1 400	–
625	26	46	–	577	606	632	733	4	4	1 460	3 000	244	1 400	–
625	–	–	–	577	606	632	733	4	4	1 460	3 000	244	1 400	–
625	26	46	–	577	606	632	733	4	4	1 460	3 000	244	1 400	–
625	–	–	–	577	603	630	733	4	4	2 450	5 500	475	1 400	450
650	–	–	–	583	620	657	797	5	5	2 700	5 100	435	1 200	600
650	30	50	–	583	620	657	797	5	5	2 700	5 100	435	1 200	600
650	–	–	–	583	620	657	797	5	5	2 700	5 100	435	1 200	600
650	30	50	–	583	620	657	797	5	5	2 700	5 100	435	1 200	600
636,7	–	–	14,8	–	–	–	–	5	5	2 000	5 100	385	1 400	400

Cylindrical roller bearings with cage

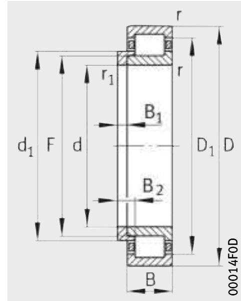
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

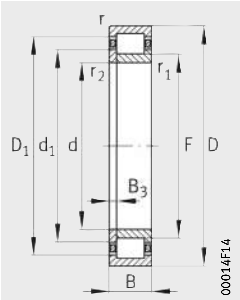


Design 1
NJ and HJ
Locating bearing

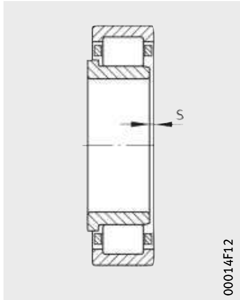
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2]	F	D_1 ≈
Z-548036.ZL	–	2 NUP	97,3	–	**570**	720	95	3	3	–	608	671,5
Z-544257.ZL	–	2 NUP	75	–	**571,5**	685,1	101,6	6	6	–	594,5	651
Z-547424.ZL	–	2 NUP	115	–	**571,5**	711,2	120,65	5	5	–	601,5	668,3
Z-544427.ZL	–	2 NUP	107	–	**571,5**	723,9	101,6	6	6	–	609,5	675,9
Z-543431.ZL	–	2 NUP	91,1	–	**588,724**	711,2	88,9	6	6	–	589	669
Z-545612.ZL	–	2 NUP	98,4	–	**596,9**	736,6	101,6	6	6	–	624,5	694,5
NJ18/600-M1	–	1	51,7	–	**600**	730	60	3	3	7	637	687
NJ18/600-M1	**HJ18/600**	1	51,7	8,22	**600**	730	60	3	3	–	637	687
NJ18/600-M1A	–	1	51,7	–	**600**	730	60	3	3	7	637	687
NJ18/600-M1A	**HJ18/600**	1	51,7	8,22	**600**	730	60	3	3	–	637	687
NJ28/600-M1	–	1	63,4	–	**600**	730	78	3	3	8,5	637	687
NUP28/600-M1	–	1	69,8	–	**600**	730	78	3	3	–	637	687
NJ19/600-M1	–	1	128	–	**600**	800	90	5	5	9,9	652	730,7
NJ19/600-M1	**HJ19/600**	1	128	15,9	**600**	800	90	5	5	–	652	730,7
NJ19/600-M1A	–	1	128	–	**600**	800	90	5	5	9,9	652	730,7
NJ19/600-M1A	**HJ19/600**	1	128	15,9	**600**	800	90	5	5	–	652	730,7
NJ29/600-E-M1	–	1	174	–	**600**	800	118	5	5	8,4	649	739
NJ10/600-M1	–	1	246	–	**600**	870	118	6	6	10,6	667	776
NJ10/600-M1	**HJ10/600**	1	246	26,4	**600**	870	118	6	6	–	667	776
NJ10/600-M1A	–	1	246	–	**600**	870	118	6	6	10,6	667	776
NJ10/600-M1A	**HJ10/600**	1	246	26,4	**600**	870	118	6	6	–	667	776
NJ18/630-M1	–	1	73,4	–	**630**	780	69	4	4	8,4	672	732
NJ18/630-M1	**HJ18/630**	1	73,4	10,4	**630**	780	69	4	4	–	672	732
NJ18/630-M1A	–	1	73,4	–	**630**	780	69	4	4	8,4	672	732
NJ18/630-M1A	**HJ18/630**	1	73,4	10,4	**630**	780	69	4	4	–	672	732
NJ28/630-M1	–	1	96,2	–	**630**	780	88	4	4	8,7	672	732
NJ28/630-M1A	–	1	96,2	–	**630**	780	88	4	4	8,7	672	732
NUP28/630-M1	–	1	97,7	–	**630**	780	88	4	4	–	672	732
NUP28/630-M1A	–	1	97,7	–	**630**	780	88	4	4	–	672	732
NJ19/630-M1	–	1	166	–	**630**	850	100	6	6	8,5	688	771
NJ19/630-M1	**HJ19/630**	1	166	18,9	**630**	850	100	6	6	–	688	771
NUP19/630-M1	–	1	172	–	**630**	850	100	6	6	–	688	771
NJ29/630-E-M1	–	1	213	–	**630**	850	128	6	6	10,3	683	784
NJ29/630-E-M1A	–	1	213	–	**630**	850	128	6	6	10,3	683	784
NJ10/630-M1	–	1	294	–	**630**	920	128	7,5	7,5	11,7	700	826,2

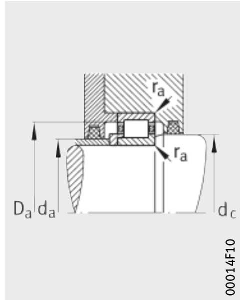
[1] Under axial load, observe the dimensions D_1 and d_1.



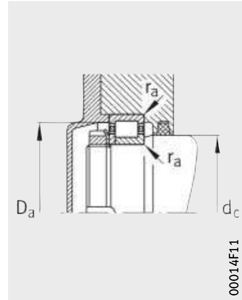
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions
for NJ and HJ
for NJ, page 373

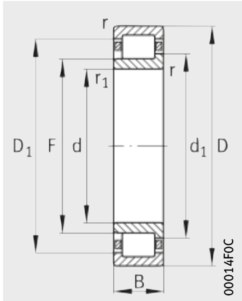


Mounting dimensions
for NUP

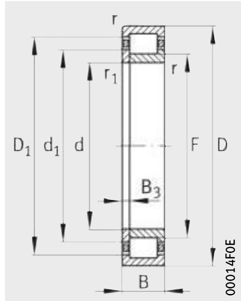
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
622,5	–	–	15	–	–	–	–	2	2	1 800	4 300	375	1 400	–
608	–	–	13,3	–	–	–	–	5	5	1 860	4 900	385	1 400	430
616,9	–	–	12,8	–	–	–	–	4	4	2 500	6 400	570	1 400	–
624,8	–	–	13,3	–	–	–	–	5	5	2 120	5 200	395	1 400	400
607	–	–	12	–	–	–	–	5	5	2 080	4 400	380	1 400	430
640,5	–	–	13,3	–	–	–	–	5	5	2 200	5 300	455	1 400	–
647	–	–	–	612	632	654	718	2,5	2,5	850	2 000	161	1 500	–
647	20	35	–	612	632	654	718	2,5	2,5	850	2 000	161	1 500	–
647	–	–	–	612	632	654	718	2,5	2,5	850	2 000	161	1 500	–
647	20	35	–	612	632	654	718	2,5	2,5	850	2 000	161	1 500	–
647	–	–	–	612	632	654	718	2,5	2,5	1 250	3 350	280	1 400	500
647	–	–	15	612	632	654	718	2,5	2,5	1 250	3 350	280	1 400	500
667,5	–	–	–	617	647	675	783	4	4	1 700	3 450	280	1 400	–
667,5	26	47	–	617	647	675	783	4	4	1 700	3 450	280	1 400	–
667,5	–	–	–	617	647	675	783	4	4	1 700	3 450	280	1 400	–
667,5	26	47	–	617	647	675	783	4	4	1 700	3 450	280	1 400	–
666	–	–	–	617	645	674	783	4	4	3 000	6 700	570	1 200	400
693,5	–	–	–	623	661	699	847	5	5	2 850	5 400	440	1 100	530
693,5	30	51,5	–	623	661	699	847	5	5	2 850	5 400	440	1 100	530
693,5	–	–	–	623	661	699	847	5	5	2 850	5 400	440	1 100	530
693,5	30	51,5	–	623	661	699	847	5	5	2 850	5 400	440	1 100	530
684	–	–	–	645	667	691	765	3	3	1 140	2 600	212	1 400	–
684	20,5	37	–	645	667	691	765	3	3	1 140	2 600	212	1 400	–
684	–	–	–	645	667	691	765	3	3	1 140	2 600	212	1 400	–
684	20,5	37	–	645	667	691	765	3	3	1 140	2 600	212	1 400	–
684	–	–	–	645	667	691	765	3	3	1 700	4 400	370	1 300	430
684	–	–	–	645	667	691	765	3	3	1 700	4 400	370	1 300	430
684	–	–	15	645	667	691	765	3	3	1 700	4 400	370	1 300	430
684	–	–	15	645	667	691	765	3	3	1 700	4 400	370	1 300	430
705	–	–	–	653	683	713	827	5	5	1 900	3 900	320	1 300	–
705	26	50	–	653	683	713	827	5	5	1 900	3 900	320	1 300	–
705	–	–	24	653	683	713	827	5	5	1 900	3 900	320	1 300	–
702,5	–	–	–	653	678	710,4	827	5	5	3 350	7 350	540	1 100	380
702,5	–	–	–	653	678	710,4	827	5	5	3 350	7 350	540	1 100	380
728	–	–	–	658	694	734	892	6	6	3 250	6 200	495	1 100	500

Cylindrical roller bearings with cage

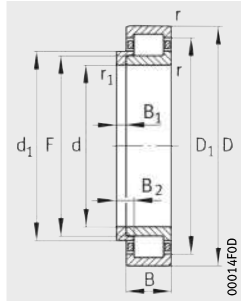
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

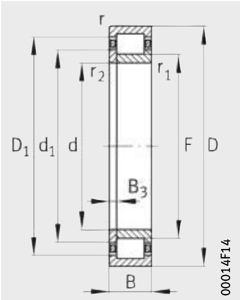


Design 1
NJ and HJ
Locating bearing

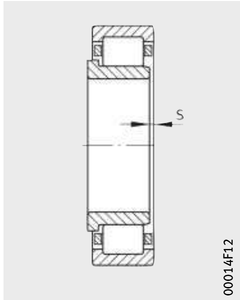
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2]	F	D_1 ≈
NJ10/630-M1	**HJ10/630**	1	294	30,7	**630**	920	128	7,5	7,5	–	700	826,2
NJ10/630-M1A	–	1	294	–	**630**	920	128	7,5	7,5	11,7	700	826,2
NJ10/630-M1A	**HJ10/630**	1	294	30,7	**630**	920	128	7,5	7,5	–	700	826,2
Z-546151.ZL	–	2 NUP	142	–	**647,7**	825,5	101,6	6	6	–	686,6	770,2
Z-544979.ZL	–	2 NUP	130	–	**660,4**	812,8	107,95	6	6	–	698,5	765,3
Z-544000.ZL	–	2 NUP	180	–	**660,4**	863,6	107,95	6	6	–	698,5	805,9
Z-544428.ZL	–	2 NUP	195	–	**660,4**	866,775	114,3	6	6	–	705	805,5
Z-544426.ZL	–	2 NUP	122	–	**660,406**	812,8	101,6	6	6	–	698,5	765,3
Z-543432.ZL	–	2 NUP	134	–	**666,75**	812,8	120,65	5	5	–	696	769,5
NJ18/670-M1	–	1	77,6	–	**670**	820	69	4	4	7,8	712	772
NJ18/670-M1	**HJ18/670**	1	77,6	10,9	**670**	820	69	4	4	–	712	772
NJ18/670-M1A	–	1	77,6	–	**670**	820	69	4	4	7,8	712	772
NJ18/670-M1A	**HJ18/670**	1	77,6	10,9	**670**	820	69	4	4	–	712	772
NJ28/670-M1	–	1	102	–	**670**	820	88	4	4	8,7	712	772
NJ28/670-M1A	–	1	102	–	**670**	820	88	4	4	8,7	712	772
NUP28/670-M1	–	1	103	–	**670**	820	88	4	4	–	712	772
NUP28/670-M1A	–	1	103	–	**670**	820	88	4	4	–	712	772
NUP19/670-M1	–	1	194	–	**670**	900	103	6	6	–	731	817
NJ10/670-M1	–	1	356	–	**670**	980	136	7,5	7,5	12,7	745	876,2
NJ10/670-M1	**HJ10/670**	1	356	35,1	**670**	980	136	7,5	7,5	–	745	876,2
NJ10/670-M1A	–	1	356	–	**670**	980	136	7,5	7,5	12,7	745	876,2
NJ10/670-M1A	**HJ10/670**	1	356	35,1	**670**	980	136	7,5	7,5	–	745	876,2
Z-546109.ZL	–	2 NUP	161	–	**673,1**	838,2	117,475	5	5	–	712	787,2
NJ18/710-M1	–	1	93,7	–	**710**	870	74	4	4	7,9	753	820
NJ18/710-M1	**HJ18/710**	1	93,7	12,6	**710**	870	74	4	4	–	753	820
NJ18/710-M1A	–	1	93,7	–	**710**	870	74	4	4	7,9	753	820
NJ18/710-M1A	**HJ18/710**	1	93,7	12,6	**710**	870	74	4	4	–	753	820
NJ28/710-M1	–	1	124	–	**710**	870	95	4	4	8,7	753	820
NJ28/710-M1A	–	1	124	–	**710**	870	95	4	4	8,7	753	820
NUP28/710-M1	–	1	126	–	**710**	870	95	4	4	–	753	820
NUP28/710-M1A	–	1	126	–	**710**	870	95	4	4	–	753	820
NJ19/710-M1	–	1	218	–	**710**	950	106	6	6	9,3	774	867,7
NJ19/710-M1	**HJ19/710**	1	218	26,4	**710**	950	106	6	6	–	774	867,7
NJ19/710-M1A	–	1	218	–	**710**	950	106	6	6	9,3	774	867,7
NJ19/710-M1A	**HJ19/710**	1	218	26,4	**710**	950	106	6	6	–	774	867,7

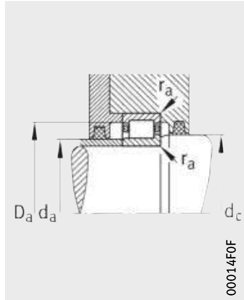
[1] Under axial load, observe the dimensions D_1 and d_1.



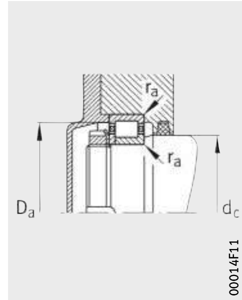
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions for NJ
for NJ and HJ, page 375

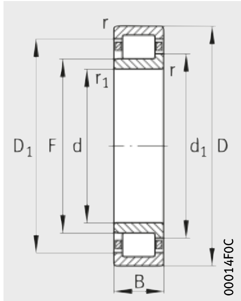


Mounting dimensions for NUP

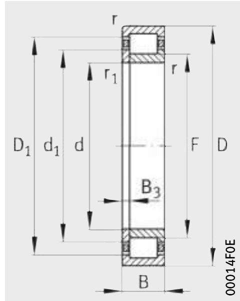
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
728	31	55	–	658	694	734	892	6	6	3 250	6 200	495	1 100	500
728	–	–	–	658	694	734	892	6	6	3 250	6 200	495	1 100	500
728	31	55	–	658	694	734	892	6	6	3 250	6 200	495	1 100	500
705,6	–	–	16,8	–	–	–	–	5	5	2 360	5 300	385	1 200	360
714,3	–	–	14	–	–	–	–	5	5	2 400	6 300	470	1 200	340
722,9	–	–	16,5	–	–	–	–	5	5	2 850	5 700	405	1 100	360
727,5	–	–	14,7	–	–	–	–	5	5	3 100	6 700	485	1 100	320
713,8	–	–	13,3	–	–	–	–	5	5	2 240	6 000	435	1 200	340
713	–	–	10,3	–	–	–	–	4	4	3 050	8 000	670	1 200	–
724	–	–	–	685	707	731	805	3	3	1 180	2 750	220	1 400	–
724	20,5	37	–	685	707	731	805	3	3	1 180	2 750	220	1 400	–
724	–	–	–	685	707	731	805	3	3	1 180	2 750	220	1 400	–
724	20,5	37	–	685	707	731	805	3	3	1 180	2 750	220	1 400	–
724	–	–	–	685	707	731	805	3	3	1 760	4 650	385	1 200	400
724	–	–	–	685	707	731	805	3	3	1 760	4 650	385	1 200	400
724	–	–	15	685	707	731	805	3	3	1 760	4 650	385	1 200	400
724	–	–	15	685	707	731	805	3	3	1 760	4 650	385	1 200	400
748,5	–	–	24,5	693	726	757	877	5	5	2 040	4 250	340	1 200	–
774,5	–	–	–	698	739	780	952	6	6	3 750	7 100	540	950	450
774,5	31	56,5	–	698	739	780	952	6	6	3 750	7 100	540	950	450
774,5	–	–	–	698	739	780	952	6	6	3 750	7 100	540	950	450
774,5	31	56,5	–	698	739	780	952	6	6	3 750	7 100	540	950	450
729,2	–	–	13,7	–	–	–	–	4	4	2 750	7 100	–	700	–
766,5	–	–	–	725	748	774	855	3	3	1 400	3 250	260	1 200	–
766,5	21	38	–	725	748	774	855	3	3	1 400	3 250	260	1 200	–
766,5	–	–	–	725	748	774	855	3	3	1 400	3 250	260	1 200	–
766,5	21	38	–	725	748	774	855	3	3	1 400	3 250	260	1 200	–
766,5	–	–	–	725	748	774	855	3	3	2 080	5 500	450	1 100	360
766,5	–	–	–	725	748	774	855	3	3	2 080	5 500	450	1 100	360
766,5	–	–	15	725	748	774	855	3	3	2 080	5 500	450	1 100	360
766,5	–	–	15	725	748	774	855	3	3	2 080	5 500	450	1 100	360
795,1	–	–	–	733	769	800	927	5	5	2 240	4 750	380	1 100	–
795,1	30	55	–	733	769	800	927	5	5	2 240	4 750	380	1 100	–
795,1	–	–	–	733	769	800	927	5	5	2 240	4 750	380	1 100	–
795,1	30	55	–	733	769	800	927	5	5	2 240	4 750	380	1 100	–

Cylindrical roller bearings with cage

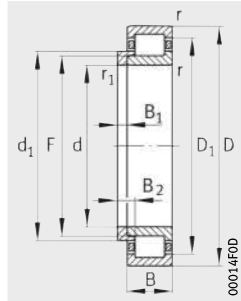
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

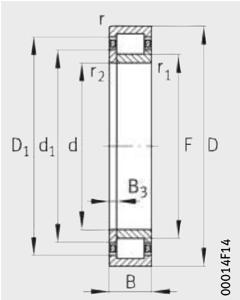


Design 1
NJ and HJ
Locating bearing

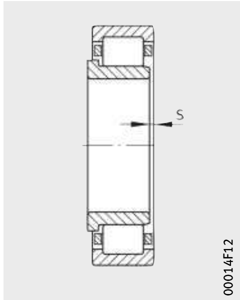
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1/r_2 min.	s[2)]	F	D_1 ≈
NUP19/710-M1	–	1	223	–	**710**	950	106	6	6	–	774	867,7
NUP29/710-M1A	–	1	297	–	**710**	950	140	6	6	–	770	866
NJ10/710-M1	–	1	407	–	**710**	1 030	140	7,5	7,5	12,6	790	924,5
NJ10/710-M1	**HJ10/710**	1	407	42,1	**710**	1 030	140	7,5	7,5	–	790	924,5
NJ10/710-M1A	–	1	407	–	**710**	1 030	140	7,5	7,5	12,6	790	924,5
NJ10/710-M1A	**HJ10/710**	1	407	42,1	**710**	1 030	140	7,5	7,5	–	790	924,5
Z-544519.ZL	–	2 NUP	139	–	**711,2**	863,6	107,95	6	6	–	739,4	819,5
Z-545611.ZL	–	2 NUP	194	–	**711,2**	914,4	107,95	6	3,5	–	752,5	853
Z-549125.ZL	–	2 NUP	172	–	**723,646**	900,113	114,3	6	6	–	760	846,9
Z-545997.ZL	–	2 NUP	183	–	**723,9**	901,7	120,65	7,5	7,5	–	760,8	847,6
NJ18/750-M1	–	1	111	–	**750**	920	78	5	5	8,8	799	866
NJ18/750-M1	**HJ18/750**	1	111	16,5	**750**	920	78	5	5	–	799	866
NJ18/750-M1A	–	1	112	–	**750**	920	78	5	5	8,8	799	866
NJ18/750-M1A	**HJ18/750**	1	112	16,5	**750**	920	78	5	5	–	799	866
NJ28/750-M1	–	1	146	–	**750**	920	100	5	5	10	799	866
NJ28/750-M1A	–	1	146	–	**750**	920	100	5	5	10	799	866
NUP28/750-M1	–	1	149	–	**750**	920	100	5	5	–	799	866
NUP28/750-M1A	–	1	149	–	**750**	920	100	5	5	–	799	866
NUP19/750-M1	–	1	256	–	**750**	1 000	112	6	6	–	815	911
NUP19/750-M1A	–	1	256	–	**750**	1 000	112	6	6	–	815	911
NJ10/750-M1	–	1	489	–	**750**	1 090	150	7,5	7,5	13,6	835	978
NJ10/750-M1	**HJ10/750**	1	489	49,6	**750**	1 090	150	7,5	7,5	–	835	978
NJ10/750-M1A	–	1	489	–	**750**	1 090	150	7,5	7,5	13,6	835	978
NJ10/750-M1A	**HJ10/750**	1	489	49,6	**750**	1 090	150	7,5	7,5	–	835	978
NJ18/800-M1	–	1	132	–	**800**	980	82	5	5	8,9	849	923
NJ18/800-M1	**HJ18/800**	1	134	18,5	**800**	980	82	5	5	–	849	923
NJ18/800-M1A	–	1	132	–	**800**	980	82	5	5	8,9	849	923
NJ18/800-M1A	**HJ18/800**	1	132	18,5	**800**	980	82	5	5	–	849	923
NJ28/800-M1	–	1	177	–	**800**	980	106	5	5	9,3	849	923
NUP28/800-M1	–	1	179	–	**800**	980	106	5	5	–	849	923
NJ19/800-M1	–	1	282	–	**800**	1 060	115	6	6	12,8	870	968,4
NJ19/800-M1	**HJ19/800**	1	282	34,2	**800**	1 060	115	6	6	–	870	968,4
NJ19/800-M1A	–	1	282	–	**800**	1 060	115	6	6	12,8	870	968,4
NJ19/800-M1A	**HJ19/800**	1	282	34,2	**800**	1 060	115	6	6	–	870	968,4
NUP19/800-M1	–	1	288	–	**800**	1 060	115	6	6	–	870	968,4

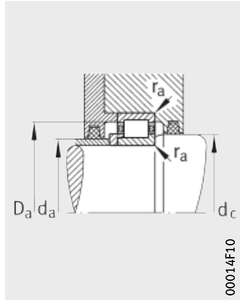
1) Under axial load, observe the dimensions D_1 and d_1.



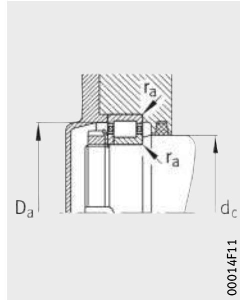
Design 2
NUP
Locating bearing



2) Axial displacement "s" for NJ



Mounting dimensions for NJ and HJ for NJ, page 377

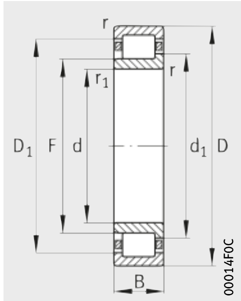


Mounting dimensions for NUP

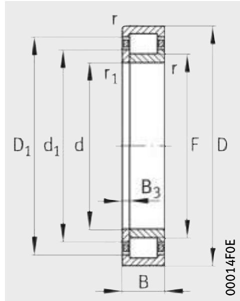
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
795,1	–	–	25	733	769	800	927	5	5	2 240	4 750	380	1 100	–
789,5	–	–	20	733	765	798	927	5	5	3 750	8 800	710	1 000	320
819,5	–	–	–	738	784	824	1 002	6	6	4 050	8 000	620	950	430
819,5	35	58	–	738	784	824	1 002	6	6	4 050	8 000	620	950	430
819,5	–	–	–	738	784	824	1 002	6	6	4 050	8 000	620	950	430
819,5	35	58	–	738	784	824	1 002	6	6	4 050	8 000	620	950	430
757,6	–	–	14	–	–	–	–	5	5	2 750	6 800	550	1 100	–
776,4	–	–	14	–	–	–	–	5	3	3 050	6 700	475	1 100	300
779,7	–	–	18,2	–	–	–	–	5	5	2 800	6 700	480	1 100	320
780,5	–	–	15,3	–	–	–	–	6	6	3 200	7 800	560	1 100	300
812,5	–	–	–	767	794	820	903	4	4	1 430	3 450	270	1 100	–
812,5	24	43	–	767	794	820	903	4	4	1 430	3 450	270	1 100	–
812,5	–	–	–	767	794	820	903	4	4	1 430	3 450	270	1 100	–
812,5	24	43	–	767	794	820	903	4	4	1 430	3 450	270	1 100	–
812,5	–	–	–	767	790	816	903	4	4	2 160	5 850	470	1 100	340
812,5	–	–	–	767	790	816	903	4	4	2 160	5 850	470	1 100	340
812,5	–	–	17,5	767	790	816	903	4	4	2 160	5 850	470	1 100	340
812,5	–	–	17,5	767	790	816	903	4	4	2 160	5 850	470	1 100	340
834,5	–	–	26	773	810	843	977	5	5	2 500	5 300	415	1 100	–
834,5	–	–	26	773	810	843	977	5	5	2 500	5 300	415	1 100	–
866	–	–	–	778	829	872	1 062	6	6	4 500	9 000	680	850	400
866	36	63,5	–	778	829	872	1 062	6	6	4 500	9 000	680	850	400
866	–	–	–	778	829	872	1 062	6	6	4 500	9 000	680	850	400
866	36	63,5	–	778	829	872	1 062	6	6	4 500	9 000	680	850	400
864	–	–	–	817	844	872	963	4	4	1 760	4 150	315	1 100	–
864	24,5	43	–	817	844	872	963	4	4	1 760	4 150	315	1 100	–
864	–	–	–	817	844	872	963	4	4	1 760	4 150	315	1 100	–
864	24,5	43	–	817	844	872	963	4	4	1 760	4 150	315	1 100	–
864	–	–	–	817	844	872	963	4	4	2 700	7 200	570	1 000	300
864	–	–	15,5	817	844	872	963	4	4	2 700	7 200	560	1 000	300
889,5	–	–	–	823	865	898	1 037	5	5	2 600	5 700	445	1 000	–
889,5	31,5	59	–	823	865	898	1 037	5	5	2 600	5 700	445	1 000	–
889,5	–	–	–	823	865	898	1 037	5	5	2 600	5 700	445	1 000	–
889,5	31,5	59	–	823	865	898	1 037	5	5	2 600	5 700	445	1 000	–
889,5	–	–	27,5	823	865	898	1 037	5	5	2 600	5 700	440	1 000	–

Cylindrical roller bearings with cage

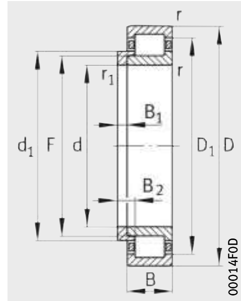
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

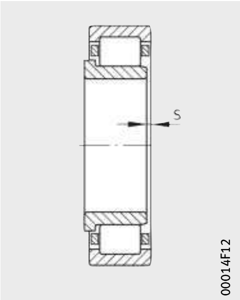


Design 1
NJ and HJ
Locating bearing

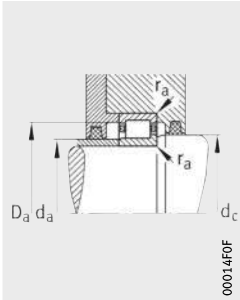
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s2)	F	D_1 ≈
NUP19/800-M1A	–	1	288	–	**800**	1 060	115	6	6	–	870	968,4
NJ29/800-M1	–	1	383	–	**800**	1 060	150	6	6	13,3	865	969
NJ29/800-M1A	–	1	383	–	**800**	1 060	150	6	6	13,3	865	969
NUP29/800-M1	–	1	383	–	**800**	1 060	150	6	6	13,3	865	969
NJ10/800-M1	–	1	567	–	**800**	1 150	155	7,5	7,5	13,6	885	1 036
NJ10/800-M1	**HJ10/800**	1	567	56,5	**800**	1 150	155	7,5	7,5	–	885	1 036
NJ10/800-M1A	–	1	567	–	**800**	1 150	155	7,5	7,5	13,6	885	1 036
NJ10/800-M1A	**HJ10/800**	1	567	56,5	**800**	1 150	155	7,5	7,5	–	885	1 036
NJ18/850-M1	–	1	140	–	**850**	1 030	82	5	5	9	895	970
NJ18/850-M1	**HJ18/850**	1	140	18,5	**850**	1 030	82	5	5	–	895	970
NJ18/850-M1A	–	1	140	–	**850**	1 030	82	5	5	9	895	970
NJ18/850-M1A	**HJ18/850**	1	140	18,5	**850**	1 030	82	5	5	–	895	970
NJ28/850-M1	–	1	187	–	**850**	1 030	106	5	5	9,3	895	970
NJ28/850-M1	**HJ28/850**	1	187	18,4	**850**	1 030	106	5	5	–	895	970
NJ28/850-M1A	–	1	187	–	**850**	1 030	106	5	5	9,3	895	970
NJ28/850-M1A	**HJ28/850**	1	187	18,4	**850**	1 030	106	5	5	–	895	970
NUP28/850-M1	–	1	190	–	**850**	1 030	106	5	5	–	895	970
NUP28/850-M1A	–	1	190	–	**850**	1 030	106	5	5	–	895	970
NJ19/850-M1	–	1	321	–	**850**	1 120	118	6	6	12,6	921	1 024,1
NJ19/850-M1	**HJ19/850**	1	321	39,7	**850**	1 120	118	6	6	–	921	1 024,1
NJ29/850-M1	–	1	432	–	**850**	1 120	155	6	6	8,6	917	1 031,5
NJ29/850-M1A	–	1	432	–	**850**	1 120	155	6	6	8,6	917	1 031,5
NJ10/850-M1	–	1	669	–	**850**	1 220	165	7,5	7,5	13,5	945	1 096,2
NJ10/850-M1	**HJ10/850**	1	669	67,3	**850**	1 220	165	7,5	7,5	–	945	1 096,2
NJ18/900-M1	–	1	163	–	**900**	1 090	85	5	5	9	951	1 031
NJ18/900-M1	**HJ18/900**	1	163	21,8	**900**	1 090	85	5	5	–	951	1 031
NJ28/900-M1	–	1	220	–	**900**	1 090	112	5	5	9,5	951	1 031
NJ28/900-M1A	–	1	220	–	**900**	1 090	112	5	5	9,5	951	1 031
NUP28/900-M1	–	1	223	–	**900**	1 090	112	5	5	–	951	1 031
NUP28/900-M1A	–	1	223	–	**900**	1 090	112	5	5	–	951	1 031
NJ29/900-M1	–	1	504	–	**900**	1 180	165	6	6	13,3	970	1 088
NJ29/900-M1A	–	1	504	–	**900**	1 180	165	6	6	13,3	970	1 088

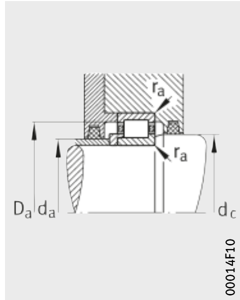
1) Under axial load, observe the dimensions D_1 and d_1.



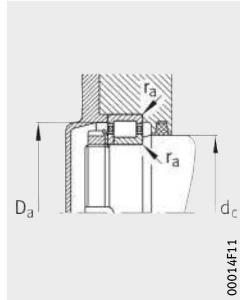
2) Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

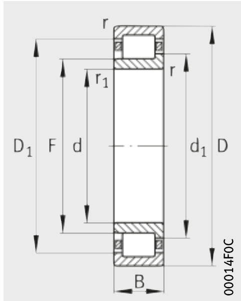


Mounting dimensions for NUP

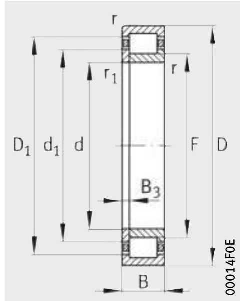
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
889,5	–	–	27,5	823	865	898	1 037	5	5	2 600	5 700	440	1 000	–
886	–	–	–	823	860	895	1 037	5	5	4 250	10 000	780	900	280
886	–	–	–	823	860	895	1 037	5	5	4 250	10 000	780	900	280
886	–	–	22,5	823	860	895	1 037	5	5	4 250	10 000	780	900	280
918	–	–	–	828	879	924	1 122	6	6	5 000	10 000	750	800	360
918	38	65,5	–	828	879	924	1 122	6	6	5 000	10 000	750	800	360
918	–	–	–	828	879	924	1 122	6	6	5 000	10 000	750	800	360
918	38	65,5	–	828	879	924	1 122	6	6	5 000	10 000	750	800	360
910	–	–	–	867	894	922	1 013	4	4	1 800	4 400	330	1 000	–
910	24,5	43	–	867	894	922	1 013	4	4	1 800	4 400	330	1 000	–
910	–	–	–	867	894	922	1 013	4	4	1 800	4 400	330	1 000	–
910	24,5	43	–	867	894	922	1 013	4	4	1 800	4 400	330	1 000	–
910	–	–	–	867	890	918	1 013	4	4	2 750	7 650	590	950	280
910	25	40,5	–	867	890	918	1 013	4	4	2 750	7 650	590	950	280
910	–	–	–	867	890	918	1 013	4	4	2 750	7 650	590	950	280
910	25	40,5	–	867	890	918	1 013	4	4	2 750	7 650	590	950	280
910	–	–	15,5	867	890	918	1 013	4	4	2 750	7 650	590	950	280
910	–	–	15,5	867	890	918	1 013	4	4	2 750	7 650	590	950	280
941,5	–	–	–	873	916	950	1 097	5	5	2 900	6 400	490	950	–
941,5	34	61	–	873	916	950	1 097	5	5	2 900	6 400	490	950	–
939	–	–	–	873	912	948	1 097	5	5	4 750	11 600	890	850	260
939	–	–	–	873	912	948	1 097	5	5	4 750	11 600	890	850	260
978	–	–	–	878	938	984	1 192	6	6	5 600	11 800	890	750	320
978	40	67,5	–	878	938	984	1 192	6	6	5 600	11 800	890	750	320
967	–	–	–	917	946	975	1 073	4	4	2 040	5 100	370	950	–
967	24,5	43	–	917	946	975	1 073	4	4	2 040	5 100	370	950	–
967	–	–	–	917	946	975	1 073	4	4	3 100	8 800	660	850	260
967	–	–	–	917	946	975	1 073	4	4	3 100	8 800	660	850	260
967	–	–	15,5	917	946	975	1 073	4	4	3 100	8 800	660	850	260
967	–	–	15,5	917	946	975	1 073	4	4	3 100	8 800	660	850	260
992	–	–	–	923	965	1 003	1 157	5	5	5 400	13 400	1 010	800	220
992	–	–	–	923	965	1 003	1 157	5	5	5 400	13 400	1 010	800	220

Cylindrical roller bearings with cage

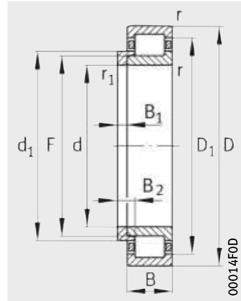
Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

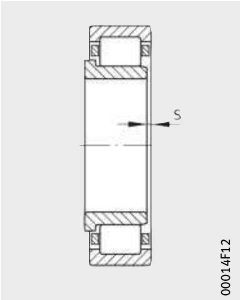


Design 1
NJ and HJ
Locating bearing

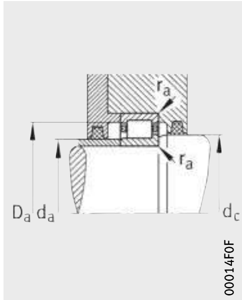
Dimension table (continued) · Dimensions in mm

Designation		De-sign	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈
NJ10/900-M1	–	1	740	–	**900**	1 280	170	7,5	7,5	13,5	990	1 158
NJ10/900-M1	**HJ10/900**	1	740	75,5	**900**	1 280	170	7,5	7,5	–	990	1 158
NJ18/950-M1	–	1	192	–	**950**	1 150	90	5	5	9,5	1 004	1 088
NJ18/950-M1	**HJ18/950**	1	192	26,3	**950**	1 150	90	5	5	–	1 004	1 088
NJ28/950-M1	–	1	261	–	**950**	1 150	118	5	5	9,8	1 004	1 088
NUP28/950-M1	–	1	265	–	**950**	1 150	118	5	5	–	1 004	1 088
NJ29/950-M1	–	1	603	–	**950**	1 250	175	7,5	7,5	14,5	1 025	1 151
NJ10/950-M1	–	1	911	–	**950**	1 360	180	7,5	7,5	13,5	1 055	1 223
NJ10/950-M1	**HJ10/950**	1	911	91,7	**950**	1 360	180	7,5	7,5	–	1 055	1 223
NJ18/1000-M	–	1	247	–	**1 000**	1 220	100	6	6	10,3	1 058	1 150
NJ18/1000-M	**HJ18/1000**	1	247	33,6	**1 000**	1 220	100	6	6	–	1 058	1 150
NUP18/1000-M	–	1	252	–	**1 000**	1 220	100	6	6	–	1 058	1 150
NJ28/1000-M	–	1	328	–	**1 000**	1 220	128	6	6	11	1 058	1 150
NUP28/1000-M	–	1	332	–	**1 000**	1 220	128	6	6	–	1 058	1 150
NUP28/1000-MA	–	1	332	–	**1 000**	1 220	128	6	6	–	1 058	1 150
NJ10/1000-M1	–	1	1 030	–	**1 000**	1 420	185	7,5	7,5	14,5	1 105	1 281
NJ10/1000-M1	**HJ10/1000**	1	1 030	103	**1 000**	1 420	185	7,5	7,5	–	1 105	1 281
NJ18/1060-M	–	1	264	–	**1 060**	1 280	100	6	6	10,3	1 118	1 210
NJ18/1060-M	**HJ18/1060**	1	264	37,6	**1 060**	1 280	100	6	6	–	1 118	1 210
NJ28/1060-M	–	1	346	–	**1 060**	1 280	128	6	6	11	1 118	1 210
NUP28/1060-M	–	1	350	–	**1 060**	1 280	128	6	6	–	1 118	1 210
NJ10/1060-M1	–	1	1 160	–	**1 060**	1 500	195	9,5	9,5	14,5	1 170	1 355
NJ10/1060-M1	**HJ10/1060**	1	1 160	121	**1 060**	1 500	195	9,5	9,5	–	1 170	1 355
F-801007.ZL	–	1	324	–	**1 120**	1 360	106	6	6	11	1 185	1 286
NJ18/1120-M	–	1	318	–	**1 120**	1 360	106	6	6	11	1 185	1 286
NJ18/1120-M	**HJ18/1120**	1	318	46,4	**1 120**	1 360	106	6	6	–	1 185	1 286
NJ18/1120-MA	–	1	318	–	**1 120**	1 360	106	6	6	11	1 185	1 286
NJ18/1120-MA	**HJ18/1120**	1	318	46,4	**1 120**	1 360	106	6	6	–	1 185	1 286
NJ28/1120-M	–	1	434	–	**1 120**	1 360	140	6	6	13,1	1 185	1 286
NUP28/1120-M	–	1	441	–	**1 120**	1 360	140	6	6	–	1 185	1 286
NJ10/1120-M1	–	1	1 320	–	**1 120**	1 580	200	9,5	9,5	16	1 235	1 428
NJ10/1120-M1	**HJ10/1120**	1	1 320	138	**1 120**	1 580	200	9,5	9,5	–	1 235	1 428

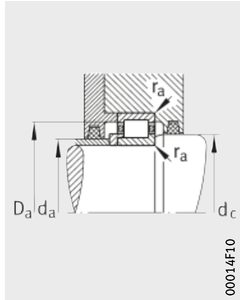
1) Under axial load, observe the dimensions D_1 and d_1.



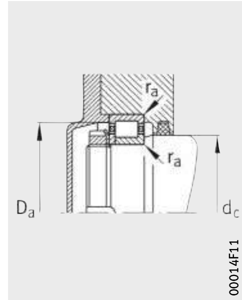
[2] Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

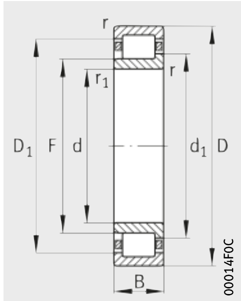


Mounting dimensions for NUP

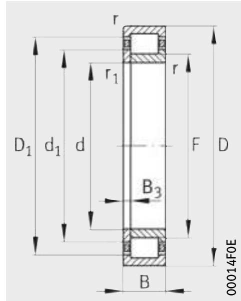
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 026	–	–	–	928	983	1 033	1 252	6	6	6 400	13 400	970	700	300
1 026	43	70,5	–	928	983	1 033	1 252	6	6	6 400	13 400	970	700	300
1 020	–	–	–	967	999	1 029	1 133	4	4	2 200	5 500	405	900	–
1 020	27	47	–	967	999	1 029	1 133	4	4	2 200	5 500	405	900	–
1 020	–	–	–	967	999	1 029	1 133	4	4	3 400	9 800	740	800	240
1 020	–	–	16,5	967	999	1 029	1 133	4	4	3 400	9 800	740	800	240
1 049	–	–	–	978	1 020	1 060	1 222	6	6	5 850	14 600	1 090	750	220
1 091	–	–	–	978	1 048	1 098	1 332	6	6	7 200	15 600	1 120	700	260
1 091	45	72,5	–	978	1 048	1 098	1 332	6	6	7 200	15 600	1 120	700	260
1 076	–	–	–	1 023	1 053	1 085	1 197	5	5	2 450	5 850	435	850	–
1 076	30	52	–	1 023	1 053	1 085	1 197	5	5	2 450	5 850	435	850	–
1 076	–	–	22	1 023	1 053	1 085	1 197	5	5	2 450	5 850	430	850	–
1 076	–	–	–	1 023	1 053	1 085	1 197	5	5	3 650	10 000	750	750	220
1 076	–	–	19	1 023	1 053	1 085	1 197	5	5	3 650	10 000	750	750	220
1 076	–	–	19	1 023	1 053	1 085	1 197	5	5	3 650	10 000	750	750	220
1 143	–	–	–	1 028	1 098	1 150	1 392	6	6	7 500	16 300	1 150	630	260
1 143	47	77	–	1 028	1 098	1 150	1 392	6	6	7 500	16 300	1 150	630	260
1 136	–	–	–	1 083	1 113	1 145	1 257	5	5	2 550	6 400	465	800	–
1 136	32	54	–	1 083	1 113	1 145	1 257	5	5	2 550	6 400	465	800	–
1 136	–	–	–	1 083	1 113	1 145	1 257	5	5	3 800	10 600	790	700	220
1 136	–	–	19	1 083	1 113	1 145	1 257	5	5	3 800	10 600	780	700	220
1 210	–	–	–	1 094	1 163	1 217	1 466	8	8	8 500	18 600	1 300	600	220
1 210	50	80	–	1 094	1 163	1 217	1 466	8	8	8 500	18 600	1 300	600	220
1 204	–	–	–	1 143	1 180	1 214	1 337	5	5	2 850	7 100	500	750	–
1 204	–	–	–	1 143	1 180	1 214	1 337	5	5	2 850	7 100	500	750	–
1 204	34	57	–	1 143	1 180	1 214	1 337	5	5	2 850	7 100	500	750	–
1 204	–	–	–	1 143	1 180	1 214	1 337	5	5	2 850	7 100	500	750	–
1 204	34	57	–	1 143	1 180	1 214	1 337	5	5	2 850	7 100	500	750	–
1 204	–	–	–	1 143	1 180	1 214	1 337	5	5	4 150	11 600	840	700	200
1 204	–	–	22,5	1 143	1 180	1 214	1 337	5	5	4 150	11 600	840	700	200
1 276	–	–	–	1 154	1 228	1 283	1 546	8	8	9 000	20 000	1 380	560	220
1 276	52	84,5	–	1 154	1 228	1 283	1 546	8	8	9 000	20 000	1 380	560	220

Cylindrical roller bearings with cage

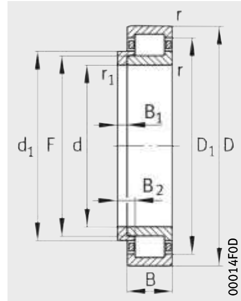
Single row
Semi-locating and
locating bearings



Design 1
NJ
Semi-locating bearing



Design 1
NUP
Locating bearing

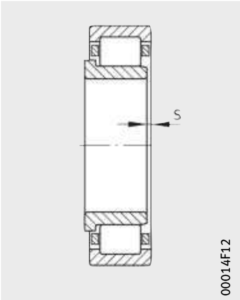


Design 1
NJ and HJ
Locating bearing

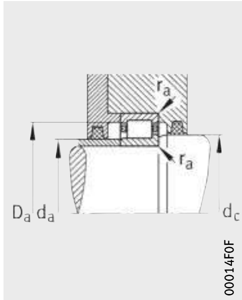
Dimension table (continued) · Dimensions in mm

Designation		Design	Mass m		Dimensions							
Bearing	L-section ring		Bearing ≈kg	L-section ring ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈
NJ18/1180-M	–	1	339	–	**1 180**	1 420	106	6	6	11	1 245	1 346
NJ18/1180-M	**HJ18/1180**	1	339	48,8	**1 180**	1 420	106	6	6	–	1 245	1 346
NJ18/1180-MA	–	1	339	–	**1 180**	1 420	106	6	6	11	1 245	1 346
NJ18/1180-MA	**HJ18/1180**	1	339	48,8	**1 180**	1 420	106	6	6	–	1 245	1 346
NJ28/1180-M	–	1	460	–	**1 180**	1 420	140	6	6	13,1	1 245	1 346
NUP28/1180-M	–	1	467	–	**1 180**	1 420	140	6	6	–	1 245	1 346
NJ10/1180-M1	–	1	1 540	–	**1 180**	1 660	212	9,5	9,5	17	1 300	1 502
NJ10/1180-M1	**HJ10/1180**	1	1 540	158	**1 180**	1 660	212	9,5	9,5	–	1 300	1 502
NJ18/1250-M	–	1	398	–	**1 250**	1 500	112	6	6	11,4	1 316	1 423,3
NJ18/1250-M	**HJ18/1250**	1	398	57,1	**1 250**	1 500	112	6	6	–	1 316	1 423,3
NJ18/1250-MA	–	1	398	–	**1 250**	1 500	112	6	6	11,4	1 316	1 423,3
NJ18/1250-MA	**HJ18/1250**	1	398	57,1	**1 250**	1 500	112	6	6	–	1 316	1 423,3
NJ28/1250-M	–	1	523	–	**1 250**	1 500	145	6	6	13,1	1 316	1 423,3
NUP28/1250-M	–	1	531	–	**1 250**	1 500	145	6	6	–	1 316	1 423,3
NJ10/1250-M1	–	1	1 730	–	**1 250**	1 750	218	9,5	9,5	18,5	1 375	1 585
NJ10/1250-M1	**HJ10/1250**	1	1 730	183	**1 250**	1 750	218	9,5	9,5	–	1 375	1 585
NJ18/1320-M	–	1	506	–	**1 320**	1 600	122	6	6	12,8	1 397	1 511
NJ18/1320-M	**HJ18/1320**	1	506	75,8	**1 320**	1 600	122	6	6	–	1 397	1 511
NJ18/1320-MA	–	1	506	–	**1 320**	1 600	122	6	6	12,8	1 397	1 511
NJ18/1320-MA	**HJ18/1320**	1	506	75,8	**1 320**	1 600	122	6	6	–	1 397	1 511
NJ28/1320-M	–	1	713	–	**1 320**	1 600	165	6	6	15,8	1 397	1 511
NUP28/1320-M	–	1	724	–	**1 320**	1 600	165	6	6	–	1 397	1 511
NJ10/1320-M1	–	1	2 070	–	**1 320**	1 850	230	12	12	19	1 455	1 673
NJ10/1320-M1	**HJ10/1320**	1	2 070	217	**1 320**	1 850	230	12	12	–	1 455	1 673
NJ18/1400-M	–	1	636	–	**1 400**	1 700	132	7,5	7,5	13,4	1 480	1 606
NJ18/1400-MA	–	1	636	–	**1 400**	1 700	132	7,5	7,5	13,4	1 480	1 606
NJ28/1400-M	–	1	861	–	**1 400**	1 700	175	7,5	7,5	17	1 480	1 606
NUP28/1400-M	–	1	874	–	**1 400**	1 700	175	7,5	7,5	–	1 480	1 606
NJ10/1400-M1	–	1	2 390	–	**1 400**	1 950	243	12	12	19,5	1 540	1 767
NJ10/1400-M1	**HJ10/1400**	1	2 390	252	**1 400**	1 950	243	12	12	–	1 540	1 767

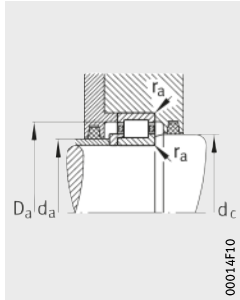
[1)] Under axial load, observe the dimensions D_1 and d_1.



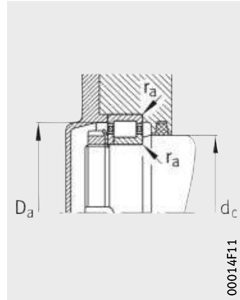
2) Axial displacement “s” for NJ



Mounting dimensions for NJ



Mounting dimensions for NJ and HJ

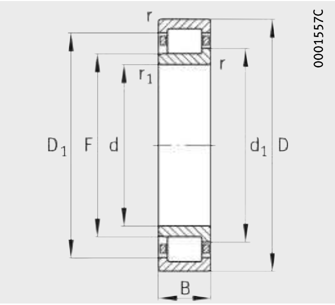


Mounting dimensions for NUP

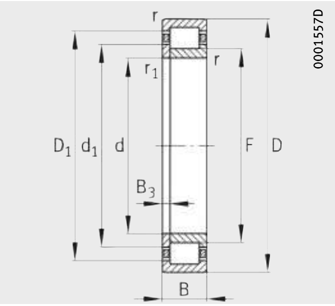
				Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	B_1	B_2	B_3	d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈				min.1)	max.	min.	max.1)	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 264	–	–	–	1 203	1 240	1 274	1 397	5	5	3 000	7 800	540	700	–
1 264	34	57	–	1 203	1 240	1 274	1 397	5	5	3 000	7 800	540	700	–
1 264	–	–	–	1 203	1 240	1 274	1 397	5	5	3 000	7 800	540	700	–
1 264	34	57	–	1 203	1 240	1 274	1 397	5	5	3 000	7 800	540	700	–
1 264	–	–	–	1 203	1 240	1 274	1 397	5	5	4 400	12 900	910	630	180
1 264	–	–	22,5	1 203	1 240	1 274	1 397	5	5	4 400	12 900	910	630	180
1 343	–	–	–	1 214	1 293	1 350	1 626	8	8	10 000	22 800	1 500	560	200
1 343	54	87,5	–	1 214	1 293	1 350	1 626	8	8	10 000	22 800	1 500	560	200
1 337	–	–	–	1 273	1 311	1 347	1 477	5	5	3 350	8 650	590	700	–
1 337	36	60	–	1 273	1 311	1 347	1 477	5	5	3 350	8 650	590	700	–
1 337	–	–	–	1 273	1 311	1 347	1 477	5	5	3 350	8 650	590	700	–
1 337	36	60	–	1 273	1 311	1 347	1 477	5	5	3 350	8 650	590	700	–
1 337	–	–	–	1 273	1 311	1 347	1 477	5	5	5 000	14 300	1 010	600	170
1 337	–	–	22,5	1 273	1 311	1 347	1 477	5	5	5 000	14 300	1 010	600	170
1 419	–	–	–	1 284	1 368	1 427	1 716	8	8	10 600	24 500	1 590	530	180
1 419	57	93,5	–	1 284	1 368	1 427	1 716	8	8	10 600	24 500	1 590	530	180
1 419	–	–	–	1 243	1 392	1 429	1 577	5	5	3 800	10 200	670	630	–
1 419	40	67	–	1 243	1 392	1 429	1 577	5	5	3 800	10 200	670	630	–
1 419	–	–	–	1 243	1 392	1 429	1 577	5	5	3 800	10 200	670	630	–
1 419	40	67	–	1 243	1 392	1 429	1 577	5	5	3 800	10 200	670	630	–
1 419	–	–	–	1 343	1 392	1 429	1 577	5	5	5 700	17 000	1 150	560	150
1 419	–	–	27,5	1 343	1 392	1 429	1 577	5	5	5 700	17 000	1 150	560	150
1 501	–	–	–	1 362	1 448	1 509	1 808	10	10	11 800	27 000	1 750	500	170
1 501	60	97,5	–	1 362	1 448	1 509	1 808	10	10	11 800	27 000	1 750	500	170
1 504	–	–	–	1 428	1 475	1 515	1 672	6	6	4 550	12 000	780	600	–
1 504	–	–	–	1 428	1 475	1 515	1 672	6	6	4 550	12 000	780	600	–
1 504	–	–	–	1 428	1 475	1 515	1 672	6	6	6 550	19 300	1 280	530	140
1 504	–	–	30	1 428	1 475	1 515	1 672	6	6	6 550	19 300	1 280	530	140
1 587	–	–	–	1 442	1 533	1 595	1 908	10	10	13 200	31 000	1 980	480	150
1 587	63	102	–	1 442	1 533	1 595	1 908	10	10	13 200	31 000	1 980	480	150

Cylindrical roller bearings with cage

Single row
Semi-locating and locating bearings



Design 1
NJ
Semi-locating bearing

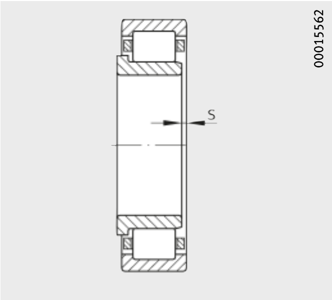


Design 1
NUP
Locating bearing

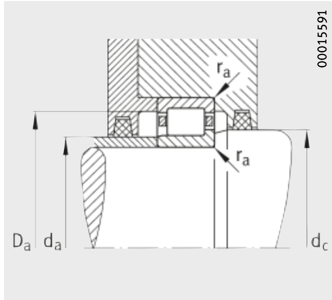
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m	Dimensions									
Bearing		Bearing ≈kg	d	D	B	r min.	r_1 min.	s[2)]	F	D_1 ≈	d_1 ≈	B_3
NJ18/1500-M	1	765	**1 500**	1 820	140	7,5	7,5	14,5	1 585	1 719	1 611	–
NJ28/1500-M	1	1 030	**1 500**	1 820	185	7,5	7,5	19,3	1 585	1 719	1 611	–
NUP28/1500-M	1	1 040	**1 500**	1 820	185	7,5	7,5	–	1 585	1 719	1 611	32,5
NJ18/1600-M	1	1 000	**1 600**	1 950	155	7,5	7,5	15,5	1 690	1 841	1 719	–
NJ28/1600-M	1	1 300	**1 600**	1 950	200	7,5	7,5	20	1 690	1 841	1 719	–
NJ28/1600-MA	1	1 300	**1 600**	1 950	200	7,5	7,5	20	1 690	1 841	1 719	–
NUP28/1600-M	1	1 320	**1 600**	1 950	200	7,5	7,5	–	1 690	1 841	1 719	35
NUP28/1600-MA	1	1 320	**1 600**	1 950	200	7,5	7,5	–	1 690	1 841	1 719	35
NJ18/1700-M	1	1 100	**1 700**	2 060	160	7,5	7,5	15,5	1 790	1 950	1 820	–
NJ18/1700-MA	1	1 100	**1 700**	2 060	160	7,5	7,5	15,5	1 790	1 950	1 820	–
NUP18/1700-MA	1	1 130	**1 700**	2 060	160	7,5	7,5	–	1 790	1 950	1 820	32,5
NJ18/1800-M	1	1 270	**1 800**	2 180	165	9,5	9,5	13	1 895	2 063	1 927	–
NJ18/1800-MA	1	1 270	**1 800**	2 180	165	9,5	9,5	13	1 895	2 063	1 927	–
NJ28/1800-M	1	1 720	**1 800**	2 180	218	9,5	9,5	17	1 895	2 063	1 927	–
NJ28/1800-MA	1	1 720	**1 800**	2 180	218	9,5	9,5	17	1 895	2 063	1 927	–
NJ18/1900-M	1	1 500	**1 900**	2 300	175	9,5	9,5	17	2 000	2 176	2 034	–
NJ18/2000-M	1	1 890	**2 000**	2 430	190	9,5	9,5	19	2 110	2 295	2 147	–

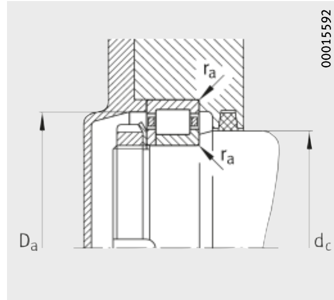
[1)] Under axial load, observe the dimensions D_1 and d_1.



[2] Axial displacement “s” for NJ



Mounting dimensions for NJ

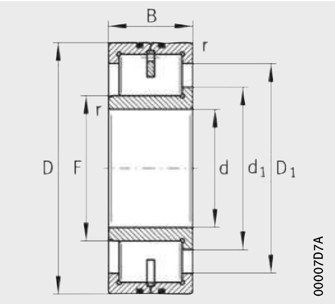


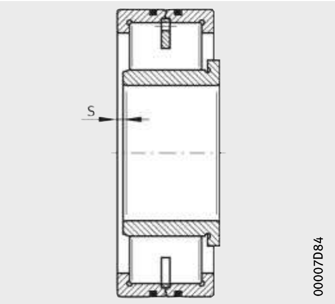
Mounting dimensions for NUP

Mounting dimensions						Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_a		d_c	D_a	r_a	r_{a1}	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
min.[1]	max.	min.	max.[1]	max.	max.	kN	kN	kN	min^{-1}	min^{-1}
1 528	1 580	1 619	1 792	6	6	5 200	14 000	870	560	–
1 528	1 580	1 619	1 792	6	6	7 350	21 600	1 390	500	130
1 528	1 580	1 619	1 792	6	6	7 350	21 600	1 380	500	130
1 628	1 685	1 727	1 922	6	6	6 200	16 300	1 020	530	–
1 628	1 685	1 727	1 922	6	6	8 300	24 000	1 540	480	120
1 628	1 685	1 727	1 922	6	6	8 300	24 000	1 540	480	120
1 628	1 685	1 727	1 922	6	6	8 300	24 000	1 540	480	120
1 628	1 685	1 727	1 922	6	6	8 300	24 000	1 540	480	120
1 728	1 785	1 829	2 032	6	6	6 950	18 600	1 150	500	–
1 728	1 785	1 829	2 032	6	6	6 950	18 600	1 150	500	–
1 728	1 785	1 829	2 032	6	6	6 950	18 600	1 140	500	–
1 834	1 890	1 936	2 146	8	8	7 800	20 800	1 260	480	–
1 834	1 890	1 936	2 146	8	8	7 800	20 800	1 260	480	–
1 834	1 890	1 936	2 146	8	8	11 400	34 500	2 130	450	90
1 834	1 890	1 936	2 146	8	8	11 400	34 500	2 130	450	90
1 934	1 995	2 042	2 266	8	8	8 500	23 200	1 370	450	–
2 034	2 105	2 154	2 396	8	8	9 300	26 000	1 520	450	–

Cylindrical roller bearings with disc cage

Single row
Semi-locating bearings





1) Axial displacement “s”

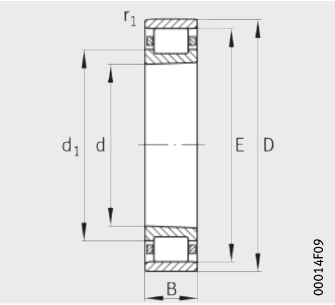
Dimension table · Dimensions in mm

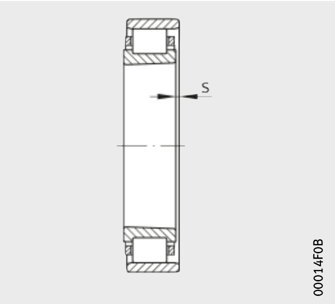
Designation	Mass m ≈kg	Dimensions d	D	B	r min.	s1)	F
LSL192330-TB	40,7	**150**	320	108	4	7	182,49
LSL192332-TB	48,1	**160**	340	114	4	7	196,38
LSL192334-TB	57,5	**170**	360	120	4	7	230,55
LSL192336-TB	67,4	**180**	380	126	4	7	221,56
LSL192338-TB	78,1	**190**	400	132	5	7	224,43
LSL192340-TB	89,3	**200**	420	138	5	7	238,45
LSL192344-TB	108	**220**	460	145	5	7	266,71
LSL192348-TB	138,6	**240**	500	155	5	10	280,55
LSL192352-TB	168	**260**	540	165	6	10	315,6
LSL192356-TB	206,6	**280**	580	175	6	12	333,1
LSL192360-TB	253	**300**	620	185	7,5	12	350,93

		Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
d_1	D_1	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈	≈	kN	kN	kN	min^{-1}	min^{-1}
203,3	263,9	1 410	1 760	199	4 250	2 020
219	284,8	1 600	2 010	224	3 950	1 820
226,6	295,4	1 740	2 210	241	3 800	1 760
245	313,3	1 840	2 430	260	3 600	1 620
250	325,5	2 100	2 750	295	3 450	1 540
265,7	345,9	2 340	3 050	315	3 250	1 420
297	385,9	2 500	3 200	320	2 900	1 270
312,5	406,1	2 750	3 550	350	2 750	1 220
351,6	457,2	3 350	4 350	425	2 470	1 010
371	485	3 700	4 850	460	2 330	950
390,9	508,5	4 150	5 500	510	2 220	890

Super precision cylindrical roller bearings

Single row,
with tapered bore
(taper 1:12)
Non-locating bearings

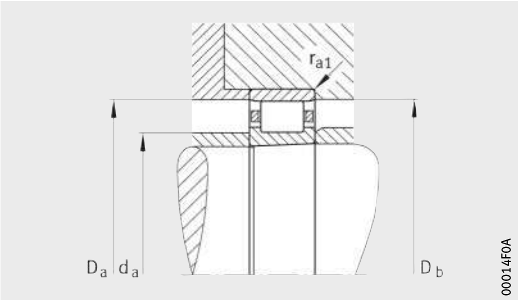




1) Axial displacement “s”

Dimension table · Dimensions in mm

Designation	Mass	Dimensions						
	m	d	D	B	r_1	s[1]	E	d_1
	≈kg				min.			
N1044-K-M1-SP	21,8	**220**	340	56	3	8	310	261,7
N1948-K-M1-SP	8,18	**240**	320	38	2,1	3,5	299	268,5
N1048-K-M1-SP	19,3	**240**	360	56	3	8	330	281,7
N1952-K-M1-SP	13,8	**260**	360	46	2,1	3,8	334	295,4
N1052-K-M1-SP	28,8	**260**	400	65	4	10	364	309,3
N1956-K-M1-SP	14,6	**280**	380	46	2,1	5,4	354	315,4
N1056-K-M1-SP	30,5	**280**	420	65	4	10	384	329,3
N1960-K-M1-SP	23,6	**300**	420	56	3	4,8	390	341,6
N1060-K-M1-SP	43,3	**300**	460	74	4	10	420	355,7
N1964-K-M1-SP	24,9	**320**	440	56	3	4,8	410	361,7
N1064-K-M1-SP	45,7	**320**	480	74	4	10	440	375,7
N1968-K-M1-SP	26,3	**340**	460	56	3	4,8	430	381,6
N1068-K-M1-SP	60,7	**340**	520	82	5	12	475	402,7
N1972-K-M1-SP	26,9	**360**	480	56	3	4,8	450	401,6
N1072-K-M1-SP	64,4	**360**	540	82	5	8,9	495	421,6
N1976-K-M1-SP	40	**380**	520	65	4	6	484	429,1
N1076-K-M1-SP	66,6	**380**	560	82	5	12	515	441,6
N1980-K-M1-SP	41	**400**	540	65	4	6	504	449,1
N1080-K-M1-SP	88,1	**400**	600	90	5	9,5	550	469,7
N1984-K-M1-SP	42,9	**420**	560	65	4	6	524	469,1
N1084-K-M1-SP	90,7	**420**	620	90	5	12,5	570	489,7
N1988-K-M1-SP	60,2	**440**	600	74	4	6,5	558	496,6
N1088-K-M1-SP	106	**440**	650	94	6	13	597	513,5
N1992-K-M1-SP	61,1	**460**	620	74	4	6,5	578	516,6
N1092-K-M1-SP	120	**460**	680	100	6	14	624	536,5
N1996-K-M1-SP	73,1	**480**	650	78	5	6,8	605	540
N1096-K-M1-SP	125	**480**	700	100	6	14	644	556,4
N19/500-K-M1-SP	74,5	**500**	670	78	5	6,8	625	560
N10/500-K-M1-SP	130	**500**	720	100	6	14	664	576,5



Mounting dimensions

Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speeds	
d_a h12	D_a H12	D_b min.	r_{a1} max.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN	n_G grease min^{-1}	n_G Oil min^{-1}
232,4	328	313	2,5	510	765	100	2 400	2 800
250,5	309	302	2	280	490	62	2 400	2 800
252,5	348	333	2,5	540	850	107	2 200	2 600
270,5	349	337	2	425	735	73	2 000	2 400
275	385	367	3	655	1 020	104	1 900	2 200
290,5	369	357	2	440	800	78	1 900	2 200
295	405	387	3	430	980	225	1 800	2 000
312,5	408	394	2,5	600	1 020	123	1 700	1 900
315	445	424	3	900	1 430	173	1 600	1 800
332,5	428	414	2,5	620	1 100	130	1 600	1 800
335	465	444	3	915	1 500	178	1 500	1 700
352,5	448	434	2,5	655	1 200	140	1 500	1 700
358	503	479	4	1 120	1 830	211	1 400	1 600
372,5	468	454	2,5	655	1 220	142	1 400	1 600
378	523	499	4	1 140	1 900	217	1 300	1 500
395	505	488	3	815	1 500	175	1 300	1 500
398	543	519	4	1 180	2 000	224	1 300	1 500
415	525	509	3	800	1 500	140	1 300	1 500
418	583	555	4	1 370	2 320	260	1 200	1 400
435	545	529	3	830	1 600	182	1 200	1 400
438	603	575	4	1 400	2 450	270	1 100	1 300
455	585	563	3	1 020	1 960	216	1 100	1 300
463	627	602	5	1 560	2 750	300	1 100	1 300
475	605	583	3	1 020	1 960	214	1 100	1 300
483	657	629	5	1 660	3 000	325	1 000	1 200
498	633	610	4	1 140	2 240	243	1 000	1 200
503	677	649	5	1 700	3 100	330	950	1 100
518	653	631	4	1 160	2 320	247	1 000	1 200
523	697	670	5	1 760	3 200	340	950	1 100

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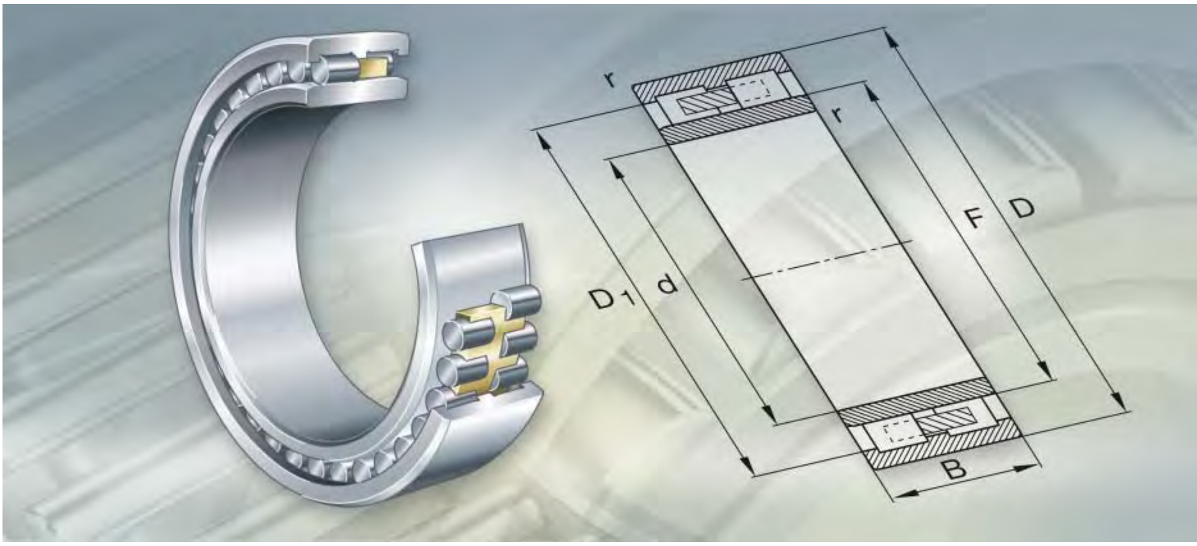


Double row cylindrical roller bearings with cage

Double row cylindrical roller bearings with cage

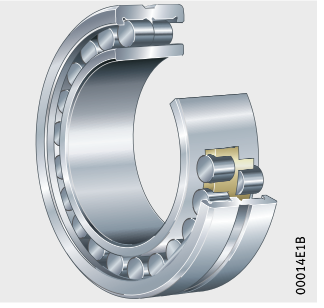
Product overview

Double row cylindrical roller bearings with cage

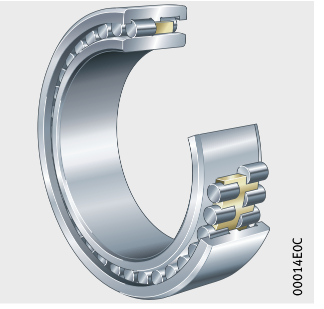
Non-locating bearings

With cylindrical bore

NNU40, NNU48, NNU49,
Z-5..ZL2-01

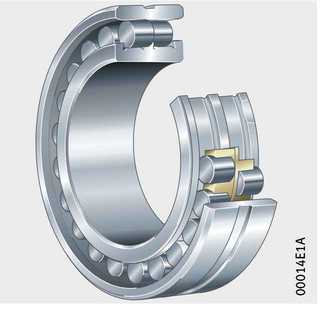


NNU41, Z-5..ZL2-01

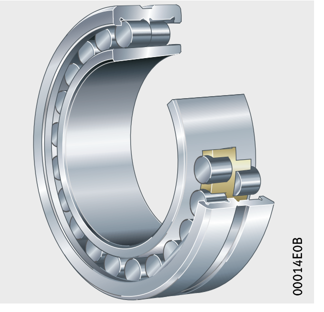


With tapered bore

NN30..-AS-K-M-SP



NNU49..-S-K-M-SP



Double row cylindrical roller bearings with cage

Features

These double row cylindrical roller bearings comprise solid bearing rings and cylindrical roller and cage assemblies with solid cages.

The bearings are suitable for very high radial loads and high speeds. They are separable and are therefore easier to mount and dismount. As a result, both bearing rings can be given a tight fit.
All the designs described are non-locating bearings, since one of the bearing rings in each case is without ribs.

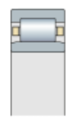
Double row cylindrical roller bearings with cylindrical bore

Design 1

- Outer ring with three rigid ribs, inner ring without ribs, lubrication groove and lubrication holes in the outer ring, brass double comb cage
- Bearings of dimension series 49 with standardised main dimensions and designations, in some cases in tolerance class P5, for high speed work rolls in rolling mills
- Non-standardised bearings (Z-5..ZL) with normal accuracy
- Application:
  - for example in rolling mills and plastics calenders.

Design 2

- Outer ring with three rigid ribs, inner ring without ribs, no lubrication groove and lubrication holes in the outer ring, brass double comb cage
- Bearings of series NNU41 or special bearings (Z-5..ZL)
- Application:
  - for example in grinding track mills.



Double row cylindrical roller bearings with cage

Design 3

- Special bearings (Z-5..ZL):
  - outer ring with two rigid ribs, inner ring without ribs, lubrication groove and lubrication holes in the outer ring
  - brass or steel window cage.

Design 4

- Special bearings (Z-5..ZL):
  - outer ring with two rigid ribs, inner ring without ribs, lubrication grooves on the end faces of the outer ring
  - brass or steel window cage.

Bearings with cylindrical bore of Design 1 to 4, *Figure 1*.

① Design 1
② Design 2
③ Design 3
④ Design 4

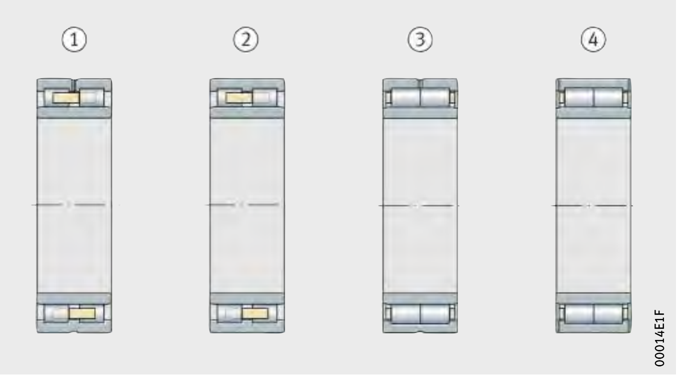


Figure 1
Double row cylindrical roller bearings with cylindrical bore

Design 5

- Special bearings:
  - outer ring with two rigid ribs, inner ring without ribs, lubrication groove and lubrication holes in the outer ring
  - steel pin cage and through-drilled rollers
- Application:
  - for example in rolling mills and plastics calenders.

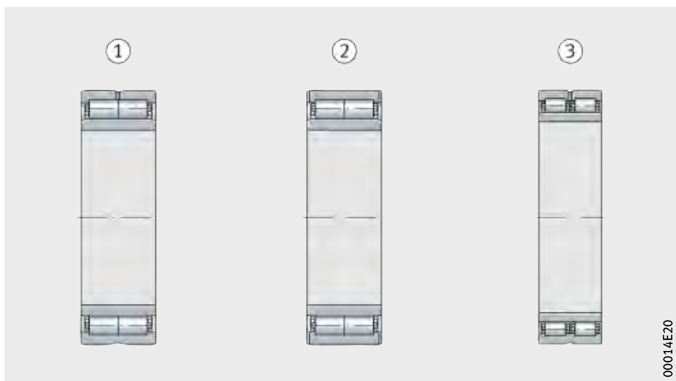
Design 6

- Special bearings:
  - outer ring with two rigid ribs, inner ring without ribs, lubrication grooves on the end faces of the outer ring
  - steel pin cage and through-drilled rollers
- Application:
  - for example in rolling mills and plastics calenders.

Design 7

- Special bearings:
  - outer ring with three rigid ribs, inner ring without ribs, lubrication groove and lubrication holes in the outer ring
  - steel pin cage
- Application:
  - for example in rolling mills and plastics calenders.

Bearings with cylindrical bore of Design 5 to 7, *Figure 2*.



① Design 5
② Design 6
③ Design 7

Figure 2
Double row cylindrical roller bearings with cylindrical bore (continued)

Double row cylindrical roller bearings with cage

Double row cylindrical roller bearings with tapered bore

Double row cylindrical roller bearings with tapered bore (taper 1:12) are super precision bearings for machine tools. The radial internal clearance can be set to an optimum value during mounting.
The bearings are suitable for particularly high speeds.
They have a lubrication groove and lubrication holes in the outer ring.

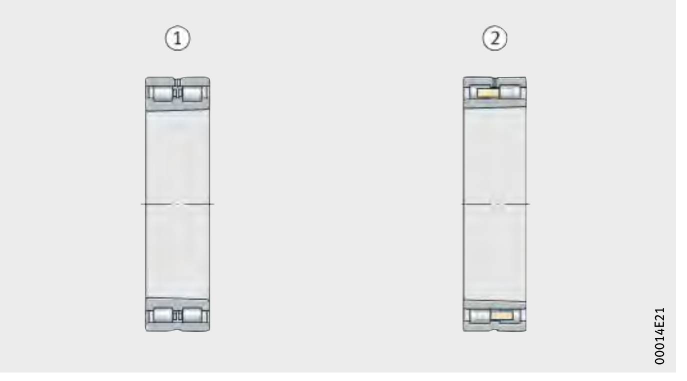
Design 8

- Bearings of series NN30..-AS-K-M-SP have a ribless outer ring and an inner ring with three rigid ribs.
- Each row of rollers has a separate solid brass cage.

Design 9

- In bearings of series NNU49..-S-K-M-SP, the outer ring has three rigid ribs, while the inner ring is without ribs.
- The bearings have a brass double comb cage.

Bearings with tapered bore of Design 8 and 9, *Figure 3*.



① Series NN30..-AS-K-M-SP (Design 8)
② Series NNU49..-S-K-M-SP (Design 9)

Figure 3
Double row cylindrical roller bearings with tapered bore

Non-locating bearings

All the double row cylindrical roller bearings described here are non-locating bearings and can support radial forces only.
Axial forces are supported by additional axial bearings, for example in the case of super precision bearings 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

The bearings are supplied without seals.

Lubrication

The bearings can be lubricated from the end faces using grease or oil. Some designs have a lubrication groove and lubrication holes in the outer ring. In the case of standardised bearings, this is indicated by the suffix S. Some special bearings have lubrication grooves in the outer ring end faces.

Operating temperature

The double row cylindrical roller bearings can be used at operating temperatures from –30 °C to +150 °C.

For continuous operation above +120 °C, please contact us.

Cages

Many double row cylindrical roller bearings have roller-guided solid cages made from brass, while some special bearings have cages made from steel.

Special bearings of Designs 5 to 7 have solid pin cages made from steel and through-drilled rollers. These bearings are designed for extremely high load carrying capacity and strong acceleration or deceleration, which occur for example in reversing roll stands.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
A	Modified internal construction	Standard
C2	Radial internal clearance smaller than normal	Special design, available by agreement only
C3	Radial internal clearance larger than normal	
K	Tapered bore, taper 1:12	Standard
M	Solid brass cage, guided by rollers	
P5	Tolerance class P5	Special design, available by agreement only
S	Lubrication groove and lubrication holes in outer ring	Standard
SP	Tolerance class SP	

Double row cylindrical roller bearings with cage

Design and safety guidelines

Permissible skewing

The permissible misalignment of the inner ring relative to the outer ring in double row cylindrical roller bearings is very limited.

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\ min} = C_{0r}/60$ is necessary.

If $F_{r\ min} < C_{0r}/60$, please contact us.

Equivalent dynamic bearing load

For bearings under dynamic loading used as non-locating bearings, the following applies:

$$P = F_r$$

P	kN
Equivalent dynamic bearing load	
F_r	kN
Radial dynamic bearing load.	

Operating life of super precision bearings

Super precision bearings must guide machine parts with very high precision and support forces at up to very high speeds.

They are selected predominantly from the perspectives of:

- accuracy
- rigidity
- running behaviour.

In order that they can fulfil these tasks for as long as possible, the bearings must run without wear. The precondition for this is the creation of a load-bearing hydrodynamic lubricant film at the contact points of the rolling contact partners.
Under these conditions, rolling bearings will achieve their fatigue life in a large number of applications. If the design is appropriate to the fatigue life, the operating life of the bearing is normally restricted by the lubricant operating life.

The decisive factors for the operating life from the perspective of load are the Hertzian pressures occurring at the contacts and the bearing kinematics. For high performance assemblies, individual design with the aid of special calculation programs is therefore advisable.

Since failure as a result of fatigue plays no part in practice in the case of high precision bearings, calculation of the rating life L_{10} in accordance with DIN ISO 281 is not suitable as a means of determining the operating life.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0 kN
Equivalent static bearing load

F_{0r} kN
Radial static bearing load.

Static load safety factor of super precision bearings

$$S_0 = \frac{C_{0r}}{P_0}$$

S_0 –
Static load safety factor

C_{0r} kN
Basic static load rating, see dimension tables

P_0 kN
Equivalent static bearing load.

In order to achieve sufficiently smooth running, the static load safety factor for super precision bearings should be $S_0 > 3$.

Speeds of super precision bearings

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, see 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

The limiting speeds n_G in the dimension tables for super precision bearings are valid for lubrication with grease or for minimal quantity lubrication with oil and must not be exceeded.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The dimension tables give the maximum dimensions of the radii r_a and r_{a1} and the diameters of the abutment shoulders.

Tapered shafts for super precision bearings

Recommendations for machining of the tapered shaft: see table and *Figure 4*.

Tapered shaft

Shaft diameter				Roundness	Flatness	Axial runout	Mean roughness
d mm		Deviation of small taper diameter µm		t_2 µm	t_3 µm	t_4 µm	R_a µm
over	incl.	max.	min.				
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

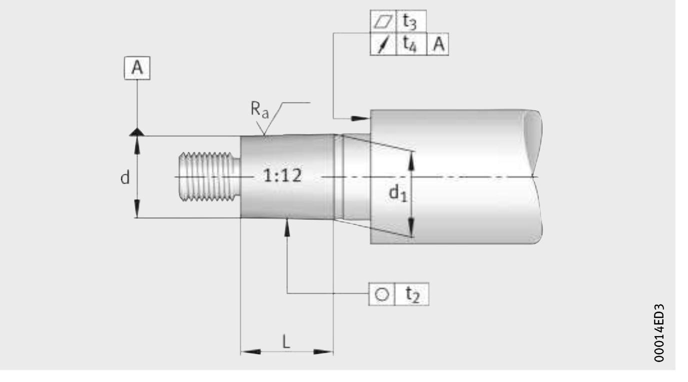


Figure 4
Design of shaft

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.
40	63	+3,2	0	+5	0
63	100	+4	0	+6,3	0
100	160	+5	0	+8	0
160	250	+3,2	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 values for the tolerance AT_D 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 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.

Housings for super precision bearings

In order to allow mounting and dismounting of the bearings, the dimension $D_{b\ min}$ in the dimension tables must be observed.

Recommendations for machining of the housings: see table and *Figure 5*.

Housing bores for super precision bearings

Housing bore				Cylin-dricity	Flatness	Axial runout	Coaxiality	Mean rough-ness
D mm		Deviation µm		t_1 µm	t_3 µm	t_4 µm	t_5 µm	R_a µm
over	incl.	max.	min.					
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	−29	9	9	11	16	1,6
630	800	0	−32	10	10	12	18	1,6

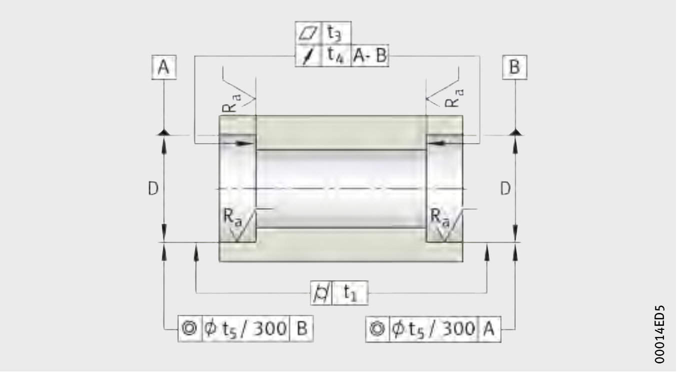


Figure 5
Design of housing

Accuracy

The dimensional and running tolerances of the bearings with cylindrical bore correspond to tolerance class PN and in some cases also to P5 to DIN 620.

Super precision bearings correspond to the more stringent tolerance class SP. Bearings of tolerance class UP are available by agreement.

Width tolerances SP

Bore d mm		Width deviation (in relation to bore) Δ_{Bs} μm		Width variation V_{Bs} μm
over	incl.	max.	min.	
180	250	0	–300	6
250	315	0	–350	8
315	400	0	–400	10
400	500	0	–450	12

Inner ring tolerances SP

Bore d mm		Bore deviation				Variation	Radial runout	Axial runout	
		Δ_{dmp} μm		$\Delta_{d1\,mp} - \Delta_{dmp}$ μm		V_{dp} μm	K_{ia} μm	S_d μm	S_{ia} μm
over	incl.								
180	250	30	0	9	0	8	8	7	8
250	315	35	0	11	0	9	8	8	10
315	400	40	0	12	0	12	10	10	12
400	500	45	0	14	0	14	10	12	15

Outer ring tolerances SP

Outside diameter D mm		Outside diameter deviation Δ_{Ds} μm		Variation V_{Dp} μm	Radial runout K_{ea} μm	Axial runout S_D μm	 S_{ea} μm
over	incl.						
250	315	0	–18	9	11	8	10
315	400	0	–20	10	13	10	13
400	500	0	–23	12	15	11	15
500	630	0	–28	14	17	13	18
630	800	0	–35	18	20	15	22

Double row cylindrical roller bearings with cage

Radial internal clearance

The radial internal clearance of bearings with a cylindrical bore normally corresponds to internal clearance group CN to DIN 620-4.

Radial internal clearance (cylindrical bore)

Bore d mm		Radial internal clearance CN μm		C3 μm		C4 μm	
over	incl.	min.	max.	min.	max.	min.	max.
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
710	800	310	470	470	630	630	790
800	900	350	520	520	690	690	860
900	1000	390	580	580	770	770	960
1000	1120	430	640	640	850	850	1060
1120	1250	470	710	710	950	950	1190
1250	1400	530	790	790	1050	1050	1310
1400	1600	610	890	890	1170	1170	1450

Radial internal clearance of super precision bearings

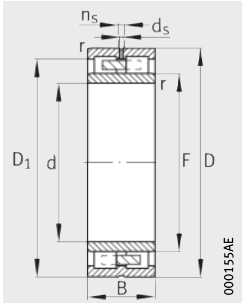
The radial internal clearance of super precision bearings is smaller than the normal internal clearance and corresponds to internal clearance group C1NA for the accuracy SP and UP.
The internal clearance is not stated in the designation.
The bearing rings are not interchangeable.

Radial internal clearance C1NA (tapered bore)

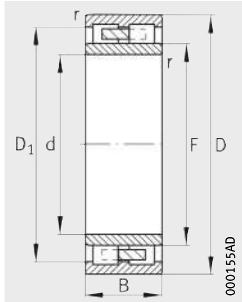
Bore d mm		Radial internal clearance C1NA µm	
over	incl.	min.	max.
200	225	60	95
225	250	65	100
250	280	75	110
280	315	80	120
315	355	90	135
355	400	100	150
400	450	110	170
450	500	120	190
500	560	130	210
560	630	140	230
630	710	160	260
710	800	170	290
800	900	190	330
900	1000	210	360
1000	1120	230	400
1120	1250	250	440
1250	1400	270	460
1400	1600	300	500
1600	1800	320	530

Cylindrical roller bearings with cage

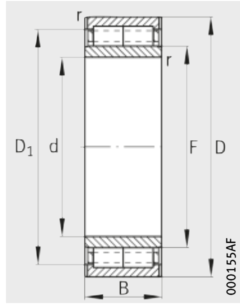
Double row,
with cylindrical bore



Design 1



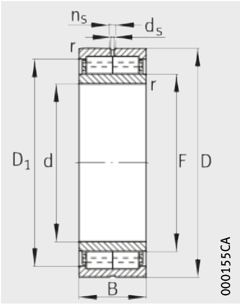
Design 2



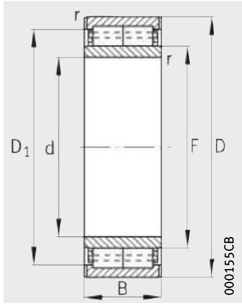
Design 4

Dimension table · Dimensions in mm

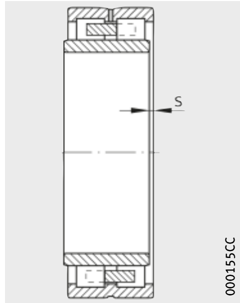
Designation	Design	Mass	Dimensions						
		m	d	D	B	r	s[1)]	F	D_1
		≈kg				min.			≈
NNU4138-M	2	42,3	**190**	320	128	3	4	222	275,3
NNU4140-M	2	52,2	**200**	340	140	3	4,3	235	295
NNU4144-M	2	65,9	**220**	370	150	4	4,9	258	321,5
NNU4948-S-M-P5-C3	1	18,2	**240**	320	80	2,1	4,7	265	292,2
NNU4148-M	2	80,9	**240**	400	160	4	5,1	282	352,1
NNU4852-S-M	1	10,6	**260**	320	60	2	2,5	279,5	299
NNU4952-S-M-P5-C3	1	31,9	**260**	360	100	2,1	4	292	325,6
NNU4052-S-M	1	65,5	**260**	400	140	4	4,5	298	354,9
NNU4152-M	2	115	**260**	440	180	4	7,7	306	381,2
NNU4856-S-M	1	15,4	**280**	350	69	2	2,5	302	326,6
NNU4956-S-M-P5-C3	1	33,7	**280**	380	100	2,1	4	312	345,6
NNU4156-M	2	121	**280**	460	180	5	5	326	401,2
NNU4860-S-M	1	22	**300**	380	80	2,1	3,4	325	353,2
NNU4960-S-M-P5-C3	1	52,3	**300**	420	118	3	5	339	379
NNU4160-M	2	161	**300**	500	200	5	9,2	351	434,6
NNU4864-S-M	1	23,2	**320**	400	80	2,1	3,4	346	373,2
NNU4964-S-M-P5-C3	1	55,2	**320**	440	118	3	8,1	359	399
Z-525271.ZL	4	68,6	**320**	460	120	4	7	364	413,9
NNU4164-M	2	208	**320**	540	218	5	9,5	375	465,1
NNU4868-S-M	1	25	**340**	420	80	2,1	5,5	366	393,2
NNU4968-S-M-P5-C3	1	58	**340**	460	118	3	6,4	379	419
NNU4068-S-M	1	140	**340**	520	180	5	8,4	385	460
NNU4168-M	2	268	**340**	580	243	5	10,3	402	502,5
NNU4872-S-M	1	25,8	**360**	440	80	2,1	3,4	386	414,1
Z-527930.ZL	6	41,9	**360**	460	100	3	8,8	384,7	426,6
NNU4972-S-M-C3	1	60,8	**360**	480	118	3	5	399	439
Z-529482.ZL	6	78,7	**360**	500	125	5	–	394	454
NNU4172-M	2	281	**360**	600	243	5	10,2	422	523
NNU4876-S-M	1	44	**380**	480	100	2,1	6,8	412	445,6
NNU4976-S-M-C3	1	91,5	**380**	520	140	4	7,5	426	470
Z-556618.ZL	5	114	**380**	540	150	3	8,7	422	485,4
Z-507768.ZL	4	135	**380**	540	180	4	8	420	490,4
NNU4176-M	2	293	**380**	620	243	5	10,3	442	542,5



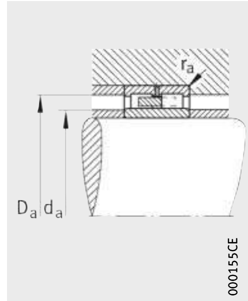
Design 5
With pin cage



Design 6
With pin cage



1) Axial displacement “s”

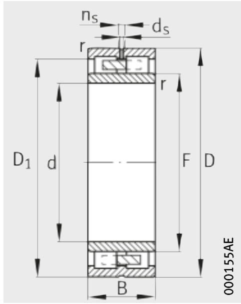


Mounting dimensions

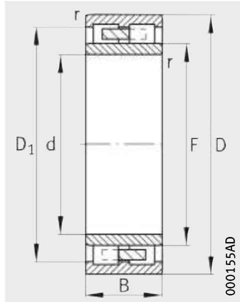
		Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_s	n_s	d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
		min.	max.	max.	kN	kN	kN	min^{-1}
–	–	204	306	2,5	1 200	2 120	237	2 400
–	–	214	326	2,5	1 430	2 500	275	2 200
–	–	237	353	3	1 630	2 900	315	1 900
6,3	12,2	250	310	2	530	1 200	127	2 000
–	–	257	383	3	1 960	3 600	380	1 800
4,8	9,5	269	311	2	375	1 020	107	1 900
8	15	270	350	2	750	1 700	173	1 800
6,3	12,2	275	385	3	1 660	3 450	365	1 700
–	–	277	423	3	2 360	4 400	450	1 700
4,8	9,5	289	341	2	520	1 370	138	1 800
8	15	290	370	2	765	1 800	181	1 700
–	–	300	440	4	2 400	4 650	470	1 600
4,8	9,5	310	370	2	630	1 630	162	1 700
9,5	17,7	312	408	2,5	1 040	2 400	243	1 600
–	–	320	480	4	2 900	5 700	570	1 500
4,8	9,5	330	390	2	640	1 700	166	1 600
9,5	17,7	332	428	2,5	1 060	2 550	255	1 600
–	–	–	–	3	1 530	3 550	350	1 500
–	–	340	520	4	3 350	6 550	640	1 400
4,8	9,5	350	410	2	655	1 800	173	1 600
9,5	17,7	352	448	2,5	1 100	2 650	265	1 500
8	19	357	503	4	2 600	5 400	520	1 400
–	–	360	560	4	4 000	7 800	740	1 300
–	–	370	430	2	670	1 900	180	1 500
–	–	–	–	2,5	1 290	3 350	330	1 500
9,5	17,7	372	468	2,5	1 140	2 800	275	1 400
–	–	–	–	4	2 040	4 650	440	1 400
–	–	380	580	4	4 050	8 150	780	1 200
6,3	12,2	390	470	2,1	965	2 600	244	1 400
9,5	17,7	395	–	3	1 430	3 600	340	1 300
–	–	–	–	2,5	2 550	6 000	580	1 300
–	–	–	–	3	2 800	6 400	620	1 300
–	–	400	600	4	4 250	8 650	810	1 200

Cylindrical roller bearings with cage

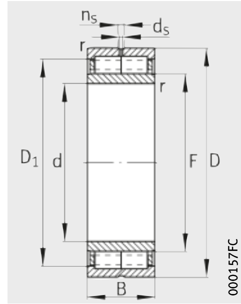
Double row,
with cylindrical bore



Design 1



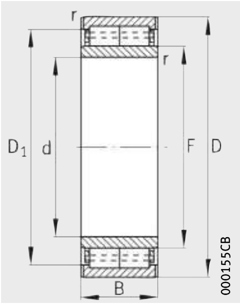
Design 2



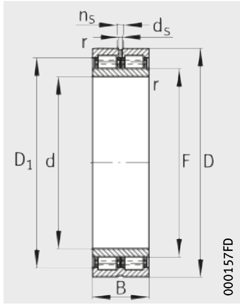
Design 3

Dimension table (continued) · Dimensions in mm

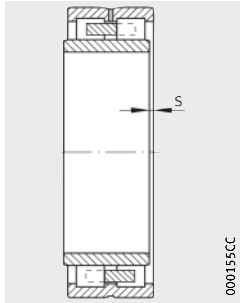
Designation	Design	Mass	Dimensions						
		m	d	D	B	r	$s^{1)}$	F	D_1
		≈kg				min.			≈
NNU4980-S-M-C3	1	95,2	**400**	540	140	4	5,5	446	490,8
NNU4080-S-M	1	199	**400**	600	200	5	9,5	450	534
Z-526089.ZL	7	343	**400**	640	260	5	–	461	568
NNU4180-M	2	324	**400**	650	250	6	11,4	463	577
NNU4884-S-M	1	48,4	**420**	520	100	2,1	6,2	453	486,6
NNU4984-S-M-C3	1	99,2	**420**	560	140	4	8,3	466	510,8
Z-539553.ZL	6	108	**420**	580	130	4	7	460	526,8
Z-533053.ZL	1	128	**420**	580	160	4	5,9	463	530
NNU4184-M	2	434	**420**	700	280	6	8,7	491	612
NNU4888-S-M	1	50,2	**440**	540	100	2,1	3,8	473	506,6
Z-528620.ZL	6	81,4	**440**	570	120	3	9	473	526,4
NNU4988-S-M-C3	1	137	**440**	600	160	4	5,8	490	544,4
NNU4088-S-M	1	243	**440**	650	212	6	8	491	581
NNU4188-M	2	453	**440**	720	280	6	12,9	511	632
Z-524628.ZL	6	58,3	**460**	570	105	3	6,3	486,7	533,6
NNU4892-S-M	1	75,1	**460**	580	118	3	4,9	499	539
NNU4992-S-M-C3	1	141	**460**	620	160	4	5,8	510	564,4
NNU4092-S-M	1	275	**460**	680	218	6	9,5	516	606
NNU4192-M	2	550	**460**	760	300	7,5	8,7	537	663
NNU4896-S-M	1	77,7	**480**	600	118	3	4,9	519	559
NNU4996-S-M-C3	1	154	**480**	650	170	5	6	534	593
NNU4096-S-M	1	282	**480**	700	218	6	9,5	538	631,5
NNU4196-M	2	602	**480**	790	308	7,5	13	557	691,5
NNU48/500-S-M	1	75,7	**500**	620	118	3	4,7	539	580,5
Z-523745.ZL	6	81,7	**500**	620	120	4	10	532	582
NNU49/500-S-M-C3	1	159	**500**	670	170	5	6	554	613
NNU40/500-S-M	1	295	**500**	720	218	6	9,5	558	651,5
Z-509393.ZL	3	312	**500**	720	218	6	9,5	558	647,6
NNU41/500-M	2	706	**500**	830	325	7,5	11,7	582	725
NNU49/530-S-M-C3	1	206	**530**	710	180	5	7,2	588	655
NNU40/530-S-M	1	407	**530**	780	250	6	11,8	591	698
NNU41/530-M	2	796	**530**	870	335	7,5	16,2	618	761
Z-549875.ZL	1	452	**550**	800	260	6	–	612	721
Z-522739.ZL	6	91	**560**	680	120	5	8,5	592	642
NNU49/560-S-M-C3	1	246	**560**	750	190	5	5,8	617	684
NNU40/560-S-M	1	461	**560**	820	258	6	13,8	630	737
NNU41/560-M	2	952	**560**	920	355	7,5	15,8	653	804



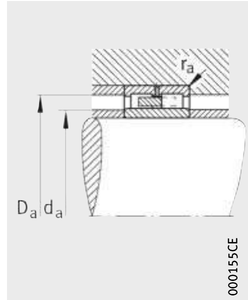
Design 6
With pin cage



Design 7
With pin cage



1) Axial displacement "s"

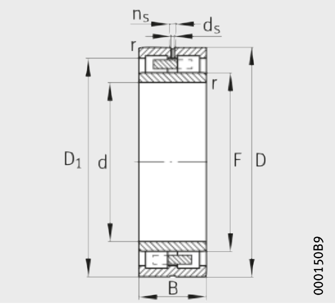


Mounting dimensions

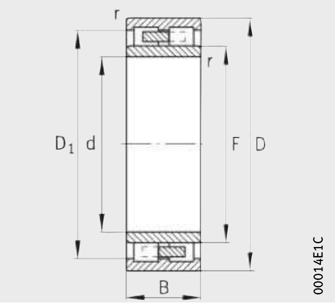
		Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_s	n_s	d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
		min.	max.	max.	kN	kN	kN	min^{-1}
9,5	17,7	415	525	3	1 500	3 800	355	1 300
9,5	17,7	417	583	4	3 200	6 950	650	1 200
9,5	17,7	–	–	4	5 300	11 200	1 040	1 100
–	–	426	624	5	4 800	9 500	860	1 100
8	15	430	510	2	1 000	2 850	260	1 300
9,5	17,7	435	545	3	1 530	4 000	370	1 200
–	–	–	–	3	2 400	5 600	520	1 200
6,3	12,2	–	–	3	2 280	5 200	485	1 100
–	–	446	674	5	5 500	11 000	970	1 000
8	15	450	530	2	1 040	3 000	270	1 200
–	–	–	–	2,5	1 960	5 100	470	1 100
9,5	17,7	455	585	3	2 040	5 200	480	1 100
9,5	21,7	463	627	5	3 800	8 300	770	1 000
–	–	466	694	5	5 600	11 600	1 010	950
–	–	–	–	2,5	1 630	4 400	400	1 100
8	15	472	568	2,5	1 320	3 650	340	1 100
9,5	17,7	475	605	3	2 120	5 500	500	1 000
9,5	21,7	–	–	5	3 900	8 800	790	950
–	–	492	728	6	6 400	13 200	1 160	900
8	15	492	588	2,5	1 340	3 800	345	1 000
9,5	17,7	497	633	4	2 360	6 100	550	950
9,5	21,7	503	677	5	4 150	9 300	840	950
–	–	512	758	6	6 550	13 400	1 140	850
8	15	512	608	2,5	1 400	4 150	370	1 000
–	–	–	–	3	1 960	5 600	495	1 000
9,5	17,7	517	653	4	2 320	6 100	540	950
9,5	21,7	523	697	5	4 250	9 650	860	900
8	15	–	–	5	4 650	11 000	980	900
–	–	532	798	6	7 200	14 600	1 250	850
9,5	17,7	547	693	4	2 900	7 650	670	900
9,5	21,7	553	757	5	5 100	11 600	1 000	850
–	–	562	838	6	7 650	16 300	1 370	800
12,5	23,5	–	–	5	6 100	14 600	1 220	800
–	–	–	–	4	2 080	6 300	540	900
9,5	17,7	577	733	4	3 150	8 800	760	850
9,5	21,7	583	797	5	5 200	12 000	1 030	800
–	–	592	888	6	8 800	19 000	1 550	750

Cylindrical roller bearings with cage

Double row,
with cylindrical bore



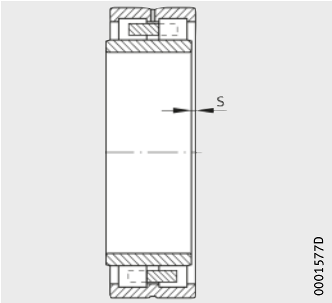
Design 1



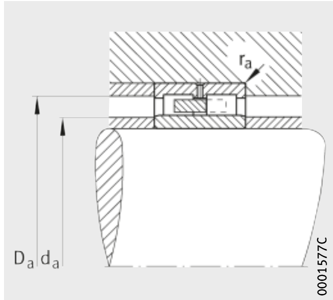
Design 2

Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions						
		m	d	D	B	r	s[1)]	F	D_1
		≈kg				min.			≈
NNU49/600-S-M-C3	1	287	**600**	800	200	5	6,3	666	741
NNU40/600-S-M	1	533	**600**	870	272	6	12	668	787,5
NNU41/600-M	2	1 120	**600**	980	375	7,5	18	699	858,5
NNU48/630-S-M	1	164	**630**	780	150	4	8,8	678	726
NNU49/630-S-M-C3	1	362	**630**	850	218	6	8,6	704	784,5
NNU41/630-M	2	1 320	**630**	1 030	400	7,5	11,7	734	902
Z-509944.ZL	2	388	**660**	880	225	6	10	727	807,3
NNU49/670-S-M-C3	1	421	**670**	900	230	6	7	738	828,5
NNU41/670-M	2	1 530	**670**	1 090	412	7,5	18,2	774	950,5
NNU49/710-S-M-C3	1	488	**710**	950	243	6	7,9	782	875,5
NNU41/710-M	2	1 790	**710**	1 150	438	9,5	20	820	1 005
NNU49/750-S-M-C3	1	563	**750**	1 000	250	6	7,5	825	918,8
NNU41/750-M	2	2 190	**750**	1 220	475	9,5	21,3	871	1 073
NNU48/800-S-M	1	279	**800**	980	180	5	5,9	856	919,5
NNU49/800-S-M-C3	1	635	**800**	1 060	258	6	10,2	880	980,8
NNU41/800-M	2	2 390	**800**	1 280	475	9,5	12,5	921	1 123
NNU48/850-S-M	1	292	**850**	1 030	180	5	5,9	910	971
NNU49/850-S-M-C3	1	722	**850**	1 120	272	6	9,5	931	1 031,8
NNU41/850-M	2	2 810	**850**	1 360	500	12	12,9	976	1 194
NNU49/900-S-M-C3	1	824	**900**	1 180	280	6	11,8	986	1 093
NNU41/900-M	2	3 100	**900**	1 420	515	12	23	1 032	1 250
NNU48/950-S-M	1	430	**950**	1 150	200	5	6,3	1 016	1 086
NNU49/950-S-M-C3	1	938	**950**	1 250	300	7,5	9,3	1 046	1 160
NNU41/950-M	2	3 660	**950**	1 500	545	12	14	1 092	1 327
NNU49/1000-S-M-C3	1	1 200	**1 000**	1 320	315	7,5	12,8	1 103	1 224
NNU41/1000-M	2	4 340	**1 000**	1 580	580	12	14,1	1 154	1 406
NNU49/1060-S-M-C3	1	1 410	**1 060**	1 400	335	7,5	17,5	1 160	1 294
NNU41/1060-M	2	4 930	**1 060**	1 660	600	15	15	1 214	1 466
NNU49/1120-S-M-C3	1	1 460	**1 120**	1 460	335	7,5	10,5	1 220	1 354
NNU41/1120-M	2	5 750	**1 120**	1 750	630	15	15,9	1 279	1 548
NNU48/1180-S-M	1	783	**1 180**	1 420	243	6	14,8	1 264	1 341
NNU49/1180-S-M-C3	1	1 750	**1 180**	1 540	355	7,5	10	1 285	1 427,5
NNU41/1180-M	2	6 880	**1 180**	1 850	670	15	16,5	1 350	1 636
NNU49/1250-S-M-C3	1	2 070	**1 250**	1 630	375	9,5	9,5	1 360	1 511
NNU41/1250-M	2	8 000	**1 250**	1 950	710	15	17,4	1 426	1 720
NNU49/1320-S-M-C3	1	2 520	**1 320**	1 720	400	7,5	10	1 430	1 581
NNU49/1600-S-M-C3	1	3 950	**1 600**	2 060	462	9,5	12	1 740	1 908



[1] Axial displacement “s”

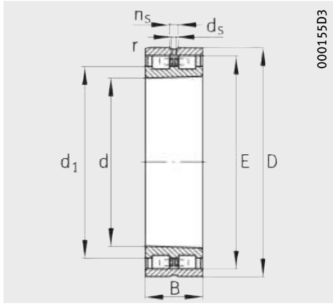


Mounting dimensions

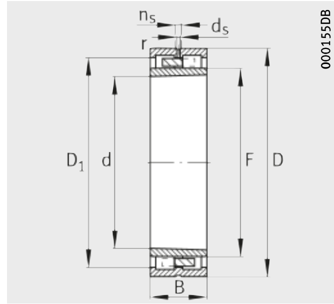
		Mounting dimensions			Basic load ratings		Fatigue limit load	Limiting speed
d_s	n_s	d_a	D_a	r_a	dyn. C_r	stat. C_{0r}	C_{ur}	n_G
		min.	max.	max.	kN	kN	kN	min^{-1}
9,5	17,7	617	783	4	3 750	10 400	860	750
12,5	27,5	623	847	5	6 300	14 600	1 200	750
–	–	632	948	6	9 650	20 800	1 680	670
9,5	17,7	645	765	3	2 240	7 100	590	750
12,5	23,5	653	827	5	4 150	11 400	940	700
–	–	692	998	6	10 800	23 600	1 860	670
–	–	–	–	5	4 250	11 800	960	700
12,5	23,5	693	877	5	5 000	13 400	1 110	700
–	–	702	1 058	6	11 600	25 500	1 990	600
12,5	23,5	733	927	5	5 500	15 000	1 240	630
–	–	750	1 110	8	12 900	28 500	2 210	560
12,5	23,5	773	977	5	5 850	16 600	1 330	600
–	–	790	1 180	8	15 300	34 500	2 550	530
9,5	17,7	817	963	4	3 450	11 400	900	600
12,5	23,5	823	1 037	5	6 100	17 300	1 350	560
–	–	840	1 240	8	15 600	36 000	2 650	500
9,5	17,7	867	1 013	4	3 550	12 000	930	560
12,5	23,5	873	1 097	5	6 300	18 000	1 400	530
–	–	898	1 312	10	17 300	39 000	2 850	480
12,5	23,5	923	1 157	5	7 100	20 400	1 550	500
–	–	948	1 372	10	18 000	42 500	3 050	450
9,5	17,7	967	1 133	4	4 500	15 600	1 170	500
12,5	23,5	978	1 222	6	8 150	24 000	1 770	480
–	–	998	1 452	10	20 400	48 000	3 400	430
12,5	23,5	1 028	1 292	6	9 000	26 500	1 930	450
–	–	1 048	1 532	10	23 600	56 000	3 850	400
12,5	23,5	1 088	1 372	6	10 400	30 000	2 120	430
–	–	1 118	1 602	12	24 500	60 000	4 100	400
12,5	23,5	1 148	1 432	6	10 400	31 000	2 150	400
–	–	1 178	1 692	12	27 500	67 000	4 500	380
12,5	23,5	1 203	1 397	5	6 000	22 000	1 540	400
12,5	23,5	1 208	1 512	6	12 200	37 500	2 550	380
–	–	1 238	1 792	12	30 500	76 500	5 000	360
12,5	23,5	1 284	1 596	8	13 700	41 500	2 850	380
–	–	1 308	1 892	12	33 500	83 000	5 500	340
12,5	23,5	1 348	1 692	6	14 600	46 500	3 150	360
12,5	23,5	1 634	2 026	8	18 300	61 000	3 850	300

Super precision cylindrical roller bearings

Double row,
with tapered bore
(taper 1:12)



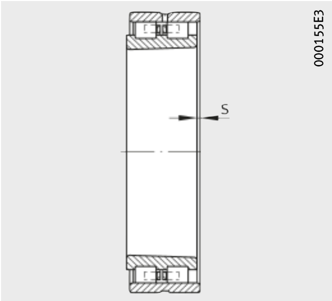
NN30..-AS-K-M-SP



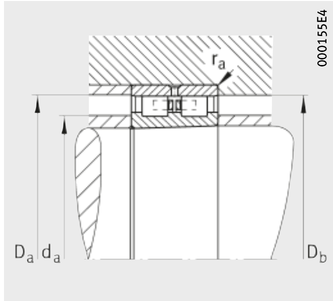
NNU49..-S-K-M-SP

Dimension table · Dimensions in mm

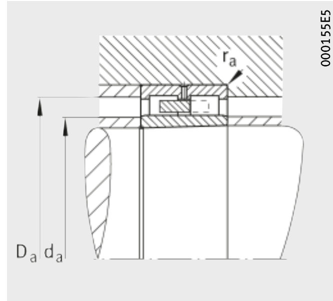
Designation	Mass	Dimensions								
	m	d	D	B	r	s[1)]	E	F	D_1	d_1
	≈kg				min.				≈	≈
NN3044-AS-K-M-SP	29,1	**220**	340	90	3	4,5	310	–	–	265,2
NNU4948-S-K-M-SP	17,1	**240**	320	80	2,1	3,4	–	265	292,2	–
NN3048-AS-K-M-SP	31,5	**240**	360	92	3	6	330	–	–	285,2
NNU4952-S-K-M-SP	30,5	**260**	360	100	2,1	4	–	292	325,6	–
NN3052-AS-K-M-SP	46,2	**260**	400	104	4	6,5	364	–	–	312,8
NNU4956-S-K-M-SP	32,3	**280**	380	100	2,1	4	–	312	345,6	–
NN3056-AS-K-M-SP	49,7	**280**	420	106	4	6,8	384	–	–	332,8
NNU4960-S-K-M-SP	50,2	**300**	420	118	4	5	–	339	379	–
NN3060-AS-K-M-SP	68,5	**300**	460	118	4	7,5	418	–	–	360,4
NNU4964-S-K-M-SP	55,2	**320**	440	118	3	8,1	–	359	399	–
NN3064-AS-K-M-SP	73,8	**320**	480	121	4	7,9	438	–	–	380,4
NNU4968-S-K-M-SP	55,6	**340**	460	118	3	5	–	379	419	–
NN3068-AS-K-M-SP	99,3	**340**	520	133	5	8,7	473	–	–	409
NNU4972-S-K-M-SP	57,3	**360**	480	118	3	5	–	399	439	–
NN3072-AS-K-M-SP	104	**360**	540	134	5	8,7	493	–	–	429
NNU4976-S-K-M-SP	85,8	**380**	520	140	4	5,5	–	426	470	–
NN3076-AS-K-M-SP	110	**380**	560	135	5	9	513	–	–	449
NNU4980-S-K-M-SP	91	**400**	540	140	4	5,5	–	446	490,8	–
NN3080-AS-K-M-SP	143	**400**	600	148	5	9,5	549	–	–	477
NNU4984-S-K-M-SP	94,1	**420**	560	140	4	5,5	–	466	510,8	–
NN3084-AS-K-M-SP	150	**420**	620	150	5	10	569	–	–	497
NNU4988-S-K-M-SP	131	**440**	600	160	4	5,8	–	490	544,4	–
NN3088-AS-K-M-SP	172	**440**	650	157	6	10,3	597	–	–	520,2
NNU4992-S-K-M-SP	134	**460**	620	160	4	5,8	–	510	564,4	–
NN3092-AS-K-M-SP	197	**460**	680	163	6	10,5	624	–	–	544
NNU4996-S-K-M-SP	158	**480**	650	170	5	6	–	534	593	–
NN3096-AS-K-M-SP	208	**480**	700	165	6	11	644	–	–	564
NNU49/500-S-K-M-SP	162	**500**	670	170	5	6	–	554	613	–
NN30/500-AS-K-M-SP	214	**500**	720	167	6	11,5	664	–	–	584
NNU49/530-S-K-M-SP	193	**530**	710	180	5	5,8	–	588	655	–
NN30/530-AS-K-M-SP	289	**530**	780	185	6	11,3	715	–	–	617,5
NNU49/560-S-K-M-SP	235	**560**	750	190	5	5,8	–	617	684	–
NN30/560-AS-K-M-SP	331	**560**	820	195	6	11,6	756	–	–	652



[1] Axial displacement "s" for NN30 and NNU49



Mounting dimensions for NN30

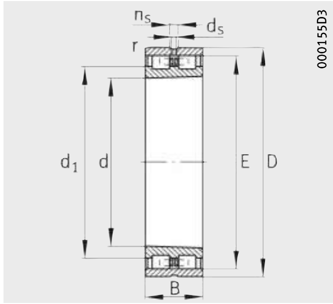


Mounting dimensions for NNU49

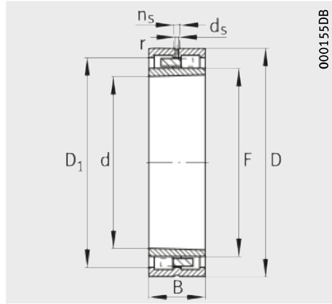
		Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speeds	
d_s	n_s	d_a min.	D_a max.	D_b min.	r_a max.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN	n_G grease min^{-1}	n_G Oil min^{-1}
8	15	232	328	313	2,5	800	1 460	150	2 200	2 800
6,3	12,2	250	310	–	2	530	1 200	127	2 200	2 800
8	15	252	348	334	2,5	850	1 560	160	2 000	2 600
8	15	270	350	–	2	750	1 700	173	1 400	1 800
8	15	275	385	368	3	1 060	2 000	200	1 900	2 400
8	15	290	370	–	2	765	1 800	181	1 300	1 700
8	15	295	405	388	3	1 080	2 080	206	1 800	2 200
9,5	17,7	312	408	–	2,5	1 040	2 400	243	1 700	2 000
9,5	17,7	315	445	422	3	1 270	2 400	232	1 600	1 900
9,5	17,7	332	428	–	2,5	1 060	2 550	255	1 200	1 600
9,5	17,7	335	465	442	3	1 320	2 600	248	1 600	1 900
9,5	17,7	352	448	–	2,5	1 100	2 650	265	1 500	1 800
9,5	17,7	357	503	477	4	1 630	3 250	305	1 400	1 700
9,5	17,7	372	468	–	2,5	1 140	2 800	275	1 500	1 800
9,5	17,7	377	523	497	4	1 660	3 350	310	1 400	1 700
9,5	17,7	395	505	–	3	1 430	3 600	340	1 400	1 700
9,5	17,7	397	543	517	4	1 700	3 450	320	1 300	1 600
9,5	17,7	415	525	–	3	1 500	3 800	355	1 300	1 600
9,5	17,7	417	583	553	4	2 160	4 500	395	1 200	1 500
9,5	17,7	435	545	–	3	1 530	4 000	370	1 300	1 600
9,5	17,7	437	603	573	4	2 120	4 500	395	1 200	1 500
9,5	17,7	455	585	–	3	2 040	5 200	480	1 200	1 500
12,5	23,5	463	627	601	5	2 450	5 100	445	1 100	1 400
9,5	17,7	475	605	–	3	2 120	5 500	500	1 100	1 400
12,5	23,5	483	657	628	5	2 600	5 400	480	1 100	1 400
9,5	17,7	497	633	–	4	2 360	6 100	550	1 100	1 400
12,5	23,5	503	677	648	5	2 700	5 850	510	1 000	1 300
9,5	17,7	517	653	–	4	2 320	6 100	540	1 000	1 300
12,5	23,5	523	697	668	5	2 650	5 850	500	1 000	1 300
9,5	17,7	547	693	–	4	2 900	7 650	670	1 000	1 300
12,5	23,5	553	757	720	5	3 450	7 350	620	950	1 200
9,5	17,7	577	733	–	4	3 150	8 800	760	950	1 200
12,5	23,5	583	797	761	5	3 900	8 300	700	900	1 100

Super precision cylindrical roller bearings

Double row,
with tapered bore
(taper 1:12)



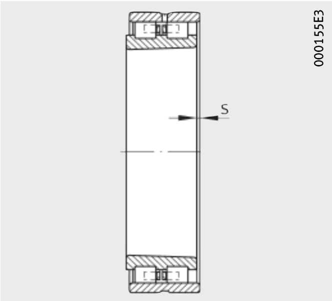
NN30..-AS-K-M-SP



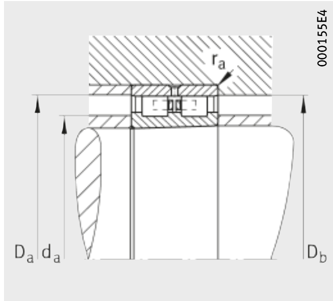
NNU49..-S-K-M-SP

Dimension table (continued) · Dimensions in mm

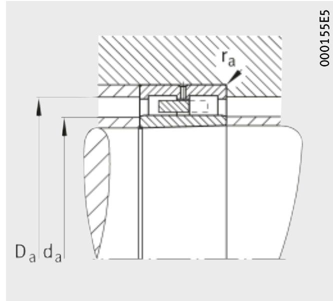
Designation	Mass	Dimensions								
	m	d	D	B	r	s[1)]	E	F	D_1	d_1
	≈kg				min.				≈	≈
NNU49/600-S-K-M-SP	275	**600**	800	200	5	6,3	–	666	741	–
NN30/600-AS-K-M-SP	377	**600**	870	200	6	11	803	–	–	692,5
NNU49/630-S-K-M-SP	347	**630**	850	218	6	6,9	–	704	784,5	–
NN30/630-AS-K-M-SP	454	**630**	920	212	7,5	12,5	845	–	–	734,5
NNU49/670-S-K-M-SP	399	**670**	900	230	6	7	–	738	828,5	–
NN30/670-AS-K-M-SP	600	**670**	980	230	7,5	13,5	901	–	–	779
NNU49/710-S-K-M-SP	466	**710**	950	243	6	7,9	–	782	875,5	–
NN30/710-AS-K-M-SP	671	**710**	1 030	236	7,5	13	951	–	–	820,5
NNU49/750-S-K-M-SP	538	**750**	1 000	250	6	7,5	–	825	918,8	–
NN30/750-AS-K-M-SP	739	**750**	1 090	250	7,5	11,5	1 007	–	–	859,5
NNU49/800-S-K-M-SP	608	**800**	1 060	258	6	10,2	–	880	980,8	–
NN30/800-AS-K-M-SP	836	**800**	1 150	258	7,5	12,5	1 065	–	–	917,5
NNU49/850-S-K-M-SP	689	**850**	1 120	272	6	9,5	–	931	1 031,8	–
NN30/850-AS-K-M-SP	989	**850**	1 220	272	7,5	13	1 130	–	–	974
NNU49/900-S-K-M-SP	784	**900**	1 180	280	6	9,3	–	986	1 093	–
NN30/900-AS-K-M-SP	1 100	**900**	1 280	280	7,5	14,5	1 185	–	–	1 029
NNU49/950-S-K-M-SP	962	**950**	1 250	300	7,5	9,3	–	1 046	1 160	–
NN30/950-AS-K-M-SP	1 460	**950**	1 360	300	7,5	16,8	1 255	–	–	1 091
NNU49/1000-S-K-M-SP	1 120	**1 000**	1 320	315	7,5	9,8	–	1 103	1 224	–
NN30/1000-AS-K-M-SP	1 490	**1 000**	1 420	308	7,5	16,5	1 316	–	–	1 143
NNU49/1060-S-K-M-SP	1 350	**1 060**	1 400	335	7,5	10,5	–	1 160	1 294	–
NN30/1060-AS-K-M-SP	1 740	**1 060**	1 500	325	9,5	17	1 391	–	–	1 210
NNU49/1120-S-K-M-SP	1 400	**1 120**	1 460	335	7,5	10,5	–	1 220	1 354	–
NN30/1120-AS-K-M-SP	2 030	**1 120**	1 580	345	9,5	18,5	1 467	–	–	1 278
NNU49/1180-S-K-M-SP	1 680	**1 180**	1 540	355	7,5	10	–	1 285	1 427,5	–
NN30/1180-AS-K-M-SP	2 300	**1 180**	1 660	355	9,5	13,3	1 542	–	–	1 350
NNU49/1250-S-K-M-SP	1 980	**1 250**	1 630	375	9,5	9,5	–	1 360	1 511	–
NNU49/1600-S-K-M-SP	3 770	**1 600**	2 060	462	9,5	12	–	1 740	1 908	–
NN30/1700-AS-K-M-SP	6 540	**1 700**	2 360	500	15	17	2 185	–	–	1 940



[1] Axial displacement "s" for NN30 and NNU49



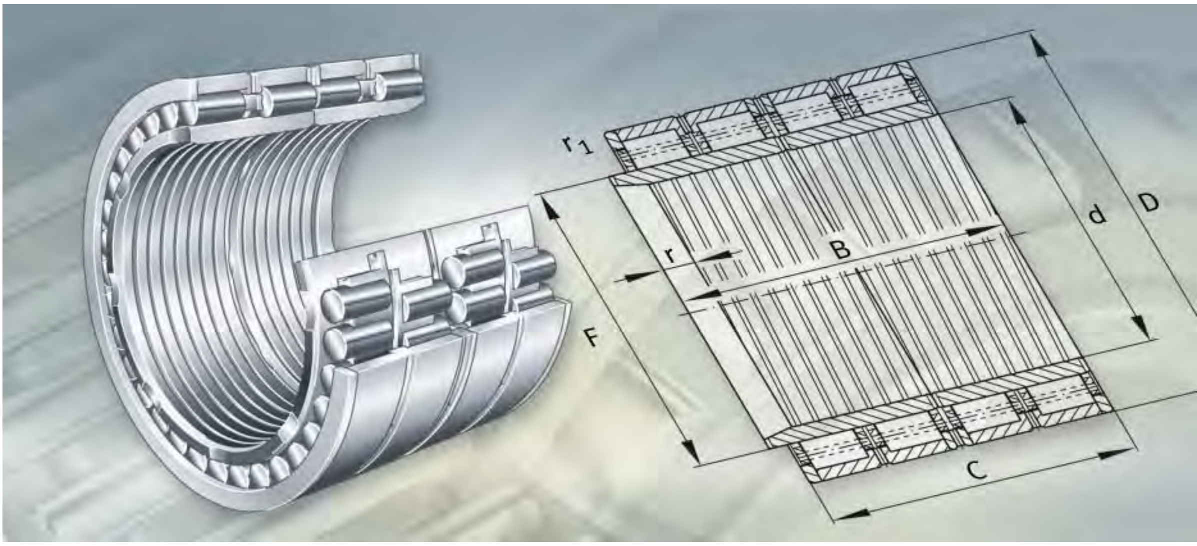
Mounting dimensions for NN30



Mounting dimensions for NNU49

		Mounting dimensions				Basic load ratings		Fatigue limit load	Limiting speeds	
d_s	n_s	d_a min.	D_a max.	D_b min.	r_a max.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN	n_G grease min^{-1}	n_G Oil min^{-1}
9,5	17,7	617	783	–	4	3 750	10 400	860	850	1 000
12,5	23,5	623	847	808	5	4 400	9 500	760	850	1 000
12,5	23,5	653	827	–	5	4 150	11 400	940	800	950
12,5	23,5	658	892	850	6	4 500	9 800	780	800	950
12,5	23,5	693	877	–	5	5 000	13 400	1 110	750	900
12,5	23,5	698	952	906	6	5 300	11 600	910	750	900
12,5	23,5	733	927	–	5	5 500	15 000	1 240	750	900
12,5	23,5	738	1 002	956	6	6 000	13 200	1 000	700	850
12,5	23,5	773	977	–	5	5 850	16 600	1 330	700	850
12,5	23,5	778	1 062	1 013	6	7 100	15 300	1 170	670	800
12,5	23,5	823	1 037	–	5	6 100	17 300	1 350	630	750
12,5	23,5	828	1 120	1 071	6	7 500	16 600	1 250	630	750
12,5	23,5	873	1 097	–	5	6 300	18 000	1 400	600	700
12,5	23,5	878	1 192	1 136	6	8 300	18 600	1 700	600	700
12,5	23,5	923	1 157	–	5	7 100	20 400	1 920	560	670
12,5	23,5	928	1 252	1 191	6	8 300	19 300	1 740	560	670
12,5	23,5	978	1 222	–	6	8 150	24 000	2 190	530	630
12,5	23,5	978	1 332	1 261	6	9 500	22 400	1 950	530	630
12,5	23,5	1 028	1 292	–	6	9 000	26 500	2 390	500	600
12,5	23,5	1 028	1 392	1 322	6	10 400	25 000	2 130	500	600
12,5	23,5	1 088	1 372	–	6	10 400	30 000	2 600	480	560
12,5	23,5	1 094	1 466	1 397	8	11 400	27 500	2 320	480	560
12,5	23,5	1 148	1 432	–	6	10 400	31 000	2 650	450	530
12,5	23,5	1 154	1 546	1 473	8	12 200	30 000	2 030	450	530
12,5	23,5	1 208	1 512	–	6	12 200	37 500	3 200	430	500
12,5	23,5	1 214	1 626	1 548	8	13 400	32 500	2 650	430	500
12,5	23,5	1 284	1 596	–	8	13 700	41 500	2 850	400	480
12,5	23,5	1 634	2 026	–	8	18 300	61 000	4 800	320	380
20	41	1 750	2 310	2 191	12	23 200	64 000	3 850	300	360

FAG



Four-row cylindrical roller bearings with cage

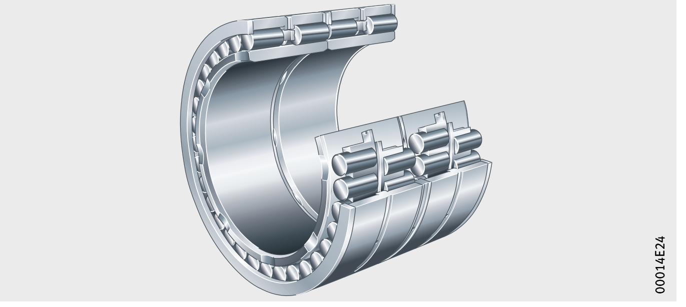
Four-row cylindrical roller bearings with cage

Four-row cylindrical roller bearings with cage

Non-locating bearings

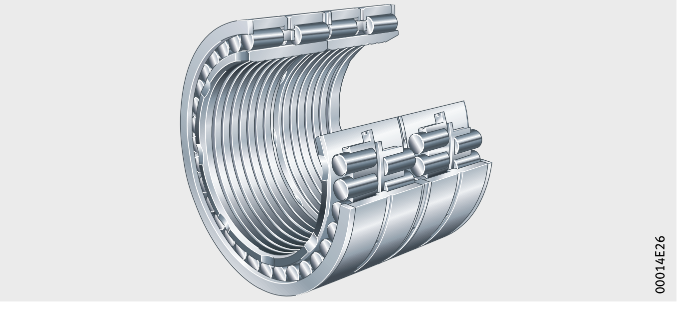
With cylindrical bore for tight fit

Z-5..ZL4-01, F-8..ZL4-01



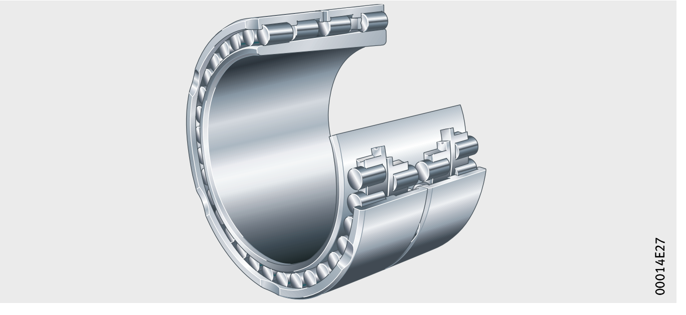
With cylindrical bore for loose fit

Z-5..ZL4-02, F-8..ZL4-02



With tapered bore

Z-5..ZL4-03, F-8..ZL4-03



Four-row cylindrical roller bearings with cage

Features

Four-row cylindrical roller bearings comprise solid bearing rings and cylindrical roller and cage assemblies with solid cages.
The bearings are suitable for very high radial loads and high speeds and are used principally in rolling mills and roller presses.
Four-row cylindrical roller bearings are separable and are therefore easy to mount and dismount.

Four-row cylindrical roller bearings with cylindrical bore

Bearings with a cylindrical bore are available in special designs with non-standardised main dimensions and designations.
The design selected will depend on the type of application.

Bearings for tight fit on the roll journal

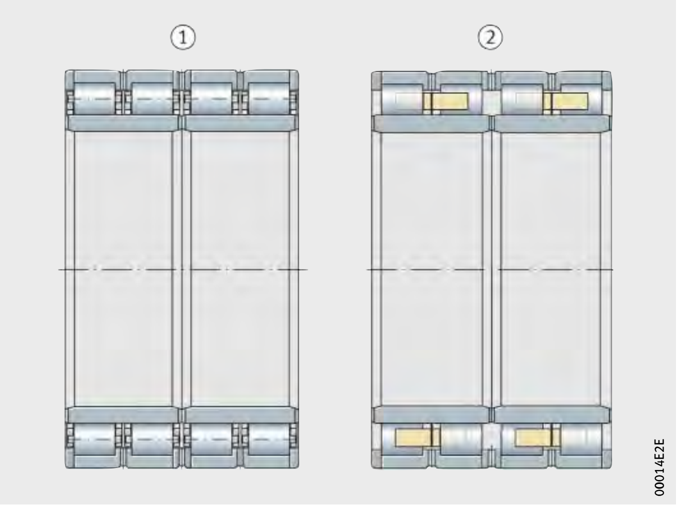
Four-row cylindrical roller bearings are generally designed such that they have a tight fit on the roll journal. In these bearings, the inner rings and outer rings are of the same width, *Figure 1* and *Figure 2*, page 418.

Design 1

- Two outer rings each with one rigid central rib, one intermediate ring, two loose rib washers, two ribless inner rings
- Lubrication groove and lubrication holes in the outer rings and in the intermediate ring, lubrication grooves in the end faces of the inner rings
- One steel pin cage per row of rollers.

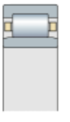
Design 2

- Two outer rings each with one rigid central rib, one intermediate ring, two loose rib washers, two ribless inner rings
- Lubrication groove and lubrication holes in the outer rings and in the intermediate ring, lubrication grooves in the end faces of the inner rings
- Brass or steel solid cages.



1 Design 1
2 Design 2

Figure 1
Four-row cylindrical roller bearings for tight fit



Four-row cylindrical roller bearings with cage

Design 3

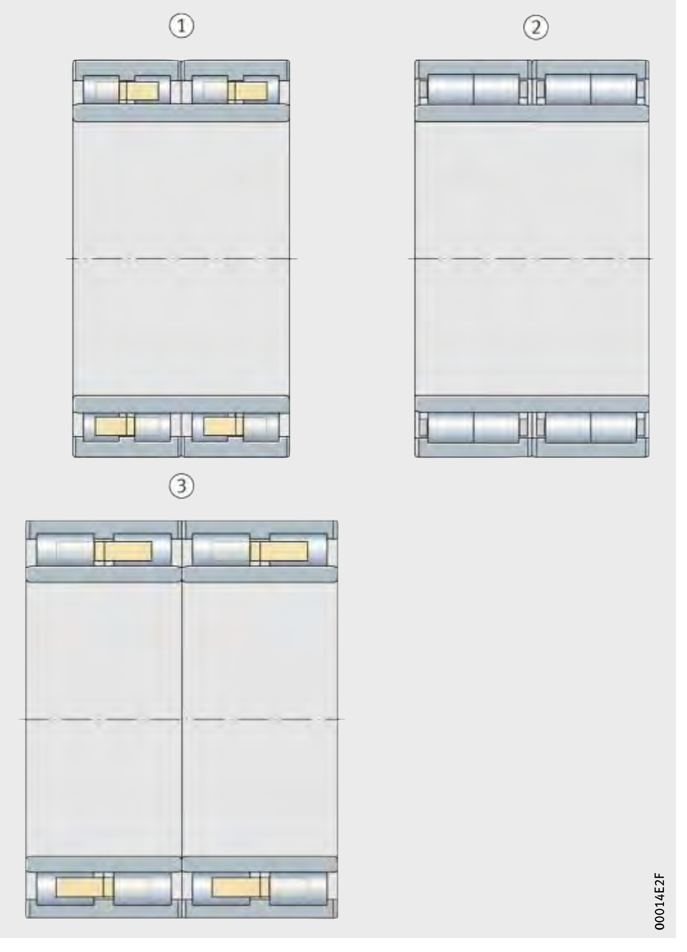
- Two outer rings each with three rigid ribs, ribless single-piece inner ring
- Lubrication grooves in the end faces of the outer rings
- Brass or steel solid cages.

Design 4

- Two outer rings each with three rigid ribs, ribless single-piece inner ring
- Lubrication grooves in the end faces of the outer rings
- Brass or steel solid cages for each two rows of rollers.

Design 5

- Two outer rings each with three rigid ribs, two ribless inner rings
- Lubrication grooves in the end faces of the outer rings
- Brass or steel solid cages.



1 Design 3
2 Design 4
3 Design 5

Figure 2
Four-row cylindrical roller bearings for tight fit (continued)

Bearings for loose fit on the roll journal

In Designs 6 to 10 for loose fit, the inner rings are wider than the outer rings. Due to the clearance betwen the inner ring and the journal, heating and wear of the journal occurs, so it is important to achieve good lubrication of the fit joint.
The radial grooves in the lateral faces of the inner rings are intended to achieve this objective.

In Designs 6 to 8 and 10, lubrication of the journal is improved by the helical groove in the inner ring bore. The inner rings are made from case hardening steel, the radial internal clearance C2 is smaller than normal, *Figure 3* and *Figure 4*, page 420.

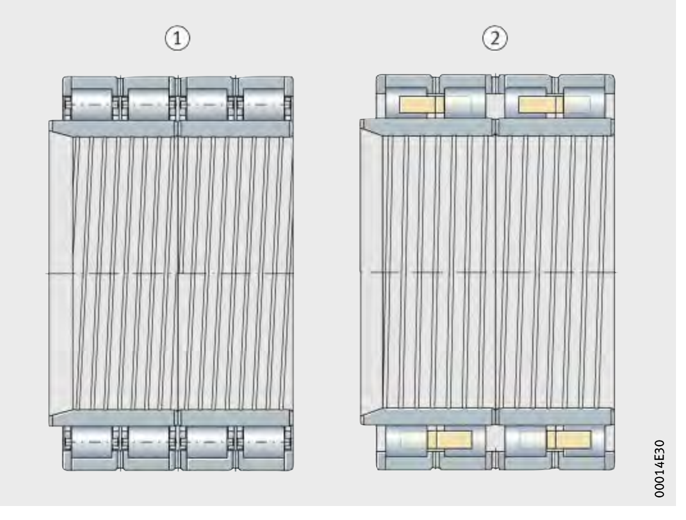
The bearings for a loose fit do not achieve the same high speeds as the bearings for a tight fit on the roll journal, *Figure 1*, page 417 and *Figure 2*, page 418.

Design 6

- Two outer rings each with one rigid central rib, one intermediate ring, two loose rib washers, two ribless inner rings
- Lubrication groove and lubrication holes in the outer rings and in the intermediate ring, lubrication grooves in the end faces of the inner rings
- One steel pin cage per row of rollers.

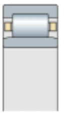
Design 7

- Two outer rings each with one rigid central rib, one intermediate ring, two loose rib washers
- Two ribless inner rings, lubrication groove and lubrication holes in the outer rings and in the intermediate ring, lubrication grooves in the end faces of the inner rings
- Brass or steel solid cages.



1 Design 6
2 Design 7

Figure 3
Four-row cylindrical roller bearings for loose fit



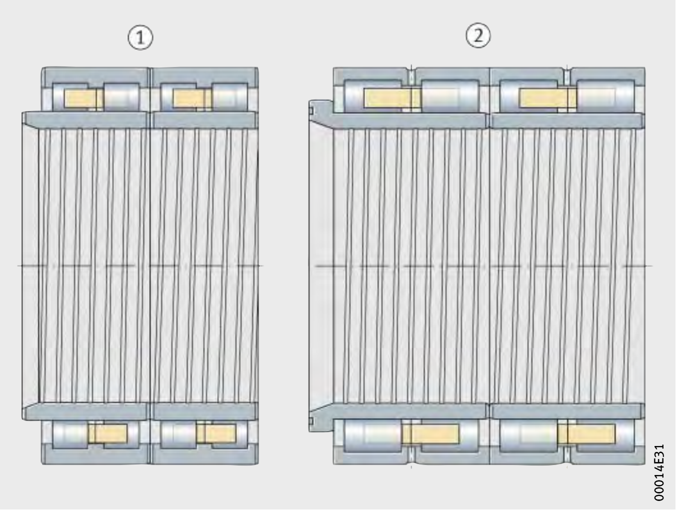
Four-row cylindrical roller bearings with cage

Design 8

- Two outer rings each with three rigid ribs, two ribless inner rings
- Lubrication grooves in the end faces of the inner and outer rings
- Brass or steel solid cages.

Design 9

- Two outer rings each with three rigid ribs, two ribless inner rings
- Lubrication groove and lubrication holes in the outer rings, lubrication grooves in the end faces of the inner rings
- Brass or steel solid cages.



1 Design 8
2 Design 9

Figure 4
Four-row cylindrical roller bearings for loose fit (continued)

Four-row cylindrical roller bearings with tapered bore

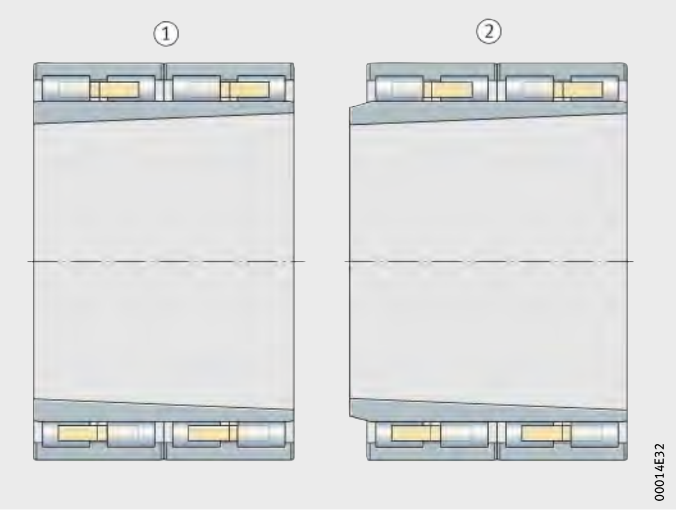
Four-row cylindrical roller bearings with tapered bore (taper 1:12) are frequently used as a replacement for oil film bearings.
In these bearings, the radial internal clearance or preload can be set to an optimum value. The ribless inner ring is of a single-piece design, *Figure 5* and *Figure 6*, page 422.

Design 10

- Two outer rings each with three rigid ribs
- Lubrication grooves in the end faces of the outer rings
- Brass or steel solid cages.

Design 11

- Two outer rings each with three rigid ribs
- Lubrication grooves in the end faces of the outer rings
- Brass or steel solid cages.



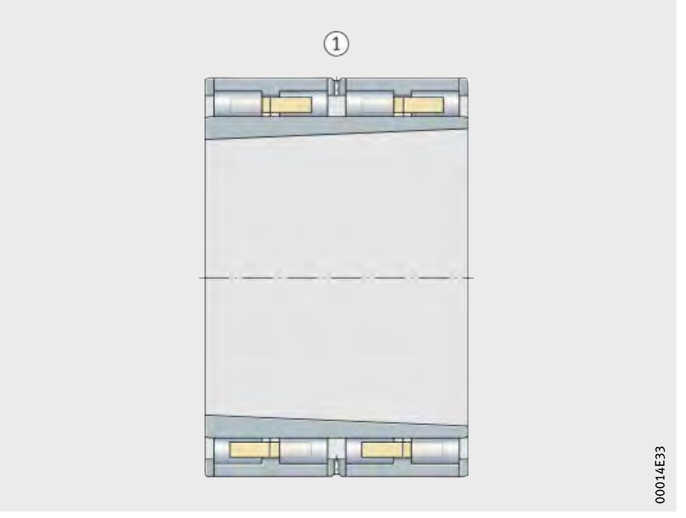
1 Design 10
2 Design 11

Figure 5
Four-row cylindrical roller bearings with tapered bore

Four-row cylindrical roller bearings with cage

Design 12

- Two outer rings each with one rigid central rib, one intermediate ring, two loose rib washers
- Lubrication groove and lubrication holes in the intermediate ring
- Brass or steel solid cages.



① Design 12

Figure 6
Four-row cylindrical roller bearing with tapered bore (continued)

Non-locating bearings

All the four-row cylindrical roller bearings described here are non-locating bearings and can support radial forces only. High axial forces are supported by using, for example, axial tapered roller bearings, axial spherical roller bearings or double row tapered roller bearings with a large contact angle. Angular contact ball bearings and deep groove ball bearings are used as axial bearings where small axial forces are present.

Sealing

Four-row cylindrical roller bearings are supplied without seals.

Lubricant

The lubricant should be supplied at two points. Many bearings have lubrication grooves and lubrication holes in the outer ring.
In other bearings, there are radial lubrication grooves in the end faces of the outer rings.

Operating temperature

The four-row cylindrical roller bearings can be used at operating temperatures from –30 °C to +150 °C.

! For continuous operation above +120 °C, please contact us.

Cages

In four-row cylindrical roller bearings for high rolling speeds, roller-guided solid cages made from brass or steel are used. These are used, for example, for work rolls in four-high stands and in small section and wire rolling lines.

Pin cages allow the use of a large number of through-drilled rollers and thus very high load carrying capacity. Their particular strength is important in the case of bearings in large stands that are subjected to strong acceleration and deceleration, for example in reversing type operation. This design is also used for the backup rolls in four-high stands.

Suffixes

The design of the four-row cylindrical roller bearings (for example radial internal clearance, accuracy, cage) is specified in the designation (Z-5..ZL or F-8..ZL). Please contact us for relevant information.

Where there are deviations from the original design, suffixes are used, for an example see the following table:

Available designs

Suffix	Description	Design
C4	Radial internal clearance larger than C3	Special design, available by agreement only
N12BA	Two double row cylindrical roller bearings in matched sets (when ordering, state double the quantity)	

Four-row cylindrical roller bearings with cage

Design and safety guidelines

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\ min} = C_{0r}/60$ is necessary.

If $F_{r\ min} < C_{0r}/60$, please contact us.

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

$$P = F_r$$

P kN
Equivalent dynamic bearing load

F_r kN
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0 kN
Equivalent static bearing load

F_{0r} kN
Radial static bearing load.

Design of bearing arrangements

Tolerances of the roll journal

The tolerance of the roll journal depends on whether the bearing should have a tight fit or loose fit.

For four-row cylindrical roller bearings that should have a tight fit on the roll journal, we recommend the values in the following table:

Bearing bore and journal tolerance

Nominal bearing bore d mm	Journal tolerance mm
< 200	n6
200 – 400	p6/r6
> 400 – 630	+0,200 – +0,260
> 630 – 800	+0,250 – +0,330
> 800 – 1 250	+0,320 – +0,420
> 1 250 – 1 400	+0,400 – +0,550
> 1 400 – 1 600	+0,520 – +0,650

Where the bearing inner ring has a loose fit, the roll journal should have a tolerance to e7.

For bearings with a tapered bore and at high speeds, please contact us to discuss tolerances.

Tolerances for the chock

We recommend the following tolerances for the bore of the chock:

- H6 for $D \leqq 800$ mm
- H7 for $D > 800$ mm.

For bearings with a tapered bore, please contact us to discuss the tolerances for the adjacent parts.

Accuracy

The dimensional and running accuracy of the four-row cylindrical roller bearings of the basic design correspond to tolerance class PN to DIN 620.

Radial internal clearance of cylindrical roller bearings with cylindrical bore

Four-row cylindrical roller bearings with a cylindrical bore have, in most cases, a radial internal clearance to C3 or C4 to DIN 620-4.

Bearings for a loose fit on the roll journal are, however, normally supplied with an internal clearance C2.

Radial internal clearance (cylindrical bore)

Bore d mm		Radial internal clearance							
		C2 µm		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
200	225	45	105	105	165	160	220	220	280
225	250	45	110	110	175	170	235	235	300
250	280	55	125	125	195	190	260	260	330
280	315	55	130	130	205	200	275	275	350
315	355	65	145	145	225	225	305	305	385
355	400	100	190	190	280	280	370	370	460
400	450	110	210	210	310	310	410	410	510
450	500	110	220	220	330	330	440	440	550
500	560	120	240	240	360	360	480	480	600
560	630	140	260	260	380	380	500	500	620
630	710	145	285	285	425	425	565	565	705
710	800	150	310	310	470	470	630	630	790
800	900	180	350	350	520	520	690	690	860
900	1000	200	390	390	580	580	770	770	960
1000	1120	220	430	430	640	640	850	850	1060
1120	1250	230	470	470	710	710	950	950	1190
1250	1400	270	530	530	790	790	1050	1050	1310
1400	1600	330	610	610	890	890	1170	1170	1450

Radial internal clearance of cylindrical roller bearings with tapered bore

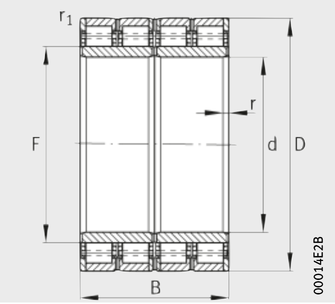
Four-row cylindrical roller bearings with a tapered bore are normally supplied with an internal clearance C3 or C4 to DIN 620-4.

Radial internal clearance (tapered bore)

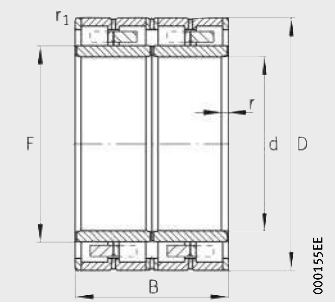
Bore d mm		Radial internal clearance					
		CN µm		C3 µm		C4 µm	
over	incl.	min.	max.	min.	max.	min.	max.
225	250	170	235	220	285	270	335
250	280	185	255	240	310	295	365
280	315	205	280	265	340	325	400
315	355	225	305	290	370	355	435
355	400	255	345	330	420	405	495
400	450	285	385	370	470	455	555
450	500	315	425	410	520	505	615

Cylindrical roller bearings

Four-row,
with cylindrical bore,
for tight fit on roll journals



Design 1
With pin cage

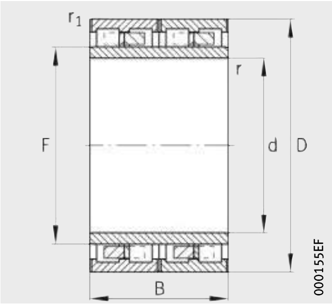


Design 2
With solid brass cage

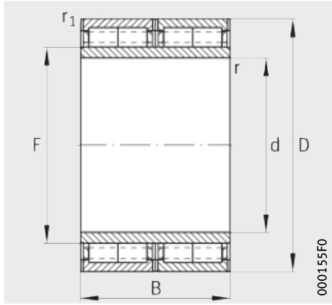
Dimension table · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	B	F
Z-509216.ZL	5	59	**220**	320	210	246
Z-541452.ZL	3	67,6	**220**	330	230	249
Z-525147.ZL	2	95,4	**220**	340	290	250
Z-508727.02.ZL	3[1)]	57,8	**230**	330	206	260
Z-504547.ZL	4	46,9	**240**	330	180	265
Z-508368.ZL	3	57,4	**240**	330	220	270
Z-512972.ZL	4	59,9	**240**	340	200	266
Z-513703.ZL	3	63,4	**240**	340	220	268
Z-514959.ZL	2	101	**240**	360	290	270
Z-522310.ZL	3[3)]	59,7	**250**	340	230	276
Z-533880.ZL	3	72,6	**260**	360	230	292,2
Z-507336.02.ZL	3	76,4	**260**	370	220	292
Z-507336.ZL	3	76,4	**260**	370	220	292
Z-518214.ZL	2	134	**260**	400	290	296
Z-521065.ZL	2	151	**260**	400	335	294
Z-517423.ZL	3	80,4	**265**	370	234	300
Z-536134.ZL	3	114	**275**	400	285	308
Z-507339.ZL	3[1)]	81,5	**280**	390	220	312
Z-507339.02.ZL	3[1)]	81,7	**280**	390	220	312
Z-513729.01.ZL	3[3)]	101	**280**	390	275	312
Z-527104.ZL	2	99,9	**280**	390	275	308
Z-513342.ZL-N12BA	5[2)]	57,1	**280**	400	286	316
Z-510350.ZL-N12BA-C4	5[2)]	66,2	**280**	410	300	313
Z-517796.ZL	3	164	**290**	440	310	328
Z-524289.02.ZL	2	130	**300**	420	300	332
Z-517795.ZL	1	233	**300**	460	350	341
Z-574469.ZL	3	115	**310**	440	240	345
Z-532220.ZL	1	161	**320**	440	340	350
F-804571.ZL	4	138	**320**	460	240	364
Z-532592.ZL	3	196	**320**	470	350	357
Z-532583.ZL	1	193	**320**	470	350	357
Z-541851.ZL	2	219	**320**	480	350	364
Z-513654.01.ZL	1	225	**320**	480	350	364

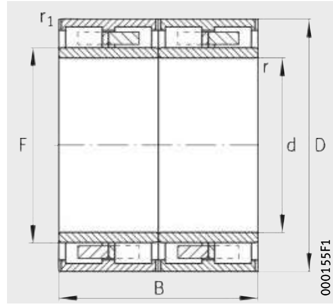
1) Steel double comb cage.
2) Two double row bearings mounted in a set with a circumferential lubrication groove and lubrication holes in the outer rings.
3) Circumferential lubrication groove and lubrication holes in the outer rings.



Design 3
With solid brass cage



Design 4
With solid brass cage

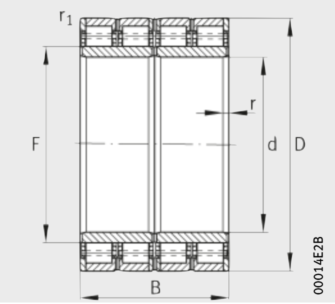


Design 5
With solid brass cage

		Basic load ratings		Fatigue limit load
r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
2,1	2,1	2 450	4 300	480
3	3	2 360	3 900	420
3	3	3 250	5 400	590
2	2	2 160	3 900	420
2,1	2,1	2 040	3 900	415
2	2	2 080	4 250	460
3	3	2 500	4 500	490
3	3	2 400	4 250	460
12,5X30°	1,2	3 450	6 000	640
2,1	2,1	2 120	4 050	435
4	4	2 500	5 000	520
3	3	2 200	4 050	430
3	3	2 200	4 050	430
4	4	4 000	6 800	710
4	1,5	4 300	7 200	760
2,1	2,1	2 500	5 100	530
4	2,5	3 750	6 800	325
3	3	2 280	4 300	450
3	3	2 400	4 550	480
2,1	2,1	3 150	6 400	670
3	2	3 600	6 800	700
4	4	2 500	6 300	560
4	4	2 850	6 900	620
4	4	4 250	6 950	700
7X20°	1,5	4 150	8 000	810
4	2,5	5 500	9 650	960
3	3	3 250	5 700	580
4	1,5	5 000	10 400	1 050
3	3	3 750	7 200	710
5	–	5 200	9 300	930
5	–	5 850	10 800	1 080
4	1,5	5 600	9 800	980
12X20°	1,5	5 850	10 800	1 070

Cylindrical roller bearings

Four-row, with cylindrical bore,
for tight fit on roll journals

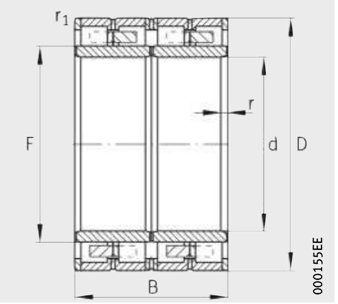


Design 1
With pin cage

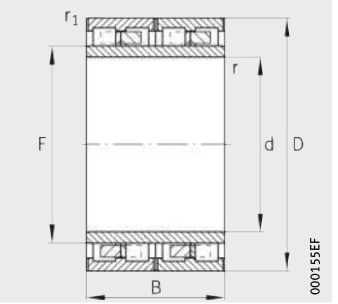
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	B	F
		≈kg				
Z-543447.ZL	2	174	**330**	460	340	365
Z-521593.01.ZL	1	176	**330**	460	340	365
Z-527634.ZL	2	205	**340**	480	350	378
Z-525837.01.ZL	1	209	**340**	480	350	378
Z-541185.ZL	1	203	**340**	480	350	378
Z-517794.ZL	1	253	**340**	500	370	385
Z-545171.ZL	1	379	**340**	560	380	396
Z-532381.ZL-N12BA	5[1)]	122	**350**	500	380	389
Z-532001.ZL	1	268	**350**	500	410	388
Z-568450.ZL	2	220	**350**	520	300	401
Z-562913.ZL	2	264	**360**	520	380	405
Z-517793.01.ZL	1	274	**360**	520	380	405
Z-543975.ZL	2	250	**370**	520	380	409
Z-524678.01.ZL	1	251	**370**	520	380	409
Z-541192.ZL	1	261	**370**	520	380	409
Z-576360.ZL	3[2)]	182	**380**	520	290	418
Z-541982.ZL	2	217	**380**	540	300	421
Z-545768.ZL	1	221	**380**	540	300	421
Z-544794.ZL	2	298	**380**	540	400	422
Z-517792.ZL	1	303	**380**	540	400	422
Z-578278.ZL	1	224	**390**	540	320	431
Z-533426.ZL	1	254	**400**	540	380	436
Z-513769.01.ZL	1	321	**400**	560	410	445
Z-542395.ZL	2	408	**400**	590	440	450
Z-513770.ZL	1	421	**400**	590	440	450
Z-543736.ZL	2	280	**410**	560	400	450
Z-561005.ZL	1	293	**410**	560	400	450
Z-517436.ZL	1	435	**410**	600	440	460
Z-533053.ZL-N12BA	5[1)]	128	**420**	580	320	463
Z-545467.ZL	2	409	**420**	600	440	470
Z-517464.ZL	1	414	**420**	600	440	470
Z-526415.ZL	1	243	**430**	570	340	465
Z-543174.ZL	1	386	**433**	600	435	478

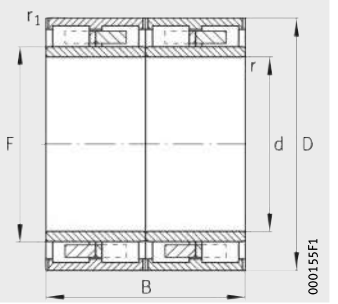
1) Two double row bearings mounted in a set with a circumferential lubrication groove and lubrication holes in the outer rings.
2) Circumferential lubrication groove and lubrication holes in the outer rings.



Design 2
With solid brass cage



Design 3
With solid brass cage

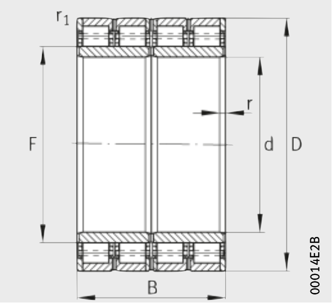


Design 5
With solid brass cage

		Basic load ratings		Fatigue limit load
r	r_1	dyn. C_r	stat. C_{0r}	C_{ur}
min.	min.	kN	kN	kN
10,5X20°	1,5	4 650	9 500	950
4	2	5 100	10 800	1 070
10X20°	1,5	5 300	11 000	1 100
10X20°	1,5	5 700	12 000	1 200
5	1,5	5 700	12 000	1 200
6	3	6 400	12 500	1 220
4	1,5	7 650	12 200	1 150
5	5	4 200	11 200	940
5	2	7 100	14 300	1 410
5	5	5 100	8 800	830
13,5X20°	2	6 200	12 200	1 190
13,5X20°	2	6 550	13 200	1 270
10X20°	1,5	6 200	12 200	1 190
10X20°	1,5	6 400	12 900	1 250
10X20°	1,5	6 400	12 900	1 250
4	4	4 500	9 000	850
3	1	5 100	9 150	840
8,5X20°	2	5 850	10 800	1 010
5	2	6 700	13 400	1 300
5	2	7 100	15 000	1 430
10X20°	3	5 500	11 000	1 100
5	2	6 400	14 000	1 330
12X20°	2	7 800	16 600	1 590
4	4	8 300	16 000	1 490
4	4	9 150	17 600	1 670
11X20°	2	6 950	14 600	1 380
11X20°	2	7 650	16 600	1 550
13X20°	1,6	9 300	18 600	1 740
4	4	3 900	10 400	830
14X20°	1,6	8 150	17 000	1 550
14X20°	1,6	8 800	19 000	1 760
5	2	6 000	12 700	1 170
14X30°	2	9 150	19 600	1 810

Cylindrical roller bearings

Four-row, with cylindrical bore,
for tight fit on roll journals

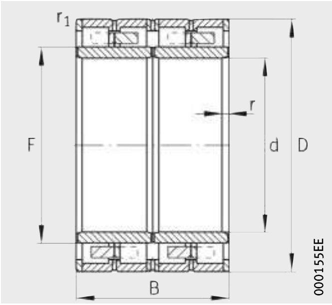


Design 1
With pin cage

Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	B	F
		≈kg				
Z-545628.ZL	2	427	**440**	620	450	487
Z-517454.01.ZL	1	434	**440**	620	450	487
Z-560371.ZL	1	479	**447,295**	635,176	464	495
Z-542648.ZL	1	311	**450**	590	435	486
Z-529095.ZL	2	1 140	**459,95**	760	600	535
Z-541756.ZL	1	375	**460**	650	355	509,5
Z-513584.01.ZL	1	446	**460**	650	424	510
Z-518846.ZL	1	498	**460**	650	470	509
Z-547660.ZL	2	429	**480**	650	450	525
Z-547659.ZL	1	437	**480**	650	450	525
Z-533522.ZL	1	500	**480**	680	420	528
Z-514445.02.ZL	1	582	**480**	680	500	532
Z-546152.ZL	1	656	**480**	700	500	534
Z-523399.ZL	2	691	**480**	700	530	536
Z-533023.ZL	1	464	**500**	670	450	556
Z-546335.ZL	1	479	**500**	680	450	550
Z-517692.ZL	1	612	**500**	700	500	554
Z-530488.ZL	1	640	**500**	710	480	558
Z-513378.01.ZL	1	735	**500**	720	530	568
Z-567725.01.ZL	1[1)]	513	**510**	680	500	560
Z-541646.ZL	1	728	**510**	730	520	565
Z-517690.ZL	1	892	**510**	760	550	570
Z-541647.ZL	1	785	**520**	750	530	576
Z-537383.ZL	2	740	**530**	760	520	587
Z-531597.ZL	1	797	**530**	760	520	587
Z-517689.01.ZL	1	946	**530**	780	570	601
Z-543481.ZL	1	1 650	**530**	870	670	615
Z-524544.01.ZL	1	849	**536,176**	762,03	559	598
Z-560507.ZL	2	815	**536,176**	762,03	559	598
Z-532843.ZL	1	639	**550**	740	510	600
Z-517688.ZL	1	974	**550**	800	560	610
Z-517687.01.ZL	1	1 100	**560**	820	600	625
Z-514444.ZL	1	1 020	**571,1**	812,97	594	636

1) Bearing with four inner rings.

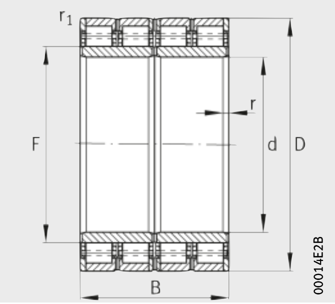


Design 2
With solid brass cage

		Basic load ratings		Fatigue limit load
r	r_1	dyn. C_r	stat. C_{0r}	C_{ur}
min.	min.	kN	kN	kN
12X20°	3	8 800	18 000	1 650
12X20°	3	9 500	20 000	1 820
5	3	10 000	20 400	1 880
5	2	8 150	19 000	1 760
5	4,5	16 000	29 000	2 550
12X20°	3	7 350	14 300	1 270
6	3	9 000	18 300	1 660
14X20°	2,5	10 400	22 000	2 000
15X20°	3	9 000	19 600	1 750
15X20°	3	9 800	22 000	1 970
15X20°	3	9 800	19 300	1 730
15X20°	2,5	11 600	24 000	2 170
6	4	12 200	23 600	2 110
6	6	11 200	22 800	2 060
15X20°	4	9 000	22 800	2 050
5	2	10 200	22 800	2 010
6	3	11 600	25 000	2 240
18X20°	5	11 200	23 200	2 080
17X20°	3	12 700	27 500	2 450
7,5	3	10 400	25 500	2 300
6	3	13 400	28 000	2 470
16X20°	3	14 600	28 000	2 430
6	3	13 700	28 000	2 450
8	3	12 000	24 000	2 080
12X20°	6	13 700	29 000	2 550
15X20°	2,5	14 600	30 500	2 650
7,5	5	21 200	38 000	3 200
18X20°	3	13 400	30 000	2 650
5	2	14 600	31 500	2 750
15X20°	2	12 200	28 500	2 490
18,5X20°	4	15 000	30 500	2 600
20X20°	4	16 300	33 500	2 850
14X20°	4	16 000	35 500	3 000

Cylindrical roller bearings

Four-row, with cylindrical bore,
for tight fit on roll journals

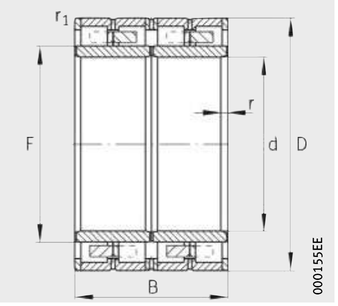


Design 1
With pin cage

Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	B	F
		≈kg				
Z-517685.ZL	1	1 260	**580**	850	640	648
Z-526413.ZL	2	605	**585**	770	480	630
Z-518780.ZL	1	886	**600**	820	550	660
Z-528518.ZL	1	936	**600**	820	575	660
Z-533259.ZL	1	1 110	**600**	870	540	672
Z-517684.01.ZL	1	1 310	**600**	870	640	672
Z-561221.ZL	1	1 400	**628**	922	600	702
Z-515141.ZL	1	1 430	**634,5**	901,87	674	705
Z-515194.01.ZL	1	1 470	**650**	920	670	723
Z-533258.ZL	1	827	**670**	870	530	725
Z-517682.ZL	1	1 610	**670**	950	690	740
Z-533683.ZL	1	1 290	**680**	940	600	743
Z-524229.ZL	1	1 640	**680**	980	640	760
Z-517681.ZL	1	1 800	**690**	980	715	767,5
Z-530487.ZL	1	1 210	**700**	930	620	763
Z-517680.01.ZL	1	1 820	**710**	1 000	715	787,5
Z-522815.ZL	1	2 220	**725**	1 040	750	809
Z-525438.ZL	1	1 220	**730**	960	620	790
Z-517679.ZL	1	2 040	**730**	1 030	750	809
Z-524881.01.ZL	1	1 500	**750**	1 000	670	813
F-800494.ZL	1	1 970	**750**	1 090	615	836
Z-524238.01.ZL	1	2 360	**761,425**	1 079,6	787	846
Z-540088.ZL	1	2 170	**780**	1 070	780	853
Z-517678.ZL	1	2 600	**790**	1 120	810	875
Z-526169.ZL	1	1 920	**800**	1 080	700	878
Z-524137.ZL	1	2 950	**800**	1 150	850	888
F-803317.ZL	1	2 480	**820**	1 130	800	903
Z-567729.ZL	1	1 720	**830**	1 080	710	896
Z-545636.ZL	1	2 580	**850**	1 150	840	928
Z-523397.ZL	1	3 570	**850**	1 220	900	960
Z-529054.ZL	1	1 900	**860**	1 131,57	670	940
Z-524239.01.ZL	1	3 480	**863**	1 219,302	889[1)]	956
Z-566883.ZL	1	2 460	**865**	1 180	750	945,3
Z-523419.ZL	1	2 950	**870**	1 180	880	950

[1)] Inner ring width 873,3 mm.

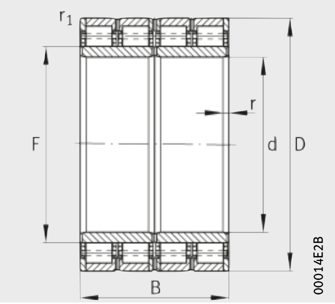


Design 2
With solid brass cage

		Basic load ratings		Fatigue limit load
r	r_1	dyn. C_r	stat. C_{0r}	C_{ur}
min.	min.	kN	kN	kN
20X20°	4	18 000	38 000	3 200
5	2,5	11 600	27 000	2 340
6	3	14 000	33 500	2 800
15X20°	3	15 000	35 500	3 050
22X20°	4	15 300	31 000	2 550
20X20°	3	18 300	40 000	3 300
18X20°	6	19 000	38 000	3 050
20X15°	3	20 400	45 000	3 700
18X20°	4	20 800	46 500	3 800
6	3	13 700	34 500	2 900
18X20°	4	22 400	50 000	4 000
7,5	4	19 000	42 500	3 400
20X20°	4	21 200	45 000	3 550
20X20°	4	22 800	52 000	4 150
18X20°	3	17 000	44 000	3 650
22X20°	4	23 200	53 000	4 250
7,5	3	25 500	58 500	4 600
20X20°	3	17 600	45 000	3 650
20X20°	6	25 500	58 500	4 600
20X20°	3	20 400	50 000	4 000
7,5	7,5	21 600	43 000	3 300
22X20°	5	28 000	63 000	4 900
7,5	5	26 500	64 000	5 100
7,5	4	30 000	69 500	5 400
25X20°	3	22 800	58 500	4 500
9,5	9,5	31 000	69 500	5 300
7,5	7,5	27 000	67 000	4 900
20X20°	2,5	22 800	61 000	4 750
23X20°	4	30 500	76 500	5 800
23X20°	5	36 000	85 000	6 400
7,5	4	23 200	60 000	6 400
13X20°	5	34 500	85 000	6 400
20X20°	8,5	27 500	64 000	4 900
8	8	32 000	81 500	6 100

Cylindrical roller bearings

Four-row, with cylindrical bore,
for tight fit on roll journals



Design 1
With pin cage

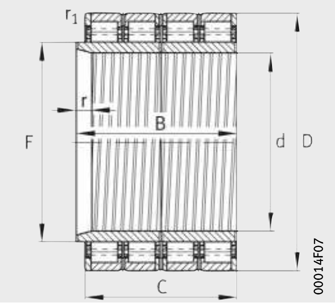
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	B	F
		≈kg				
Z-527048.ZL	1	2 950	**900**	1 220	840	989
Z-541812.ZL	1	3 950	**900**	1 280	930	1 000
Z-527977.ZL	1	3 130	**937,5**	1 270,25	826	1 027
Z-517676.ZL	1	4 380	**940**	1 320	1 000	1 029
Z-517369.01.ZL	1	5 030	**950**	1 360	1 000	1 075
Z-580309.ZL	1	3 450	**980**	1 310	880	1 061,7
Z-517740.ZL	1	4 670	**980**	1 360	1 000	1 080
Z-522071.ZL	1	3 270	**990**	1 360	760	1 080
Z-527021.ZL	1	3 520	**1 000**	1 360	800	1 101
Z-517675.ZL	1	5 070	**1 040**	1 440	1 000	1 133
Z-521910.ZL	1	3 010	**1 060**	1 360	800	1 137
Z-517737.ZL	1	5 300	**1 100**	1 500	1 000	1 194
Z-518206.ZL	1	3 620	**1 150**	1 500	760	1 240
Z-518649.ZL	1	5 790	**1 200**	1 590	1 050	1 305
Z-518578.ZL	1	7 010	**1 200**	1 620	1 150	1 305
Z-528717.ZL	1	9 470	**1 400**	1 900	1 150	1 520
Z-534900.ZL	1	9 880	**1 500**	1 950	1 230	1 610

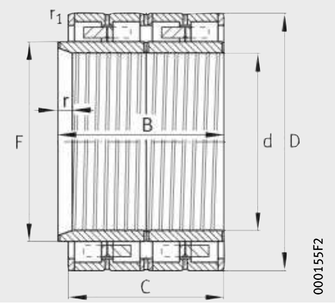
		Basic load ratings		Fatigue limit load
r	r_1	dyn. C_r	stat. C_{0r}	C_{ur}
min.	min.	kN	kN	kN
24X20°	4	31 500	80 000	6 000
6	3	36 500	85 000	6 300
25X20°	4	32 000	80 000	5 900
7,5	4	41 500	98 000	7 200
9,5	5	44 000	108 000	7 900
20X20°	6	35 500	93 000	6 900
25X20°	5	41 500	106 000	7 800
12	6	30 500	68 000	4 900
25X20°	3	34 000	83 000	6 000
20X20°	5	45 000	106 000	7 600
18X20°	5	32 500	91 500	6 500
7,5	4	46 500	114 000	8 000
20X20°	5	33 500	86 500	6 100
30X20°	6	47 500	129 000	8 900
9,5	9,5	56 000	146 000	10 200
40X20°	10	64 000	156 000	10 200
9,5	6	71 000	200 000	13 000

Cylindrical roller bearings

Four-row,
with cylindrical bore,
for loose fit on roll journals



Design 6
With pin cage

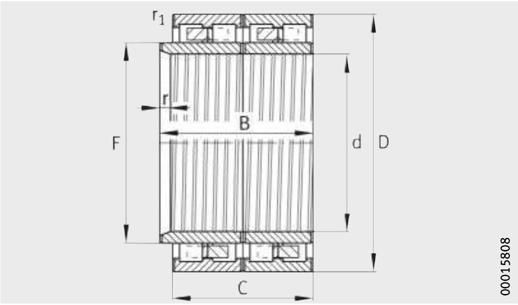


Design 7
With solid brass cage

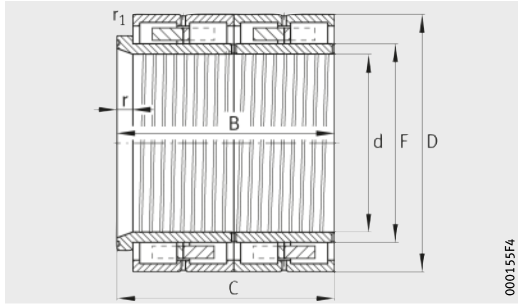
Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	B	C
		≈kg				
Z-580510.ZL	9[1,2]	100	**220**	340	320	290
F-801076.ZL	9	86,5	**250**	350	320	290
Z-536897.ZL	7[3]	79,4	**260**	370	240	220
Z-522009.ZL	8[4]	102	**270**	380	295	275
Z-533575.ZL	8	82,9	**280**	390	240	220
Z-532504.ZL	7	134	**300**	420	320	300
Z-580511.ZL	9[2]	160	**320**	440	370	340
Z-531839.ZL	7	211	**340**	480	370	350
Z-580512.ZL	9[2,4]	267	**340**	500	410	370
Z-538977.ZL	6[2]	246	**350**	500	400	380
F-801476.ZL	7	225	**350**	520	320	300
Z-533808.ZL	7	244	**360**	510	400	380
F-801082.ZL	9	258	**370**	520	410	380
Z-522007.ZL	6	290	**380**	540	400	380
Z-565463.ZL	7	286	**380**	540	400	380
Z-536713.ZL	6	306	**380**	540	420	400
F-803580.ZL	9[1,5]	232	**390**	540	350	320
Z-561270.ZL	7	280	**410**	560	420	400
Z-561269.ZL	6	293	**410**	560	420	400
Z-533022.ZL	6	245	**430**	570	360	340
Z-579578.ZL	6	398	**440**	620	430	410
Z-572891.ZL	6	434	**440**	620	450	450
Z-561271.ZL	7	428	**440**	620	470	450
Z-533578.ZL	6	438	**440**	620	470	450
F-808290.ZL	9[1,5]	444	**440**	620	485	450
Z-532465.ZL	6[2]	500	**460**	650	470	470
Z-536712.ZL	6[6]	513	**460**	650	490	470
Z-567014.ZL	6	526	**460**	680	410	410
Z-524081.ZL	6	322	**480**	620	420	400
Z-533487.ZL	6	439	**480**	650	450	450

1) With rib washers.
2) Chamfer distance instead of inner ring bevel.
3) Single-piece inner ring.
4) Circumferential lubrication groove and lubrication holes in the outer rings.
5) With pin cages.
6) Without helical groove in bearing bore.



Design 8
With solid brass cage

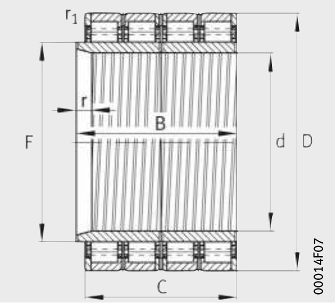


Design 9
With solid brass cage

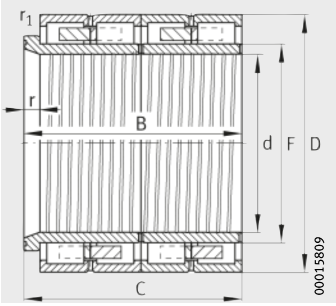
			Basic load ratings		Fatigue limit load
F	r	r_1	dyn. C_r	stat. C_{0r}	C_{ur}
	min.	min.	kN	kN	kN
250	3	2	3 550	5 850	640
277	28X20°	3	3 100	6 000	650
292	15X20°	2,5	2 200	4 050	430
300	15,5X15°	2,1	3 550	6 800	720
312	17X20°	3	2 280	4 300	450
332	15X20°	2	4 150	8 000	820
350	4	1,5	4 650	9 500	950
378	15X20°	1,5	5 300	11 000	1 100
385	6	3	5 850	11 200	1 110
388	6	3	6 550	13 200	1 280
401	28X20°	5	5 100	8 800	830
399	28X15°	2	6 100	11 800	1 150
409	30X20°	1,5	6 100	11 800	1 150
424	35X15°	1,5	6 700	13 700	1 300
422	20X20°	1,5	6 700	13 200	1 250
422	34X15°	2	7 100	15 000	1 430
431	10X20°	2	5 500	11 000	1 100
450	32X15°	2	6 700	13 700	1 300
450	30X15°	2	7 500	16 000	1 520
465	35X15°	5	6 200	13 200	1 230
487	12X20°	2	8 650	17 600	1 590
487	12X20°	3	9 500	20 000	1 820
487	32X20°	3	9 300	19 300	1 760
487	30X20°	3	9 500	20 000	1 820
487	44X10,3°	3	9 500	20 000	1 820
509	6	2,5	10 400	22 000	2 000
509	34X15°	2,5	10 400	22 000	2 000
516	14X20°	2,5	9 800	18 300	1 650
515	4	2	7 800	18 300	1 680
525	12,5X20°	3	9 800	22 000	1 970

Cylindrical roller bearings

Four-row,
with cylindrical bore,
for loose fit on roll journals



Design 6
With pin cage



Design 9
With solid brass cage

Dimension table (continued) · Dimensions in mm

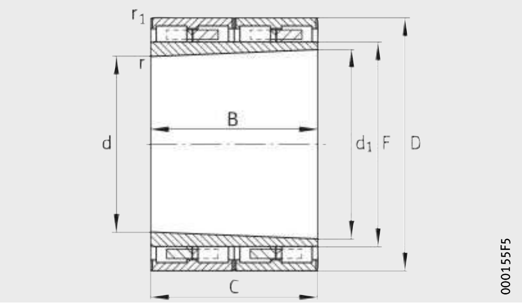
Designation	Design	Mass	Dimensions			
		m	d	D	B	C
		≈kg				
Z-540386.ZL	6	459	**500**	670	450	450
Z-564182.ZL	6	454	**500**	670	470	450
Z-579713.ZL	9[1)2)]	809	**530**	760	555	520
Z-566466.ZL	6	845	**536,176**	762,03	559	558,8
Z-579741.ZL	6	645	**550**	740	527	510
Z-532470.ZL	6[3)]	1 160	**570**	830	630	600
Z-572176.ZL	6	1 020	**571,1**	812,97	594	594
Z-565652.ZL	6	942	**600**	820	575	575
Z-572137.ZL	9	1 260	**600**	870	578	540

1) With pin cages.
2) With rib washers.
3) Without helical groove in bearing bore.

			Basic load ratings		Fatigue limit load
F	r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
540	13X20°	5	9 500	21 200	1 880
540	34X15°	4	9 500	21 600	1 900
587	45X12,5°	2,5	13 700	29 000	2 550
598	18X20°	4	13 400	30 000	2 650
600	15X20°	2	12 200	28 500	2 490
635	35X15°	4	16 600	34 500	2 950
636	15X20°	5	16 000	35 500	3 000
660	15X20°	3	15 000	35 500	3 050
672	53X12°	4	15 300	31 000	2 550

Cylindrical roller bearings

Four-row, with tapered bore
(taper 1:12)



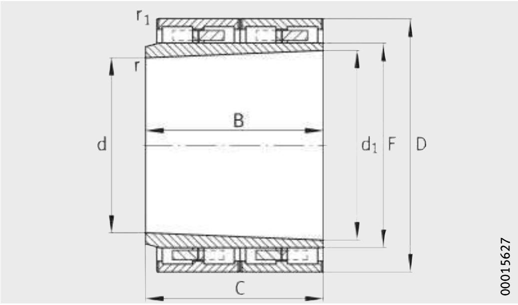
Design 10

Dimension table · Dimensions in mm						
Designation	Design	Mass	Dimensions			
		m	d	d_1	D	B
		≈kg				
Z-506743.01.ZL	10	57,1	**230**	248,333	330	220
Z-500857.01.ZL	11	58,8	**231**	249,333	330	220
Z-507518.ZL	10	121	**260**	283,75	400	285
Z-522518.01.ZL	10	109	**260**	280,833	400	250
Z-505356.ZL	12	211	**320**	349,167	480	350
Z-510302.01.ZL	12	328	**356,667**	390	550	400
Z-527181.ZL	10[1)2)]	580	**412,335**	453,002	650	488
Z-538221.ZL	10[2)3)]	382	**440**	469,583	650	355
Z-527388.ZL	12[3)]	806	**485**	530	740	540
Z-577938.ZL	12[3)]	803	**485**	530	740	540

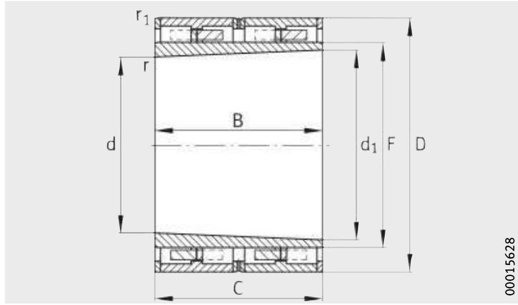
1) Circumferential lubrication groove and lubrication holes in the outer rings.

2) Without lubrication grooves in the end faces of the outer rings.

3) With pin cage.

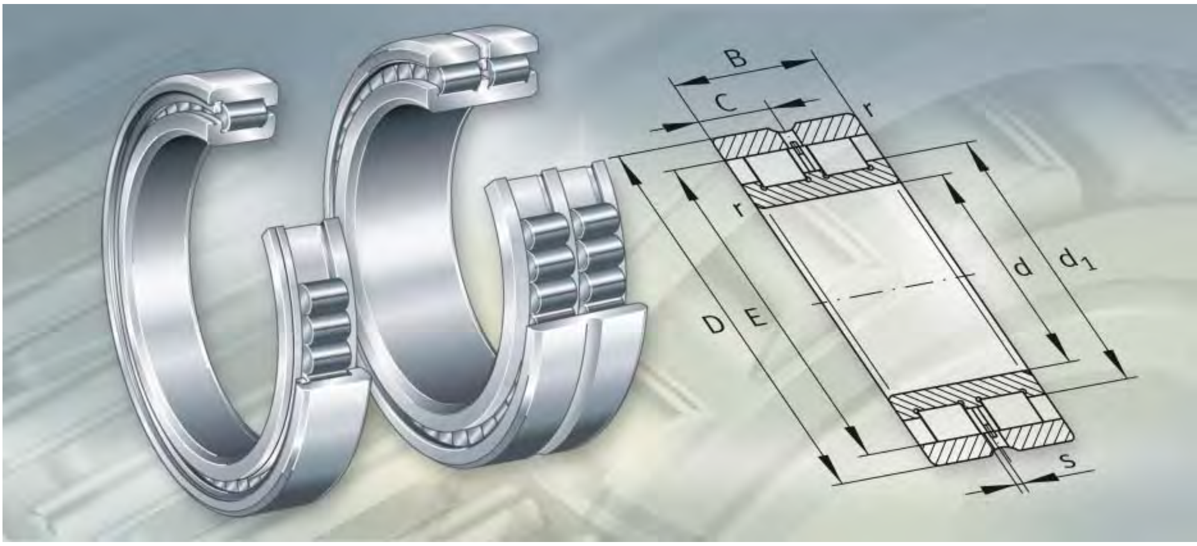


Design 11



Design 12

				Basic load ratings		Fatigue limit load
C	F	r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
220	266	2,1	1	2 200	4 250	455
235	270	1,5	2	2 080	4 250	460
285	316	4	1,5	3 400	6 300	650
250	310	1,5	3	3 000	5 400	550
350	378	1,5	1,5	5 400	11 200	1 090
400	423,4	2,5	4	6 700	13 400	1 270
488	494,5	4	1,5	9 650	18 600	1 720
355	509,5	6	3	8 800	17 600	1 600
540	572	3	5	13 200	27 500	2 410
540	572,3	5	5	13 200	27 500	2 410



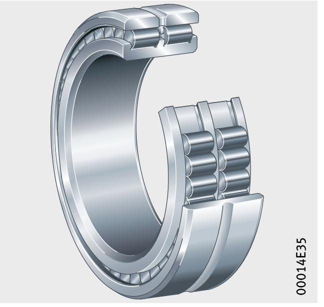
Full complement cylindrical roller bearings

Full complement cylindrical roller bearings

Non-locating bearings

Double row

SL0248, SL0249

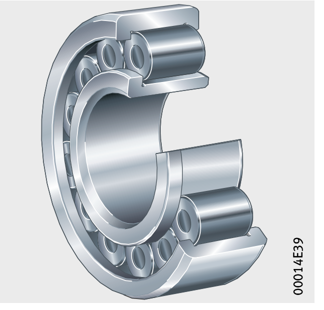


Semi-locating bearings

Single row

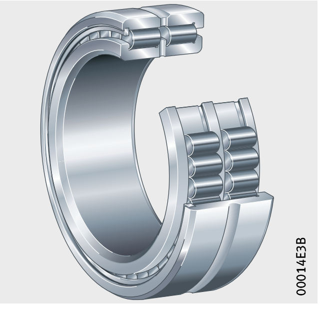
SL1818, SL1829, SL1830, SL1822

SL1923



Double row

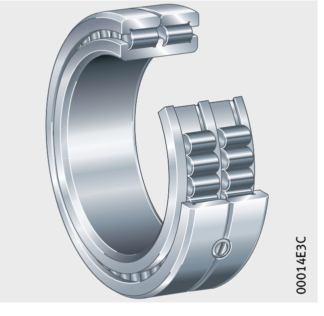
SL1850



Locating bearings

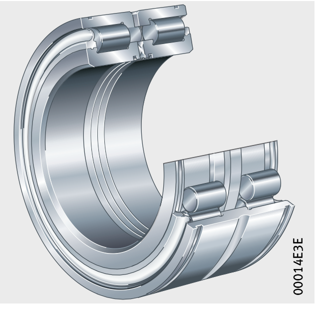
Double row, open

SL0148, SL0149



Cable sheave bearings, sealed

SL0450..-PP, SL04..-PP



Full complement cylindrical roller bearings

Features

Full complement cylindrical roller bearings comprise solid outer and inner rings and rib-guided cylindrical rollers. Since these bearings have the largest possible number of rolling elements, they have extremely high radial load carrying capacity, 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.

Single row full complement cylindrical roller bearings are available as non-locating, semi-locating and locating bearings.

Bearings of TB design

In the case of bearings of TB design, the axial load carrying capacity of cylindrical roller bearings was significantly improved with the aid of new calculation and manufacturing methods.

A special curvature on the end faces of the rollers ensures optimum contact conditions between roller and rib.
As a result, the axial contact pressures on the rib are significantly minimised and a lubricant film capable of supporting higher loads is formed. Under normal operating conditions, wear and fatigue at the rib contact running and roller end faces are completely eliminated.

In addition, axial torque is reduced by up to 50%. The bearing temperature during operation is therefore significantly lower.

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.

! The bearings are held together in handling and transport by a transport and mounting retaining device on the outer ring. This retaining device remains in the bearing and must not be subjected to axial load.

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.

Sealing

The cylindrical roller bearings are of an open design.

Lubrication

The bearings can be lubricated with oil or grease.
For lubrication, the outer ring has a lubrication groove and lubrication holes.

Semi-locating bearings

Semi-locating bearings are available in a single row design as SL1818 (dimension series 18), SL1829 (dimension series 29), SL1830 (dimension series 30), SL1822 (dimension series 22) and SL1923 (dimension series 23).
Bearings of series SL1850 (dimension series 50) are of a double row design.

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 and a self-retaining rolling element set. As a result, the inner ring can be removed from the bearing. As a result, mounting and dismounting is considerably easier.

The bearings SL1818, SL1829, SL1830, SL1822 and SL1850 are held together in handling and transport by a transport and mounting retaining device on the outer ring. This retaining device remains in the bearing and must not be subjected to axial load.

Axial displacement of the inner ring

The inner ring can be axially displaced in one direction by the dimension "s", see dimension table.

Sealing

The cylindrical roller bearings are supplied in an open design.

Lubrication

The single row bearings can be lubricated via the end faces with oil or grease.

Locating bearings

Bearings SL0148 (designation to DIN 5 412-9: NNC 48..V) and bearings SL0149 (designation to DIN 5 412-9: NNC 49..V) are double row locating bearings. These bearings can support axial forces in both directions as well as radial forces.

The outer ring has ribs on both sides, is axially split and held together by retaining rings. The inner ring has an additional central rib. The retaining rings must not be subjected to axial load.

Cable sheave bearings

Cable sheave bearings (cylindrical roller bearings with annular slots) are locating bearings. These bearings are very rigid and can support moderate axial forces in both directions as well as high radial forces. They comprise solid outer and inner rings with ribs, rib-guided cylindrical rollers and sealing rings.

The outer rings have annular slots 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.

Cylindrical roller bearings with annular slots are available as a light series SL04..-PP and in the dimension series 50 as SL0450..-PP.

Sealing

In the case of cable sheave bearings, the rolling element system is protected against contamination and moisture by sealing rings on both sides.

Lubrication

Open locating bearings can be lubricated with oil or grease. For lubrication, the outer ring has a lubrication groove and lubrication holes.

Cable sheave bearings are greased using a lithium complex soap grease to GA08 and can be lubricated via the outer or inner ring. Arcanol LOAD150 is suitable for relubrication.

Operating temperature

Open full complement cylindrical roller bearings are suitable for operating temperatures from –30 °C to +120 °C.

Cylindrical roller bearings with annular slots are suitable for operating temperatures from –20 °C to +80 °C, restricted by the grease and seal material.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
BR	Black oxide coated	Special design, available by agreement only
C3	Radial internal clearance larger than normal	
C4	Radial internal clearance larger than C3	
C5	Radial internal clearance larger than C4	
E	Increased capacity design	
P	Seal on one side	
PP	Seals on both sides	Standard
RR	Corrosion-resistant design, with Corrotect® coating	Special design, available by agreement only
2NR	Cable sheave bearing supplied with two loose-packed retaining rings WRE	
–	Without seals	
TB	Bearing with increased axial load carrying capacity	

Available bearings of TB design

Series available by agreement	From bore diameter d mm
SL1818	460
SL1822	180
SL1829	300
SL1830	240
SL1923	150
SL1850	300

Design and safety guidelines

Permissible skewing

There is no significant reduction in rating life if the misalignment of the inner ring relative to the outer ring does not exceed the following values:

- 4′ in bearings of series SL1818
- 3′ in bearings of series SL1923, SL1822, SL1829, SL1830.

Double row bearings do not permit any skewing between the inner and outer ring.

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 of the contact surfaces
- tilting of the bearings (in single row bearings).

!

Ribs subjected to load must be supported across their entire height.

The permissible axial load $F_{a\ per}$ must not be exceeded in order to avoid an unacceptable increase in temperature.

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 must not exceed the value 0,4.

In the case of bearings of TB design, the value 0,6 is permissible.

Continuous axial loading without simultaneous radial loading is not permissible.

Permissible and maximum load

The axial load $F_{a\ per}$ and the limiting load $F_{a\ max}$ are calculated according to the following equations.

Bearings in standard design

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

Bearings of TB design

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

Bearings of standard and TB design

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

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

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

k_S –
Factor as a function of the lubrication method, see table

k_B –
Factor as a function of the bearing series, see table, page 450

d_M mm
Mean bearing diameter (d + D)/2, see dimension table

n min^{-1}
Operating speed.

Cable sheave bearings

In the case of cylindrical roller bearings with annular slots, application engineering advice is necessary. The limit values and calculations for $F_{a\ per}$ and $F_{a\ max}$ are not therefore valid for these bearings.

Factor k_S for the 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 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	Factor k_B
SL1818, SL0148	4,5
SL1829, SL0149	11
SL1830, SL1850	17
SL1822	20
SL1923	30

Equivalent dynamic bearing load

Non-locating bearings and cable sheave 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 load ratio must be taken into consideration.

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leqq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = 0,92 \cdot F_r + Y \cdot F_a$

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, Y –
Factors, see table.

Factors e and Y

Series	Calculation factors	
	e	Y
SL1818, SL1850	0,2	0,6
SL0148, SL0149	0,4	0,5
SL1822, SL1829, SL1830, SL1923	0,3	0,4

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0 kN
Equivalent static bearing load

F_{0r} kN
Radial static bearing load.

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\ min} = C_{0r}/60$ is necessary.

!

If $F_{r\ min} < C_{0r}/60$, please contact us.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Cable sheave bearings

Cable sheave bearings are normally subjected to circumferential load on the outer ring. The outer ring must therefore have a press fit.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by force locking or form fit.

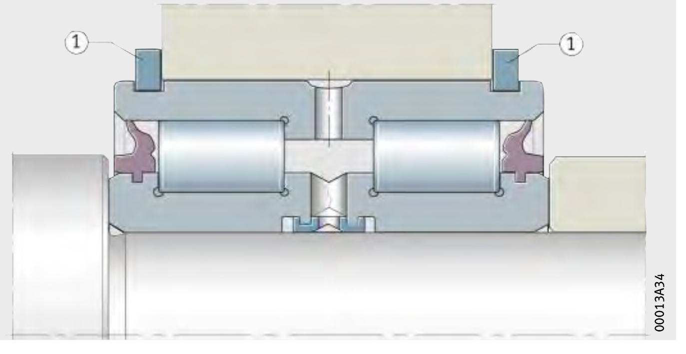
The abutment shoulders (shaft and housing) should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seating point to the abutment shoulder must be designed with rounding to DIN 5 418 or an undercut to DIN 509. The minimum values for the chamfer dimensions r in the dimension tables must be observed.

For semi-locating bearings, the bearings only require support on one side, on the rib supporting the axial load.

!

In axially loaded bearings, full support must be provided for the ribs transmitting forces, *Figure 1*.



1 Retaining ring

Figure 1
Axial location of outer and inner ring, support of ribs

Location of cable sheave bearings

The annular slots allow axial location of the outer rings using retaining rings, *Figure 1*, page 451. Rings of series WRE or rings to DIN 471 are suitable. Locating rings are not included in the delivery. In the design 2NR, the delivery includes two retaining rings WRE packed loose.

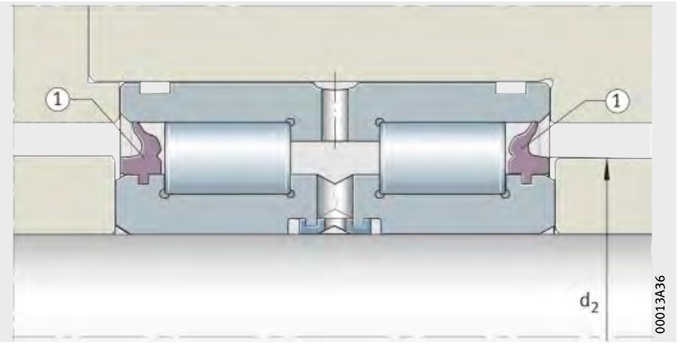
!

The split inner ring must be axially secured, *Figure 1*, page 451.

The fasteners must not be subjected to axial load.

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 must be observed, see dimension table.



① Sealing ring

Figure 2
Support of sealing rings

Mounting and dismounting of cable sheave bearings

!

During mounting and dismounting 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 running tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

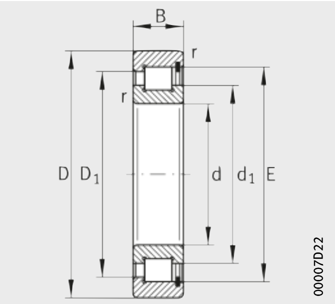
The radial internal clearance corresponds to internal clearance group CN to DIN 620-4.

Radial internal clearance

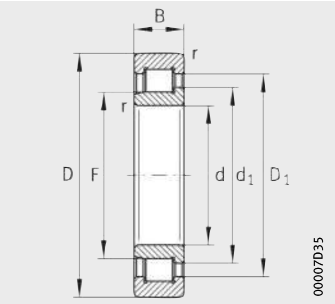
Bore		Radial internal clearance							
d mm		CN μm		C3 μm		C4 μm		C5 μm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
200	225	105	165	160	220	220	280	305	365
225	250	110	175	170	235	235	300	330	395
250	280	125	195	190	260	260	330	370	440
280	315	130	205	200	275	275	350	410	485
315	355	145	225	225	305	305	385	455	535
355	400	190	280	280	370	370	460	510	600
400	450	210	310	310	410	410	510	565	665
450	500	220	330	330	440	440	550	625	735

Single row full complement cylindrical roller bearings

Semi-locating bearings



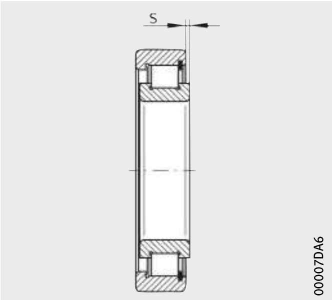
SL1818, SL1829,SL1830,
SL1822



SL1923

Dimension table · Dimensions in mm

Designation	Mass	Dimensions						
	m	d	D	B	r	s[1)]	F	d_1
	≈kg				min.			≈
SL192330-TB	42,1	**150**	320	108	4	7	182,49	203,3
SL192332-TB	49,7	**160**	340	114	4	7	196,38	219
SL192334-TB	59,2	**170**	360	120	4	7	203,55	226,6
SL182236	29,8	**180**	320	86	4	7	–	232,4
SL192336-TB	69,1	**180**	380	126	4	7	221,56	245
SL182238	35,65	**190**	340	92	4	9	–	243,5
SL192338-TB	80,3	**190**	400	132	5	7	224,43	250
SL182240	43,12	**200**	360	98	4	9	–	246,6
SL192340-TB	92,1	**200**	420	138	5	7	238,45	265,7
SL183044	28,4	**220**	340	90	3	9	–	254,6
SL192344-TB	111,2	**220**	460	145	5	7	266,71	297
SL182948	10,6	**240**	320	48	2,1	3	–	267,5
SL183048	30,9	**240**	360	92	3	11	–	277,5
SL192348-TB	142,3	**240**	500	155	5	10	280,55	312,5
SL181852-E	4,61	**260**	320	28	2	2	–	281
SL182952	18,5	**260**	360	60	2,1	5	–	291,5
SL183052	44,5	**260**	400	104	4	11	–	304
SL192352-TB	173,2	**260**	540	165	6	10	315,6	351,6
SL181856-E	6,89	**280**	350	33	2	2,5	–	304
SL182956	19,7	**280**	380	60	2,1	3,5	–	314
SL183056	48	**280**	420	106	4	11	–	319,5
SL181860-E	9,79	**300**	380	38	2,1	3	–	323,5
SL182960	31,2	**300**	420	72	3	5	–	338
SL183060-TB	66,6	**300**	460	118	4	14	–	353,6
SL181864-E	10,36	**320**	400	38	2,1	3	–	344,5
SL182964	32,9	**320**	440	72	3	5	–	358,5
SL183064-TB	71,7	**320**	480	121	4	14	–	369,5
SL181868-E	10,93	**340**	420	38	2,1	3	–	365,5
SL182968	34,7	**340**	460	72	3	5	–	379
SL183068-TB	95,8	**340**	520	133	5	16	–	396,1
SL181872-E	11,49	**360**	440	38	2,1	3	–	387
SL182972	36,4	**360**	480	72	3	5	–	399,5
SL183072-TB	101	**360**	540	134	5	16	–	414
SL181876-E	18,87	**380**	480	46	2,1	4	–	415,5
SL182976	52,1	**380**	520	82	4	5	–	426
SL183076-TB	106	**380**	560	135	5	16	–	431,7

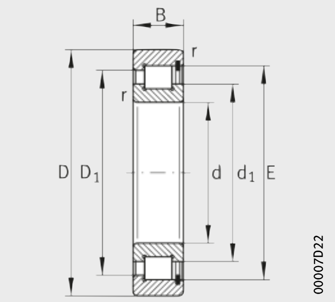


1) Axial displacement “s”

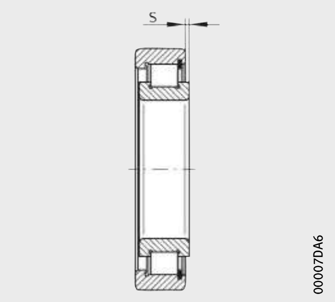
		Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
D_1	E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈		kN	kN	kN	min^{-1}	min^{-1}
263,5	–	1 680	1 900	265	1 380	840
284,4	–	1 900	2 170	300	1 280	760
295	–	2 070	2 380	320	1 240	730
279,5	294	1 180	1 760	208	1 270	800
312,9	–	2 190	2 600	345	1 160	670
295,5	311,5	1 300	1 900	223	1 210	770
326,8	–	2 500	2 950	390	1 120	630
302,4	319,4	1 410	2 010	235	1 180	770
347,2	–	2 800	3 300	420	1 060	570
299,2	312	1 150	1 820	209	1 170	800
388,3	–	3 000	3 450	425	950	520
294,4	303,7	600	1 120	124	1 150	750
322,1	336	1 210	1 990	224	1 080	720
408,5	–	3 300	3 800	465	900	500
301,5	308	275	530	54	1 110	790
323,4	333,7	780	1 450	160	1 060	690
358,4	375,97	1 600	2 500	280	980	620
459,6	–	4 000	4 700	560	800	410
327	335	355	670	69	1 030	730
348,5	359,5	910	1 710	184	980	590
372,9	390,3	1 650	2 650	290	940	590
350,5	360	455	840	86	960	680
376,9	389,45	1 170	2 200	235	910	540
415,6	434,85	2 020	3 300	325	840	500
371,5	381	470	900	90	910	620
397,4	409,85	1 210	2 340	246	860	495
430,1	449,5	2 080	3 450	340	810	480
392,5	402,2	485	960	94	860	570
418,7	430,2	1 250	2 470	255	810	460
463,9	485,65	2 490	4 150	400	750	430
413,5	423,5	500	1 010	98	810	530
438,6	450,6	1 280	2 600	265	770	430
481,6	503,45	2 550	4 350	410	720	405
448	459	650	1 290	126	750	490
472,1	486,7	1 660	3 300	335	720	380
499,5	521,25	2 600	4 450	425	700	390

Single row full complement cylindrical roller bearings

Semi-locating bearings



SL1818, SL1829, SL1830



1) Axial displacement “s”

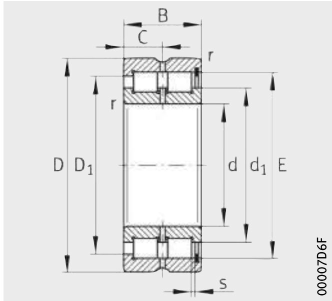
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions					
	m	d	D	B	r	s[1)]	d_1
	≈kg				min.		≈
SL181880-E	19,81	**400**	500	46	2,1	4	432
SL182980	54,3	**400**	540	82	4	5	450
SL183080-TB	140	**400**	600	148	5	18	462,5
SL181884-E	20,6	**420**	520	46	2,1	4	457
SL182984	56,9	**420**	560	82	4	5	462
SL181888-E	21,54	**440**	540	46	2,1	4	473,5
SL182988	78,1	**440**	600	95	4	7	490
SL181892-E	33,21	**460**	580	56	3	5	501,5
SL182992	81,1	**460**	620	95	4	7	504
SL181896-E	34,53	**480**	600	56	3	5	522
SL182996	94,7	**480**	650	100	5	7	538
SL1818/500-E	35,73	**500**	620	56	3	5	542
SL1829/500	98,3	**500**	670	100	5	7	553

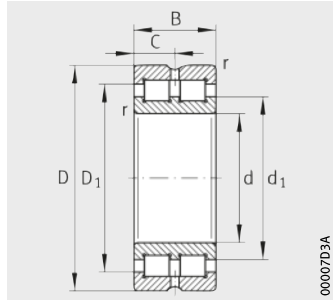
		Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
D_1	E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
≈		kN	kN	kN	min^{-1}	min^{-1}
464,5	475,5	660	1 340	130	720	470
496,1	510,85	1 710	3 500	350	690	350
535,1	558,52	3 050	5 400	500	650	345
489,5	500	680	1 420	135	690	430
509	522,95	1 730	3 600	355	670	340
506	517	700	1 470	139	660	415
544,6	562	2 090	4 100	405	630	325
541	554	940	1 890	179	620	385
559,6	576,3	2 130	4 250	410	610	310
561	474,5	960	1 970	185	600	365
596,6	614,75	2 390	4 800	460	570	280
581,5	594,5	980	2 050	190	580	345
612,7	630	2 430	4 950	470	560	270

Double row full complement cylindrical roller bearings

Semi-locating, locating and non-locating bearings



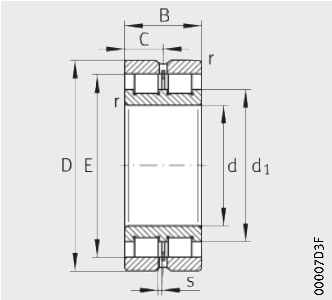
SL1850
Semi-locating bearings



SL0148, SL0149
Locating bearings

Dimension table · Dimensions in mm

Semi-locating bearings Designation	Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5412	Mass m ≈kg	Dimensions d	D	B	r min.	s
SL185044	–	–	–	51,6	**220**	340	160	3	9
–	**SL014948**	–	NNC 4948 V	18,5	**240**	320	80	2,1	–
–	–	**SL024948**	NNCL 4948 V	17,9	**240**	320	80	2,1	5
SL185048	–	–	–	55,2	**240**	360	160	3	9
–	**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
SL185052	–	–	–	82,6	**260**	400	190	4	11,3
–	**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
SL185056	–	–	–	88	**280**	420	190	4	11,3
–	**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
SL185060-TB	–	–	–	124	**300**	460	218	4	12,5
–	**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
SL185064-TB	–	–	–	128,4	**320**	480	218	4	12,5
–	**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
SL185068-TB	–	–	–	178	**340**	520	243	5	14,3
–	**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
SL185072-TB	–	–	–	178	**360**	540	243	5	14

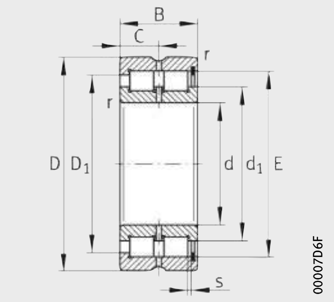


SL0248, SL0249
Non-locating bearings

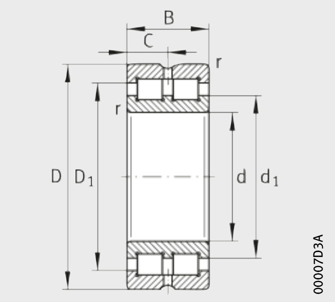
				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1	D_1	E	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈	≈		kN	kN	kN	min^{-1}	min^{-1}
80	254,6	297,8	312,2	1 980	3 650	420	1 170	630
40	270,6	292,3	–	740	1 700	186	1 150	660
40	270,6	–	299,46	740	1 700	186	1 150	660
80	277,5	322,1	335,1	2 080	4 000	445	1 080	550
30	281,8	298,8	–	540	1 370	143	1 120	650
30	281,8	–	304,2	540	1 370	143	1 120	650
50	294,5	322,1	–	1 100	2 470	270	1 050	570
50	294,5	–	331,33	1 100	2 470	270	1 050	570
95	304	359,7	375,97	2 750	5 000	560	980	490
34,5	306,8	326,4	–	700	1 820	189	1 020	570
34,5	306,8	–	332,4	700	1 820	189	1 020	570
50	316,5	344,6	–	1 150	2 650	285	980	520
50	316,5	–	353,34	1 150	2 650	285	980	520
95	318,3	374,1	390,3	2 850	5 300	580	940	460
40	327,9	349,9	–	820	2 070	214	960	550
40	327,9	–	356,7	820	2 070	214	960	550
59	340,7	374,3	–	1 630	3 700	390	910	445
59	340,7	–	385,51	1 630	3 700	390	910	445
109	353,6	413,6	433,6	3 450	6 600	650	840	395
40	350,9	372,9	–	850	2 220	225	900	495
40	350,9	–	379,7	850	2 220	225	900	495
59	367,5	401,1	–	1 700	4 050	415	840	395
59	367,5	–	412,27	1 700	4 050	415	840	395
109	369,5	431,5	449,5	3 550	6 900	680	810	375
40	368,1	390,1	–	870	2 330	233	860	465
40	368,1	–	396,9	870	2 330	233	860	465
59	385,3	418,9	–	1 750	4 250	430	810	375
59	385,3	–	430,11	1 750	4 250	430	810	375
121,5	396	465,5	485,65	4 250	8 300	800	750	355
40	391	413,2	–	900	2 480	244	810	430
40	391	–	419,8	900	2 480	244	810	430
59	404	436,8	–	1 790	4 450	445	770	350
59	404	–	447,95	1 790	4 450	445	770	350
121,5	413,8	481	503,45	4 400	8 700	820	720	320

Double row full complement cylindrical roller bearings

Full complement, double row
Semi-locating, locating and non-locating bearings



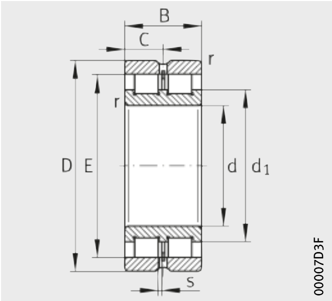
SL1850
Semi-locating bearings



SL0148, SL0149
Locating bearings

Dimension table (continued) · Dimensions in mm

Semi-locating bearings Designation	Locating bearings Designation	Non-locating bearings Designation	Designation to DIN 5412	Mass	Dimensions				
				m	d	D	B	r	s
				≈kg				min.	
–	**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
SL185076-TB	–	–	–	196,5	**380**	560	243	5	14,1
–	**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

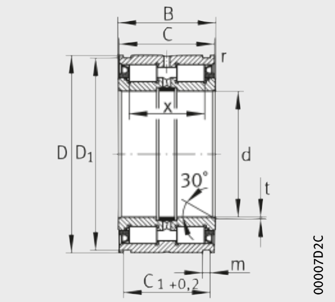


SL0248, SL0249
Non-locating bearings

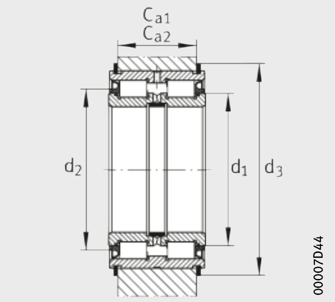
				Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
C	d_1 ≈	D_1 ≈	E	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN	n_G min^{-1}	n_B min^{-1}
50	419	447,2	–	1 320	3 500	345	750	375
50	419	–	455,8	1 320	3 500	345	750	375
70	430,2	468,7	–	2 250	5 500	560	720	325
70	430,2	–	481,35	2 250	5 500	560	720	325
121,5	432	499	521,25	4 450	8 900	850	700	305
50	433,8	462	–	1 350	3 650	355	720	360
50	433,8	–	470,59	1 350	3 650	355	720	360
70	450,5	489	–	2 310	5 800	580	690	300
70	450,5	–	501,74	2 310	5 800	580	690	300

Cable sheave bearings

Cylindrical roller bearings with annular slots
Full complement, sealed
Locating bearings



SL0450..-PP
SL04..-PP



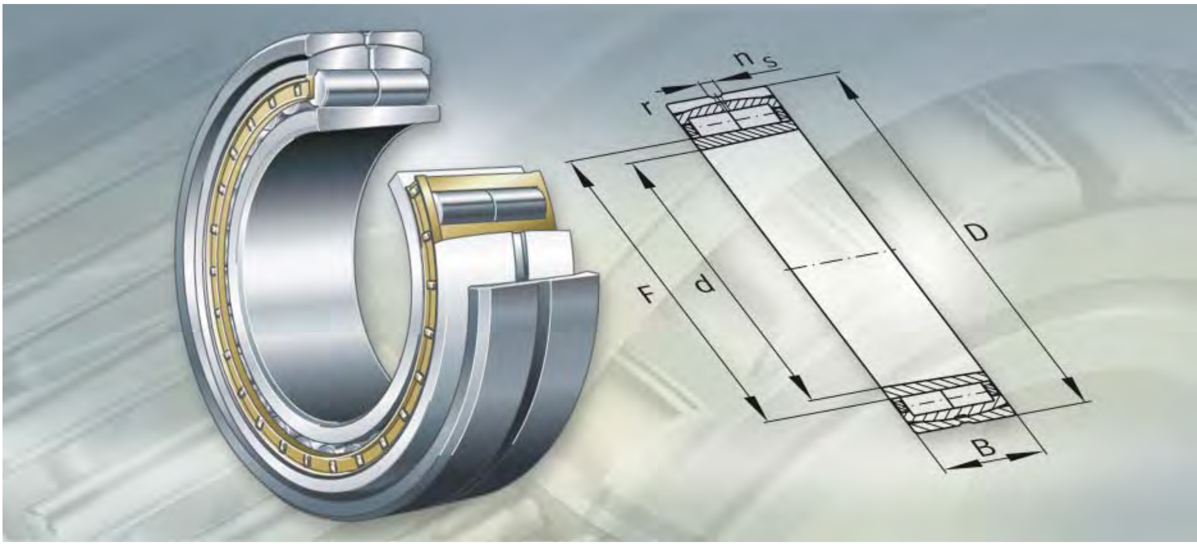
Mounting dimensions

Dimension table · Dimensions in mm

Designation	Mass	Dimensions									
	m	d	D	B	C	C_1	D_1	m	r	t	x
	≈kg					+0,2			min.		
SL045044-PP	52,5	**220**	340	160	159	138,2	334	6,3	1	2	132
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

1) For snap rings WRE.
2) For retaining ring to DIN 471.

Mounting dimensions					Basic load ratings		Fatigue limit load	Limiting speed	Snap ring WRE	Retaining ring to DIN 471
C_{a1} 1)	C_{a2} 2)	d_1	d_2	d_3 1)	dyn. C_r	stat. C_{0r}	C_{ur}	n_G grease		
−0,2	−0,2				kN	kN	kN	min^{-1}		
130	126	259,85	286	366	1 570	3 050	350	480	WRE340	340X6
130	126	279,25	305	386	1 630	3 300	370	440	WRE360	360X6
75	71	271,7	287	346	740	1 700	186	480	WRE320	320X6
154	150	304,95	336	426	2 380	4 700	520	400	WRE400	400X6
75	71	292,7	310	366	840	1 990	215	440	WRE340	340X6
154	149	320,95	354	453	2 600	5 200	570	380	WRE420	420X7
176	171	346,85	375	493	3 000	5 800	620	340	WRE460	460X7
75	71	328	346	406	900	2 250	234	380	WRE380	380X6

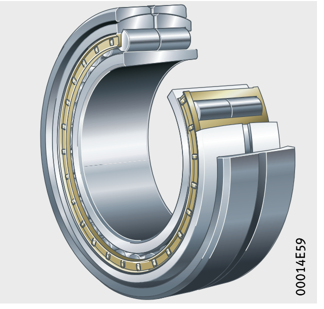


Self-aligning cylindrical roller bearings

Self-aligning cylindrical roller bearings

Non-locating bearings
With tapered bore

Z-5..ZL2-02, F-8..ZL2-02



Self-aligning cylindrical roller bearings

Features

These double row cylindrical roller bearings comprise solid bearing rings and cylindrical roller and cage assemblies with solid cages. The bearings have outer rings with two rigid ribs and ribless inner rings. The spherical outer ring is seated in a plain bearing pivot ring and can compensate misalignment of the bearing seats as well as deflections. The ribless inner ring allows constraint-free axial displacement in the bearing. The very high radial load carrying capacity of the cylindrical roller bearing is maintained in full even under large displacements.

The external dimensions of the complete bearing with the pivot ring correspond to the main dimensions of dimension series 30, 22 and 31 to DIN 616.
These bearings are used as non-locating bearings on the tending side of the dryer roll in paper machinery. They are mounted in normal paper machinery housings.

The same design is used in cylindrical roller bearings with main dimensions of dimension series 22, 23 and 32 that are intended for guide rolls.

Bearings with tapered bore

Self-aligning double row cylindrical roller bearings with a tapered bore (taper 1:12) are directly located on tapered journals.
The radial internal clearance can thus be set to an optimum value.

Non-locating bearings

All self-aligning double row cylindrical roller bearings are non-locating bearings and can support radial forces only.
The changes in length of the heated dryer roll are made possible without constraint in the cylindrical roller bearing between the raceway of the inner ring and the rolling elements.
Axial forces are supported on the drive side of the dryer roll by spherical roller 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

The bearings are supplied without seals.

Lubrication

The plain bearing pivot ring and the bearing outer ring each have a lubrication groove and lubrication holes for the best possible supply of lubricant directly into the interior of the bearing.
Due to the central position of the feed, oil outlet of a high quality oil corresponding to ISO-VG 220 or 320 is possible on both sides of the bearing.

Operating temperature and material

The ambient temperature for bearings in the dry section of paper machinery may be more than +100 °C on a continuous basis. By means of bainitic hardening, the rings of the double row cylindrical roller bearings are dimensionally stabilised up to +200 °C. Connection to a central recirculating oil lubrication system allows heat to be continuously dissipated from the bearing. For dryer rolls and M.G. cylinders with steam heating, case hardened inner rings are recommended and these are indicated by the suffix W209B.

Cages

Self-aligning double row cylindrical roller bearings have a solid brass cage that encloses both rows of rollers.

Suffixes

Suffixes for available designs: see table.

Available designs

Suffix	Description	Design
C3	Radial internal clearance larger than normal	Standard
C5	Radial internal clearance larger than C4	
K	Tapered bore (taper 1:12)	

Design and safety guidelines

Permissible skewing

The permissible misalignment between the plain bearing pivot ring and the bearing is 2°.
The pivot ring has a Durotect®-Z (zinc phosphate) coating and the concave surface has a molybdenum disulphide coating.
The alignment movement in operation is additionally supported by the steady feed of lubricant.

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

$$P = F_r$$

P kN
Equivalent dynamic bearing load
F_r kN
Radial dynamic bearing load.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0 kN
Equivalent static bearing load
F_{0r} kN
Radial static bearing load.

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\ min} = C_{0r}/60$ is necessary.

If $F_{r\ min} < C_{0r}/60$, please contact us.

Design of bearing arrangements

Mounting dimensions

The dimension tables give the maximum dimension of the radius r_a and the diameters of the abutment shoulders D_a, d_a.

Accuracy

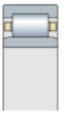
The dimensional and running tolerances of the bearings correspond to tolerance class PN to DIN 620.

Radial internal clearance

Due to the high operating temperatures and the associated large temperature differential between the inner and outer ring, the bearings for dryer rolls and M.G. cylinders are supplied with the increased radial internal clearance C5. Bearings for guide rolls have the increased radial internal clearance C3.

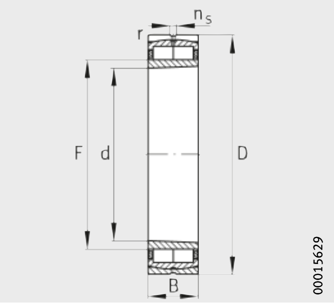
Radial internal clearance of cylindrical roller bearings with tapered bore

Bore		Radial internal clearance							
d mm		CN µm		C3 µm		C4 µm		C5 µm	
over	incl.	min.	max.	min.	max.	min.	max.	min.	max.
180	200	140	195	180	235	220	275	275	330
200	225	155	215	200	260	245	305	305	365
225	250	170	235	220	285	270	335	335	400
250	280	185	255	240	310	295	365	365	435
280	315	205	280	265	340	325	400	400	475
315	355	225	305	290	370	355	435	435	515
355	400	255	345	330	420	405	495	495	585
400	450	285	385	370	470	455	555	555	655
450	500	315	425	410	520	505	615	615	725
500	560	350	470	455	575	560	680	680	800
560	630	380	500	500	620	620	740	740	860
630	710	435	575	565	705	695	835	835	975



Self-aligning cylindrical roller bearings

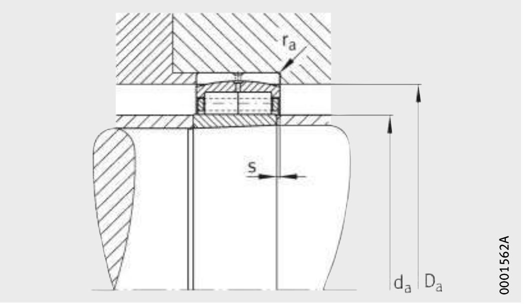
Double row,
with tapered bore (taper 1:12)



Dimension table · Dimensions in mm

Designation	Mass	Dimensions						
	m	d	D	B	r	s1)	F	n_s
	≈kg				min.			
F-804272.ZL-K-C3	44,3	**150**	320	108	3	13	184	17,7
Z-548428.ZL-K-C3	53,9	**160**	340	114	4	13	196	17,7
Z-567601.ZL-K-C3	31,7	**180**	320	86	4	7,5	211	17,7
Z-567601.ZL-K-C5	31,7	**180**	320	86	4	7,5	211	17,7
F-803792.ZL-K-C3	40,5	**180**	320	112	4	12,5	211	15
Z-580454.ZL-K-C5	36	**190**	320	104	3	10,5	222	15
Z-566170.ZL-K-C3	38,5	**190**	340	92	4	8,5	223	17,7
Z-566170.ZL-K-C5	38,5	**190**	340	92	4	8,5	223	17,7
Z-566487.ZL-K-C5	44,6	**200**	340	112	3	9,5	233	17,7
F-804462.ZL-K-C3	60	**200**	360	128	4	12,5	234	17,7
Z-565531.ZL-K-C5	31,5	**220**	340	90	3	7,5	246	15
Z-565688.ZL-K-C5	55,5	**220**	370	120	4	8,5	256	17,7
Z-567498.ZL-K-C3	63,5	**220**	400	108	4	10,5	258	17,7
Z-567498.ZL-K-C5	63,5	**220**	400	108	4	10,5	258	17,7
F-804463.ZL-K-C3	86,7	**220**	400	144	4	10,5	260	17,7
Z-565668.ZL-K-C5	34,6	**240**	360	92	3	8	269	15
Z-566484.ZL-K-C5	68	**240**	400	128	4	12	278	17,7
F-804464.ZL-K-C3	115	**240**	440	160	4	13	285	23,5
Z-565499.ZL-K-C5	49,7	**260**	400	104	4	10	292	17,7
Z-566488.ZL-K-C5	93,6	**260**	440	144	4	16	301	17,7
Z-565669.ZL-K-C5	58,8	**280**	420	106	4	11	313	17,7
Z-566489.ZL-K-C5	102	**280**	460	146	5	16	324	17,7
Z-565670.ZL-K-C5	75,2	**300**	460	118	4	9,5	330	17,7
Z-566490.ZL-K-C5	133	**300**	500	160	5	17,5	348	17,7
Z-565671.ZL-K-C5	81,5	**320**	480	121	4	11	357	17,7
Z-566491.ZL-K-C5	174	**320**	540	176	5	20,5	369	23,5
Z-565672.ZL-K-C5	109	**340**	520	133	5	14	381	23,5
Z-566492.ZL-K-C5	221	**340**	580	190	5	17,5	390	23,5

Bearings with case hardened inner rings have the suffix W209B.
Ordering example: Z-566490.ZL-K-W209B-C5.

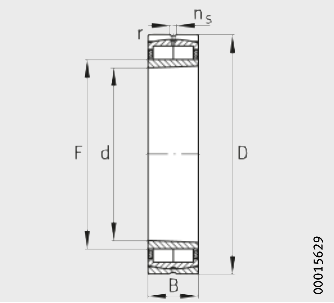


1) Axial displacement “s”

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
max.	max.	max.	kN	kN	kN	min^{-1}
182,5	303	2,5	1 110	1 600	177	2 800
194,4	323	3	1 240	1 870	206	2 600
209,2	303	3	910	1 530	167	2 600
209,2	303	3	910	1 530	167	2 600
209,2	303	3	1 040	1 830	204	2 600
213,1	306	2,5	950	1 860	212	2 400
221,1	323	3	1 020	1 740	187	2 400
221,1	323	3	1 020	1 740	187	2 400
231	326	2,5	1 150	2 250	247	2 200
232	343	3	1 380	2 600	285	2 200
243,8	327,6	2,5	920	1 900	206	2 200
253,8	353	3	1 320	2 750	295	2 000
255,8	383	3	1 440	2 350	242	1 900
255,8	383	3	1 440	2 350	242	1 900
257,8	383	3	1 860	3 500	370	1 900
266,6	347,6	2,5	950	2 100	222	1 900
275,6	383	3	1 490	3 000	315	1 800
282,6	423	3	2 160	4 200	440	1 800
289,4	385,4	3	1 200	2 550	260	1 800
298,4	423	3	1 790	3 600	370	1 700
310,2	405,4	3	1 170	2 650	270	1 700
321,2	440	4	1 830	3 950	405	1 600
327	445,4	3	1 580	3 450	345	1 600
345	480	4	2 170	4 650	460	1 600
353,8	465,4	3	1 640	3 700	360	1 500
365,8	520	4	2 650	5 400	520	1 500
377,6	502	4	1 940	4 150	395	1 500
386,6	560	4	3 250	6 700	640	1 400

Self-aligning cylindrical roller bearings

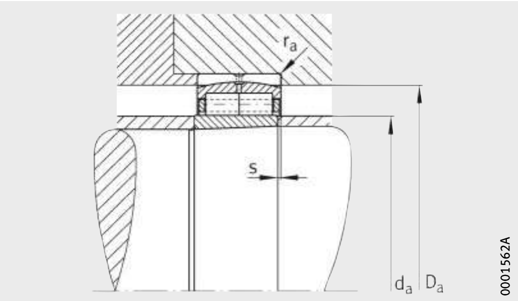
Double row,
with tapered bore (taper 1:12)



Dimension table (continued) · Dimensions in mm

Designation	Mass m ≈kg	Dimensions d	D	B	r min.	$s^{1)}$	F	n_s
Z-565673.ZL-K-C5	114	**360**	540	134	5	10,5	403	23,5
F-800479.ZL-K-C5	219	**360**	600	192	5	19	425	23,5
Z-565674.ZL-K-C5	121	**380**	560	135	5	10	419	23,5
F-800480.ZL-K-C5	241	**380**	620	194	5	20,5	440	23,5
Z-565675.ZL-K-C5	159	**400**	600	148	5	11,5	449	23,5
Z-565874.ZL-K-C5	140	**400**	650	200	6	17,5	450	23,5
Z-565676.ZL-K-C5	164	**420**	620	150	5	12	469	23,5
Z-572777.ZL-K-C5	363	**420**	700	224	6	19	475	23,5
Z-565677.ZL-K-C5	188	**440**	650	157	6	15,5	488	23,5
F-800481.ZL-K-C5	378	**440**	720	226	6	25	492	23,5
Z-565678.ZL-K-C5	214	**460**	680	163	6	13,5	514	23,5
F-800482.ZL-K-C5	472	**460**	760	240	7,5	22	528	23,5
Z-565679.ZL-K-C5	225	**480**	700	165	6	13,5	532	23,5
F-800483.ZL-K-C5	507	**480**	790	248	7,5	27	544	23,5
Z-565680.ZL-K-C5	234	**500**	720	167	6	14,5	553	23,5
F-800484.ZL-K-C5	621	**500**	830	264	7,5	28	568	23,5
Z-565681.ZL-K-C5	322	**530**	780	185	6	14,5	592	23,5
Z-574099.ZL-K-C5	671	**530**	870	272	7,5	22	609	23,5
Z-565682.ZL-K-C5	365	**560**	820	195	6	15,5	618	23,5
F-800485.ZL-K-C5	771	**560**	920	280	7,5	28	630	23,5
Z-572367.ZL-K-C5	422	**600**	870	200	6	16	665	23,5
Z-573929.ZL-K-C5	962	**600**	980	300	7,5	26	678	23,5
Z-565684.ZL-K-C5	499	**630**	920	212	7,5	17	700	23,5
F-800592.ZL-K-C5	1 110	**630**	1 030	315	7,5	33,5	716	23,5
Z-565685.ZL-K-C5	627	**670**	980	230	7,5	21	738	23,5
F-800593.ZL-K-C5	1 280	**670**	1 090	336	7,5	34	755	23,5
Z-565686.ZL-K-C5	695	**710**	1 030	236	7,5	21	778	23,5
F-800594.ZL-K-C5	1 430	**710**	1 150	345	7,5	38,5	795	23,5

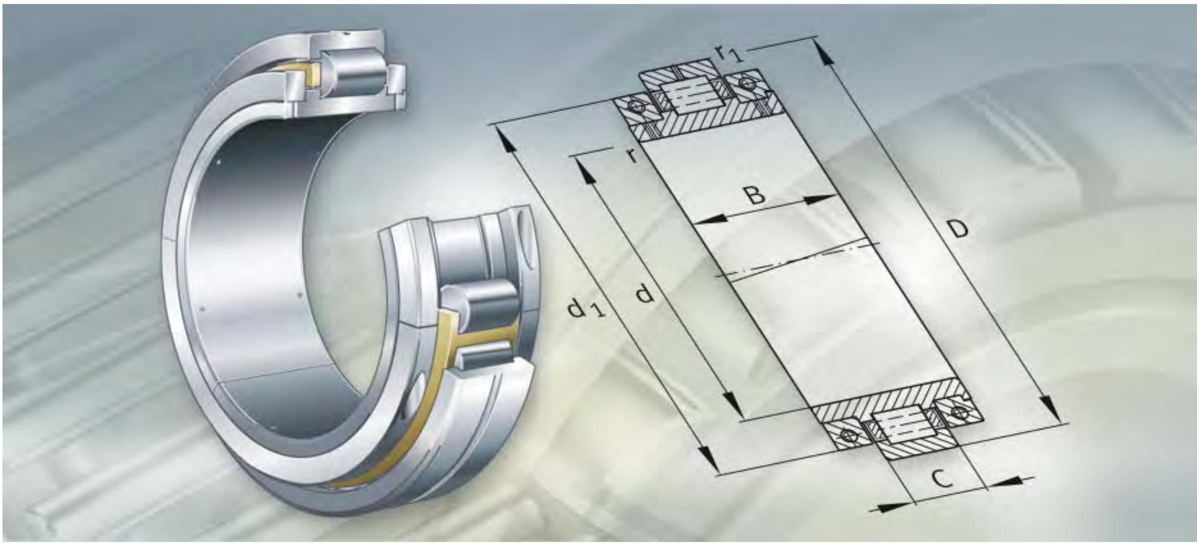
Bearings with case hardened inner rings have the suffix W209B.
Ordering example: F-800484.ZL-K-W209B-C5.



1) Axial displacement “s”

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
max.	max.	max.	kN	kN	kN	min^{-1}
399,4	522	4	2 070	4 750	450	1 400
421,4	580	4	3 200	6 700	630	1 300
415,2	542	4	2 080	5 000	480	1 300
436,2	600	4	3 300	7 300	670	1 200
445	582	4	2 600	6 100	560	1 200
446	624	5	3 550	7 800	730	1 200
464,8	602	4	2 550	6 300	580	1 200
470,8	674	5	4 500	9 600	870	1 000
483,6	627	5	2 750	6 600	590	1 100
487,6	694	5	4 450	9 400	850	1 000
509,4	657	5	3 050	7 600	680	1 000
523,4	728	6	5 300	11 500	1 000	950
527,2	677	5	3 100	7 800	700	950
539,2	758	6	5 300	11 200	970	900
548	697	5	3 150	8 100	710	950
563	798	6	6 000	12 800	1 090	850
586,7	757	5	3 900	9 900	850	850
603,7	838	6	6 800	15 500	1 300	800
612,4	797	5	4 350	10 900	930	850
624,4	888	6	7 100	15 400	1 260	750
659	847	5	4 400	12 100	1 010	750
672	948	6	8 200	18 800	1 520	700
693,7	892	6	5 200	13 600	1 130	700
709,7	998	6	9 000	20 000	1 600	670
731,3	952	6	5 700	15 000	1 220	670
748,3	1 058	6	10 200	23 000	1 810	630
770,9	1 002	6	6 500	16 500	1 290	630
787,9	1 110	6	10 800	24 200	1 850	600

FAG



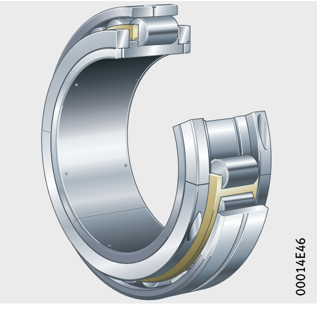
Split cylindrical roller bearings

Split cylindrical roller bearings

Non-locating bearings

Single row

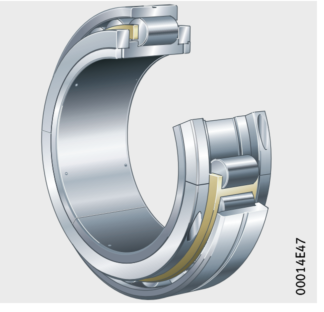
Z-5..ZL1-05, F-8..ZL1-05



Semi-locating bearings

Single row

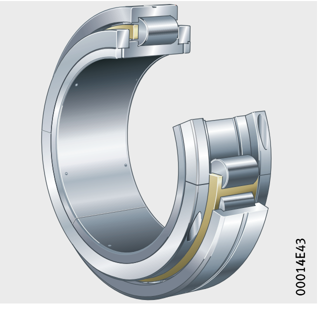
Z-5..ZL1-06



Locating bearings

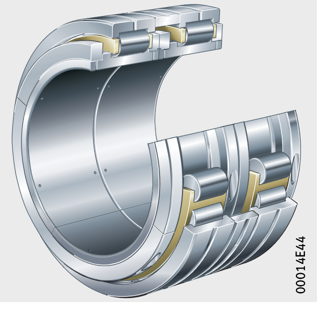
Single row

Z-5..ZL1-07, F-8..ZL1-07



Double row

Z-5..ZL2-03, F-8..ZL2-03



Split cylindrical roller bearings

Features

Split cylindrical roller bearings are generally single row bearings with a cylindrical bore. These bearings comprise two inner ring and two outer ring halves and a split cage with cylindrical rollers.

The outer rings have no rigid ribs, *Figure 1*, one rigid rib, *Figure 2*, page 480, or two rigid ribs, *Figure 3*, page 481.

Only the locating bearings of Design 8 have two rows of rollers, *Figure 4*, page 481.

The inner rings are located on the shaft by means of loose, split locking collars. The rings are split obliquely to the bearing axis in order to ensure that the rolling elements pass over the joints without shocks. The bearing dimensions and designations are not standardised.

Sealing

The split cylindrical roller bearings are supplied without seals.

Lubrication

Most bearings can be lubricated via the outer ring or the outer intermediate ring. We recommend grease lubrication due to the simple sealing arrangement and ease of relubrication.

Non-locating bearings

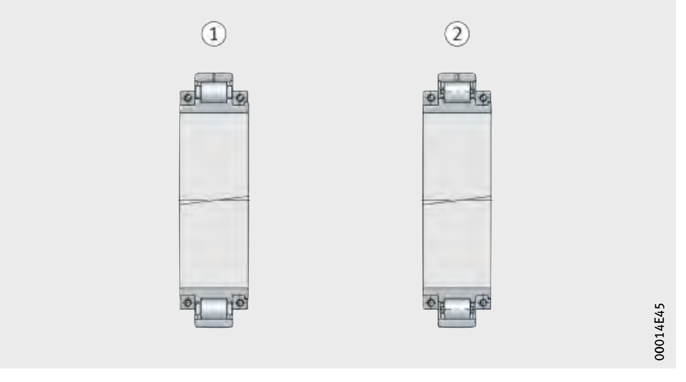
Non-locating bearings support radial forces only.

Design 1

- Ribless outer ring, inner ring with two rigid ribs, solid cage, relubrication facility via the outer ring
- Application:
  - for example in air prewarmers, converter drives, drive spindles in rolling mills, bucket wheel excavators.

Design 2

- Ribless outer ring, inner ring with two rigid ribs, pin cage, relubrication facility via the outer ring
- Application:
  - for example in converter drives, bucket wheel excavators.



1 Design 1
2 Design 2

Figure 1
Split cylindrical roller bearings, single row non-locating bearings

Semi-locating bearings

In addition to high radial forces, these bearings can also support axial forces in one direction.
They act as non-locating bearings in the opposite direction.

Design 3

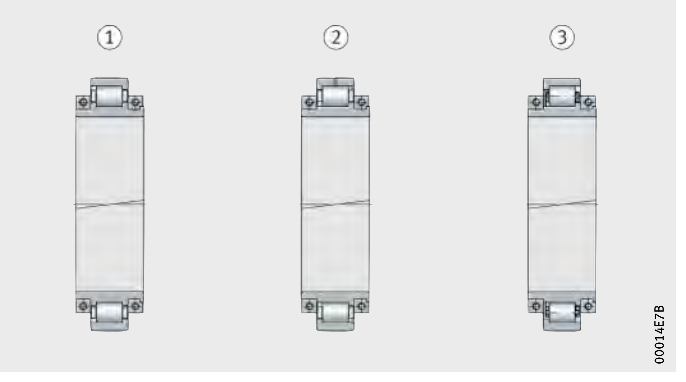
- Outer ring with one rigid rib, inner ring with two rigid ribs, solid cage
- Application:
  - for example in air prewarmers, converter drives, drive spindles in rolling mills, bucket wheel excavators.

Design 4

- Outer ring with one rigid rib, inner ring with one rigid rib, solid cage, relubrication facility via the outer ring
- Application:
  - for example in air prewarmers, converter drives, drive spindles in rolling mills, bucket wheel excavators.

Design 5

- Outer ring with one rigid rib, inner ring with one rigid rib, pin cage
- Application:
  - for example in converter drives, bucket wheel excavators.



1 Design 3
2 Design 4
3 Design 5

Figure 2
Split cylindrical roller bearings, single row semi-locating bearings

Locating bearings

In addition to high radial forces, locating bearings can also support axial forces in both directions.

Single row locating bearings

Design 6

- Outer ring with two rigid ribs, inner ring with two rigid ribs, solid cage
- Application:
  - for example in air prewarmers, converter drives, drive spindles in rolling mills, bucket wheel excavators.

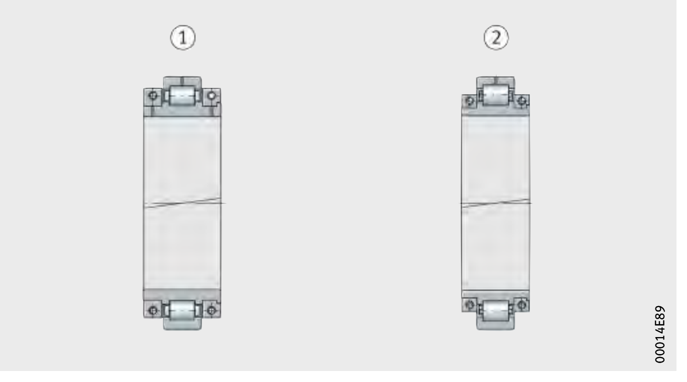
Design 7

- Outer ring with two rigid ribs, inner ring with two rigid ribs, pin cage, relubrication facility via the outer ring
- Application:
  - for example in converter drives, bucket wheel excavators.

Double row locating bearings

Design 8

- Double row bearing (two matched single row bearings), specially for drive spindles in rolling mills
- Relubrication facility via the outer intermediate ring.



① Design 6
② Design 7

Figure 3
Split cylindrical roller bearings, single row locating bearings

① Design 8

Figure 4
Split cylindrical roller bearings, double row locating bearings

Split cylindrical roller bearings

Operating temperature

Split cylindrical roller bearings can be used at operating temperatures from –30 °C to +150 °C.

Cages

The bearings of most designs are fitted with a split solid cage made from brass or steel.

Bearings of Designs 2, 5 and 7 have a split pin cage made from steel. This offers very high load carrying capacity and is also suitable for strong accelerations and decelerations.

Suffixes

The design of the split cylindrical roller bearings
(for example radial internal clearance, accuracy, cage)
is specified in the designation (Z-5..ZL or F-8..ZL).

Please contact us for further information on the bearing design.

Design and safety guidelines

Load limit

The loading of split bearings must be restricted.

The load limit $P/C_r \leqq 0{,}2$ must be observed.

P	kN	Equivalent dynamic bearing load
C_r	kN	Basic dynamic load rating.

Axial load carrying capacity

Based on experience, the permissible axial force F_a of semi-locating and locating bearings is 10% to 20% of the radial force F_r.
If higher axial forces are expected, our advisory service should be contacted for assistance.

Equivalent dynamic bearing load

For bearings under dynamic loading, the following applies:

$$P = f_s \cdot F_r$$

P	kN	Equivalent dynamic bearing load
$f_s = 1{,}1$	–	Shock factor
F_r	kN	Radial dynamic bearing load.

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 rating life must be calculated using our calculation program BEARINX®.

Equivalent static bearing load

For bearings under static loading, the following applies:

$$P_0 = F_{0r}$$

P_0	kN	Equivalent static bearing load
F_{0r}	kN	Radial static bearing load.

Minimum radial load

In continuous operation, a minimum radial load of the order of $F_{r\,min} = C_{0r}/60$ is necessary.

If $F_{r\,min} < C_{0r}/60$, please contact us.

Design of bearing arrangements

The shaft diameter and the bearing bore should match as precisely as possible. It is recommended that the shaft is machined to g6 or h6. Once the screws in the locking collars have been tightened, there is a gap at the parting lines of 0,3 mm to 0,4 mm. This gives a tight fit of the bearing inner ring.

The housing bore should be machined to H6 or H7.

Split cylindrical roller bearings

Accuracy

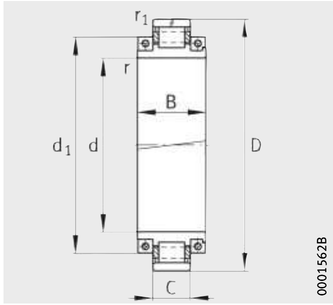
The dimensional and running accuracy of the split cylindrical roller bearings of the basic design correspond to tolerance class PN to DIN 620.

Radial internal clearance

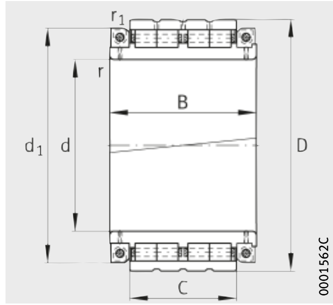
In most cases, split cylindrical roller bearings have a radial internal clearance to internal clearance group CN.
Please contact us for further information on the radial internal clearance.

Split cylindrical roller bearings

Single and double row
Non-locating, semi-locating
and locating bearings



Design 1
Non-locating bearing

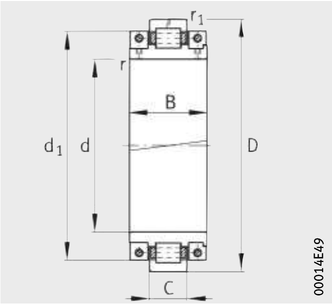


Design 1
Non-locating bearing, four-row

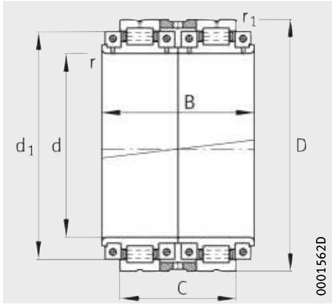
Dimension table · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	B	C
Z-533705.ZL	6	111	**279,4**	430	203,35	110
F-804807.ZL	6[1)]	131	**300**	558,8	220	139,7
Z-521220.ZL	1	50,9	**304,8**	438,15	142,875	74,613
Z-541234.ZL	8	111	**350**	470	240	170
Z-528438.ZL	1	73,5	**355,6**	488,95	146,05	74,613
Z-549659.ZL	6	18,7	**360**	440	80	38
Z-577892.ZL	8	89,5	**360**	460	225	164
Z-561001.ZL	1	115	**400**	600	160	90
Z-577677.ZL	8	289	**400**	600	328	244
Z-581006.ZL	8	334	**400**	600	420	200
Z-572885.ZL	1	190	**400**	615,95	200	115,9
Z-572886.ZL	1	194	**400**	615,95	200	115,9
Z-543717.ZL	1	73,3	**406,4**	546,1	161	76,2
Z-579574.ZL	6	224	**440**	666,75	200	115,9
Z-538563.ZL	1[2)]	213	**450**	600	275	200
F-807475.ZL	6	88,6	**480**	600	160	75
F-804678.ZL	6	109	**500**	635	155	73
Z-577893.ZL	8	234	**500**	635	310	228
Z-545148.ZL	8	337	**500**	680	332	220
Z-546551.ZL	6	760	**500**	850,9	360	210
Z-543852.ZL	1	117	**533,4**	692,15	187	81
Z-548795.ZL	8	239	**553**	700	260	184
Z-563458.ZL	8	255	**553**	710	260	184
Z-580869.ZL	6	95,8	**560**	680	142	72
F-807125.ZL	8	456	**560**	730	460	350
F-804627.ZL	6	218	**580**	750	257,5	85
F-801807.ZL	8	490	**580**	750	515	305
F-804300.ZL	8	307	**600**	735	380	278
Z-577936.ZL	8	432	**600**	775	380	278
Z-567618.ZL	6	200	**610**	775	190	88
Z-572298.ZL	1	202	**610**	775	190	100

1) Outer ring split (in vee-shape).
2) Four-row.



Design 6
Locating bearing

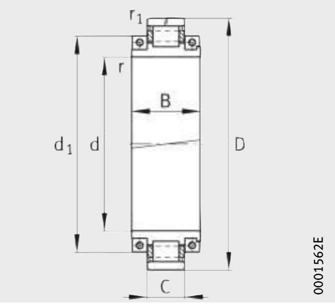


Design 8
Locating bearing

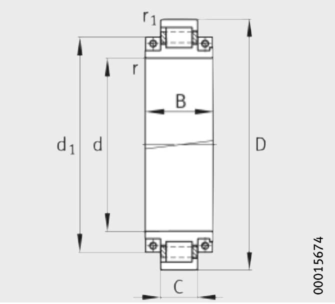
			Basic load ratings		Fatigue limit load
d_1	r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
378	6	6	1 460	2 600	270
440	12	4	2 400	3 400	325
–	2,4	3,2	815	1 530	134
433	5	5	1 900	4 750	470
443	2	2	915	1 900	182
–	3	3	415	880	71
433	4	4	1 160	2 900	280
–	5	5	1 630	2 500	198
–	5	5	2 240	4 300	335
549	7,5	3	3 100	7 800	730
508	5	5	2 080	3 750	350
508	5	5	2 080	3 750	350
–	2	2	1 160	2 320	186
580	3	3	2 200	4 150	380
–	5	5	2 850	7 650	640
565	3	3	1 060	2 500	223
600	8	5	1 290	2 900	260
600	8	5	2 240	5 850	520
622	12	5	3 200	8 150	730
–	12	5	5 300	9 300	780
–	2	2	1 120	2 280	178
668	3	3	2 750	8 150	710
668	3	3	2 750	8 150	710
645	3	3	1 250	3 200	280
678	8	5	3 750	10 000	850
–	5	5	1 730	3 900	330
–	18	5	3 000	7 800	660
690	6	6	3 000	8 800	750
720	15	6	3 250	9 000	750
720	5	5	1 900	4 500	380
730	5	5	1 900	4 500	380

Split cylindrical roller bearings

Single and double row
Non-locating, semi-locating
and locating bearings



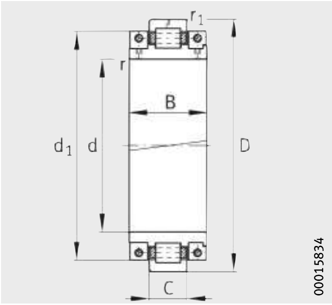
Design 1
Non-locating bearing



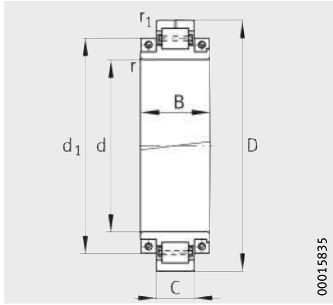
Design 3
Semi-locating bearing

Dimension table (continued) · Dimensions in mm

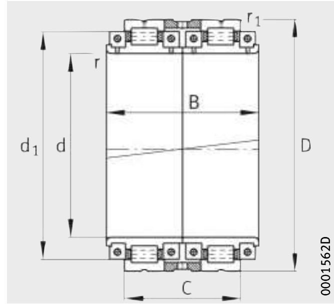
Designation	Design	Mass m ≈kg	Dimensions d	D	B	C
Z-526783.01.ZL	1	190	**630**	794	190	88
Z-526783.02.ZL	1	200	**630**	794	190	88
Z-526783.03.ZL	6	193	**630**	794	190	88
Z-549642.ZL	6	191	**630**	794	190	88
Z-548937.ZL	1	231	**630**	850	172	100
Z-548907.ZL	1	277	**630**	850	230	128
Z-568614.ZL	6	209	**640**	805	190	88
Z-574879.ZL	8	425	**640**	805	380	290
Z-579611.ZL	8	350	**650**	785	310	228
Z-573047.ZL	6	694	**650**	940	320	200
Z-573048.ZL	1	669	**650**	940	320	200
F-809831.ZL	6	720	**650**	980	320	200
F-809832.ZL	1	706	**650**	980	320	200
Z-525120.ZL	1	115	**670**	820	120	69
Z-556785.ZL	3	117	**670**	820	120	69
Z-526784.01.ZL	1	203	**690**	864	196	94
Z-577902.ZL	8	531	**690**	865	390	284
Z-514893.ZL	1	158	**710**	870	140	76
F-809613.ZL	8	447	**710**	880	380	290
Z-522468.ZL	7	260	**750**	920	185	106
Z-578276.ZL	8	550	**750**	920	400	300
Z-514128.ZL	1	541	**750**	940	210	128
Z-523125.ZL	7	325	**750**	940	210	128
F-801623.01.ZL	6	220	**775**	945	165	80
F-809722.ZL	8	470	**775**	945	330	245
Z-529031.01.ZL	7	470	**799,8**	1 080	210	128
F-801572.ZL	8	552	**820**	990	380	290



Design 6
Locating bearing



Design 7
With pin cage
Locating bearing

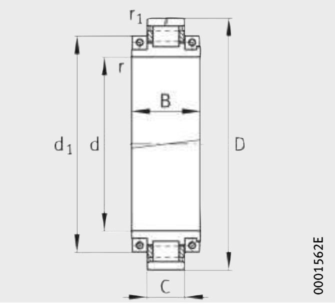


Design 8
Locating bearing

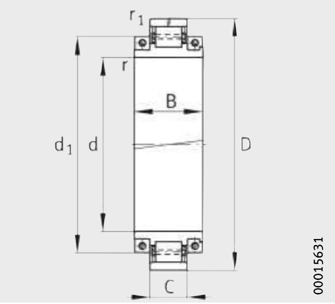
			Basic load ratings		Fatigue limit load
d_1	r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
740	5	2	1 900	4 650	390
740	16	3	1 900	4 650	390
740	5	2	1 900	4 650	390
740	5	5	1 900	4 650	390
738	6	6	2 280	4 650	390
–	6	6	2 800	6 100	455
750	5	5	1 960	4 650	390
750	5	5	3 750	11 000	920
–	5	5	2 500	7 350	530
810	6	6	5 600	11 800	960
810	6	6	5 600	11 800	960
835	6	6	5 600	10 400	830
835	6	9,5	5 600	10 400	830
760	4	4	1 290	2 900	232
760	4	4	1 290	2 900	232
805	6	2	2 240	5 400	440
815	12	6	3 550	10 200	840
–	5	5	1 370	3 150	248
822	12	6	3 900	11 400	910
–	7,5	7,5	2 600	7 350	540
870	5	5	3 900	12 000	970
–	7,5	7,5	2 600	7 500	540
880	9,5	7,5	2 900	8 650	560
895	10	5	1 830	4 550	360
895	10	5	3 100	9 150	720
–	9,5	9,5	4 050	9 000	600
–	5	5	4 300	14 000	970

Split cylindrical roller bearings

Single and double row
Non-locating, semi-locating
and locating bearings



Design 1
Non-locating bearing

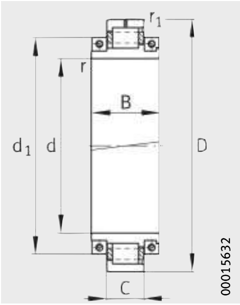


Design 2
With pin cage
Non-locating bearing

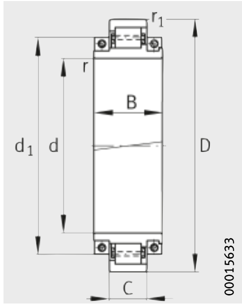
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	B	C
Z-540908.ZL	4	205	**900**	1 090	150	85
Z-522292.ZL	1	213	**900**	1 090	150	85
Z-537876.ZL	4	189	**950**	1 150	160	90
Z-527210.ZL	7	596	**950**	1 220	220	128
Z-525667.ZL	7	591	**1 000**	1 255	222,5	115
Z-513201.ZL	2	667	**1 000**	1 255	240	150
Z-533265.ZL	2	1 190	**1 150**	1 490	305	175
Z-533266.ZL	7	1 210	**1 150**	1 490	305	175
Z-526112.ZL	6[1]	603	**1 250**	1 500	192	112
Z-531338.01.ZL	5	909	**1 400**	1 700	225	132
Z-537179.ZL	1	1 680	**1 700**	2 060	300	160

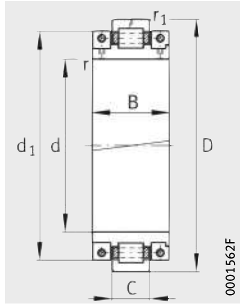
[1] Without lubrication groove and lubrication hole.



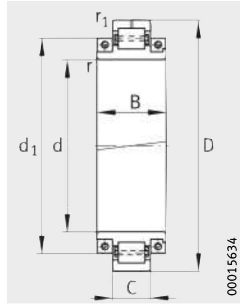
Design 4
Semi-locating bearing



Design 5
With pin cage
Semi-locating bearing

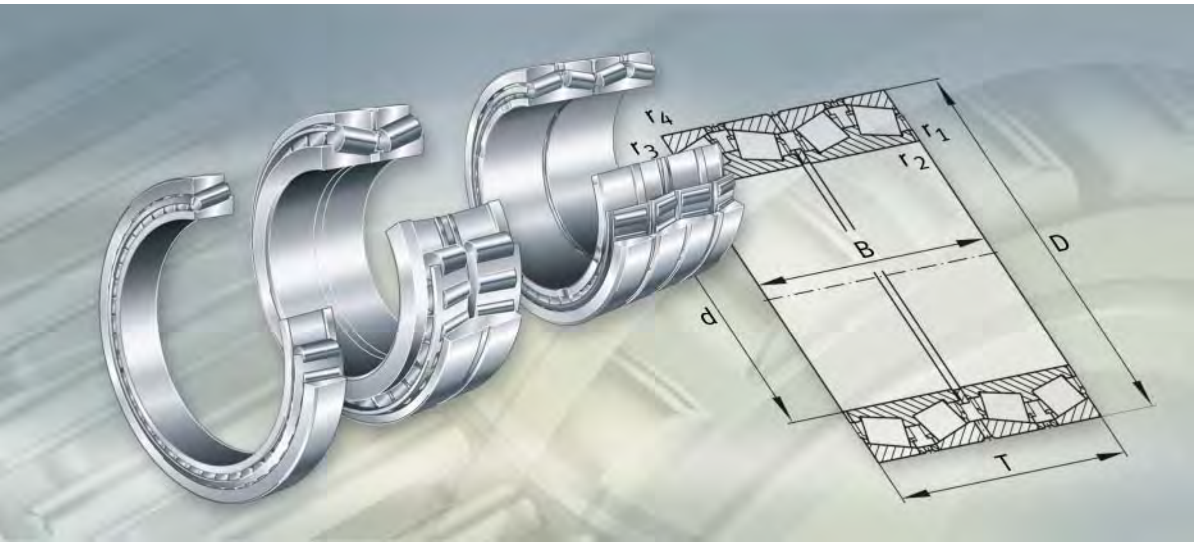


Design 6
Locating bearing



Design 7
With pin cage
Locating bearing

			Basic load ratings		Fatigue limit load
d_1	r min.	r_1 min.	dyn. C_r kN	stat. C_{0r} kN	C_{ur} kN
–	6	6	1 900	4 650	290
–	5	5	1 930	4 750	290
–	6	6	2 000	4 900	310
–	9,5	9,5	4 400	10 400	810
–	9,5	7,5	3 800	10 000	830
1 168	6	6	4 550	12 700	940
1 355	12	7,5	6 800	17 300	1 210
1 355	12	7,5	6 800	17 300	1 210
1 413	6	6	3 350	8 800	520
1 570	6	6	5 400	15 000	1 020
1 900	7,5	7,5	6 800	18 000	1 120



Tapered roller bearings

Single row
Double row
Four-row

Tapered roller bearings

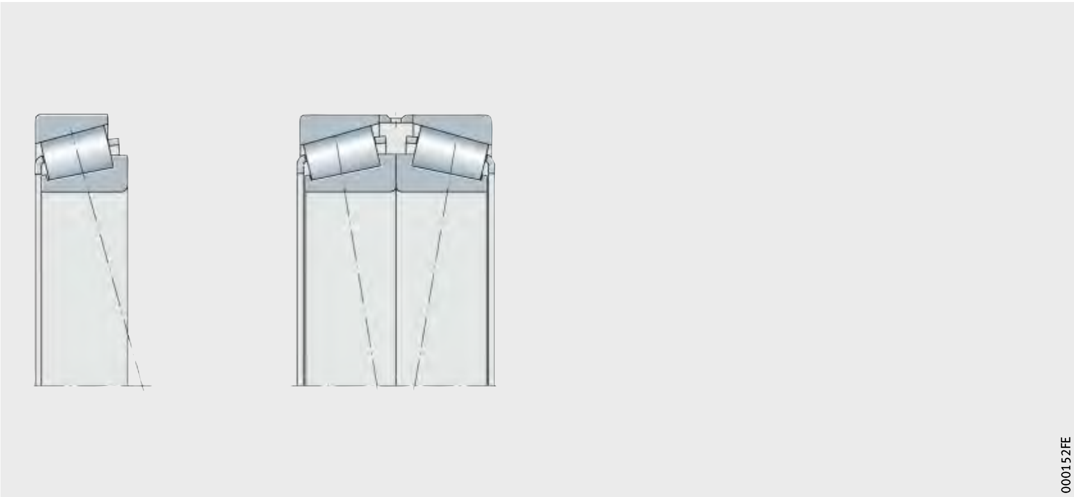
In some single row tapered roller bearings, the outer ring can be removed. As a result, the rings can be mounted separately. Tapered roller bearings can support high radial loads and can support axial forces in one direction. They must normally be axially adjusted against a second bearing mounted in a mirror image arrangement. Single row tapered roller bearings matched in an X arrangement can support high axial forces from both directions. In addition to bearings with standardised main dimensions (DIN 720), bearings in metric and inch sizes with non-standardised designations (Z-5..TR1 or F-8..TR1) are also available. A typical application for single row tapered roller bearings is in gearboxes.

The bearings can support high radial and axial loads. The main dimensions and designations are not standardised in DIN and ISO.

Bearings with two outer rings and an outer intermediate ring are designed for a loose fit on the roll journal. A similar design with extended inner rings achieves a tight fit when used in conjunction with a tapered bore.

Bearings with one outer ring have two inner rings and are used, for example, as cable sheave bearings in drilling towers. Bearings with one inner intermediate ring are used, for example, in rolling mills. Double row tapered roller bearings with two outer rings, without an intermediate ring and with a particularly large contact angle are suitable for supporting very high axial forces. They are used as axial bearings, for example for work rolls or oil film bearings.

Four-row tapered roller bearings are special bearings for rolling mills. They can support axial forces in both directions as well as very high radial forces. The bearings are separable but must be mounted as complete units in the chock before this is slid onto the roll journal. Four-row bearings with a cylindrical bore are therefore designed for a loose fit on the roll journal. Lubrication of the journal is improved in many cases by a helical groove in the bore of the inner ring. For high speeds and loads, a tight fit on the journal is necessary. In this case, we can by agreement supply four-row bearings with a tapered bore. Four-row tapered roller bearings with integral seals can achieve longer life than open bearings as a result of better lubrication and cleanliness. The main dimensions and designations are not standardised in DIN and ISO.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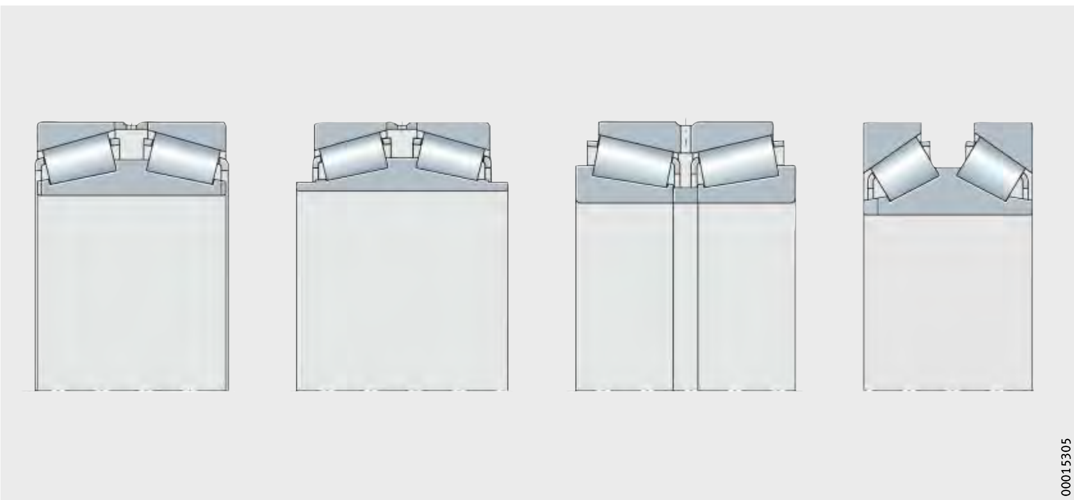
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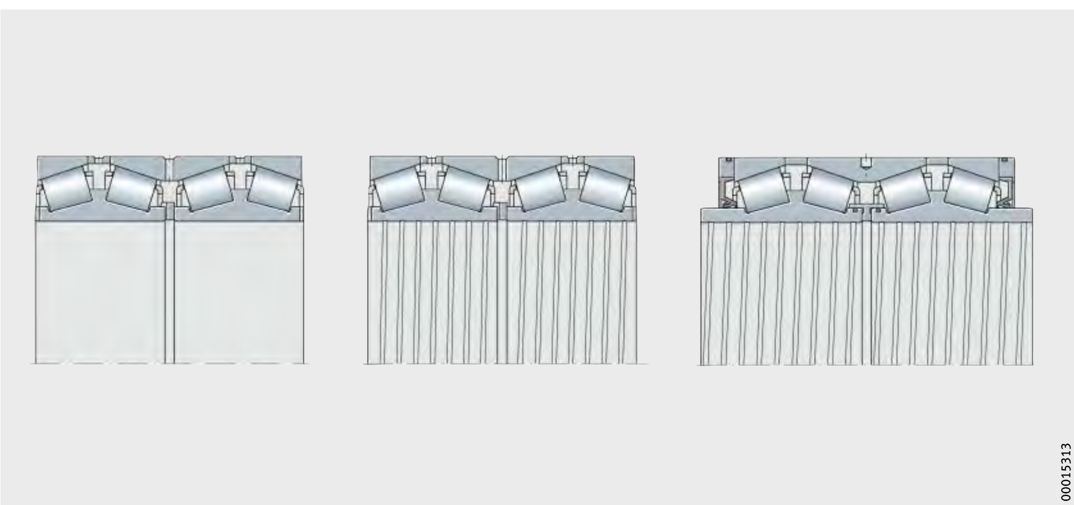
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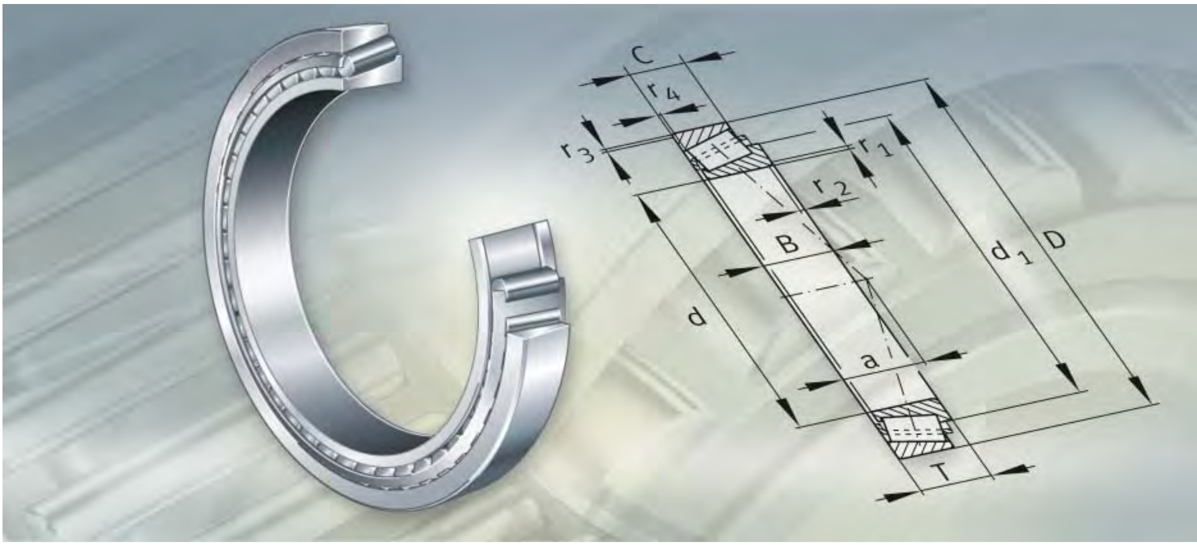


Single row tapered roller bearings

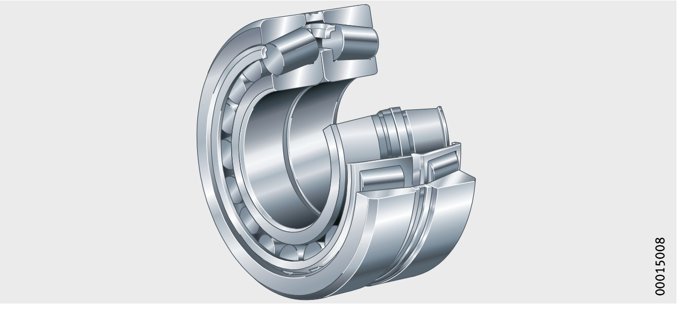
Single row tapered roller bearings

Single row

302, 303, 313, 320, 322, 323..-A, 329, Z-5..TR1, F-8..TR1

Matched
In X arrangement

302..-N11CA, 303..-N11CA, 313..-N11CA, 320..-N11CA, 322..-N11CA, 323..-N11CA, 329..-N11CA



Single row tapered roller bearings

Features

Single row 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 mounted separately from the outer ring.

In addition to bearings with standardised main dimensions and standardised designations, special bearings in metric and inch sizes with non-standardised designations (Z-5..TR1 or F-8..TR1) are also available.

For new designs, bearings in metric sizes should always be used in preference.

Radial and axial load capacity

Single row tapered roller bearings can support axial forces in one direction and high radial forces.
They must normally be axially adjusted against a second bearing mounted in a mirror image arrangement. This bearing combination is mounted in an O or X arrangement, *Figure 1* and *Figure 2*, page 501.

Contact angle

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 size of the contact angle and thus the load carrying capacity is indicated by the bearing-specific value e in the dimension tables. Bearings of series 313 have a very high axial load carrying capacity due to their particularly large contact angle.

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.

Single row tapered roller bearings

Matched bearings

Tapered roller bearings with the suffix 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 section Axial internal clearance, page 510.

We can also supply bearing pairs by agreement matched in an O arrangement (N11BA).

When ordering, the number of bearings must be stated, not the number of bearing pairs.

Sealing

Tapered roller bearings in either standard design or in matched pairs are not sealed.

Lubrication

They can be lubricated using oil or grease.

Operating temperature

Single row tapered roller bearings can be used at operating temperatures from –30 °C to +120 °C.
For continuous operating temperatures > +120 °C, please contact us.

Bearings with outside diameters of more than 240 mm are dimensionally stable up to +200 °C.

Cages

Single row 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 505, 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 outer rings. Axial internal clearance in µm	
W209C	Rings and rollers made from case hardening steel	
X	External dimensions matched to international standards	
P5	Increased accuracy	Special design, available by agreement and in certain series only

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, *Figure 1* and *Figure 2* as well as the table, page 502.

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 a load F_{rB}.
- F is an external axial force acting on bearing A.

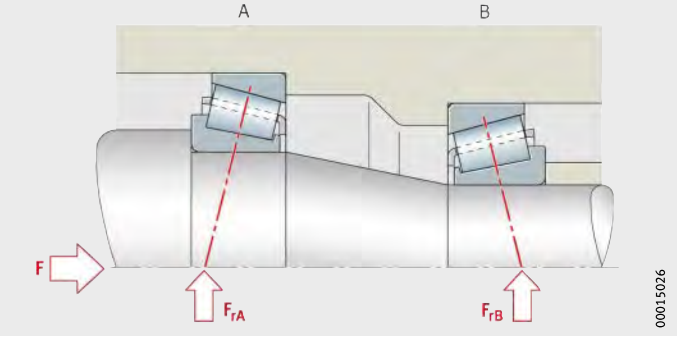


Figure 1
Bearings in O arrangement

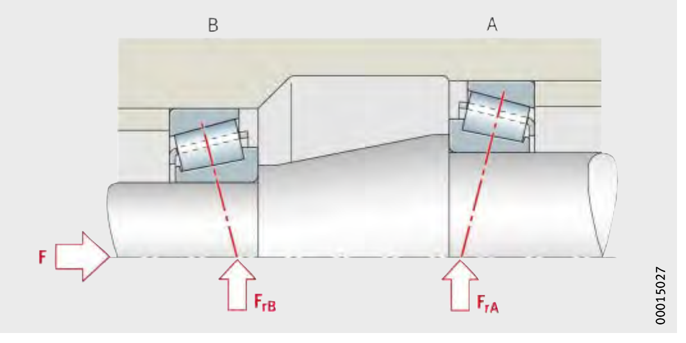


Figure 2
Bearings in X arrangement

Single row tapered roller bearings

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 equation is given, the axial force is not taken into consideration.

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies:

Single bearings 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 kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, Y –
Factors, see dimension tables.

For bearing pairs under dynamic load in an X or O arrangement, the following applies:

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 kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load of bearing pair

F_r kN
Radial dynamic bearing load of bearing pair

e, Y –
Factors for single bearing, see dimension tables.

For matched bearing pairs under dynamic load (suffix N11CA), the following applies:

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 kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load of bearing pair

F_r kN
Radial dynamic bearing load of bearing pair

e, Y_1, Y_2 –
Factors for bearing pair, see dimension tables.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads. It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

Single bearings under static load

For single bearings under static load, the following applies:

Load ratio	Equivalent static load
$\frac{F_{0a}}{F_{0r}} \leq \frac{1}{2 \cdot Y_0}$	$P_0 = F_{0r}$
$\frac{F_{0a}}{F_{0r}} > \frac{1}{2 \cdot Y_0}$	$P_0 = 0{,}5 \cdot F_{0r} + Y_0 \cdot F_{0a}$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load

F_{0r} kN
Radial static bearing load

Y_0 –
Factor, see dimension tables.

Bearing pairs under static load

For bearing pairs under static load in an X or O arrangement, the following applies:

$$P_0 = F_{0r} + 2 \cdot Y_0 \cdot F_{0a}$$

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load of bearing pair

F_{0r} kN
Radial static bearing load of bearing pair

Y_0 –
Factor for single bearing, see dimension tables.

Matched bearing pairs under static load

For matched bearing pairs under static load (suffix N11CA), the following applies:

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

P_0 kN
Equivalent static bearing load for combined load

F_{0a} kN
Axial static bearing load of bearing pair

F_{0r} kN
Radial static bearing load of bearing pair

Y_0 –
Factor for bearing pair, see dimension tables.

Basic load ratings and fatigue limit load for bearing pairs

If two bearings of the same size and design are mounted immediately adjacent to each other in an O or X arrangement, the basic dynamic load rating C_r, the basic static load rating C_{0r} and the fatigue limit load C_{ur} of the bearing pair are as follows:

- $C_r = 1{,}715 \cdot C_{r\ \text{single bearing}}$
- $C_{0r} = 2 \cdot C_{0r\ \text{single bearing}}$
- $C_{ur} = 2 \cdot C_{ur\ \text{single bearing}}$.

Matched bearings

For matched bearing pairs (suffix N11CA), the basic load ratings are given in the dimension tables.

Minimum radial load

In order to ensure operation without slippage, the bearings must be subjected to a minimum load $F_{r\ min}$ in a radial direction. This applies particularly in the case of high speeds and high accelerations.
For continuous operation, roller bearings with cage must therefore be subjected to a minimum radial load of the order of $P/C_r \geqq 0{,}02$.

Speeds

!

The limiting speeds n_G in the dimension tables must not be exceeded.

Matched bearings

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.

Design of bearing arrangements

Shaft and housing tolerances

Recommended shaft tolerances for radial bearings with cylindrical bore, see table, page 130.

Recommended housing tolerances for radial bearings, see table, page 131.

Mounting dimensions

The dimension tables give the maximum dimensions of the radii r_a and r_b and the diameters of the abutment shoulders.

Cage projection

!

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.

Single row tapered roller bearings

Accuracy

Bearings in metric sizes

The main dimensions of the standardised bearings conform to DIN ISO 355 and DIN 720, the dimensional and running tolerances conform to DIN 620-2.

Width tolerance to PN

Single row tapered roller bearings 303, 313, 322 and 323..-A correspond to tolerance class PN.

Bearings 320 and 329 for shaft diameters of more than 200 mm have width tolerances to tolerance class PN.

Inner ring tolerances, Part 1

Bore d mm		Bore deviation Δ_{dmp} μm		Variation V_{dp} μm	V_{dmp} μm	Radial runout K_{ia} μm
over	incl.	max.	min.	max.	max.	max.
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
400	500	0	−45	45	–	70
500	630	0	−50	50	–	85
630	800	0	−75	75	–	100

Inner ring tolerances, Part 2

Bore d mm		Width deviation Δ_{Bs} μm		Width deviation Δ_{Ts} μm		Δ_{T1s} μm		Δ_{T2s} μm	
over	incl.	max.	min.	max.	min.	max.	min.	max.	min.
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
400	500	0	−450	+450	−450	–	–	–	–
500	630	0	−500	+500	−500	–	–	–	–
630	800	0	−750	+600	−600	–	–	–	–

Outer ring tolerances

Outside diameter D mm		Outside diameter deviation Δ_{Dmp} μm		Variation V_{Dp} μm	V_{Dmp} μm	Radial runout K_{ea} μm
over	incl.	max.	min.	max.	max.	max.
315	400	0	−40	40	30	70
400	500	0	−45	45	34	80
500	630	0	−50	50	38	100
630	800	0	−75	75	–	120
800	1000	0	−100	100	–	120

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

Restricted tolerance P5

We can by agreement supply tapered roller bearings with restricted tolerances to tolerance class P5 to DIN 620-2.

Inner ring tolerances, Part 1

Bore		Bore deviation		Variation		Radial runout
d mm		Δ_{dmp} µm		V_{dp} µm	V_{dmp} µm	K_{ia} µm
over	incl.	max.	min.	max.	max.	max.
120	180	0	−18	14	9	11
180	250	0	−22	17	11	13
250	315	0	−25	–	–	–
315	400	0	−30	–	–	–
400	500	0	−35	–	–	–
500	630	0	−40	–	–	–
630	800	0	−75	–	–	–

Inner ring tolerances, Part 2

Bore		Width deviation		Width deviation	
d mm		Δ_{Bs} µm		Δ_{Ts} µm	
over	incl.	max.	min.	max.	min.
120	180	0	−500	+350	−250
180	250	0	−600	+350	−250
250	315	0	–	+350	−250
315	400	0	–	+400	−400
400	500	0	–	+400	−400
500	630	0	–	+500	−500
630	800	0	–	+600	−600

Outer ring tolerances

Outside diameter		Outside diameter deviation		Variation		Radial runout
D mm		Δ_{Dmp} µm		V_{Dp} µm	V_{Dmp} µm	K_{ea} µm
over	incl.	max.	min.	max.	max.	max.
315	400	0	−28	22	14	20
400	500	0	−33	–	–	23
500	630	0	−38	–	–	25
630	800	0	−45	–	–	30
800	1000	0	−60	–	–	35

Total width tolerance of matched bearings

The total width tolerance of bearing pairs with the suffix N11CA is determined from the axial internal clearance and the deviations of the width Δ_{Ts} of the single bearings, see table Inner ring tolerances, Part 2, page 506.

Bearings in inch sizes

Tapered roller bearings in inch sizes are manufactured as standard with normal tolerances to ANSI/ABMA.
The deviation of the width Δ_{Bs} and radial runout correspond to tolerance class PN to 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 d mm		Bore deviation Δ_{dmp} μm		Width deviation Δ_{Ts} μm	
over	incl.	max.	min.	max.	min.
127	305	+25	0	+350	−250
305	508	+50	0	+375	−375
508	610	+50	0	+375	−375
610	915	+75	0	+375	−375
915	1220	+100	0	+375	−375
1220	–	+125	0	+375	−375

Inner ring tolerances, Part 2

Bore d mm		Width deviation (in relation to bore) Δ_{Bs} μm		Radial runout K_{ia} μm
over	incl.	max.	min.	max.
180	250	0	−300	50
250	315	0	−350	60
315	400	0	−400	70
400	500	0	−450	70
500	630	0	−500	85
630	800	0	−750	100
800	1000	0	−1000	120

Outer ring tolerances, Part 1

Outside diameter D mm		Outside diameter deviation Δ_{Dmp} μm	
over	incl.	max.	min.
–	305	+25	0
305	610	+50	0
610	915	+75	0
915	1 220	+100	0

Outer ring tolerances, Part 2

Outside diameter D mm		Radial runout K_{ea} μm
over	incl.	max.
315	400	70
400	500	80
500	630	100
630	800	120
800	1 000	120
1 000	1 250	120

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 section Technical principles, table, page 118.

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.		
101,6	254	+0,65	+1,8

[1] r_{min}: see dimension table.

Limit values for chamfer dimensions r_{max} for the outer ring

Nominal outside diameter D mm		Chamfer dimension[1]	
		r_3 mm	r_4 mm
over	incl.		
266,7	355,6	+1,7	+1,7

[1] r_{min}: see dimension table.

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.

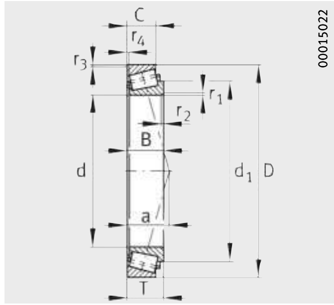
Example:

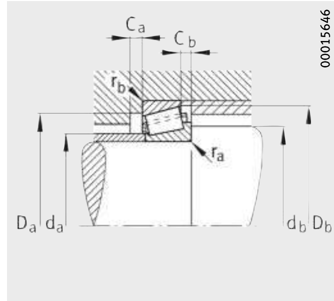
- A400-450 indicates that the axial internal clearance of the bearing pair before mounting is between 400 μm and 450 μm.

Once bearing pairs are mounted, the preset axial internal clearance is reduced by the fit conditions and the axial clamping forces.

Tapered roller bearings

Single row





Mounting dimensions

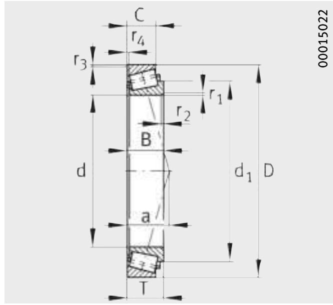
Dimension table · Dimensions in mm

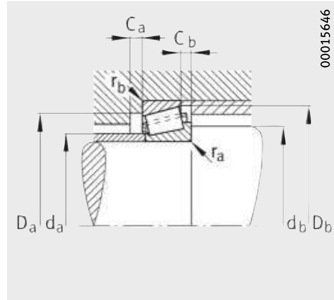
Designation	Mass	Dimensions									Mounting dimensions	
	m	d	D	T	B	C	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b
	≈kg						min.	min.	≈	≈	max.	min.
31330-X	28	**150**	320	82	75	50	5	4	100	231	181	168
32330-A	46,1	**150**	320	114	108	90	5	4	79	230	184	167
30332-A	29,9	**160**	340	75	68	58	5	4	63	237	201	178
Z-536739.TR1	34	**160**	340	87	79	54	5	4	107	253	189	206
32332	49,5	**160**	340	121	114	95	5	4	86	245	190	177
Z-536748.01.TR1	29,6	**170**	330	85	79	54	5	4	103	253	191	218
30334-A	35,3	**170**	360	80	72	62	5	4	67	252	213	188
Z-529416.TR1	39,2	**170**	360	92	84	56	5	4	113	260	194	210
32334	61,3	**170**	360	127	120	100	5	4	89	256	208	187
30236-A	17,9	**180**	320	57	52	43	5	4	62	242	211	198
32236-A	30,1	**180**	320	91	86	71	5	4	77	249,5	204	198
30336	40,9	**180**	380	83	75	64	5	4	69	–	230	197
Z-534422.TR1	45,9	**180**	380	97	88	60	5	4	119	274	210	197
Z-534215.TR1	30,1	**190**	340	80	80	55	5	4	103	269,9	210	230
32238-A	39,1	**190**	340	97	92	75	5	4	81	263	216	207
Z-538034.TR1	54,1	**190**	400	100	90	65	5	4	115	292,9	224	242
32338	83,2	**190**	400	140	132	109	6	5	97	281	230	210
30240-A	25,2	**200**	360	64	58	48	5	4	69	272	237	217
32240-A	43,2	**200**	360	104	98	82	5	4	83	274,5	226	217
30340	52,3	**200**	420	89	80	67	6	5	76	294	250	220
Z-538035.TR1	65,1	**200**	420	110	100	70	5	4	130	308,6	229	250
Z-514561.TR1	33,4	**206,375**	336,55	98,425	100,012	77,788	3,3	3,3	74	271,7	227	231
Z-514561.TR1-W209C	33,3	**206,375**	336,55	98,425	100,012	77,788	3,3	3,3	74	271,7	227	231
32044-X	24,3	**220**	340	76	76	57	4	3	73	280	243	234
Z-534216.TR1	44,8	**220**	400	90	90	62	5	4	118	313	249	266
32244-A	59,5	**220**	400	114	108	90	5	4	95	310,5	258	237
Z-531856.TR1	47	**230**	425	85	78	50	6	6	133	330,5	53	54
Z-536377.TR1	22,8	**234,95**	355,6	68,263	66,675	47,625	7	3,3	86	295,9	249	265
32948	11,1	**240**	320	51	51	39	3	2,5	65	281	254	252
32048-X	25,9	**240**	360	76	76	57	4	3	79	300	261	254
30248	48	**240**	440	79	72	60	5	4	76	325	285	257
32248-A	80,5	**240**	440	127	120	100	5	4	105	332	286	257
30348	88,6	**240**	500	105	95	80	6	5	90	347,5	296	260
Z-501927.TR1	21,3	**254**	358,775	71,438	71,438	53,975	3,6	3,3	65	302	270	274
Z-521849.TR1	14,5	**257,175**	342,9	57,15	57,15	44,45	6,4	3,3	72	301,5	269	281

							Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed	Interchange designation to ISO 355
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	
min.	max.	min.	min.	min.	max.	max.	kN	kN				kN	min^{-1}	min^{-1}	
251	302	300	9	32	5	4	790	1 040	0,83	0,73	0,4	115	2 240	1 530	T7GB150
264	302	299	12	24	5	4	1 330	1 950	0,35	1,74	0,96	221	2 240	1 320	–
290	322	310	9	17	5	4	890	1 140	0,35	1,74	0,96	123	2 240	1 510	T2GB160
268	–	321	9	33	5	4	890	1 190	0,83	0,73	0,4	128	2 200	–	–
280	–	320	12	26	5	4	1 170	1 740	0,38	1,58	0,87	194	2 100	1 390	–
260	–	311	9	31	5	4	810	1 150	0,8	0,75	0,41	126	2 100	–	–
307	342	329	9	18	5	4	1 040	1 360	0,35	1,74	0,96	146	2 100	1 350	–
304	–	336	9	30	5	4	1 010	1 360	0,83	0,73	0,4	145	2 000	–	–
295	–	335	12	27	5	4	1 640	2 550	0,36	1,67	0,92	280	1 960	1 090	–
278	302	297	9	14	5	4	610	850	0,45	1,33	0,73	93	2 240	1 500	T4GB180
267	302	303	10	20	5	4	1 010	1 640	0,45	1,33	0,73	187	2 100	1 230	T4GD180
327	–	350	10	19	5	4	1 120	1 470	0,35	1,74	0,96	155	1 960	1 260	–
297	–	356	10	37	5	4	1 100	1 500	0,83	0,73	0,4	158	1 800	–	–
269	–	320	12	25	5	4	810	1 310	0,78	0,77	0,42	144	2 000	–	–
286	322	323	10	22	5	4	1 140	1 820	0,44	1,38	0,76	203	1 960	1 260	T4GD190
314	–	370	11	35	5	4	1 170	1 620	0,73	0,82	0,45	169	1 700	–	–
330	–	373	14	31	6	5	1 960	2 950	0,35	1,73	0,95	315	1 680	970	–
315	342	336	9	16	5	4	760	1 060	0,44	1,38	0,76	113	1 960	1 300	T4GB200
302	342	340	11	22	5	4	1 320	2 080	0,41	1,48	0,81	225	1 960	1 060	T3GD200
360	–	385	10	22	6	5	1 300	1 720	0,35	1,74	0,96	174	1 680	1 110	–
328	–	395	12	40	5	4	1 390	1 890	0,79	0,76	0,42	192	1 500	–	–
306	–	318	8,5	14,5	3,3	3,3	1 120	2 000	0,34	1,78	0,98	223	2 000	–	–
306	–	317,7	10	16,5	3,3	3,3	1 120	2 000	0,34	1,78	0,98	223	2 000	–	–
300	326	326	12	19	4	3	890	1 630	0,43	1,39	0,77	179	1 820	1 130	T4FD220
321	–	376	10	28	5	4	1 020	1 570	0,75	0,8	0,44	164	1 500	–	–
336	382	380	12	24	5	4	1 540	2 550	0,44	1,38	0,76	270	1 540	910	–
68,4	–	78,6	9	35	6	6	950	1 440	0,88	0,68	0,37	146	1 400	–	–
318	–	333	7	21	7	3,3	660	1 310	0,59	1,02	0,56	144	1 800	–	–
294	308	311	9	12	3	2,5	510	1 050	0,46	1,31	0,72	116	1 960	1 160	T4EC240
318	346	346	12	19	4	3	900	1 680	0,46	1,31	0,72	181	1 680	1 060	T4FD240
383	–	410	10	19	5	4	870	1 260	0,36	1,68	0,92	126	1 540	1 120	–
372	422	415	14	27	5	4	1 850	3 100	0,44	1,38	0,76	320	1 400	800	–
425	–	454	12	25	6	5	1 780	2 410	0,35	1,74	0,96	232	1 330	870	–
335	–	343	8	17	3,6	3,3	800	1 560	0,34	1,76	0,97	168	1 700	–	–
322	–	333	6	12	6,4	3,3	500	1 150	0,46	1,29	0,71	126	1 800	–	–

Tapered roller bearings

Single row





Mounting dimensions

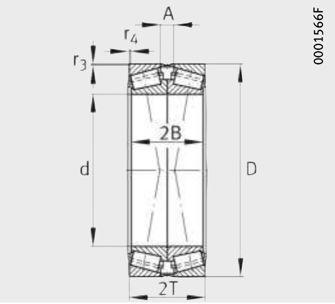
Dimension table (continued) · Dimensions in mm

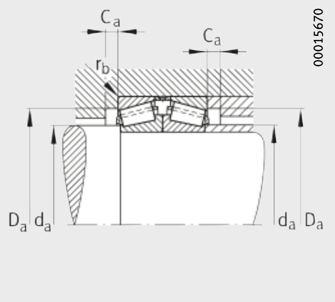
Designation	Mass	Dimensions									Mounting dimensions	
	m	d	D	T	B	C	r_1, r_2	r_3, r_4	a	d_1	d_a	d_b
	≈kg						min.	min.	≈	≈	max.	min.
32952	18,7	**260**	360	63,5	63,5	48	3	2,5	70	309	279	272
32052-X	41,1	**260**	400	87	87	65	5	4	86	331,5	287	278
30252-A	62,2	**260**	480	89	80	67	6	5	89	357	310	280
Z-507531.TR1	29,6	**260,35**	400,05	69,85	67,47	46,038	9,7	6,4	76	320,7	280	296
F-807586.TR1	15,7	**262**	355,6	57,15	57,15	44,45	3,6	3,3	61	312,5	281	285
Z-534990.TR1	5,72	**263,525**	325,438	28,575	28,575	25,4	1,5	1,5	48	295	277	277
32956	19,9	**280**	380	63,5	63,5	48	3	2,5	75	330	298	292
32056-X	40,5	**280**	420	87	87	65	5	4	91	349	305	298
32256	112	**280**	500	137	130	106	6	5	117	390	322	300
32960	31,4	**300**	420	76	76	57	4	3	80	362	324	314
32260	139	**300**	540	149	140	115	6	5	127	409,5	346	320
32964	33,5	**320**	440	76	76	57	4	3	86	382	343	334
32064-X	60,5	**320**	480	100	100	74	5	4	104	397,5	350	338
32264	170	**320**	580	159	150	125	6	5	136	439	372	340
32968	35,5	**340**	460	76	76	57	4	3	91	404	361	354
32972	37,1	**360**	480	76	76	57	4	3	97	423	380	374
Z-538300.TR1	19,1	**381**	479,425	49,212	47,625	34,925	6,4	3,3	75	429	395	406
Z-531341.01.TR1	76,6	**384,175**	546,1	104,775	104,775	82,55	6,4	6,4	98	459,5	407	417
Z-580755.TR1	6,68	**403,225**	460,375	28,575	28,575	20,638	3,5	3,3	70	431,1	414	418
Z-511041.TR1	27,2	**406,4**	508	61,912	61,912	47,625	3,3	3,3	83	455	423	426
Z-507170.TR1	43,3	**406,4**	546,1	76,2	61,12	55,562	6,4	6,4	113	469	425	435
Z-532528.TR1	93,4	**415,925**	590,55	114,3	114,3	88,9	6,4	6,4	105	492	441	451
Z-526434.TR1	115	**447,675**	635	120,65	120,65	95,25	6,4	6,4	111	534,9	474	484
Z-531546.TR1	68,1	**482,6**	634,873	80,962	80,962	63,5	6,4	3,3	116	564	510	516
Z-535194.TR1	56,7	**498,475**	634,873	80,962	80,962	63,5	6,4	3,3	116	564	524	529
Z-533416.TR1	115	**558,8**	736,6	104,775	104,775	80,962	6,4	6,4	121	645	585	594
Z-521901.TR1	110	**609,6**	787,4	93,662	93,662	69,85	6,4	6,4	156	699,5	633	642
F-808306.TR1	99,2	**620**	800	85	78	54	6	5	244	723	654	676
Z-507596.TR1	90,6	**670**	820	88	80	68	6	4	182	745	696	720
Z-510362.TR1	118	**723,9**	914,4	84,138	80,962	60,325	5,6	6,4	138	809	750	756
Z-534835.TR1	67	**760**	889	69,85	69,85	51,18	3,3	3,3	147	822,3	779	783
F-808307.TR1	235	**850**	1 090	115	106	77	7,5	7,5	218	963	900	918
F-808305.TR1	319	**1 000**	1 250	115	115	85	9,5	9,5	180	1 110	1 058	1 070

							Basic load ratings		Calculation factors			Fatigue limit load	Limiting speed	Reference speed	Interchange designation to ISO 355
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	
min.	max.	min.	min.	min.	max.	max.	kN	kN				kN	min^{-1}	min^{-1}	
328	348	347	11	15,5	3	2,5	750	1 500	0,41	1,48	0,81	161	1 680	990	T3EC260
352	382	383	14	22	5	4	1 150	2 140	0,43	1,38	0,76	225	1 540	920	T4FC260
419	–	447	10	22	6	5	1 460	2 090	0,4	1,48	0,81	202	1 330	860	–
366	–	371,5	7	18	9,7	6,4	710	1 260	0,44	1,36	0,75	132	1 500	–	–
335	–	346	6	11	3,6	3,3	590	1 200	0,36	1,69	0,93	129	1 700	–	–
312	–	315	5	3	1,5	1,5	226	530	0,37	1,64	0,9	36	1 800	–	–
348	368	368	11	15,5	3	2,5	740	1 520	0,43	1,39	0,76	162	1 540	940	T4EC280
370	402	402	14	22	5	4	1 200	2 300	0,46	1,31	0,72	238	1 400	840	T4FC280
418	–	475	14	31	6	5	2 290	3 950	0,45	1,34	0,73	395	1 190	660	–
383	406	405	12	19	4	3	990	2 030	0,39	1,52	0,84	208	1 330	820	T3FD300
453	–	510	16	34	6	5	2 650	4 550	0,43	1,38	0,76	445	1 120	590	–
402	426	426	13	19	4	3	1 060	2 270	0,42	1,44	0,79	229	1 260	740	–
424	462	461	15	26	5	4	1 560	3 050	0,46	1,31	0,72	305	1 190	690	T4GD320
486	–	555	16	34	6	5	3 000	5 200	0,44	1,38	0,76	490	1 050	530	–
421	446	446	12	19	4	3	1 080	2 370	0,44	1,37	0,75	236	1 190	690	–
439	466	466	14	19	4	3	1 060	2 370	0,46	1,31	0,72	233	1 120	660	–
455	–	465	5	12	6,4	3,3	455	1 140	0,38	1,57	0,86	110	1 100	–	–
507	–	519	10	17,5	6,4	6,4	1 780	3 950	0,33	1,8	0,99	375	1 100	–	–
445	–	452	5	6	3,5	3,3	233	670	0,4	1,49	0,82	41	1 100	–	–
483	–	492	7	14	3,3	3,3	810	1 980	0,36	1,65	0,9	191	1 100	–	–
504	–	516	–	16,5	6,4	6,4	1 030	2 120	0,47	1,27	0,7	195	1 100	–	–
549	–	562,4	12	25	6,4	6,4	1 970	4 150	0,34	1,76	0,97	385	950	–	–
591	–	610	10	20	6,4	6,4	2 460	5 200	0,33	1,84	1,01	470	900	–	–
603	–	609	5	13,5	6,4	3,3	1 170	2 800	0,43	1,4	0,77	250	850	–	–
603	–	610	9	13	6,4	3,3	1 170	2 800	0,43	1,4	0,77	250	850	–	–
696	–	708	11	19	6,4	6,4	2 270	5 500	0,35	1,73	0,95	470	700	–	–
747	–	756	10	19	6,4	6,4	1 800	4 500	0,5	1,2	0,66	380	670	–	–
723	–	776	13	31	6	5	1 450	3 550	0,88	0,68	0,38	295	670	–	–
770	–	804	10	15	6	4	1 400	3 650	0,57	1,05	0,58	305	630	–	–
873	–	876	9	19	5,6	6,4	1 980	4 750	0,38	1,57	0,87	375	560	–	–
857	–	860	7	19	3,3	3,3	1 120	3 700	0,43	1,38	0,76	300	560	–	–
1 006	–	1 047	13	38	7,5	7,5	2 750	6 800	0,53	1,14	0,63	520	500	–	–
1 175	–	1 201	15	30	9,5	9,5	3 650	9 900	0,35	1,72	0,95	720	450	–	–

Tapered roller bearings

Matched pairs
in X arrangement





Mounting dimensions

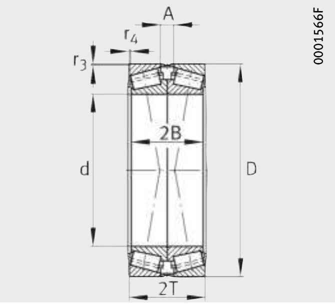
Dimension table · Dimensions in mm

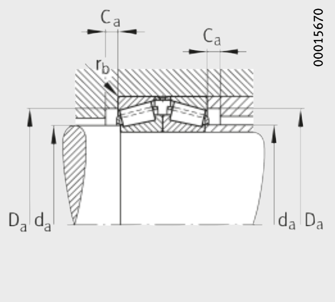
Designation	Mass for bearing pair	Dimensions						Mounting dimensions				
	m	d	D	2B	2T	r_3, r_4	A	d_a	D_a		C_a	r_b
	≈kg					min.		max.	min.	max.	min.	max.
30330-A-N11CA-A380-430	51,6	**150**	320	130	144	4	34	189	273	302	9	4
31330-X-N11CA	57,7	**150**	320	150	164	4	64	181	251	302	9	4
32330-A-N11CA	87,9	**150**	320	216	228	4	48	184	264	302	12	4
30332-A-N11CA	60,7	**160**	340	136	150	4	34	201	290	322	9	4
32332-N11CA	92,9	**160**	340	228	242	4	52	190	280	322	12	4
30334-A-N11CA	73,3	**170**	360	144	160	4	36	213	307	342	9	4
32334-N11CA	125	**170**	360	240	254	4	54	208	295	342	12	4
30236-A-N11CA	36	**180**	320	104	114	4	28	211	278	302	9	4
32236-A-N11CA	61,3	**180**	320	172	182	4	40	204	267	302	10	4
32236-A-N11CA-A430-480	61,3	**180**	320	172	182	4	40	204	267	302	10	4
30336-N11CA	83,7	**180**	380	150	166	4	38	230	327	362	10	4
32336-N11CA	128	**180**	380	252	268	4	56	215	310	362	14	4
30238-N11CA	41,9	**190**	340	110	120	4	28	224	298	322	9	4
32338-N11CA	164	**190**	400	264	280	5	62	230	330	377	14	5
30240-A-N11CA	52,9	**200**	360	116	128	4	32	237	315	342	9	4
30240-A-N11CA-A550-600	52,9	**200**	360	116	128	4	32	237	315	342	9	4
32240-A-N11CA	88,2	**200**	360	196	208	4	44	226	302	342	11	4
32240-A-N11CA-A400-450	88,2	**200**	360	196	208	4	44	226	302	342	11	4
30340-N11CA	107	**200**	420	160	178	5	44	250	360	397	10	5
32340-N11CA	168	**200**	420	276	292	5	62	240	345	397	14	5
32044-X-N11CA	49,4	**220**	340	152	152	3	38	243	300	326	12	3
32044-X-N11CA-A300-350	49,4	**220**	340	152	152	3	38	243	300	326	12	3
32244-A-N11CA	123	**220**	400	216	228	4	48	258	336	382	12	4
32244-A-N11CA-A400-450	123	**220**	400	216	228	4	48	258	336	382	12	4
30344-N11CA	136	**220**	460	176	194	5	48	274	392	437	10	5
32048-X-N11CA	58,3	**240**	360	152	152	3	38	261	318	346	12	3
32048-X-N11CA-A450-500	58,3	**240**	360	152	152	3	38	261	318	346	12	3
30248-N11CA	87,6	**240**	440	144	158	4	38	285	383	417	10	4
32248-A-N11CA	166	**240**	440	240	254	4	54	286	372	422	14	4
32248-A-N11CA-A450-500	166	**240**	440	240	254	4	54	286	372	422	14	4
30348-N11CA	177	**240**	500	190	210	5	50	296	425	477	12	5
32052-X-N11CA	77,5	**260**	400	174	174	4	44	287	352	382	14	4
32052-X-N11CA-A500-550	77,5	**260**	400	174	174	4	44	287	352	382	14	4

Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed Bearing pair	Reference speed Bearing pair
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	n_G min^{-1}	n_B min^{-1}
1 380	2 050	0,35	1,96	2,91	1,91	225	2 240	1 310
1 360	2 090	0,83	0,82	1,22	0,8	230	2 240	1 220
2 270	3 900	0,35	1,96	2,91	1,91	445	2 240	1 060
1 520	2 280	0,35	1,96	2,91	1,91	246	2 240	1 210
2 010	3 450	0,38	1,78	2,65	1,74	385	2 100	1 120
1 780	2 700	0,35	1,96	2,91	1,91	290	2 100	1 090
2 800	5 100	0,36	1,87	2,79	1,83	560	1 960	870
1 040	1 700	0,45	1,5	2,23	1,47	185	2 240	1 200
1 730	3 300	0,45	1,5	2,23	1,47	375	2 100	990
1 730	3 300	0,45	1,5	2,23	1,47	375	2 100	990
1 930	2 950	0,35	1,96	2,91	1,91	310	1 960	1 010
2 460	4 350	0,38	1,78	2,65	1,74	470	1 820	950
910	1 560	0,39	1,75	2,61	1,71	169	2 120	1 210
3 350	5 900	0,35	1,95	2,9	1,91	630	1 680	780
1 300	2 120	0,44	1,55	2,31	1,52	225	1 960	1 040
1 300	2 120	0,44	1,55	2,31	1,52	225	1 960	1 040
2 270	4 150	0,41	1,66	2,47	1,62	450	1 960	850
2 270	4 150	0,41	1,66	2,47	1,62	450	1 960	850
2 230	3 450	0,35	1,96	2,91	1,91	350	1 680	880
3 000	5 300	0,37	1,8	2,69	1,76	560	1 680	820
1 530	3 250	0,43	1,57	2,34	1,53	355	1 820	910
1 530	3 250	0,43	1,57	2,34	1,53	355	1 820	910
2 650	5 100	0,44	1,55	2,31	1,52	540	1 540	730
2 650	5 100	0,44	1,55	2,31	1,52	540	1 540	730
2 470	3 750	0,35	1,96	2,91	1,91	370	1 400	820
1 540	3 350	0,46	1,47	2,19	1,44	360	1 680	850
1 540	3 350	0,46	1,47	2,19	1,44	360	1 680	850
1 490	2 550	0,36	1,89	2,81	1,85	255	1 540	890
3 150	6 200	0,44	1,55	2,31	1,52	660	1 400	640
3 150	6 200	0,44	1,55	2,31	1,52	660	1 400	640
3 050	4 800	0,35	1,96	2,91	1,91	465	1 330	700
1 980	4 300	0,43	1,55	2,31	1,52	450	1 540	730
1 980	4 300	0,43	1,55	2,31	1,52	450	1 540	730

Tapered roller bearings

Matched pairs
In X arrangement





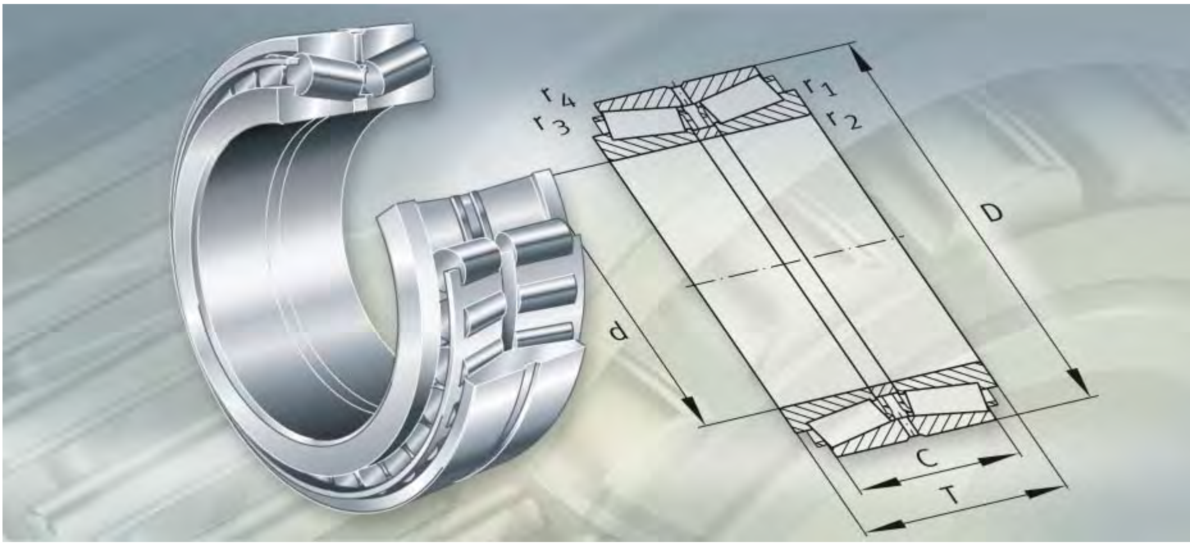
Mounting dimensions

Dimension table (continued) · 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		C_a	r_b
	≈kg					min.		max.	min.	max.	min.	max.
32056-X-N11CA	82	**280**	420	174	174	4	44	305	370	402	14	4
32056-X-N11CA-A550-600	82	**280**	420	174	174	4	44	305	370	402	14	4
32256-N11CA	227	**280**	500	260	274	5	62	322	418	477	14	5
32960-N11CA	63,6	**300**	420	152	152	3	38	324	383	406	12	3
32960-N11CA-A650-700	63,6	**300**	420	152	152	3	38	324	383	406	12	3
32060-X-N11CA	117	**300**	460	200	200	4	52	329	404	442	15	4
32060-X-N11CA-A450-500	117	**300**	460	200	200	4	52	329	404	442	15	4
32964-N11CA	67,2	**320**	440	152	152	3	38	343	402	426	13	3
32964-N11CA-A600-650	67,2	**320**	440	152	152	3	38	343	402	426	13	3
32064-X-N11CA	125	**320**	480	200	200	4	52	350	424	462	15	4
32064-X-N11CA-A650-700	125	**320**	480	200	200	4	52	350	424	462	15	4
32968-N11CA	73,1	**340**	460	152	152	3	38	361	421	446	12	3
32968-N11CA-A550-600	73,1	**340**	460	152	152	3	38	361	421	446	12	3

Basic load ratings		Calculation factors				Fatigue limit load	Limiting speed Bearing pair	Reference speed Bearing pair
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	n_G min^{-1}	n_B min^{-1}
2 050	4 600	0,46	1,47	2,19	1,44	475	1 400	670
2 050	4 600	0,46	1,47	2,19	1,44	475	1 400	670
3 950	7 900	0,45	1,5	2,24	1,47	790	1 190	520
1 760	4 300	0,39	1,71	2,54	1,67	440	1 330	630
1 760	4 300	0,39	1,71	2,54	1,67	440	1 330	630
2 600	5 700	0,43	1,55	2,31	1,52	580	1 260	600
2 600	5 700	0,43	1,55	2,31	1,52	580	1 260	600
1 810	4 550	0,42	1,62	2,42	1,59	460	1 260	590
1 810	4 550	0,42	1,62	2,42	1,59	460	1 260	590
2 700	6 100	0,46	1,47	2,19	1,44	610	1 190	580
2 700	6 100	0,46	1,47	2,19	1,44	610	1 190	580
1 850	4 750	0,44	1,54	2,3	1,51	475	1 190	550
1 850	4 750	0,44	1,54	2,3	1,51	475	1 190	550

FAG



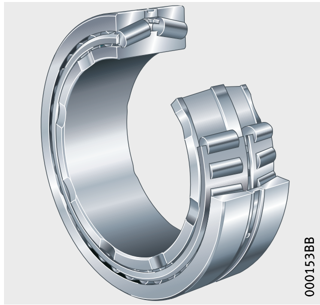
Double row tapered roller bearings

Double row tapered roller bearings

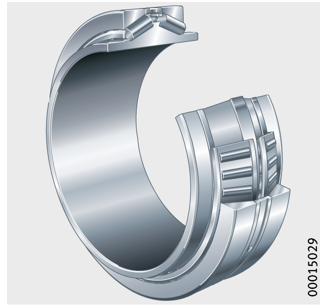
With two outer rings (X arrangement)

For loose fit on the journal
With extended inner ring

Z-5..TR2-06, F-8..TR2-06



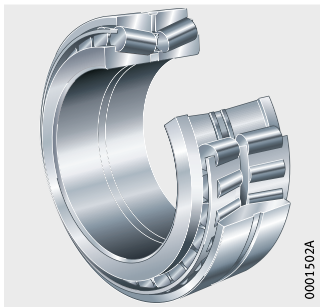
Z-5..TR2-03, F-8..TR2-03



With two inner rings (O arrangement)

With intermediate ring
Without intermediate ring

Z-5..TR2-05, F-8..TR2-05

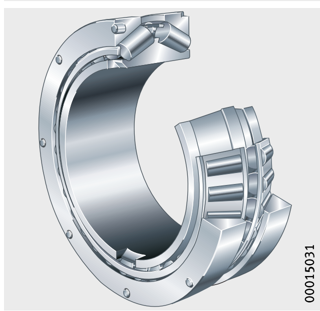


Z-5..TR2-04, F-8..TR2-04

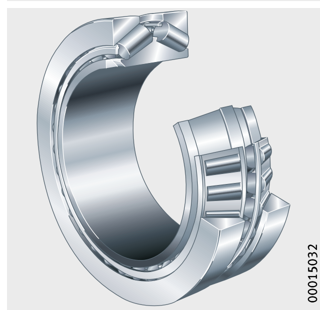
With large contact angle (X arrangement)

Axial bearings for work rolls
Axial bearings for oil film bearings

Z-5..TR2-01, F-8..TR2-01



Z-5..TR2-02, F-8..TR2-02



Double row tapered roller bearings

Features

Double row tapered roller bearings of various designs are special bearings with the designation Z-5..TR2 or F-8..TR2. They comprise solid bearing rings and tapered roller and cage assemblies.
The bearings are suitable for axial loads in both directions and high radial loads. Most of the bearings are separable and give a loose fit on the journal. The complete bearing is then mounted in the chock, after which the chock together with the bearing is slid onto the journal. The exception is bearings with an extended inner ring and tapered bore. These give a tight fit on the journal.

Bearings with two outer rings (X arrangement) for a loose fit on the journal

In bearings with two outer rings and one inner ring, the rows of rollers are in an X arrangement. The outer intermediate ring with a lubrication groove and lubrication holes defines the axial internal clearance suitable for the specific application.
Application: for example in roll stands, *Figure 1*.

Design 1

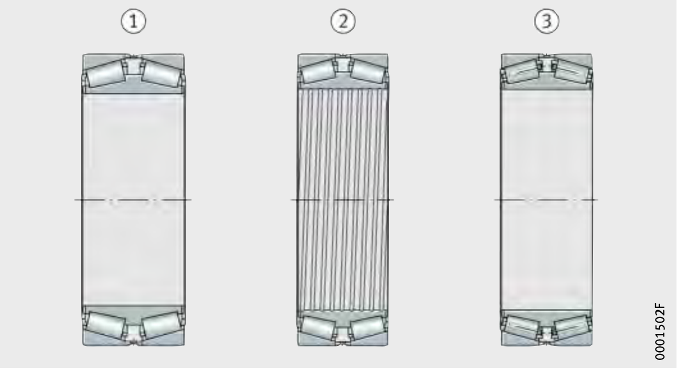
- Bearings with cylindrical bore for loose fit on the journal.
- Cages made from sheet steel
- Main dimensions and tolerances in inches.

Design 2

- Bearings with cylindrical bore for loose fit on the journal.
- Cages made from sheet steel
- Main dimensions and tolerances in inches.
- Helical groove in the inner ring for improved journal lubrication.

Design 3

- Bearings with cylindrical bore for loose fit on the journal.
- Through-drilled rollers and pin cages for very high loads.
- Main dimensions and tolerances in inches.



① Design 1
② Design 2
③ Design 3

Figure 1
Double row tapered roller bearings with two outer rings for loose fit on the journal

Double row tapered roller bearings

Bearings with two outer rings (X arrangement) and extended inner ring

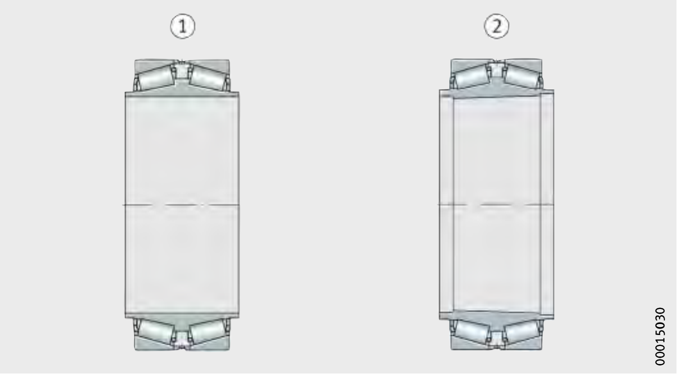
These double row tapered roller bearings also have two outer rings. The lateral extended sections of the inner ring are ground on the outside and serve as running surfaces for rotary shaft seals. Application: for example in roll stands, *Figure 2*.

Design 4

- Bearings with cylindrical bore for loose fit on the roll journal.
- Cages made from sheet steel
- Metric or inch sizes and tolerances.

Design 5

- Bearings with tapered bore (taper 1:12 or 1:30) for tight fit on the roll journal.
- Cages made from sheet steel
- Metric or inch sizes and tolerances.



1 Design 4
2 Design 5

Figure 2
Double row tapered roller bearings with two outer rings and extended inner ring

Bearings with two inner rings (O arrangement)

In tapered roller bearings with two inner rings and one outer ring, the two rows of rollers are in an O arrangement.
As a result, these bearings are also suitable for tilting moments.
If the bearings are used as non-locating bearings, the outer ring must have a loose fit. Normally, an inner intermediate ring defines the axial internal clearance suitable for the specific application.
The main dimensions and tolerances are metric or in inches.
Application: for example in roll stands, *Figure 3*, page 525.

Design 6

- Bearings with sheet steel cages and inner intermediate ring.
- Lubrication groove and lubrication holes in the outer ring.

Design 7

- Bearings with sheet steel cages and inner intermediate ring.
- Lubrication groove and lubrication holes as well as retaining hole in the outer ring.

Design 8

- Bearings with pin cages and inner intermediate ring.
- Lubrication groove and lubrication holes in the outer ring.

Design 9

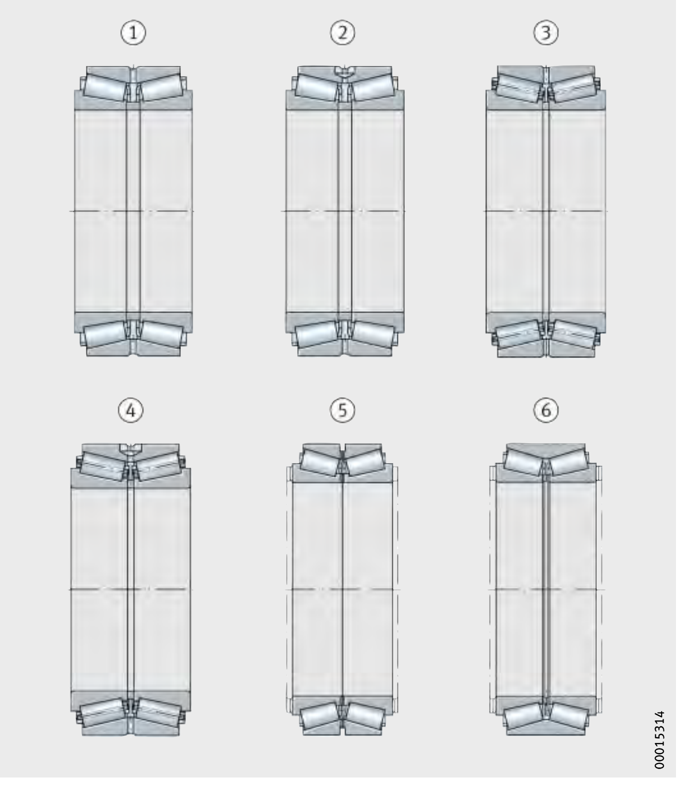
- Bearings with pin cages and inner intermediate ring.
- Lubrication groove and lubrication holes as well as retaining hole in the outer ring.

Design 10

- Bearings without intermediate ring, with lubrication hole at the joint between the two inner rings.
- Cages made from sheet steel
- Application:
  - for example cable sheaves in drilling towers (additional lubrication groove and lubrication holes in the outer ring), vertical roll stands (preloaded bearings with rings and rollers made from case hardening steel).

Design 11

- Bearings with lubrication groove and lubrication holes in the intermediate ring.
- Cages made from sheet steel
- Preloaded special bearings for vertical rolls in universal roll stands with rings and rollers made from case hardening steel.



1 Design 6
2 Design 7
3 Design 8
4 Design 9
5 Design 10
6 Design 11

Figure 3
Double row tapered roller bearings with two inner rings

Bearings with large contact angle

Axial bearings for work rolls

Tapered roller bearings with two outer rings and a large contact angle are suitable for particularly high axial loads.
They are therefore used as axial bearings.

Designs 12 to 14 in metric or inch sizes are intended for work rolls, *Figure 4*.

Integrated springs or a retaining sleeve are used to give acceptable rolling behaviour.

Design 12

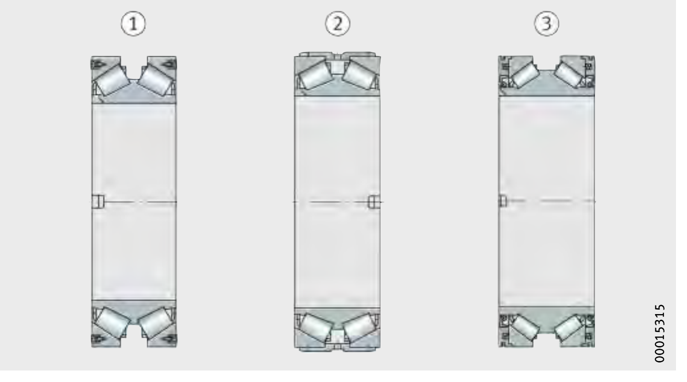
- Bearings with sheet steel cages.
- Spring assemblies integrated in the outer rings.
- Retaining slot on one side of the inner ring.

Design 13

- Bearings with sheet steel cages.
- Self-retaining design with outer retaining sleeve.
- Retaining slot on one side of the inner ring.

Design 14

- Bearings with sheet steel cages.
- Seal carrier with springs and rotary shaft seal on both sides.
- Retaining slot on one side of the inner ring.



(1) Design 12
(2) Design 13
(3) Design 14

Figure 4
Double row tapered roller bearings with large contact angle (axial bearings for work rolls)

Axial bearings for oil film bearings

In axial bearings for oil film bearings (Designs 15 to 19), the outer rings are axially adjusted by means of external springs to give acceptable rolling behaviour. Since the bearings are seated on the roll journal with a loose fit, the inner ring has various retaining slots depending on the bearing design to act as anti-rotation devices.
Bearings are available in metric and inch sizes, *Figure 5*.

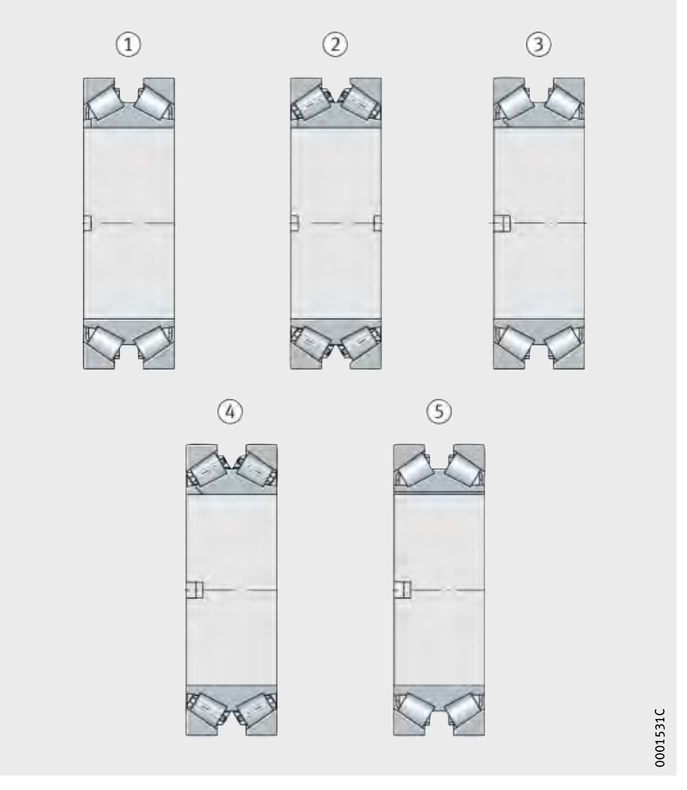
Design 15
- Bearings with sheet steel cages
- Retaining slot on one side of the inner ring.

Design 16
- Bearings with pin cages.
- Retaining slots on both sides of the inner ring.

Design 17
- Bearings with sheet steel cages
- Retaining slot on one side of the inner ring.

Design 18
- Bearings with pin cages.
- Retaining slot on one side of the inner ring.

Design 19
- Bearings with sheet steel cages
- Axial retaining slot in the inner ring.



① Design 15
② Design 16
③ Design 17
④ Design 18
⑤ Design 19

Figure 5
Double row tapered roller bearings with large contact angle (axial bearings for oil film bearings)

Double row tapered roller bearings

Sealing

With the exception of Design 14 (axial bearings for work rolls), all the bearings described here are supplied without seals.

Lubrication

These open double row tapered roller bearings can be lubricated with grease or oil. The sealed bearings are supplied filled with high quality rolling bearing grease.

Operating temperature

Double row tapered roller bearings can be used at operating temperatures from –30 °C to +150 °C, depending on the lubricant.

Sealed bearings are suitable for temperatures from –30 °C to +110 °C, restricted by the lubricant and seal material.

Cages

Most double row tapered roller bearings have pressed cages made from sheet steel.

Bearings with a pin cage and through-drilled rollers are specifically identified in the dimension tables.
These bearings are designed for very high load carrying capacity and strong acceleration or deceleration.

Design and safety guidelines

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies:

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic bearing load
$\frac{F_a}{F_r} \leq e$	$P = F_r + Y_1 \cdot F_a$
$\frac{F_a}{F_r} > e$	$P = 0{,}67 \cdot F_r + Y_2 \cdot F_a$

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, Y_1, Y_2 –
Factors, see dimension tables.

Bearings under axial load with large contact angle

For bearings under purely axial load with a large contact angle, the following applies:

$$P = Y \cdot F_a$$

Y –
Factor, see dimension tables

F_a kN
Axial dynamic bearing load.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads. It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies:

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

P_0 kN
Equivalent static bearing load for combined load

F_{0r} kN
Radial static bearing load

Y_0 –
Factor, see dimension tables

F_{0a} kN
Axial static bearing load.

Bearings under axial load with large contact angle

For bearings under purely axial load with a large contact angle, the following applies:

$$P_0 = Y_0 \cdot F_{0a}$$

P_0 kN
Equivalent static bearing load for combined load

Y_0 –
Factor, see dimension tables

F_{0a} kN
Axial 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 $C_r/P > 0{,}02$ is therefore necessary.

Comparative load ratings

The basic dynamic load ratings C_r to DIN ISO 281 are based on a basic rating life of 1 million revolutions. Competitors sometimes give different load ratings that are based on 90 million revolutions (3 000 h at 500 min^{-1}).
Since it is not possible to compare these values with the basic load ratings calculated according to ISO, please contact us regarding the comparative load ratings C_{r90} and C_{a90}.

Design of bearing arrangements

Shaft tolerances

Double row tapered roller bearings	Nominal dimension d mm	Tolerance[1)] mm
Metric tolerances, with loose fit	< 315	–0,180...–0,230
	315 ...630	–0,240...–0,300
	> 630 ...800	–0,325...–0,410
	> 800	–0,350...–0,450
Inch tolerances, with loose fit	> 152,4...203,2	–0,150...–0,175
	> 203,2...304,8	–0,180...–0,205
	> 304,8...609,6	–0,200...–0,249
	> 609,6...914,4	–0,250...–0,334
	> 914,4	–0,300...–0,400
Axial bearings	d	e7

1) In the case of high speeds and bearings with a tapered bore, please contact us to discuss the tolerances for the adjacent parts.

Housing tolerances

Double row tapered roller bearings	Nominal dimension D mm	Tolerance[1)] mm
Metric tolerances	≦ 800	H6
	> 800	H7
Inch tolerances	> 304,8... 609,6	+0,101...+0,150
	> 609,6... 914,4	+0,156...+0,230
	> 914,4...1 219,2	+0,202...+0,300
	> 1 219,6	+0,257...+0,380
Axial bearings	≦ 500	+0,6 ...+0,8
	> 500 ... 800	+0,8 ...+1,1
	> 800	+1,2 ...+1,5

1) In the case of high axial forces and bearings with a tapered bore, please contact us to discuss the tolerances for the adjacent parts.

Double row tapered roller bearings

Accuracy

The dimensional and running tolerances of double row tapered roller bearings are generally defined for individual cases.
Please contact us regarding the values.
Normal tolerances for bearings in metric and inch sizes should be taken from the following tables.

Normal tolerances for bearings in metric sizes

Nominal dimension mm		Bore deviation Δ_{dmp} µm		Outside diameter deviation Δ_{Dmp} µm		Width deviation $\Delta_{Bs} = \Delta_{Cs}$ µm	
over	incl.	max.	min.	max.	min.	max.	min.
180	250	0	−30	0	−30	0	−300
250	315	0	−35	0	−35	0	−350
315	400	0	−40	0	−40	0	−400
400	500	0	−45	0	−45	0	−450
500	630	0	−50	0	−50	0	−500
630	800	0	−75	0	−75	0	−750
800	1 000	0	−100	0	−100	0	−1 000
1 000	1 250	0	−125	0	−125	0	−1 250
1 250	1 600	0	−160	0	−160	0	−1 600
1 600	2 000	0	−200	0	−200	0	−2 000

Normal tolerances for bearings in inch sizes

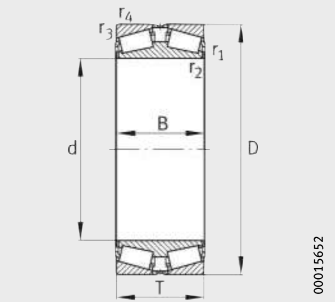
Nominal dimension mm		Bore deviation Δ_{dmp} µm		Outside diameter deviation Δ_{Dmp} µm		Width deviation $\Delta_{Bs} = \Delta_{Cs}$ µm	
over	incl.	max.	min.	max.	min.	max.	min.
304,8	609,6	+51	0	+51	0	±762	0
609,6	914,4	+76	0	+76	0	±762	0
914,4	1 219,2	+102	0	+102	0	±762	0
1 219,2	–	+127	0	+127	0	±762	0

Axial internal clearance

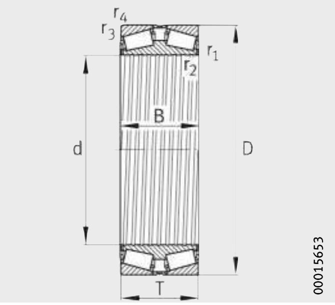
The axial internal clearance of double row tapered roller bearings differs according to the bearing size and application.
Please contact us for values.

Tapered roller bearings

Double row,
X arrangement
For loose fit
on the roll journal



Design 1

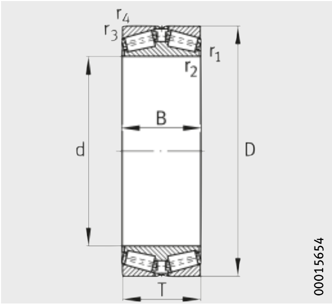


Design 2

Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-541397.TR2	1	77,1	**203,2**	368,3	158,75	152,4	3,3	3,3
F-800579.TR2	1	24,7	**234,95**	327,025	93,662	93,662	3,3	3,3
Z-564290.TR2	1	67,8	**2 44,475**	381	146,05	146,05	3,3	4,8
Z-511577.TR2	1	41,6	**254**	358,775	130,175	130,175	1,5	3,3
Z-547757.TR2	1	104	**254**	438,15	165,1	165,1	3,3	6,4
Z-505684.TR2	1	89,7	**254**	444,5	133,35	133,35	3,3	6,4
Z-517563.01.TR2	1	50,2	**269,875**	381	136,525	136,525	3,3	3,3
Z-564144.TR2	1	129	**279,4**	469,9	169,863	166,688	3,3	6,4
Z-546348.TR2	1	59,5	**288,925**	406,4	144,462	144,462	3,3	3,3
Z-542664.TR2	1	67,8	**300,038**	422,275	150,813	150,812	3,3	3,3
Z-572151.TR2	1	55,2	**304,8**	419,1	130,175	130,175	1,5	6,4
Z-575744.TR2	1	68	**305**	438,048	133,35	134,938	3,3	4,8
Z-510687.01.TR2	1	92	**333,375**	469,9	166,688	166,688	3,3	3,3
Z-515956.TR2	1	112	**342,9**	533,4	139,69	146,05	3,3	3,3
Z-575296.TR2	2	106	**346,075**	488,95	174,625	174,625	3,3	3,3
Z-518240.01.TR2	2	150	**384,175**	546,1	193,675	193,675	3,3	6,4
Z-533805.TR2	3	150	**384,175**	546,1	193,675	193,675	3,3	6,4
F-804701.TR2	2	89	**406,4**	546,1	138,112	138,112	1,5	6,4
Z-531821.TR2	1	145	**406,4**	565,15	184,15	184,15	3,3	6,4
Z-525090.TR2	1	115	**409,575**	546,1	161,925	161,925	1,5	6,4
Z-524903.TR2	1	184	**415,925**	590,55	209,55	209,55	3,3	6,4
Z-528949.TR2	1	474	**431,902**	685,698	330,2	330,2	6,4	6,4
Z-518667.TR2	1	222	**447,675**	635	223,838	223,838	3,3	6,4
Z-515087.01.TR2	1	281	**479,425**	679,45	238,125	238,125	3,3	6,4
Z-503772.TR2	2	320	**501,65**	711,2	250,825	250,825	3,3	6,4
Z-536245.TR2	1	351	**508**	762	219,075	219,075	6,4	6,4
Z-532273.TR2	3	610	**520**	820	300	300	4	6
Z-526165.TR2	2	392	**536,575**	761,873	269,875	269,875	3,3	6,4
Z-544145.TR2	1	228	**558,8**	736,6	196,85	196,85	3,3	6,4
Z-543718.TR2	3	505	**571,5**	812,8	285,75	285,75	3,3	6,4

1) The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.

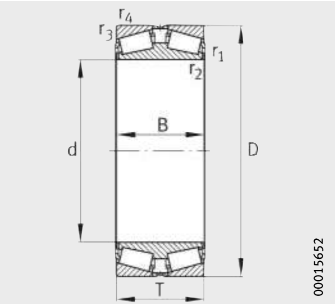


Design 3
With pin cage

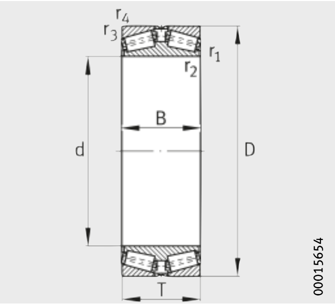
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TDI types
1 690	3 450	0,39	1,71	2,54	1,67	375	EE420800DW.450
830	1 960	0,41	1,66	2,47	1,62	–	85 76D W.8 520
1 600	3 500	0,46	1,46	2,17	1,43	370	EE126096DW.150
1 360	3 150	0,34	1,98	2,95	1,94	335	M249749DW.710
2 170	4 100	0,36	1,87	2,78	1,83	415	EE738101DW.712
1 710	3 050	0,36	1,85	2,76	1,81	305	EE822101DW.175
1 550	3 700	0,33	2,03	3,02	1,99	390	M252349DW.310
2 400	5 100	0,37	1,8	2,69	1,76	–	EE722111DW.185
1 730	4 100	0,35	1,94	2,89	1,9	430	M255449DW.410
1 790	4 350	0,36	1,86	2,77	1,82	450	HM256849DW.810
1 560	3 800	0,32	2,12	3,15	2,07	–	M257149DW.110
1 340	3 200	0,4	1,69	2,52	1,65	–	EE129123DW.172
2 120	5 400	0,38	1,79	2,67	1,75	540	HM261049DW.010
2 120	3 900	0,33	2,03	3,02	1,98	–	EE971355DW.100
2 480	6 300	0,33	2,03	3,02	1,98	620	HM262749DW.710
3 050	7 900	0,33	2,03	3,02	1,98	750	HM266449DW.410
3 050	7 900	0,33	2,03	3,02	1,98	750	HM266449D.410
1 910	4 650	0,43	1,56	2,33	1,53	435	LM767749DW.710
3 000	7 500	0,43	1,57	2,34	1,53	–	M267949DW.910
2 240	6 200	0,45	1,5	2,24	1,47	–	M667947DW.911
3 400	8 300	0,34	1,98	2,94	1,93	770	M268749DW.710
6 700	15 000	0,32	2,12	3,15	2,07	–	EE650171D.270
4 900	10 400	0,33	2,07	3,09	2,03	940	M270749DW.710
4 700	12 200	0,33	2,03	3,02	1,98	1 090	M272749DW.710
4 900	12 800	0,35	1,92	2,86	1,88	1 130	M274149DW.110
4 500	10 200	0,39	1,73	2,58	1,69	870	EE531201DW.300
7 600	17 300	0,4	1,68	2,5	1,64	1 440	–
5 900	15 000	0,3	2,28	3,39	2,23	1 290	M276449DW.410
3 900	10 800	0,35	1,95	2,9	1,91	–	LM377449.410
6 900	18 100	0,33	2,03	3,02	1,98	1 530	M278749DW.710

Tapered roller bearings

Double row,
X arrangement
For loose fit
on the roll journal



Design 1



Design 3
With pin cage

Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-538086.TR2	1	267	**609,6**	820	171,45	171,45	3,3	6,4
F-804575.TR2	1	709	**635**	939,8	304,8	304,8	3,3	6,4
F-800501.TR2	3	746	**635**	939,8	304,8	304,8	3,3	6,4
Z-515897.01.TR2	3	735	**657,225**	933,45	328,613	328,613	3,3	6,4
Z-568023.TR2	3	828	**682,625**	965,2	338,138	338,138	3,3	6,4
Z-532828.TR2	3[1)]	320	**710**	900	197	197	3,3	6,4
Z-518933.TR2	1	253	**711,2**	914,4	149,225	149,225	3,3	6,4
Z-524770.TR2	3	1 440	**825,5**	1 168,4	409,575	409,575	4,8	12,7
Z-539945.TR2	3[2)]	2 000	**901,7**	1 295,4	450,85	438,15	4,8	12,7
Z-521872.TR2	3	2 030	**939,8**	1 333,5	463,55	463,55	4,8	12,7

1) Bearing with helical grooves in the inner ring bore.

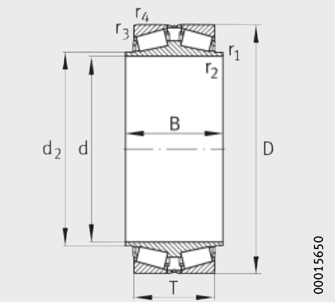
2) Bearing with lubrication holes through the central rib of the inner ring.

3) The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.

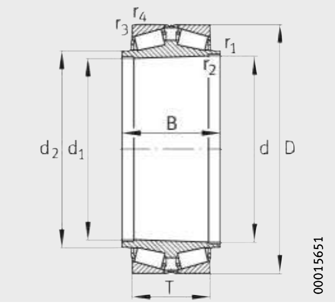
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[3)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TDI types
3 300	9 300	0,48	1,39	2,07	1,36	770	–
6 400	15 300	0,56	1,2	1,79	1,18	–	–
6 800	16 800	0,56	1,2	1,79	1,18	1 350	–
8 900	23 700	0,33	2,03	3,02	1,98	1 920	M281649D.610
9 000	25 500	0,33	2,03	3,02	1,98	2 050	M282249DW.210
4 550	13 500	0,35	1,95	2,9	1,91	1 090	SKF 331581A
3 400	9 500	0,38	1,77	2,63	1,73	750	EE755281D.360
12 800	36 500	0,34	2	2,98	1,96	2 750	M285848D.810
16 000	43 000	0,32	2,12	3,15	2,07	3 150	EE634356D.510
16 000	45 000	0,33	2,03	3,02	1,98	–	LM287849DW.810

Tapered roller bearings

Double row,
X arrangement
With two outer rings and
extended inner ring



Design 4
Cylindrical bore



Design 5
Tapered bore taper 1:12

Dimension table · Dimensions in mm

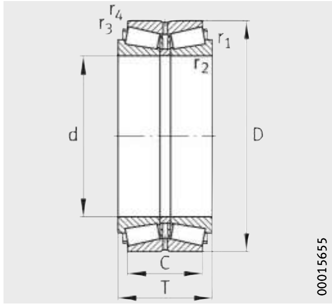
Designation	Design	Mass	Dimensions					
		m ≈kg	d	d_1	D	T	B	r_1, r_2 min.
Z-535082.TR2	5	70	**208,89**	188,517	336,55	180,975	244,475	1,5
Z-539084.TR2	5	58	**219,605**	206,243	336,55	160,34	223,83	1,5
Z-548244.TR2	4	51,3	**220**	–	340	140	200	1,5
Z-564232.TR2	5[1)]	55	**220**	215,333	340	140	200	1,5
Z-542129.TR2	5	70,4	**220,13**	205,049	336,55	180,975	244,475	1,5
Z-539574.TR2	5	77	**230**	216,658	370	160	223,5	3
Z-535081.TR2	4	52,5	**269,875**	–	381	136,525	196,85	3,3
Z-542146.TR2	5	56	**272,39**	255,985	381	136,525	196,85	1,5
Z-544753.TR2	5	170	**280**	261,666	460	220	280	1
Z-548243.TR2	4	74	**288,925**	–	406,4	165,1	234,95	1,5
Z-564231.TR2	5[1)]	76	**288,925**	283,422	406,4	165,1	234,95	1,5
Z-539576.TR2	5	92	**317,5**	304,271	447,675	159,512	222,25	3,3
F-803981.TR2	4[2)]	117	**325**	–	469,9	182,563	247,65	1,5
Z-548242.TR2	4	100	**333,375**	–	469,9	166,688	231,775	1,5
Z-564230.TR2	5[1)]	102	**333,375**	327,819	469,9	166,688	231,775	1,5
Z-541965.TR2	5	115	**333,375**	318,161	469,9	182,563	247,65	1,5
Z-544754.TR2	5	228	**340**	321,666	520	220	280	1

1) With tapered bore, taper 1:30.
2) With helical grooves in the inner ring bore.

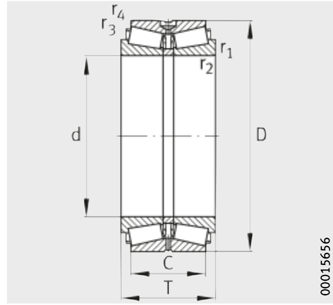
		Basic load ratings		Calculation factors				Fatigue limit load
r_3, r_4	d_2	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}
min.		kN	kN					kN
3,3	228,6	1 920	4 000	0,34	2	2,98	1,96	445
3	241,3	1 680	3 600	0,35	1,95	2,9	1,91	395
4	244,5	1 530	3 250	0,43	1,57	2,34	1,53	355
4	241,3	1 530	3 250	0,43	1,57	2,34	1,53	355
3,3	242	1 860	4 200	0,35	1,95	2,9	1,91	465
3	260,35	1 820	3 700	0,39	1,71	2,55	1,67	395
3,3	292,1	1 550	3 700	0,33	2,03	3,02	1,99	390
3,3	292,1	1 550	3 700	0,33	2,03	3,02	1,99	390
6	311,15	3 150	6 300	0,35	1,93	2,87	1,88	640
3,3	307,975	2 000	4 750	0,33	2,06	3,07	2,02	495
3,3	307,975	2 000	4 750	0,33	2,06	3,07	2,02	495
3,3	342,9	2 070	5 200	0,33	2,03	3,02	1,98	520
3,3	355,6	2 550	6 400	0,32	2,12	3,15	2,07	–
3,3	355,6	2 120	5 400	0,38	1,79	2,67	1,75	540
3,3	355,6	2 120	5 400	0,38	1,79	2,67	1,75	540
3,3	361,9	2 550	6 400	0,32	2,12	3,15	2,07	–
6	371,475	3 350	7 200	0,4	1,67	2,49	1,63	–

Tapered roller bearings

Double row,
O arrangement



Design 6

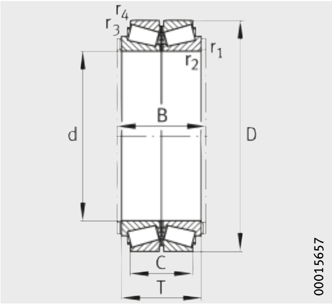


Design 7

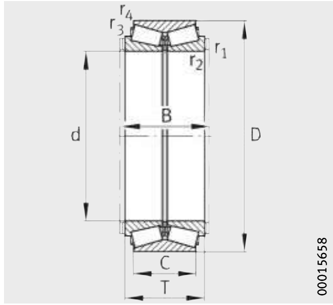
Dimension table · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	T	B	C	r_1, r_2 min.	r_3, r_4 min.
Z-543034.TR2	10	77	**165,1**	336,55	194,15	–	149,7	3,3	3,3
Z-577350.TR2	6	49,6	**190**	320	172	–	134	4	1,5
Z-511982.TR2	6	61,1	**200**	340	184	–	150	4	1,5
F-800116.TR2	10	63,6	**200**	360	218	–	174	5	1,5
Z-577083.TR2	10	110	**203,2**	393,7	212	–	171,45	3	1,5
Z-567227.TR2	11	72	**206,375**	336,55	211,138	–	169,863	3,3	1,5
Z-566204.TR2	10	48,6	**220**	340	154	–	120	4	1,5
Z-511984.TR2	7	51,7	**220**	340	165	–	130	4	1,5
Z-548864.TR2	10	60	**220**	340	196	–	160	3	1,5
Z-580871.TR2	6	79,7	**220**	370	200	–	166	5	1,5
Z-573103.TR2	10	93,2	**220**	370	225	–	184	3	1,5
Z-541910.TR2	7	48,7	**230**	355	145	–	110	6	2,5
Z-568648.TR2	6	22,3	**240**	320	110	–	87	3	1
Z-511985.TR2	7	58,5	**240**	360	165	–	130	3	1
Z-511983.TR2	6	100	**240**	400	210	–	168	5	1,5
Z-566443.01.TR2	11[1)2)]	174	**240**	440	268	278	200	5	4
F-803101.TR2	11	101	**242**	406	206	–	160	6	1,5
Z-543185.01.TR2	11[1)2)]	102	**242**	406	206	216	150	6	5
Z-543325.01.TR2	11[1)]	102	**242**	406	206	216	160	6	1,5
Z-564234.TR2	10[1)]	102	**242**	406	206	216	162	5	1,5
Z-576107.TR2	10	158	**255**	440	265	–	214	3	1,5
Z-511987.TR2	6	37,8	**260**	360	134	–	108	3	1
Z-514164.TR2	6	60,9	**260**	400	150	–	110	6	2,5
Z-511988.TR2	7	81	**260**	400	186	–	146	5	3
Z-579708.TR2	10[1)]	84	**260**	400	194	204	150	3	1,5
Z-577881.TR2	10	84	**260**	400	196	–	160	3	1,5
Z-539099.TR2	7	93,5	**260**	430	180	–	130	10	2,5
Z-511989.TR2	6	129	**260**	440	225	–	180	4	1
Z-564747.TR2	11[1)2)]	220	**260**	480	282	292	212	6	5
Z-564746.TR2	10[1)]	218	**260**	480	282	292	440	6	1,5
Z-565251.TR2	11[1)]	219	**260**	480	284	294	220	6	1,5
Z-573594.TR2	11[1)]	220	**260**	480,5	284	294	220	6	1,5
Z-538180.TR2	6	85,2	**280**	420	189	–	154	5	2
F-800117.TR2	10	231	**280**	500	284	–	222	6	2

1) Spacer ring on both sides.
2) Two outer rings with intermediate ring.



Design 10

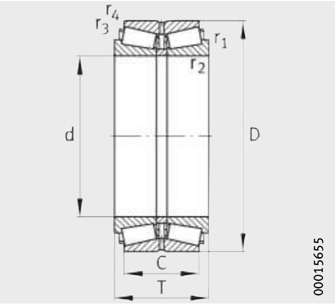


Design 11

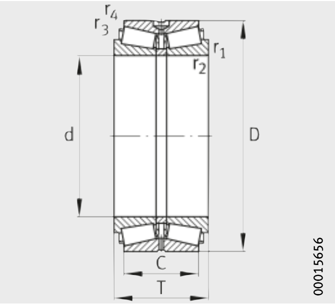
Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
1 930	3 100	0,32	2,12	3,15	2,07	–
1 480	2 800	0,36	1,9	2,83	1,86	315
1 710	3 150	0,26	2,55	3,8	2,5	350
2 240	4 150	0,41	1,66	2,47	1,62	–
2 270	3 950	0,35	1,95	2,9	1,91	415
1 920	4 000	0,34	2	2,98	1,96	445
1 460	3 100	0,43	1,57	2,34	1,53	–
1 530	3 250	0,43	1,57	2,34	1,53	355
1 800	3 900	0,35	1,95	2,9	1,91	–
1 930	3 750	0,24	2,84	4,22	2,77	405
2 440	4 900	0,35	1,95	2,9	1,91	530
1 320	2 650	0,33	2,05	3,05	2	285
880	2 030	0,29	2,33	3,47	2,28	223
1 470	3 350	0,31	2,2	3,27	2,15	365
770	1 790	0,37	1,81	2,7	1,77	200
3 300	6 500	0,44	1,55	2,31	1,52	670
2 320	4 700	0,37	1,81	2,7	1,77	495
2 320	4 700	0,37	1,81	2,7	1,77	495
2 320	4 700	0,37	1,81	2,7	1,77	495
2 320	4 650	0,37	1,81	2,7	1,77	–
3 250	6 600	0,35	1,95	2,9	1,91	680
1 280	3 000	0,41	1,66	2,47	1,62	320
1 220	2 500	0,44	1,53	2,28	1,5	265
1 980	4 300	0,43	1,55	2,31	1,52	450
1 920	4 200	0,43	1,55	2,31	1,52	440
2 160	4 650	0,35	1,95	2,9	1,91	485
1 870	3 550	0,33	2,02	3	1,97	360
2 850	5 500	0,28	2,41	3,59	2,36	560
3 800	7 500	0,43	1,57	2,34	1,53	–
3 850	7 600	0,43	1,57	2,34	1,53	760
3 800	7 500	0,43	1,57	2,34	1,53	–
3 800	7 500	0,43	1,57	2,34	1,53	–
2 050	4 600	0,46	1,47	2,19	1,44	475
3 900	7 800	0,45	1,5	2,24	1,47	–

Tapered roller bearings

Double row,
O arrangement



Design 6

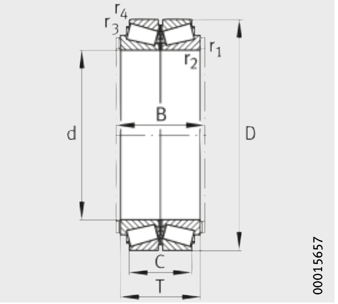


Design 7

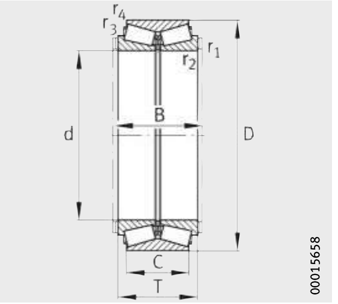
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	C	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-511990.TR2	7	63,8	**300**	420	159	128	4	1
Z-565735.TR2	6	121	**300**	500	180	125	9,5	2,5
Z-511991.TR2	7	145	**300**	500	205	152	6	2,5
Z-532655.TR2	6	72,6	**340**	460	160	128	4	1,5
Z-549929.TR2	6	126	**340**	520	180	135	6	2
Z-511992.TR2	6	228	**340**	580	242	170	6	2
Z-541911.TR2	7	208	**350**	590	200	140	12	2,5
Z-511993.TR2	7	73,3	**360**	480	160	128	4	1,5
Z-525858.TR2	6	135	**360**	540	185	140	5	1,5
Z-566764.TR2	10[1)]	540	**367,5**	647,7	410	336	4,8	3,3
Z-566765.TR2	11[1)]	540	**367,5**	647,7	410	336	4,8	3,2
Z-538179.TR2	7	86,4	**380**	520	149	112	5	2
Z-511994.TR2	6	244	**380**	620	242	170	5	2
F-808453.TR2	7	236	**381**	590,55	245	190	6,4	1,5
Z-565736.TR2	6	146	**400**	590	185	125	6	2,5
Z-511995.TR2	7	183	**400**	600	206	150	6	2
Z-549965.TR2	7	192	**420**	620	206	150	6	5
Z-511996.TR2	7	365	**420**	700	275	200	6	2
Z-511997.TR2	7	219	**440**	650	212	152	8	3
Z-579097.TR2	11[1)]	244	**447,675**	635	257,175	206,375	6,4	1,5
Z-549964.TR2	7	135	**460**	620	170	131	5	4
Z-534866.TR2	7	255	**460**	680	230	175	7,5	3
Z-511998.TR2	7	152	**480**	650	180	130	5	2
Z-573216.TR2	10[1)]	255	**480**	680	238	190	4	3
Z-541912.TR2	7	141	**490**	640	180	144	9,5	3
Z-539031.TR2	7	162	**500**	670	180	130	5	2
Z-544199.TR2	6	281	**500**	720	236	180	7,5	3
Z-539117.TR2	7	225	**520**	740	190	120	3	3
Z-510043.TR2	7	189	**530**	710	190	136	6	2,5
Z-532951.TR2	7	236	**560**	750	213	156	6	2,5
Z-578732.TR2	7	418	**560**	820	260	185	7,5	3
Z-541806.TR2	6	416	**560**	820	270	190	9,5	3

[1)] With pin cages.



Design 10

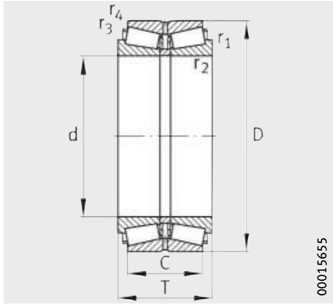


Design 11

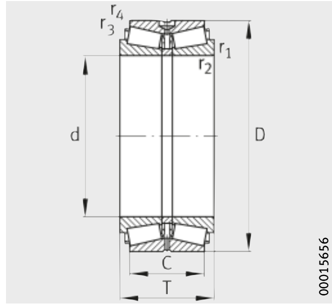
Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
1 560	3 850	0,32	2,12	3,15	2,07	395
2 270	4 150	0,26	2,55	3,8	2,5	400
2 700	5 300	0,37	1,8	2,69	1,76	510
1 890	4 850	0,4	1,69	2,52	1,65	485
2 270	4 850	0,31	2,21	3,28	2,16	465
3 350	6 300	0,47	1,44	2,15	1,41	590
2 850	5 400	0,56	1,2	1,79	1,18	495
1 910	4 700	0,32	2,11	3,14	2,06	460
2 550	5 500	0,3	2,25	3,35	2,2	–
7 400	16 000	0,29	2,32	3,45	2,26	1 470
7 400	16 000	0,29	2,32	3,45	2,26	1 470
1 590	3 900	0,36	1,86	2,76	1,81	370
3 650	7 100	0,46	1,47	2,19	1,44	640
3 350	8 300	0,34	1,98	2,94	1,93	–
2 550	5 300	0,33	2,05	3,05	2	480
3 000	6 600	0,46	1,45	2,16	1,42	610
2 900	6 400	0,43	1,58	2,36	1,55	580
4 700	9 200	0,42	1,6	2,38	1,56	800
3 100	6 800	0,48	1,42	2,11	1,39	610
4 300	10 600	0,33	2,07	3,09	2,03	–
2 500	6 100	0,38	1,77	2,63	1,73	550
3 850	8 800	0,31	2,18	3,24	2,13	780
2 600	6 400	0,4	1,69	2,52	1,65	570
4 150	10 600	0,32	2,12	3,15	2,07	–
2 600	6 400	0,4	1,69	2,52	1,65	570
2 600	6 600	0,41	1,63	2,43	1,6	580
4 000	9 400	0,33	2,04	3,04	2	810
2 550	5 700	0,48	1,42	2,11	1,39	480
3 100	7 900	0,41	1,65	2,45	1,61	680
3 050	8 000	0,43	1,56	2,32	1,52	680
4 750	11 400	0,49	1,38	2,05	1,35	950
4 750	11 400	0,49	1,38	2,05	1,35	950

Tapered roller bearings

Double row,
O arrangement



Design 6



Design 7

Dimension table (continued) · Dimensions in mm

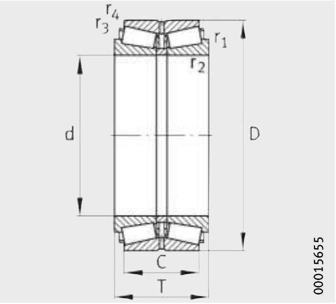
Designation	Design	Mass	Dimensions					
		m	d	D	T	C	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-538181.TR2	7	262	**600**	800	208,5	160	6	2,5
Z-538183.TR2	7	473	**600**	870	270	198	7,5	3
Z-538182.TR2	7	293	**630**	850	242	182	7,5	2,5
Z-510041.TR2	7	422	**710**	950	240	175	7,5	3
Z-534867.TR2	6	753	**710**	1 030	315	220	9,5	4
Z-564801.TR2	7	587	**800**	1 060	270	204	6	2,5
Z-538339.TR2	7	638	**850**	1 120	268	190	7,5	3
Z-538341.TR2	7	883	**950**	1 250	298	220	9,5	4
Z-568323.TR2	6[1)]	813	**1 250**	1 500	250	190	6	1,5
Z-572139.TR2	6[1)]	1 390	**1 450**	1 770	290	170	9,5	5

1) With pin cages.

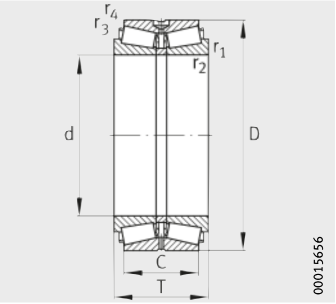
Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
3 700	9 100	0,32	2,08	3,1	2,04	750
5 200	12 300	0,41	1,66	2,47	1,62	1 000
4 450	11 500	0,4	1,69	2,52	1,65	940
5 100	13 000	0,46	1,47	2,19	1,44	1 030
7 200	17 000	0,43	1,57	2,34	1,53	1 300
6 100	16 400	0,35	1,95	2,9	1,91	1 250
5 600	15 500	0,46	1,45	2,16	1,42	1 170
7 500	21 300	0,32	2,12	3,15	2,07	1 550
7 100	24 100	0,37	1,8	2,69	1,76	1 650
7 600	26 500	0,87	0,78	1,16	0,76	1 710

Tapered roller bearings

Double row,
O arrangement,
in inch sizes



Design 6



Design 7

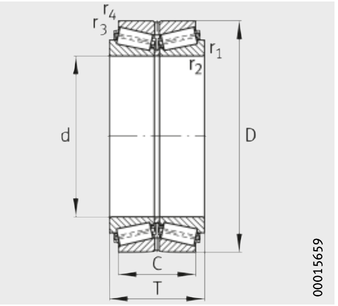
Dimension table · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	T	C	r_1, r_2 min.	r_3, r_4 min.
Z-523062.TR2	7	69,8	**206,375**	336,55	211,138	169,862	3,3	1,5
Z-503656.TR2	7	50,7	**228,6**	355,6	146,05	111,125	6,8	1,5
Z-514401.TR2	6	52,8	**228,6**	355,6	152,4	114,3	6,4	1,5
Z-518468.TR2	6	53,6	**228,6**	355,6	152,4	111,125	6,9	1,5
Z-515125.TR2	7	205	**228,6**	488,95	254	152,4	6,4	1,5
Z-547139.TR2	6[2)]	27,2	**234,95**	327,025	117,475	82,55	6,4	1,6
Z-547957.TR2	6[2)]	27,8	**234,95**	328,625	117,475	82,55	6,4	1,5
Z-517152.TR2	6[2)]	24,4	**253,975**	347,662	101,6	69,85	3,6	1,5
Z-505612.TR2	7	44,4	**254**	358,775	152,4	117,475	3,6	1,5
F-804367.TR2	8[1)]	86,3	**254**	422,275	173,038	128,588	6,9	1,5
Z-515129.TR2	6	259	**254**	533,4	276,225	165,1	6,4	1,5
Z-514599.TR2	6	85,5	**260,35**	422,275	178,592	139,7	6,9	1,5
Z-535605.TR2	6[2)]	25,9	**266,7**	352,425	107,95	82,55	6,4	1,5
Z-524440.01.TR2	7	42	**285,75**	380,898	139,7	107,95	3,6	1,5
Z-525830.TR2	6	139	**285,75**	501,65	203,2	120,65	6,4	3,3
Z-505614.01.TR2	7	62,6	**288,925**	406,4	165,1	130,175	6,4	1,5
Z-526864.TR2	6	71,2	**300,038**	422,275	174,625	136,525	6,4	1,5
Z-539192.TR2	6[2)]	33,3	**304,8**	393,7	107,95	82,55	6,4	1,5
Z-527128.TR2	7	73,8	**304,8**	438,048	165,1	120,65	6,4	1,5
Z-512601.TR2	6	172	**311,15**	558,8	190,5	111,125	9,7	3,3
Z-521746.TR2	7	59,8	**317,5**	444,5	146,05	98,425	7,9	1,5
Z-510607.01.TR2	7	85	**317,5**	447,675	180,975	146,05	3,6	1,5
Z-515495.TR2	7	96,6	**330,2**	482,6	177,8	127	6,4	1,5
Z-526831.TR2	7	97,8	**333,375**	469,9	190,5	152,4	6,4	1,5
F-807462.TR2	8[1)]	113	**346,075**	488,95	200,025	158,75	6,4	1,5
Z-505613.01.TR2	7	113	**346,075**	488,95	200,025	158,75	6,4	1,5
F-804108.TR2	8[1)]	43,4	**355,6**	444,5	127	101,6	3,6	1,5
Z-523319.TR2	7	45	**355,6**	444,5	136,525	111,125	3,6	1,5
F-807283.TR2	8[1)]	78,2	**355,6**	501,65	154	107,95	6,4	1,6
Z-510608.01.TR2	6	83,9	**355,6**	501,65	155,575	107,95	6,4	1,5
Z-581099.TR2	9	141	**368,249**	523,875	214,312	169,862	6,4	1,5
Z-573335.TR2	7	184	**368,3**	596,9	203,2	133,35	9,7	2,4

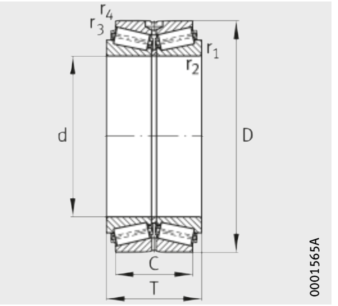
1) Without intermediate ring.

2) Without intermediate ring, with lubrication groove in the inner and outer ring.

3) The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 8
With pin cage

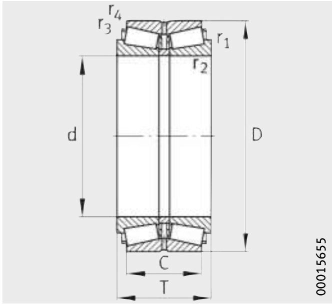


Design 9
With pin cage

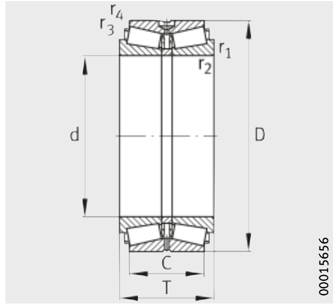
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[3)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TDO types
1 920	4 000	0,34	2	2,98	1,96	445	H242649.610CD
1 120	2 600	0,59	1,14	1,7	1,12	285	NA130902.131401D
1 120	2 600	0,59	1,14	1,7	1,12	285	HM746646.610D
1 120	2 600	0,59	1,14	1,7	1,12	285	130902.131401D
2 600	4 500	0,94	0,72	1,07	0,7	440	HH949549.510CD
830	1 960	0,41	1,66	2,47	1,62	–	NA8575SW.8520D
830	1 960	0,41	1,66	2,47	1,62	–	NA8575SW.8522D
820	1 720	0,33	2,03	3,02	1,98	182	LM249747NW.LM249710CD
1 360	3 150	0,34	1,98	2,95	1,94	335	M249749.710CD
1 870	3 550	0,33	2,02	3	1,97	360	HM252344NW.HM252311D
3 450	5 700	0,87	0,78	1,16	0,76	530	HH953749.710D
1 870	3 550	0,33	2,02	3	1,97	360	HM252349.310D
880	2 160	0,32	2,12	3,15	2,07	–	LM251649NW.LM251610D
1 180	3 200	0,43	1,56	2,33	1,53	–	LM654649.610CD
2 220	3 850	0,78	0,87	1,29	0,85	365	EE147112.198D
1 730	4 100	0,35	1,94	2,89	1,9	430	M255449.410CD
1 790	4 350	0,36	1,86	2,77	1,82	450	HM256849.810D
980	2 550	0,36	1,88	2,8	1,84	260	L357049NW.L357010D
1 350	3 200	0,4	1,69	2,52	1,65	325	EE129120X.173CD
2 210	4 000	0,88	0,76	1,14	0,75	370	EE148122.220D
1 250	2 800	0,38	1,79	2,67	1,75	280	EE291250.751CD
2 070	5 200	0,33	2,03	3,02	1,98	520	HM259049.010CD
2 070	4 500	0,47	1,43	2,12	1,4	440	EE526130.191CD
2 120	5 400	0,38	1,79	2,67	1,75	540	HM261049.010CD
2 480	6 300	0,33	2,03	3,02	1,98	620	–
2 480	6 300	0,33	2,03	3,02	1,98	620	HM262749.710CD
1 210	3 600	0,31	2,2	3,27	2,15	–	TIMKENSERIE L163100
1 250	3 750	0,31	2,2	3,27	2,15	–	L163149.110CD
1 620	3 650	0,44	1,53	2,28	1,5	345	–
1 620	3 650	0,44	1,53	2,28	1,5	345	EE231400.231976CD
2 750	6 800	0,35	1,92	2,86	1,88	660	HM265049.010CD
2 850	5 500	0,42	1,62	2,42	1,59	495	EE181453.351CD

Tapered roller bearings

Double row,
O arrangement,
in inch sizes



Design 6



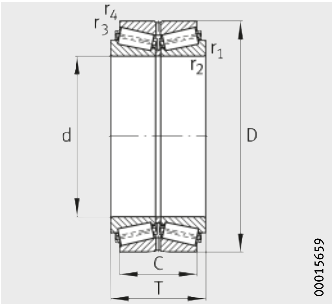
Design 7

Dimension table (continued) · Dimensions in mm

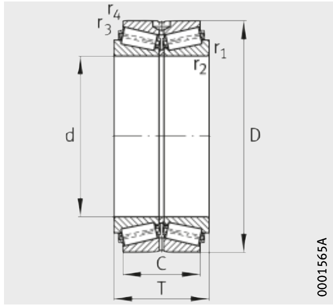
Designation	Design	Mass	Dimensions					
		m	d	D	T	C	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-527366.TR2	7	73,7	**371,475**	501,65	155,575	107,95	6,4	1,5
Z-526251.TR2	6	66,8	**381**	508	139,7	88,9	6,4	1,5
Z-547099.TR2	7	238	**381**	590,55	244,475	193,675	6,4	1,5
Z-581097.TR2	9	247	**381**	590,55	244,475	193,675	6,4	1,5
Z-505615.TR2	6	159	**384,175**	546,1	222,25	177,8	6,4	1,5
Z-579745.TR2	9	159	**384,175**	546,1	222,25	177,8	6,4	1,5
Z-505611.02.TR2	6	96,5	**396,875**	546,1	158,75	117,475	6,4	1,5
Z-525845.TR2	7	117	**406,4**	546,1	185,738	147,638	6,4	1,5
Z-507670.TR2	6[1]	110	**406,4**	574,675	157,162	106,362	6,4	1,5
Z-515494.TR2	7	167	**406,4**	609,524	177,8	133,35	8,1	1,5
Z-578129.TR2	9	207	**415,925**	590,55	244,475	193,675	6,4	1,5
Z-517498.01.TR2	7	200	**415,925**	590,55	244,475	193,675	6,4	1,5
Z-517498.TR2	6	200	**415,925**	590,55	244,475	193,675	6,4	1,5
Z-527127.TR2	7	95,5	**431,8**	571,5	155,575	111,125	3,3	1,5
Z-512346.TR2	6	241	**447,675**	635	257,175	206,375	6,4	1,6
Z-521467.01.TR2	7	241	**447,675**	635	257,175	206,375	6,4	1,5
Z-579097.TR2	8	244	**447,675**	635	257,175	206,375	6,4	1,5
Z-529635.TR2	7	110	**457,2**	596,9	165,1	120,65	9,7	1,5
Z-541705.TR2	7	238	**457,2**	660,4	228,6	171,45	6,4	1,5
Z-578647.TR2	9	304	**479,425**	679,45	276,225	222,25	6,4	1,5
Z-517499.02.TR2	7	299	**479,425**	679,45	276,225	222,25	6,4	1,5
Z-515917.01.TR2	7	135	**488,95**	634,873	180,975	136,525	6,4	1,5
Z-505610.TR2	6	184	**488,95**	660,4	206,375	158,75	6,4	1,5
Z-515127.01.TR2	7	122	**498,475**	634,873	177,8	142,875	6,4	1,5
Z-528996.TR2	7	344	**501,65**	711,2	292,1	231,775	6,4	1,5
Z-578586.TR2	9	354	**501,65**	711,2	292,1	231,775	6,4	1,5
Z-518884.TR2	6	589	**508**	838,2	304,8	222,25	9,7	3,3
Z-528407.TR2	7	210	**520,7**	736,6	186,502	114,3	6,4	1,5
Z-581098.TR2	9	427	**536,575**	761,873	311,15	247,65	6,4	1,5
Z-577417.TR2	9	431	**536,575**	761,873	311,15	247,65	6,4	1,5
Z-536948.01.TR2	7	191	**558,8**	736,6	187,328	138,112	6,4	1,5
Z-521229.02.TR2	7	244	**558,8**	736,6	225,425	177,8	6,4	1,5
Z-541361.TR2	9	255	**558,8**	736,6	225,425	177,8	6,4	1,5

[1] Without intermediate ring.

[2] The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 8
With pin cage

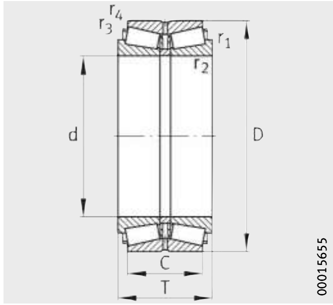


Design 9
With pin cage

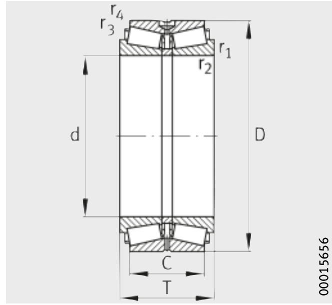
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[2)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TDO types
1 600	3 650	0,44	1,53	2,28	1,5	–	EE231462.976CD
1 280	3 200	0,53	1,27	1,89	1,24	305	EE192150.201CD
3 350	8 300	0,34	1,98	2,94	1,93	–	M268730.710CD
3 550	8 900	0,34	1,98	2,94	1,93	820	M268730.710CD
3 050	7 800	0,33	2,03	3,02	1,98	–	HM266449.HM410CD
3 050	7 900	0,33	2,03	3,02	1,98	750	HM266449.410CD
1 770	4 250	0,47	1,43	2,12	1,4	390	EE234156.216D
2 260	6 200	0,45	1,5	2,24	1,47	590	M667944.911CD
1 690	3 650	0,51	1,31	1,96	1,28	325	NA285160.228D
2 470	5 500	0,47	1,44	2,15	1,41	495	EE736160.239CD
3 550	8 900	0,34	1,98	2,94	1,93	820	M268749.710CD
3 600	9 150	0,33	2,03	3,02	1,98	–	M268749.710CD
3 600	9 150	0,33	2,03	3,02	1,98	–	M268749.710CD
2 000	4 800	0,55	1,24	1,84	1,21	445	LM869448.410CD
4 200	10 400	0,33	2,07	3,09	2,03	940	M270749.M270710D
4 200	10 400	0,33	2,07	3,09	2,03	940	M270749.710CD
4 300	10 700	0,33	2,07	3,09	2,03	970	M270749.M270710D
2 040	5 600	0,4	1,68	2,51	1,65	510	EE244180.236CD
3 750	9 000	0,35	1,95	2,9	1,91	800	M271648.610CD
4 600	11 900	0,35	1,92	2,86	1,88	1 060	M272749.710CD
4 650	12 200	0,33	2,03	3,02	1,98	–	M272749.710CD
2 490	6 700	0,47	1,43	2,12	1,4	600	LM772748.710CD
2 550	6 800	0,45	1,5	2,23	1,46	610	EE640192.261D
2 010	5 600	0,43	1,58	2,35	1,54	500	EE243196.251CD
4 900	12 800	0,35	1,92	2,86	1,88	1 130	M274149.110CD
5 000	13 200	0,35	1,92	2,86	1,88	1 160	M274149.110CD
5 500	11 900	0,49	1,38	2,06	1,35	1 000	EE426200.331D
2 550	5 700	0,48	1,42	2,11	1,39	480	EE982051.901CD
6 000	15 300	0,3	2,28	3,39	2,23	–	M276449.410CD
6 100	15 400	0,3	2,28	3,39	2,23	1 330	M276449.410CD
2 950	7 600	0,34	1,98	2,94	1,93	640	EE843220.291CD
3 900	11 000	0,35	1,95	2,9	1,91	940	LM377449.410CD
3 950	11 200	0,35	1,95	2,9	1,91	960	LM377449.410CD

Tapered roller bearings

Double row,
O arrangement,
in inch sizes



Design 6

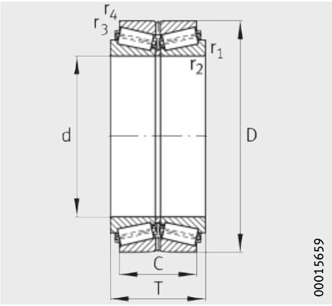


Design 7

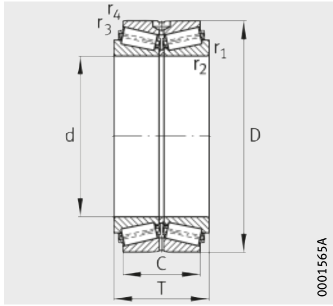
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	C	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-536529.TR2	7	514	**571,5**	812,8	333,375	263,525	6,4	1,5
Z-566721.TR2	9	535	**571,5**	812,8	333,375	263,525	6,4	1,5
Z-524528.TR2	7	248	**602,945**	787,4	206,375	158,75	6,4	1,5
Z-513974.TR2	7	237	**609,6**	787,4	206,375	158,75	6,4	1,5
Z-533433.TR2	6	244	**609,6**	812,8	190,5	146,05	6,4	3,3
Z-574101.TR2	8	920	**635**	990,6	339,725	212,725	6,4	1,5
Z-514502.TR2	7	207	**660,4**	812,8	203,2	158,75	6,4	1,5
Z-512516.TR2	7	275	**685,8**	876,3	200,025	152,4	6,4	1,5
Z-521233.TR2	6	285	**711,2**	914,4	190,5	139,7	6,4	1,5
Z-512878.TR2	6	258	**723,9**	914,4	187,325	139,7	5,6	1,5
Z-514528.TR2	6	293	**762**	965,2	187,325	133,35	6,4	1,5
Z-512407.TR2	6	277	**774,7**	965,2	187,325	133,35	6,4	1,5
Z-576448.TR2	7	269	**774,7**	965,2	187,325	133,35	6,4	1,5
Z-521084.TR2	6	420	**812,8**	1 016	190,5	146,05	6,4	1,5
Z-518817.TR2	6	430	**812,8**	1 066,8	190,5	146,05	6,4	3,3
Z-512406.TR2	6	188	**914,4**	1 066,8	139,7	101,6	6,4	3,3
Z-579565.TR2	8	200	**914,4**	1 066,8	139,7	101,6	6,4	3,3
Z-579534.TR2	8	812	**1 160**	1 430	240	180	9,5	5
Z-563113.TR2	8	2 370	**1 320,8**	1 727,2	412,75	254	31	3

[1] The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 8
With pin cage

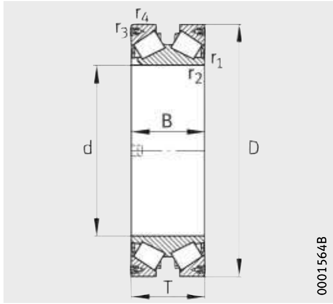


Design 9
With pin cage

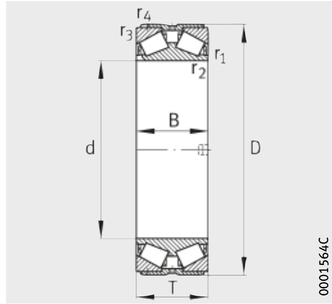
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TDO types
6 600	17 000	0,33	2,03	3,02	1,98	1 440	M278749.710CD
6 900	18 100	0,33	2,03	3,02	1,98	1 530	M278749.M278710CD
3 100	9 000	0,5	1,35	2,01	1,32	760	EE649237.311CD
3 100	9 000	0,5	1,35	2,01	1,32	760	EE649240.311CD
3 150	8 200	0,33	2,03	3,02	1,98	670	EE743240.321D
7 400	16 500	0,87	0,78	1,16	0,76	1 260	SKF BT28 332493
3 550	10 600	0,33	2,03	3,02	1,98	–	L281148.110CD
3 350	9 900	0,41	1,66	2,47	1,62	810	EE655270.346CD
3 400	9 500	0,38	1,77	2,63	1,73	750	EE755280.361D
3 400	9 500	0,38	1,77	2,63	1,73	750	EE755285.361CD
3 500	10 100	0,4	1,67	2,49	1,63	780	EE752300.381D
3 500	10 100	0,4	1,67	2,49	1,63	780	EE752305.381D
3 500	10 100	0,4	1,67	2,49	1,63	780	EE752305.381CD
3 550	11 300	0,48	1,42	2,11	1,38	880	EE762320.401D
3 550	11 300	0,48	1,42	2,11	1,38	880	EE762320.420XD
2 400	7 700	0,41	1,64	2,44	1,6	570	LL686947.910D
2 550	8 300	0,41	1,64	2,44	1,6	620	LL686947.910D
6 700	23 000	0,4	1,68	2,5	1,64	1 600	–
13 500	42 000	0,83	0,81	1,21	0,79	2 750	SKF BT2B 332495

Tapered roller bearings

Double row,
X arrangement
With large contact angle
Axial bearings for work rolls



Design 12



Design 13

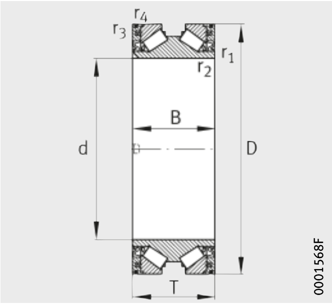
Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
F-803422.TR2	12	66	**160**	343	160	160	2	2
F-801948.TR2	12	77,5	**190**	370	170	170	2	2
F-801984.TR2	14	97	**190**	370	210	210	2	2
F-800942.TR2	12	74,3	**230**	404	152	144	2	2
F-803185.TR2	14	78	**230**	404	152	152	2	2
F-803722.TR2	13	62	**300**	460	105	105	4	2
F-801555.TR2	13	126	**300**	480	180	180	3	2
F-801521.TR2	12	112	**300**	480	180	180	2	3
F-801925.TR2	14[1)]	140	**300**	480	220	220	5	4
F-801250.TR2	12	92,3	**320**	480	160	160	2	2
F-801949.TR2	12	86,6	**365,6**	514,35	140	140	2	2
F-804525.TR2	13	163	**380**	568	180	180	2	2
F-801926.TR2	12	154	**380**	570	180	180	2	2
F-801999.TR2	14[1)]	245	**380**	590	260	260	2,5	3
Z-578815.TR2	13	150	**390**	568	180	180	2	2
F-804510.TR2	14	136	**390**	570	180	180	4	7
F-801249.TR2	12	145	**390**	570	180	180	2	2
Z-579673.TR2	13	191	**390**	570	200	200	5	2
F-800967.TR2	12	180	**390**	590	200	200	5	5
F-801950.TR2	12	280	**400**	650	240	240	6	6
F-803312.TR2	14[2)]	80	**406,4**	546,1	138,113	138,113	1,5	3
F-801951.TR2	12	107	**406,4**	566,1	150	150	2	4
Z-578243.TR2	13	64,4	**420**	525	112	112	1,5	2
F-803169.TR2	14	166	**440**	615,95	200	200	3,3	4,8
F-801946.TR2	14[1)]	182	**440**	615,95	220	220	3,3	4,8
F-803717.TR2	12	138	**445**	620	160	160	2	2
Z-578242.TR2	13	140	**445**	620	160	160	2	2
F-801674.TR2	13	248	**450**	680	180	180	2,5	6
Z-578619.TR2	13	243	**460**	702	180	180	2,5	6
Z-580901.TR2	13	127	**482**	620	160	160	2	5
F-801495.TR2	12	140	**482**	640	160	160	2	2
Z-578620.TR2	13	152	**540**	685	146	146	3	4

1) No retaining slots in the inner ring.

2) Outside diameter of seal carriers = 547 mm.

Design 12 Inner ring, outer rings and rollers made from case hardening steel.
Design 13, 14 Inner ring made from case hardening steel.

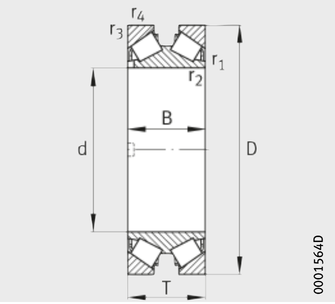


Design 14
Sealed

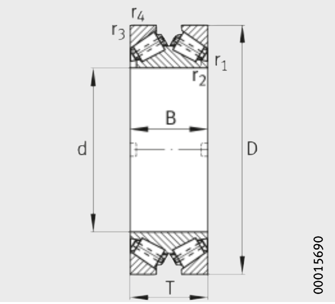
Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
1 390	2 300	0,8	0,84	1,25	0,82	250
1 440	2 600	0,87	0,78	1,16	0,76	280
1 440	2 600	0,87	0,78	1,16	0,76	280
1 440	2 650	1,05	0,64	0,96	0,63	270
1 040	1 930	0,87	0,78	1,16	0,76	–
910	1 970	0,86	0,79	1,17	0,77	188
1 820	4 000	0,87	0,78	1,16	0,76	400
1 940	4 000	0,87	0,78	1,16	0,76	390
1 990	4 250	0,87	0,78	1,16	0,76	–
1 640	3 650	0,87	0,78	1,16	0,76	360
1 460	3 800	0,87	0,78	1,16	0,76	365
2 060	5 300	0,87	0,78	1,16	0,76	500
2 060	5 300	0,87	0,78	1,16	0,76	500
2 950	6 800	0,87	0,78	1,16	0,76	630
2 060	5 300	0,87	0,78	1,16	0,76	510
1 600	3 550	0,82	0,82	1,22	0,8	335
2 060	5 300	0,87	0,78	1,16	0,76	500
2 440	5 600	0,87	0,78	1,16	0,76	520
2 440	5 600	0,87	0,78	1,16	0,76	520
3 550	7 200	0,87	0,78	1,16	0,76	630
1 160	2 850	0,87	0,78	1,16	0,76	–
1 600	4 300	0,87	0,78	1,16	0,76	–
1 140	3 450	0,7	0,97	1,44	0,94	325
1 880	4 750	0,87	0,78	1,16	0,76	430
2 450	5 800	0,87	0,78	1,16	0,76	510
1 880	4 750	0,87	0,78	1,16	0,76	430
1 880	4 750	0,87	0,78	1,16	0,76	430
2 700	6 000	0,87	0,78	1,16	0,76	520
2 650	6 100	0,97	0,69	1,03	0,68	–
1 760	5 600	0,94	0,72	1,07	0,7	–
2 000	6 000	0,87	0,78	1,16	0,76	–
1 960	6 000	0,87	0,78	1,16	0,76	–

Tapered roller bearings

Double row,
X arrangement
With large contact angle
Axial bearings
for oil film bearings



Design 15



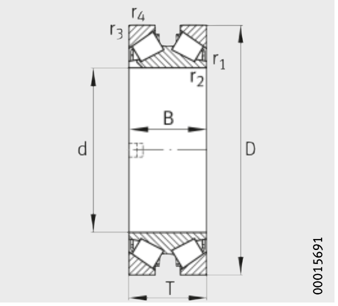
Design 16
With pin cage

Dimension table · Dimensions in mm

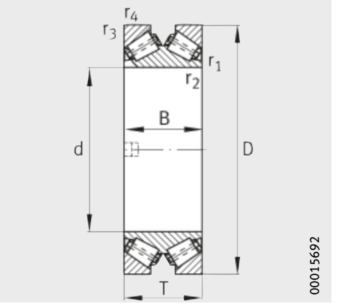
Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-564447.TR2	15	19,1	**250**	340	76	76	2,5	2
Z-566446.TR2	15	17,8	**250**	350	67	67	2,5	2
Z-549122.TR2	15	21,5	**250**	350	76	76	2,5	2
Z-567453.TR2	15	57,3	**280**	420	130	130	2,5	2
Z-575386.TR2	15	28,1	**285**	380	92	92	2,5	2
Z-531529.TR2	19	49	**300**	440	105	105	4	4
Z-531296.01.TR2	19	143	**305**	500	200	200	6	6
Z-533062.TR2	18[1)]	150	**305**	500	200	200	5	6
F-801264.TR2	16[1)]	190	**305**	560	200	200	6	12
Z-525154.TR2	16	206	**305**	560	200	200	6	12
Z-575342.TR2	17	207	**380**	590	210	210	2,5	5
Z-535533.TR2	18[1)]	270	**400**	650	200,025	200	2,5	5
Z-531295.01.TR2	19	281	**400**	650	240	240	6	6
F-801317.TR2	17	135	**445**	620	160	160	2	5
Z-525155.TR2	16	280	**483**	734	200	200	6,4	6,4
F-807792.TR2	17	271	**510**	734	200,025	200,025	3,3	4,8
Z-524209.01.TR2	17[2)]	285	**510**	734	200,025	200,025	3,3	4,8
Z-531530.TR2	19	484	**510**	800	285	285	7,5	6
Z-531531.02.TR2	17	684	**635**	940	304,8	304,8	3,3	6,4
Z-524241.TR2	15	761	**635**	940	304,8	304,8	3,3	6,4
Z-524210.TR2	18	475	**686**	940	228,575	235,077	3,3	6,4
Z-535959.TR2	17[2)]	869	**800**	1 100	300	300	1	6

[1)] With sheet steel cages.

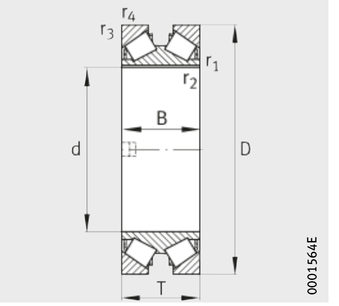
[2)] With pin cages.



Design 17

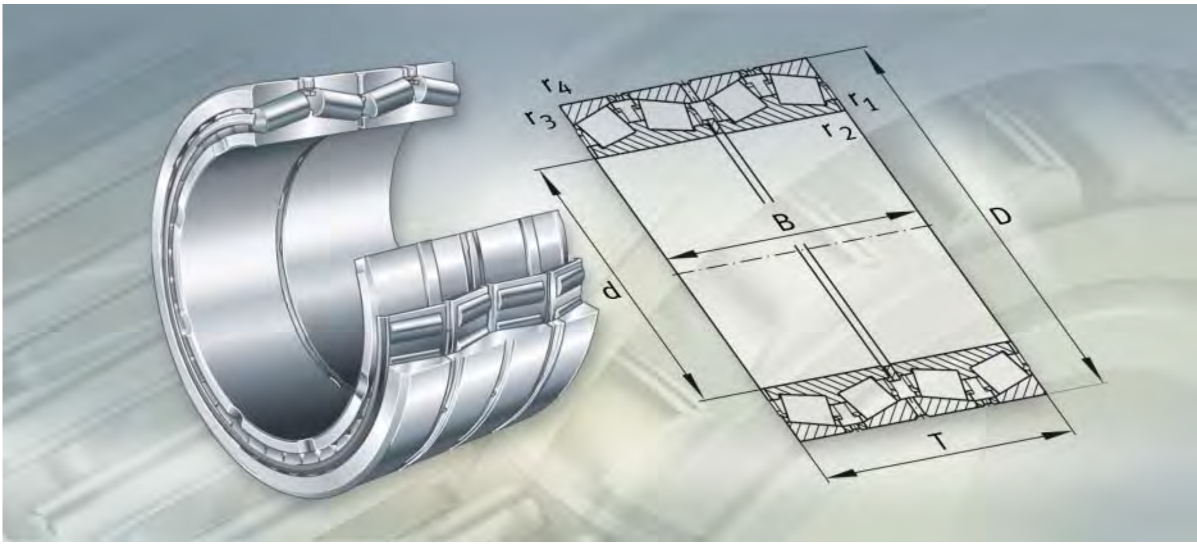


Design 18
With pin cage



Design 19

Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
550	1 210	0,96	0,7	1,05	0,69	95
425	880	0,94	0,72	1,07	0,7	75
550	1 210	0,96	0,7	1,05	0,69	95
1 240	2 440	0,79	0,85	1,27	0,83	245
710	1 700	0,94	0,72	1,07	0,7	166
910	1 970	0,86	0,79	1,17	0,77	188
2 280	4 700	0,87	0,78	1,16	0,76	450
2 280	4 700	0,87	0,78	1,16	0,76	450
2 410	4 450	0,87	0,78	1,16	0,76	415
2 600	5 000	0,87	0,78	1,16	0,76	470
2 950	6 800	0,87	0,78	1,16	0,76	630
2 900	6 400	0,87	0,78	1,16	0,76	570
3 550	7 200	0,87	0,78	1,16	0,76	630
2 040	5 000	0,87	0,78	1,16	0,76	455
3 100	6 700	0,99	0,68	1,01	0,67	570
3 100	8 200	0,94	0,72	1,07	0,7	710
3 200	8 700	0,94	0,72	1,07	0,7	750
5 100	11 300	0,87	0,78	1,16	0,76	950
5 900	15 600	0,87	0,78	1,16	0,76	1 250
6 200	16 500	0,87	0,78	1,16	0,76	1 320
4 600	14 000	0,8	0,85	1,26	0,83	1 130
6 600	21 000	0,8	0,85	1,26	0,83	1 610

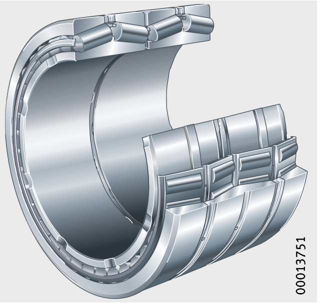


Four-row tapered roller bearings

Four-row tapered roller bearings

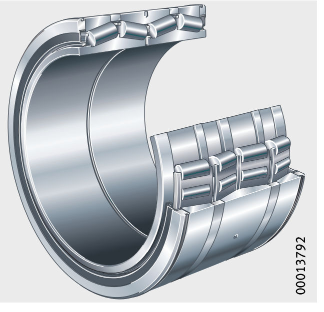
Metric sizes and inch sizes

Z-5..TR4-01, Z-5..TR4-02,
F-8..TR4-01, F-8..TR4-02



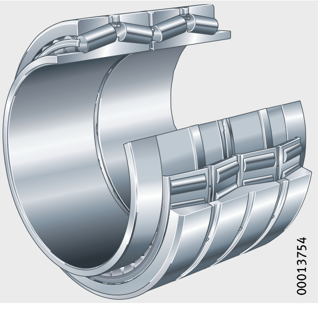
With integral seals

Z-5..TR4-03, F-8..TR4-03



With extended inner rings

Z-5..TR4-04, F-8..TR4-04



Four-row tapered roller bearings

Features

Four-row tapered roller bearings comprise solid bearing rings and tapered roller and cage assemblies. They are suitable for axial loads in both directions and high radial loads.

The bearings described here are separable. The complete bearing must be mounted in the chock, after which the chock together with the bearing is slid onto the journal. This requires a loose fit for the inner ring on the journal.

For high speeds and loads, however, the inner ring must have a tight fit. This can be achieved by mounting bearings with a tapered bore on tapered roll journals.

Four-row tapered roller bearings are normally supplied with spacer rings between the outer rings while, in a few cases, they do not have intermediate rings.

Four-row tapered roller bearings are used, for example, in bearing arrangements for work rolls (bearings with sheet metal cage) or back-up rolls (bearings with pin cage). In addition to open bearings, sealed designs are also available. They are used to reduce the grease consumption in work roll bearings.

Four-row tapered roller bearings have non-standardised metric or inch dimensions and designations Z-5..TR4 or F-8..TR4.
Design variants are indicated by the Technical Specification H122**.
These can requested from Schaeffler.

Radial and axial load capacity

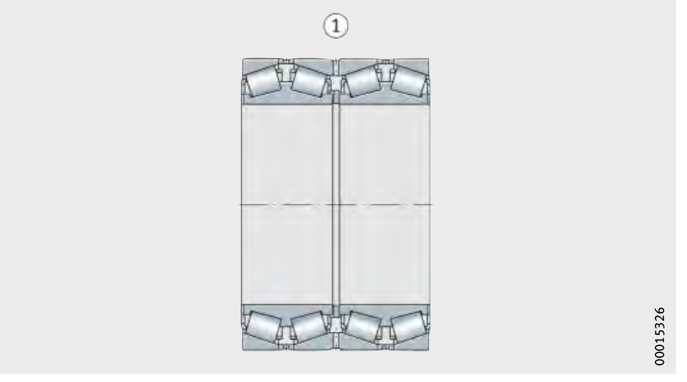
Four-row tapered roller bearings can support axial forces in both directions as well as high radial forces. Where there are particularly high demands on axial guidance, an additional axial bearing is used in some cases.

Open bearings

Open four-row tapered roller bearings are available in four designs in metric or inch sizes and tolerances, *Figure 1* and *Figure 2*, page 561.

Design 1

- The outer ring comprises a double ring and two single rings.
- The inner ring bore is smooth.
- The bearings have sheet metal cages.
- Design 1 is particularly suitable for smaller bearings in work rolls that are subjected to low loads and exhibit little journal wear.



1 Design 1

Figure 1
Open four-row tapered roller bearing

Design 2

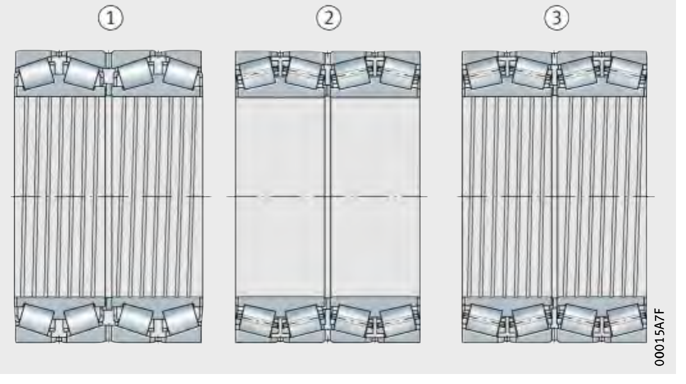
- The outer ring comprises a double ring and two single rings.
- The helical groove in the inner ring bore is intended to give good lubrication of the fit joint.
- The bearings have sheet metal cages.

Design 3

- The outer ring comprises a double ring and two single rings.
- The inner ring bore is smooth.
- Large bearings have through-drilled rollers and pin cages. This is necessary in reversing type stands due to the high inertia forces.

Design 4

- The outer ring comprises a double ring and two single rings.
- The inner ring bore has a helical groove.
- The bearings have through-drilled rollers and pin cages.



1 Design 2
2 Design 3
3 Design 4

Figure 2
Open four-row tapered roller bearings

Sealed bearings

Work roll bearing arrangements in hot or cold rolling lines must be effectively sealed against large quantities of water or roll coolant that are mixed with contaminants.
These bearing arrangements are normally lubricated with grease. For cost and environmental reasons, it is desirable to achieve low levels of grease consumption. Four-row tapered roller bearings with integrated seals have therefore been developed, *Figure 3*.
These bearings have main dimensions identical to those of the open bearings. Only small quantities of the high quality rolling bearing grease used are required.
Although the basic load ratings of the sealed bearings are lower, they normally have a longer life than the open bearings due to the improved cleanliness in the lubrication gap.

Design 5

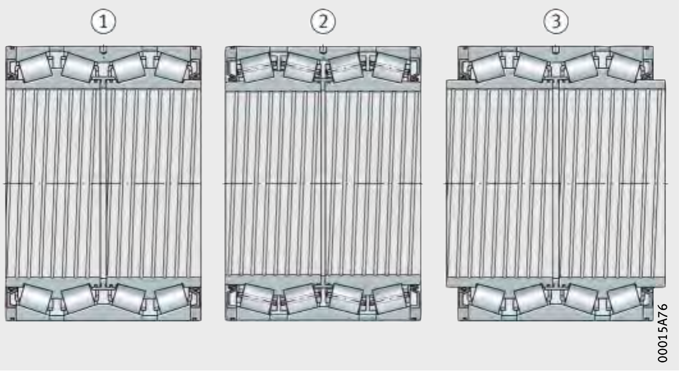
- The outer ring comprises a double ring and two single rings.
- The inner ring bore has a helical groove.
- The bearings have sheet metal cages.

Design 6

- The outer ring comprises a double ring and two single rings.
- The inner ring bore has a helical groove.
- The bearings have pin cages.

Design 7

- The outer ring comprises a double ring and two single rings.
- The inner rings are laterally extended.
- The inner ring bore has a helical groove.
- The bearings have sheet metal cages.



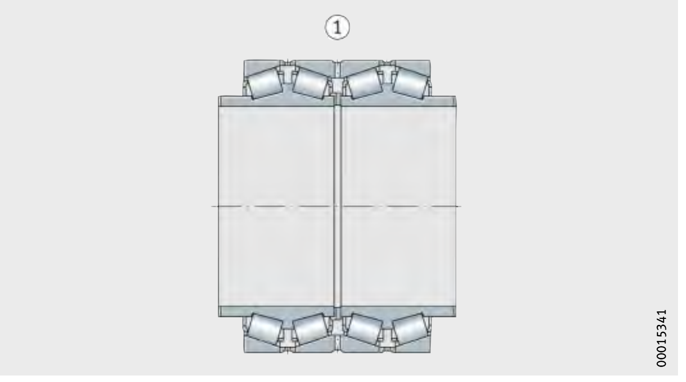
1 Design 5
2 Design 6
3 Design 7

Figure 3
Sealed four-row tapered roller bearings

Bearings with extended inner rings

Design 8

- The outer ring comprises a double ring and two single rings.
- The inner ring bore is smooth.
- The bearings have sheet metal cages.
- The lateral extended sections of the inner ring are ground and designed as sliding surfaces for rotary shaft seals, *Figure 4*.



(1) Design 8

Figure 4
Four-row tapered roller bearing with extended inner rings

Operating temperature

Open and sealed four-row tapered roller bearings can be used at operating temperatures from –30 °C to +150 °C, depending on the lubricant.

! The rotary shaft seals on the sealed bearings are made from fluoro elastomer, which can give off gases and vapours harmful to health at approx. +300 °C or higher. This may occur, for example, if a welding torch is used in the dismounting of the bearings. If high temperatures are unavoidable, attention must be paid to the valid safety data sheet for the material.

Cages

Smaller four-row tapered roller bearings, which are used predominantly in work rolls, are subjected to smaller loads. For these bearings, a sheet steel cage is normally suitable.

Large back-up roll bearings must generally support very high loads. These bearings are fitted with through-drilled rollers and pin cages. Pin cages are necessary in reversing type stands due to the high inertia forces.

Design and safety guidelines

Equivalent loads

Four-row tapered roller bearings can support radial and axial loads. When determining the equivalent dynamic and static loads, only one row of rollers is considered, in contrast to DIN ISO 281.

Equivalent dynamic bearing load

The equivalent dynamic load P is valid for bearings that are subjected to radial and axial dynamic loads. It gives the same rating life as the combined bearing load occurring in practice.

For bearings under dynamic loading, the following applies (for one row):

Load ratio and equivalent dynamic load

Load ratio	Equivalent dynamic load
$\frac{F_a}{F_r} \leq e$	$P = F_r$
$\frac{F_a}{F_r} > e$	$P = 0{,}4 \cdot F_r + Y \cdot F_a$

P kN
Equivalent dynamic bearing load for combined load

F_a kN
Axial dynamic bearing load

F_r kN
Radial dynamic bearing load

e, Y –
Factors, see dimension tables.

Equivalent static bearing load

The equivalent static load P_0 is valid for bearings that are subjected to radial and axial static loads. It induces the same load at the centre point of the most heavily loaded contact point between the rolling element and raceway as the combined bearing load occurring in practice.

For bearings under static loading, the following applies (for one row):

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

P_0 kN
Equivalent static bearing load for combined load

F_{0r} kN
Radial static bearing load

Y_0 –
Factor, see dimension tables

F_{0a} kN
Axial 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 $C_r/P > 0{,}02$ is therefore necessary.

Comparative load ratings

The basic dynamic load ratings C_r to DIN ISO 281 are based on a basic rating life of 1 million revolutions. Competitors sometimes give different load ratings that are based on 90 million revolutions (3 000 h at 500 min^{-1}).
Since it is not possible to compare these values with the basic load ratings calculated according to ISO, please contact us regarding the comparative load ratings C_{r90} and C_{a90}.

Design of bearing arrangements

Shaft tolerances

Four-row tapered roller bearings	Nominal dimension d mm	Tolerance[1)] mm
Metric tolerances, with loose fit	< 315	–0,180...–0,230
	315 ...630	–0,240...–0,300
	> 630 ...800	–0,325...–0,410
	> 800	–0,350...–0,450
Inch tolerances, with loose fit	> 152,4...203,2	–0,150...–0,175
	> 203,2...304,8	–0,180...–0,205
	> 304,8...609,6	–0,200...–0,249
	> 609,6...914,4	–0,250...–0,334
	> 914,4	–0,300...–0,400
Axial bearings	d	e7

1) In the case of high speeds and bearings with a tapered bore, please contact us to discuss the tolerances for the adjacent parts.

Housing tolerances

Four-row tapered roller bearings	Nominal dimension D mm	Tolerance[1)] mm
Metric tolerances	≦ 800	H6
	> 800	H7
Inch tolerances	> 304,8... 609,6	+0,101...+0,150
	> 609,6... 914,4	+0,156...+0,230
	> 914,4...1 219,2	+0,202...+0,300
	> 1 219,6	+0,257...+0,380

1) In the case of high axial forces and bearings with a tapered bore, please contact us to discuss the tolerances for the adjacent parts.

Four-row tapered roller bearings

Accuracy

The dimensional and running tolerances of four-row tapered roller bearings are generally defined for individual cases.
Please contact us regarding the values.
Normal tolerances for bearings in metric and inch sizes should be taken from the following tables.

Normal tolerances for bearings in metric sizes

Nominal dimension mm		Bore deviation Δ_{dmp} µm		Outside diameter deviation Δ_{Dmp} µm		Width deviation $\Delta_{Bs} = \Delta_{Cs}$ µm	
over	incl.	max.	min.	max.	min.	max.	min.
180	250	0	−30	0	−30	0	−300
250	315	0	−35	0	−35	0	−350
315	400	0	−40	0	−40	0	−400
400	500	0	−45	0	−45	0	−450
500	630	0	−50	0	−50	0	−500
630	800	0	−75	0	−75	0	−750
800	1 000	0	−100	0	−100	0	−1 000
1 000	1 250	0	−125	0	−125	0	−1 250
1 250	1 600	0	−160	0	−160	0	−1 600
1 600	2 000	0	−200	0	−200	0	−2 000

Normal tolerances for bearings in inch sizes

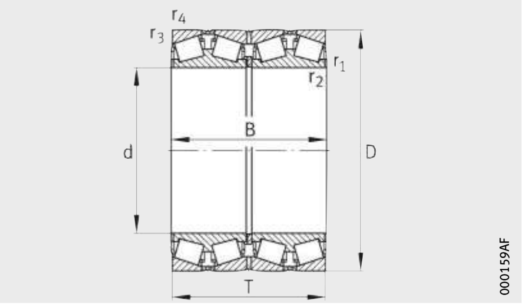
Nominal dimension mm		Bore deviation Δ_{dmp} µm		Outside diameter deviation Δ_{Dmp} µm		Width deviation $\Delta_{Bs} = \Delta_{Cs}$ µm	
over	incl.	max.	min.	max.	min.	max.	min.
304,8	609,6	+51	0	+51	0	±1 524	0
609,6	914,4	+76	0	+76	0	±1 524	0
914,4	1 219,2	+102	0	+102	0	±1 524	0
1 219,2	–	+127	0	+127	0	±1 524	0

Axial internal clearance

The axial internal clearance of four-row tapered roller bearings differs according to the bearing size and application.
Please contact us for values.

Tapered roller bearings

Four-row,
in inch sizes



Design 1
With sheet steel cages

Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-507747.TR4	1	104	**215,9**	355,6	254	254	1,6	1,6
F-802100.TR4	1	84,1	**216,103**	330,2	269,875	263,525	1,5	3,3
Z-511115.TR4	1	101	**228,6**	355,6	260,35	266,7	1,5	1,5
Z-524152.TR4	1	164	**228,6**	400,05	296,875	296,875	3,3	3,3
Z-564027.TR4	1	80	**241,224**	355,498	288,6	228,6	1,5	3,3
F-802115.TR4	1	72	**241,478**	349,148	228,6	228,6	1,5	3,3
F-802194.TR4	1	45,5	**244,475**	327,025	193,675	193,675	1,5	3,3
F-802194.TR4-H122AA	2	45,5	**244,475**	327,025	193,675	193,675	1,5	3,3
F-802199.TR4	1	129	**244,475**	381	304,8	304,8	3,3	4,8
F-802252.TR4	1	84,5	**254**	358,775	269,875	269,875	1,5	3,3
Z-510375.TR4	1	115	**260,35**	400,05	253,995	255,585	1,5	6,4
Z-517254.TR4	1	180	**260,35**	422,275	317,5	314,325	6,4	3,3
F-802010.TR4	1	62,6	**266,7**	355,6	228,6	230,188	1,5	3,3
F-802010.TR4-H122AA	2	62,6	**266,7**	355,6	228,6	230,188	1,5	3,3
Z-515700.TR4	1	116	**266,7**	393,7	269,878	269,878	3,3	6,4
F-802099.TR4	1	103	**269,875**	381	282,575	282,575	3,3	3,3
F-802279.TR4	1	101	**276,225**	393,7	269,878	269,878	1,5	6,4
F-802009.TR4	1	100	**279,4**	393,7	269,875	269,875	1,5	6,4
F-802009.TR4-H122AA	2	100	**279,4**	393,7	269,875	269,875	1,5	6,4
F-802051.TR4	1	84	**279,578**	380,898	244,475	244,475	1,5	3,3
F-802051.TR4-H122AA	2	84	**279,578**	380,898	244,475	244,475	1,5	3,3
F-802056.TR4	1	79	**285,75**	380,898	244,475	244,475	1,5	3,3
F-802056.TR4-H122AA	2	79	**285,75**	380,898	244,475	244,475	1,5	3,3
F-802228.TR4	1	121	**288,925**	406,4	298,45	298,45	3,3	3,3
Z-533455.TR4	1	114	**298,45**	438,15	228,6	228,6	3,2	3,2
F-802067.TR4	1	145	**300**	440	279,4	280,988	3,3	4,8
F-802067.TR4-H122AA	2	145	**300**	440	279,4	280,988	3,3	3,3
F-802136.TR4	1	137	**300,038**	422,275	311,15	311,15	3,3	3,3
Z-511861.TR4	1	115	**304,8**	419,1	269,875	269,875	1,5	6,4
Z-575220.TR4	1	271	**304,8**	495,3	349,25	342,9	3,3	6,4
F-802024.TR4	1	103	**304,902**	412,648	266,7	266,7	3,3	3,3
F-802024.TR4-H122AA	2	103	**304,902**	412,648	266,7	266,7	3,3	3,3
Z-518078.TR4	1	131	**305,003**	438,048	279,4	280,99	3,3	4,8

[1] The comparative designations were taken from documents available to us.
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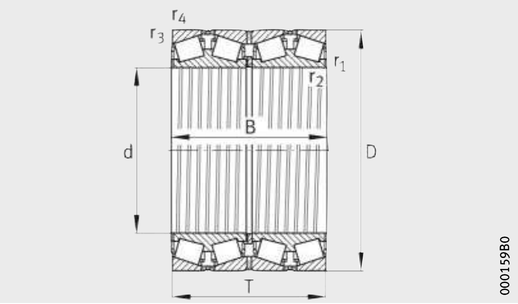
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.

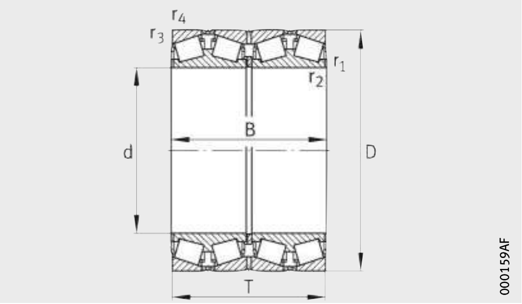


Design 2
With sheet steel cages

Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TQO types
3 050	5 400	0,34	1,96	2,91	1,91	580	130850DW.400.401D
2 750	5 200	0,56	1,21	1,81	1,19	570	9974DW.9920.9920D
2 900	5 000	0,34	1,96	2,91	1,91	540	EE130904DW.400.402D
4 150	6 400	0,31	2,18	3,25	2,13	670	EE529091DW.157.158D
2 400	4 500	0,35	1,92	2,86	1,88	–	EE127094DW.138.139D
2 400	4 500	0,35	1,92	2,86	1,88	490	EE127097DW.135.136D
1 590	3 400	0,48	1,41	2,1	1,38	370	LM247748DW.710.710D
1 590	3 400	0,48	1,41	2,1	1,38	370	LM247748DW.710.710D
3 750	6 950	0,46	1,46	2,17	1,43	–	EE126096DW.150.151D
3 200	6 300	0,34	1,98	2,95	1,94	–	M249749DW.710.710D
2 850	5 000	0,44	1,53	2,28	1,5	530	EE221027DW.575.576D
4 350	7 100	0,33	2,02	3	1,97	720	HM252349DW.310.310D
2 550	5 400	0,36	1,9	2,83	1,86	580	LM451349DW.310.310D
2 550	5 400	0,36	1,9	2,83	1,86	580	LM451349DGW.310.310D
3 200	6 000	0,45	1,49	2,21	1,45	–	EE275106DW.155.156D
3 600	7 400	0,33	2,03	3,02	1,99	780	M252349DW.310.310D
3 200	6 000	0,45	1,49	2,21	1,45	–	EE275109DW.155.156D
3 550	6 800	0,38	1,78	2,65	1,74	700	EE135111DW.155.156D
3 550	6 800	0,38	1,78	2,65	1,74	700	EE135111DGW.155.156D
2 600	6 100	0,42	1,6	2,39	1,57	650	LM654644DW.610.610D
2 600	6 100	0,42	1,6	2,39	1,57	650	LM654644DGW.610.610D
2 600	6 100	0,42	1,6	2,39	1,57	650	LM654648DW.610.610D
2 600	6 100	0,42	1,6	2,39	1,57	650	LM654648DGW.610.610D
4 050	8 200	0,35	1,94	2,89	1,9	860	M255449DW.410.410D
3 000	5 500	0,37	1,81	2,7	1,77	–	–
3 150	6 400	0,4	1,69	2,52	1,65	650	EE129119DW.174.175D
3 150	6 400	0,4	1,69	2,52	1,65	650	EE129119DGW.174.175D
4 150	8 700	0,36	1,86	2,77	1,82	900	HM256849DW.810.810D
3 650	7 650	0,32	2,12	3,15	2,07	–	M257149DW.110.110D
5 500	9 300	0,4	1,69	2,52	1,65	900	EE724121DW.195.196D
3 650	7 700	0,32	2,12	3,15	2,07	790	M257248DW.210.210D
3 650	7 700	0,32	2,12	3,15	2,07	790	M257248DGW.210.210D
3 900	7 200	0,47	1,43	2,12	1,4	720	M757449DW.410.410D

Tapered roller bearings

Four-row,
in inch sizes



Design 1
With sheet steel cages

Dimension table (continued) · Dimensions in mm								
Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
F-802045.TR4	1	103	**317,5**	422,275	269,875	269,875	1,5	3,3
F-802045.TR4-H122AA	2	103	**317,5**	422,275	269,875	269,875	1,5	3,3
Z-531883.TR4	1	136	**330,2**	444,5	301,625	301,625	3,3	3,3
Z-531281.TR4	1	144	**330,2**	482,6	222,25	212,725	1,6	6,4
F-802287.TR4-H122AA	2	100	**330,302**	438,023	254	247,65	1,5	3,3
F-802062.TR4	1	187	**333,375**	469,9	342,9	342,9	3,3	3,3
F-802062.TR4-M	3	193	**333,375**	469,9	342,9	342,9	3,3	3,3
Z-539439.TR4	1	236	**342,9**	533,4	301,625	307,985	3,3	3,3
Z-572452.TR4	3	369	**342,9**	571,5	342,9	342,9	3,3	6,4
F-802002.TR4-A370-400	1	110	**343,052**	457,098	254	254	1,5	3,3
F-802002.TR4-H122AA-A370-400	2	110	**343,052**	457,098	254	254	1,5	3,3
F-802028.TR4	1	215	**346,075**	488,95	358,775	358,775	3,3	3,3
F-802052.TR4	1	140	**347,662**	469,9	292,1	292,1	3,3	3,3
F-802119.TR4	1	104	**355,6**	457,2	252,412	252,412	1,5	3,3
F-802022.TR4	1	143	**355,6**	482,6	269,875	265,112	1,5	3,3
F-802022.TR4-H122AA	2	142	**355,6**	482,6	269,875	265,112	1,5	3,3
F-802137.TR4-H122AA	2	179	**355,6**	488,95	317,5	317,5	1,5	3,3
Z-548757.TR4	1	272	**368,3**	523,875	382,588	382,588	3,3	6,4
F-802177.TR4	1	135	**374,65**	501,65	260,35	250,825	1,5	3,3
F-802251.TR4	1	306	**384,175**	546,1	400,05	400,05	3,3	6,4
F-802014.TR4	1	183	**385,762**	514,35	317,5	317,5	3,3	3,3
F-802014.TR4-H122AA	2	183	**385,762**	514,35	317,5	317,5	3,3	3,3
Z-508328.02.TR4	1	192	**406,4**	546,1	288,925	268,288	1,5	6,4
F-802104.TR4-H122AA	2	183	**406,4**	546,1	288,925	288,925	1,5	6,4
F-802104.TR4	1	183	**406,4**	546,1	288,925	288,925	1,5	6,4
F-802086.TR4	1	290	**406,4**	565,15	381	381	3,3	6,4
F-802086.TR4-H122AA	2	290	**406,4**	565,15	381	381	3,3	6,4
Z-511569.TR4	1	367	**406,4**	590,55	400,05	400,05	3,3	6,4
Z-517944.TR4	3	378	**406,4**	590,55	400,05	400,05	3,3	6,4
F-802047.TR4	1	218	**409,575**	546,1	334,962	334,962	1,5	6,4
F-802047.TR4-H122AA	2	218	**409,575**	546,1	334,962	334,962	1,5	6,4
F-802047.TR4-M	3	225	**409,575**	546,1	334,962	334,962	1,5	6,4

1) The comparative designations were taken from documents available to us.
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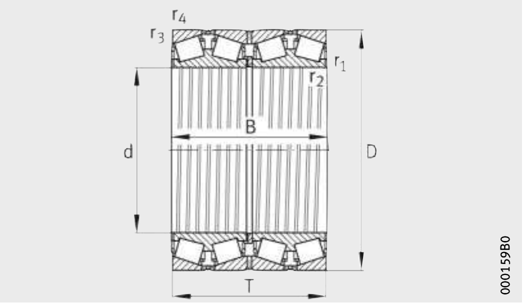
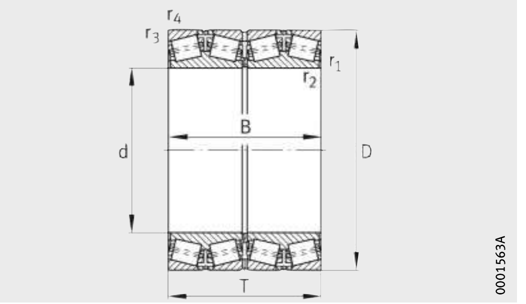


Design 2
With sheet steel cages

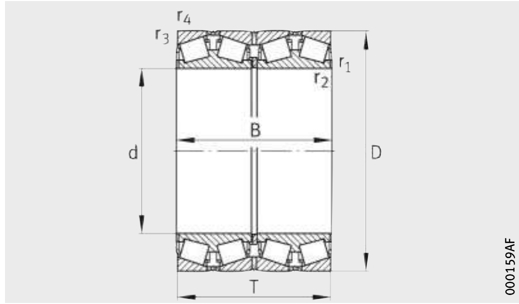


Design 3
With pin cages

Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TQO types
3 500	7 800	0,32	2,12	3,15	2,07	800	LM258648DW.610.610D
3 500	7 800	0,32	2,12	3,15	2,07	800	LM258648DGW.610.610D
3 800	8 500	0,4	1,69	2,52	1,65	850	M260149DW.110.110D
2 900	5 600	0,41	1,65	2,45	1,61	540	161301D.900.901D
3 250	6 700	0,44	1,54	2,29	1,5	670	EE138131DW.172.173D
4 950	10 700	0,38	1,79	2,67	1,75	1 070	HM261049DW.010.010D
5 000	11 000	0,38	1,79	2,67	1,75	1 100	HM261049DW.010.010D
4 950	8 000	0,33	2,03	3,02	1,98	740	971355DW.972100.972103D
6 550	10 600	0,33	2,03	3,02	1,98	–	EE536136DW.225.226D
3 250	6 700	0,47	1,43	2,12	1,4	–	LM761649DW.610.610D
3 250	6 700	0,47	1,43	2,12	1,4	–	LM761649DGW.610.610D
5 800	12 600	0,33	2,03	3,02	1,98	1 230	HM262749DW.710.710D
4 200	8 700	0,31	2,16	3,22	2,12	860	M262449DW.410.410D
3 450	8 100	0,32	2,12	3,15	2,07	810	LM263149DW.110.110D
3 550	7 900	0,45	1,51	2,25	1,48	770	LM763449DW.410.410D
3 550	7 900	0,45	1,51	2,25	1,48	770	LM763449DGW.410.410D
4 900	10 800	0,39	1,71	2,54	1,67	1 060	M263349DGW.310.310D
6 400	13 700	0,35	1,92	2,86	1,88	1 320	HM265049DW.010.010D
3 750	7 600	0,47	1,43	2,12	1,4	730	LM765149DW.110.110D
7 100	15 800	0,33	2,03	3,02	1,98	1 510	HM266449DW.410.410D
4 600	10 700	0,45	1,5	2,23	1,47	1 040	LM665949DW.910.910D
4 600	10 700	0,45	1,5	2,23	1,47	1 040	LM665949DGW.910.910D
4 150	8 500	0,47	1,43	2,12	1,4	780	EE234161DW.215.216D
4 400	9 300	0,43	1,56	2,33	1,53	–	LM767749DGW.710.710D
4 450	9 300	0,43	1,56	2,33	1,53	870	LM767749DW.710.710D
6 900	15 000	0,43	1,57	2,34	1,53	1 410	M267949DW.910.910D
6 900	15 000	0,43	1,57	2,34	1,53	1 410	M267949DGW.910.910D
7 350	15 000	0,34	1,99	2,96	1,94	–	EE833161DW.232.233D
7 700	16 100	0,34	1,99	2,96	1,94	1 490	EE833161DW.232.233D
5 300	12 400	0,45	1,5	2,24	1,47	1 190	M667947DW.910.910D
5 300	12 400	0,45	1,5	2,24	1,47	1 190	M667947DGW.910.910D
5 500	13 000	0,45	1,5	2,24	1,47	1 240	M667947DW.910.910D

Tapered roller bearings

Four-row,
in inch sizes

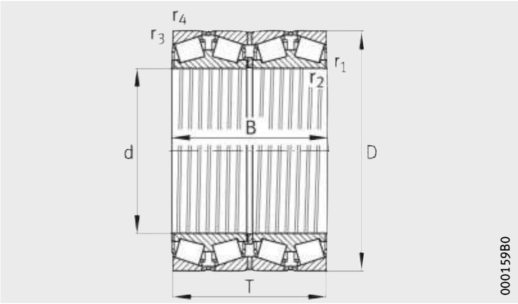


Design 1
With sheet steel cages

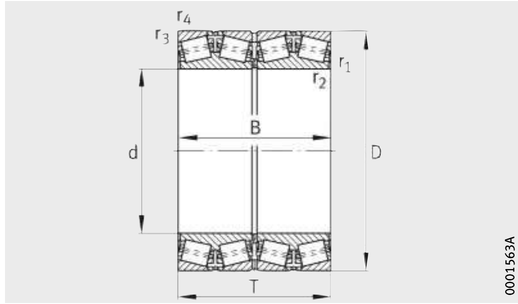
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
F-802048.TR4-H122AA	2	376	**415,925**	590,55	434,975	434,975	3,3	6,4
F-802048.TR4-M	3	402	**415,925**	590,55	434,975	434,975	3,3	6,4
F-802155.TR4	1	185	**431,8**	571,5	279,4	279,4	1,5	3,3
F-802012.TR4	1	236	**431,8**	571,5	336,55	336,55	1,5	6,4
F-802012.TR4-H122BP	2	236	**431,8**	571,5	336,55	336,55	1,5	6,4
F-802012.TR4-M	3	246	**431,8**	571,5	336,55	336,55	1,5	6,4
Z-530985.TR4	1	385	**431,8**	635	355,6	355,6	6,4	6,4
Z-530731.TR4	3	396	**431,8**	635	355,6	355,6	6,4	6,4
F-802209.TR4-H122AC	1	279	**432,003**	609,524	317,5	317,5	3,6	6,4
F-802179.TR4-H122AA	2	461	**447,675**	635	463,55	463,55	3,3	6,4
F-802179.TR4-M-H122AD	3	477	**447,675**	635	463,55	463,55	3,3	6,4
F-802098.TR4	1	197	**457,2**	596,9	279,4	276,225	1,5	3,3
F-802098.TR4-M	3	205	**457,2**	596,9	279,4	276,225	1,5	3,3
Z-506201.TR4	1	574	**479,425**	679,45	495,3	495,3	3,3	6,4
Z-561038.TR4	3	576	**479,425**	679,45	495,3	495,3	3,3	6,4
F-802006.TR4-H122AB	1	244	**482,6**	615,95	330,2	330,2	6,4	6,4
F-802006.TR4-H122BA	2	244	**482,6**	615,95	330,2	330,2	6,4	6,4
Z-561772.TR4	1	358	**482,6**	635	421	421	3	6,4
F-802237.TR4	1	384	**482,6**	647,7	417,512	417,512	3,3	6,4
F-802122.TR4	1	348	**488,95**	660,4	361,95	365,125	8	6,4
Z-518570.03.TR4	2	256	**489,026**	634,873	320,675	320,675	3,3	3,3
F-802037.TR4	1	253	**489,026**	634,873	320,675	320,675	3,3	3,3
F-802037.TR4-H122BB	2	253	**489,026**	634,873	320,675	320,675	3,3	3,3
F-802085.TR4-H122AC	1	385	**501,65**	673,1	387,35	400,05	3,3	6,4
F-802085.TR4-M	3	400	**501,65**	673,1	387,35	400,05	3,3	6,4
F-802195.TR4	1	656	**501,65**	711,2	520,7	520,7	3,3	6,4
F-802195.TR4-H122CP	2	656	**501,65**	711,2	520,7	520,7	4,6	6,4
F-802195.TR4-M	3	680	**501,65**	711,2	520,7	520,7	3,3	6,4
F-802053.TR4	1	710	**508**	762	463,55	463,55	6,4	6,4
F-802053.TR4-M	3	762	**508**	762	463,55	463,55	6,4	6,4
F-802030.TR4	1	394	**514,35**	673,1	422,275	422,275	3,3	6,4
F-802030.TR4-H122AA	2	393	**514,35**	673,1	422,275	422,275	3,3	6,4
F-802030.TR4-M	3	395	**514,35**	673,1	422,275	422,275	3,3	6,4

[1] The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 2
With sheet steel cages

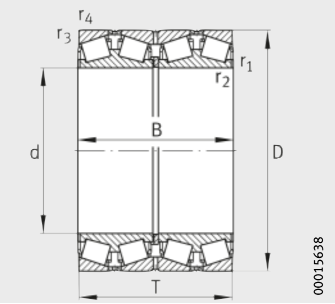


Design 3
With pin cages

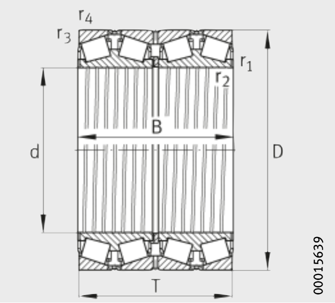
Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TQO types
7 900	16 700	0,34	1,98	2,94	1,93	1 540	M268749DGW.710.710D
8 200	17 700	0,34	1,98	2,94	1,93	1 640	M268749DW.710.710D
4 650	9 600	0,55	1,24	1,84	1,21	890	LM869449DW.410.410D
5 800	13 500	0,44	1,54	2,29	1,5	1 260	LM769349DW.310.310D
5 800	13 500	0,44	1,54	2,29	1,5	1 260	LM769349DGW.310.310D
5 900	13 800	0,44	1,54	2,29	1,5	1 290	LM769349DW.310.310D
7 300	13 100	0,32	2,12	3,15	2,07	1 170	EE931170DW.250.251D
7 500	13 600	0,32	2,12	3,15	2,07	1 210	EE931170DW.250.251D
5 700	10 800	0,47	1,44	2,15	1,41	–	EE736173DW.238.239D
9 800	20 800	0,33	2,07	3,09	2,03	–	M270749DW.710.710D
10 000	21 200	0,33	2,07	3,09	2,03	–	M270749DW.710.710D
4 700	10 100	0,47	1,43	2,12	1,4	910	L770847DW.810.810D
4 750	10 300	0,47	1,43	2,12	1,4	930	L770847DW.810.810D
10 200	22 500	0,35	1,92	2,86	1,88	2 010	M272749DW.710.710D
10 700	23 900	0,35	1,92	2,86	1,88	2 130	M272749DW.710.710D
5 400	14 000	0,37	1,83	2,72	1,79	1 280	LM272248DW.210.210D
5 400	14 000	0,37	1,83	2,72	1,79	1 280	LM272248DGW.210.210D
7 700	19 000	0,33	2,03	3,02	1,98	1 730	M272449DW.410.410D
7 800	18 400	0,31	2,18	3,24	2,13	1 670	M272647DW.610.610D
6 000	13 700	0,45	1,5	2,23	1,46	–	EE640193DW.260.261D
5 600	12 800	0,47	1,43	2,12	1,4	1 150	LM772749DGW.710.710D
5 800	13 400	0,47	1,43	2,12	1,4	1 210	LM772749DW.710.710D
5 800	13 400	0,47	1,43	2,12	1,4	1 210	LM772749DGW.710.710D
8 000	18 200	0,32	2,12	3,15	2,07	1 600	EE641198DW.265.266D
8 100	18 600	0,32	2,12	3,15	2,07	1 640	EE641198DW.265.266D
11 400	25 500	0,35	1,92	2,86	1,88	–	M274149DW.110.110D
11 400	25 500	0,35	1,92	2,86	1,88	–	Timken series: M274100
11 600	26 000	0,35	1,92	2,86	1,88	–	M274149DW.110.110D
10 500	20 300	0,39	1,73	2,58	1,69	1 730	EE531201DW.300.301D
11 000	21 700	0,39	1,73	2,58	1,69	1 850	EE531201DW.300.301D
8 200	19 800	0,33	2,07	3,09	2,03	1 770	LM274449DW.410.410D
8 200	19 800	0,33	2,07	3,09	2,03	1 770	LM274449DGW.410.410D
8 300	20 300	0,33	2,07	3,09	2,03	1 810	LM274449DW.410.410D

Tapered roller bearings

Four-row,
in inch sizes



Design 1
With sheet steel cages



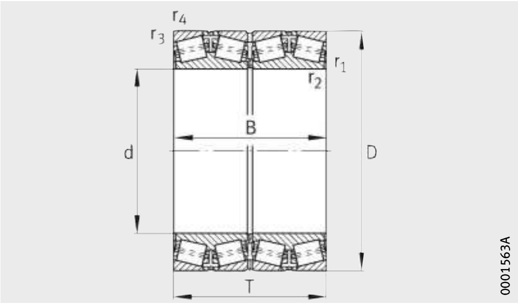
Design 2
With sheet steel cages

Dimension table (continued) · Dimensions in mm

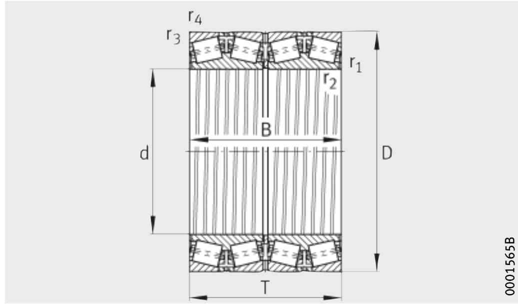
Designation	Design	Mass m ≈kg	Dimensions d	D	T	B	r_1, r_2 min.	r_3, r_4 min.
F-802148.TR4-H122BD	1	734	**519,112**	736,6	536,575	536,575	3,3	6,4
F-802210.TR4	1	451	**520,7**	711,2	400,05	400,05	3,3	6,4
F-802038.TR4	1	800	**536,575**	761,873	558,8	558,8	3,3	6,4
F-802038.TR4-M	3	836	**536,575**	761,873	558,8	558,8	3,3	6,4
F-802102.TR4	1	363	**558,8**	736,6	322,268	322,265	3,3	6,4
F-802102.TR4-M	3	376	**558,8**	736,6	322,268	322,265	3,3	6,4
F-802093.TR4	1	466	**558,8**	736,6	409,575	409,575	3,3	6,4
F-802093.TR4-M	3	486	**558,8**	736,6	409,575	409,575	3,3	6,4
Z-521179.TR4	1[1]	530	**558,8**	736,6	457,2	455,612	3,3	6,4
F-802049.TR4	1	974	**571,5**	812,8	593,725	593,725	3,3	6,4
F-802049.TR4-M	3	1 030	**571,5**	812,8	593,725	593,725	3,3	6,4
F-802090.TR4	1	470	**584,2**	762	401,638	396,875	3,3	6,4
F-802090.TR4-M	3	483	**584,2**	762	401,638	396,875	3,3	6,4
Z-535868.TR4	1	1 500	**584,2**	901,7	539,747	584,2	3,2	9,7
F-802198.TR4-H122AA	2	589	**585,788**	771,525	479,425	479,425	3,3	6,4
F-802198.TR4-M	3	610	**585,788**	771,525	479,425	479,425	3,3	6,4
F-802185.TR4	1	1 090	**595,312**	844,55	615,95	615,95	3,3	6,4
F-802185.TR4-M	3	1 160	**595,312**	844,55	615,95	615,95	3,3	6,4
F-802075.TR4	1	1 130	**603,25**	857,25	622,3	622,3	3,3	6,4
F-802075.TR4-M-H122AA	4	1 200	**603,25**	857,25	622,3	622,3	3,3	6,4
F-802054.TR4-M-H122AB	3	463	**609,6**	787,4	361,95	361,95	3,3	6,4
F-802054.TR4-M-H122AP	3	463	**609,6**	787,4	361,95	361,95	6,4	6,4
Z-529150.TR4	4	710	**609,6**	813,562	479,425	479,425	6,4	3,3
Z-530986.TR4	3	1 270	**609,6**	863,6	660,4	660,4	3,3	6,4
Z-513141.TR4	3	1 360	**635**	901,7	654,05	654,05	3,3	6,4
F-802147.TR4-M	3	901	**646,112**	857,25	542,925	542,925	3,3	6,4
F-802183.TR4-M	3	1 840	**647,7**	1 028,7	565,15	558,8	11,2	6,4
F-802057.TR4-M-H122AA	4	1 450	**650**	915	674	674	3,6	6,1
F-802057.TR4-M-H122AB	1	462	**660**	855	319,192	318,48	4,8	9,7
F-802203.TR4-H122AA	2	398	**660,4**	812,8	365,125	365,125	3,3	6,4
F-802203.TR4-M-H122AA	4	412	**660,4**	812,8	365,125	365,125	3,3	6,4
Z-515672.TR4	3	2 210	**660,4**	1 066,8	647,703	638,175	6,4	6,4

[1] Bearing with lubrication holes through the central rib of the inner ring.

[2] The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 3
With pin cages

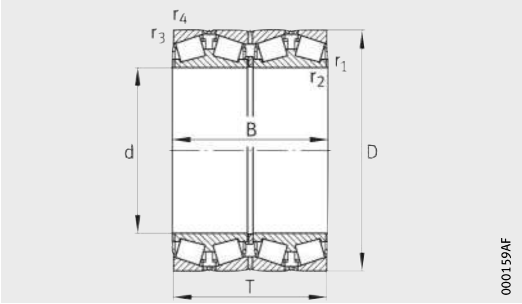


Design 4
With pin cages

Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[2)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TQO types
11 800	27 000	0,33	2,04	3,04	2	–	M275349DW.310.310D
8 500	18 300	0,43	1,57	2,34	1,53	1 580	LM275349DW.310.310D
13 800	30 000	0,3	2,28	3,39	2,23	2 600	M276449DW.410.410D
14 200	31 000	0,3	2,28	3,39	2,23	2 650	M276449DW.410.410D
6 900	15 300	0,34	1,98	2,94	1,93	1 290	EE843221DW.290.291D
7 000	15 600	0,34	1,98	2,94	1,93	1 320	EE843221DW.290.291D
9 100	21 900	0,35	1,95	2,9	1,91	1 880	LM377449DW.410.410D
9 200	22 400	0,35	1,95	2,9	1,91	1 920	LM377449DW.410.410D
10 000	24 500	0,32	2,14	3,18	2,09	–	LM277149DA.110.110D
15 400	34 000	0,33	2,03	3,02	1,98	2 900	M278749DW.710.710D
16 100	36 000	0,33	2,03	3,02	1,98	3 050	M278749DW.710.710D
8 400	20 600	0,35	1,91	2,85	1,87	1 760	LM778549DW.510.510D
8 600	21 500	0,35	1,91	2,85	1,87	1 830	LM778549DW.510.510D
14 900	27 000	0,33	2,03	3,02	1,98	2 120	665231DW.355.356D
10 200	25 500	0,33	2,03	3,02	1,98	2 160	LM278849DW.810.810D
10 200	25 500	0,33	2,03	3,02	1,98	2 140	LM278849DW.810.810D
16 400	37 000	0,34	1,99	2,96	1,95	3 100	M280049DW.010.010D
17 200	39 500	0,34	1,99	2,96	1,95	3 300	M280049DW.010.010D
16 700	38 500	0,35	1,95	2,9	1,91	3 200	M280249DW.M210.210D
17 500	40 500	0,35	1,95	2,9	1,91	3 400	M280249DGW.210.210D
7 400	18 800	0,5	1,35	2,01	1,32	1 590	649241DW.310.311D
7 400	18 800	0,5	1,35	2,01	1,32	1 590	649242DW.310.311D
12 400	29 500	0,26	2,55	3,8	2,5	2 470	LM280249DGW.210.210D
18 100	42 500	0,35	1,95	2,9	1,91	3 500	M280349DW.310.310D
18 600	44 000	0,33	2,03	3,02	1,98	–	M281049DW.010.010D
14 500	35 500	0,33	2,03	3,02	1,98	2 950	LM281049DW.010.010D
18 000	32 500	0,31	2,16	3,22	2,12	–	EE424257DW.405.407D
18 700	45 000	0,33	2,03	3,02	1,98	3 650	M281349DGW.310.310D
7 650	17 600	0,35	1,91	2,84	1,87	–	EE749259DW.334.335D
8 200	21 400	0,33	2,03	3,02	1,98	1 780	L281149DGW.110.110D
8 400	22 200	0,33	2,03	3,02	1,98	1 850	L281149DGW.110.110D
23 100	42 500	0,31	2,15	3,2	2,1	3 200	428262DW.420.420XD

Tapered roller bearings

Four-row,
in inch sizes

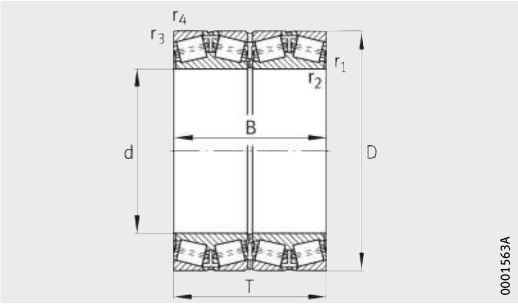


Design 1
With sheet steel cages

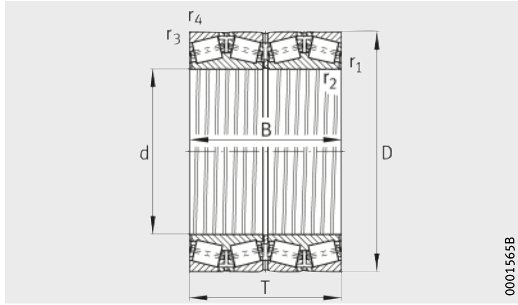
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	T	B	r_1, r_2 min.	r_3, r_4 min.
Z-568422.TR4	3	995	**679,45**	901,7	552,45	552,45	3,3	6,4
Z-521612.TR4	1	970	**679,45**	901,7	552,45	679,45	3,2	6,4
F-802040.TR4	1	523	**685,8**	876,3	355,6	352,425	3,3	6,4
F-802040.TR4-M	3	542	**685,8**	876,3	355,6	352,425	3,3	6,4
F-802170.TR4-M	3	1 070	**708,025**	930,275	565,15	565,15	3,3	6,4
F-802055.TR4	1	518	**711,2**	914,4	317,5	317,5	3,3	6,4
F-802055.TR4-M	3	542	**711,2**	914,4	317,5	317,5	3,3	6,4
F-802173.TR4-M-H122AB	3	1 910	**714,375**	1 016	704,85	704,85	3,3	6,4
F-802103.TR4-M	3	1 120	**717,55**	946,15	565,15	565,15	3,3	6,4
F-802103.TR4-M-H122AA	4	1 120	**717,55**	946,15	565,15	565,15	3,3	6,4
F-802182.TR4-M-H122AA	4	2 060	**730,25**	1 035,05	755,65	755,65	3,3	6,4
Z-526837.TR4	1	1 270	**749,3**	990,6	605	605	3,3	6,4
Z-527082.TR4	3	1 300	**749,3**	990,6	605	605	3,3	6,4
Z-513140.TR4	3	2 190	**749,3**	1 066,8	736,6	723,9	4,8	12,7
F-802032.TR4-M	3	2 130	**762**	1 066,8	736,6	723,9	7,9	12,7
Z-532879.TR4	3	3 110	**774,7**	1 220	838,474	774,7	6,4	12,7
Z-526416.TR4	3	3 530	**780**	1 220	838,474	838,474	6,4	12,7
F-802110.TR4-M-H122AA	4	2 590	**812,8**	1 143	768,35	768,35	6,4	12,7
F-802234.TR4-M	3	2 990	**825,5**	1 168,4	844,55	844,55	4,8	12,7
Z-514432.TR4	3	3 110	**825,5**	1 193,8	812,8	812,8	6,4	12,7
Z-528337.TR4	3	1 360	**863,6**	1 090	669,925	669,925	4,8	12,7
F-802204.TR4-M-A300-350	3	1 870	**863,6**	1 130,3	669,925	669,925	4,8	12,7
Z-561585.TR4	3	2 170	**863,6**	1 181,1	666,75	666,75	4,8	12,7
F-802247.TR4-M-H122AD	3	3 400	**863,6**	1 219,2	889	876,3	4,8	12,7
Z-521592.TR4	3	4 080	**901,7**	1 295,4	914,4	901,7	4,8	12,7
F-802139.TR4-M	3	3 170	**938,212**	1 270	825,5	825,5	4,8	12,7
Z-511781.TR4	3	4 390	**939,8**	1 333,5	952,5	952,5	4,8	12,7
Z-539519.TR4	3	2 600	**1 006,475**	1 295,4	764	764	4,8	12,7
F-802027.TR4-M	3	4 690	**1 139,825**	1 509,712	923,925	923,925	4,8	12,7
Z-523207.TR4	3	5 770	**1 200,15**	1 593,85	990,6	990,6	4,8	12,7
F-801326.TR4	4	6 920	**1 346,2**	1 729,74	1 143	1 143	4,8	12,7

[1] The comparative designations were taken from documents available to us.
They give information on identical main dimensions and chamfer dimensions only.
The cage and bearing designs are not always identical.
Furthermore, the table makes no claims to completeness.



Design 3
With pin cages

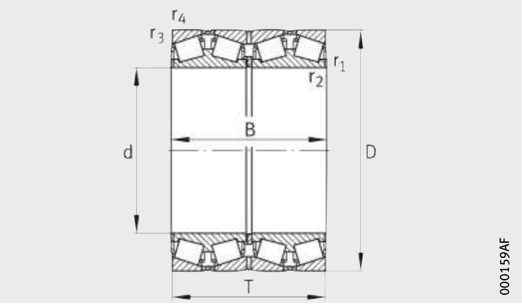


Design 4
With pin cages

Basic load ratings		Calculation factors				Fatigue limit load	Interchange designation[1)]
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN	TQO types
13 800	35 000	0,33	2,07	3,09	2,03	2 850	LM281849DW.810.810D
13 100	32 500	0,33	2,07	3,09	2,03	2 650	LM281849DW.810.810D
7 800	19 900	0,41	1,66	2,47	1,62	1 620	EE655271DW.345.346D
8 200	21 000	0,41	1,66	2,47	1,62	1 710	EE655271DW.345.346D
15 800	41 000	0,33	2,06	3,07	2,02	3 300	LM282549DW.510.510D
7 900	19 000	0,38	1,77	2,63	1,73	1 500	EE755281DW.360.361D
8 000	19 400	0,38	1,77	2,63	1,73	1 530	EE755281DW.360.361D
23 200	53 000	0,32	2,08	3,09	2,03	–	M383240DW.210.210D
15 700	41 000	0,33	2,03	3,02	1,98	3 300	LM282847DW.810.810D
15 700	41 000	0,33	2,03	3,02	1,98	3 300	LM282847DGW.810.810D
23 600	54 000	0,33	2,03	3,02	1,98	4 200	M283449DGW.410.410D
16 600	43 500	0,34	2,01	2,99	1,97	3 450	LM283649DW.610.610D
17 400	46 500	0,34	2,01	2,99	1,97	3 700	LM283649DW.610.610D
24 600	57 000	0,34	1,98	2,95	1,94	4 400	EE325296DW.420.421D
24 200	59 000	0,33	2,03	3,02	1,98	4 500	M284148DW.111.110D
31 500	70 000	0,39	1,72	2,56	1,68	5 200	EE631305D.484.483XD
30 000	67 000	0,39	1,72	2,56	1,68	–	EE631307D.484.483XD
26 500	65 000	0,37	1,83	2,72	1,79	4 900	–
29 500	72 000	0,34	2	2,98	1,96	5 500	M285848DW.810.810D
31 000	69 000	0,39	1,72	2,56	1,68	5 100	EE631325DW.470.470D
19 200	58 000	0,26	2,55	3,8	2,5	4 450	–
22 400	60 000	0,33	2,03	3,02	1,98	4 200	LM286249DW.210.210D
22 800	58 500	0,38	1,76	2,62	1,72	–	LM286449DW.410.410D
32 000	77 000	0,33	2,03	3,02	1,98	5 800	EE547341DW.480.481D
36 500	84 000	0,32	2,12	3,15	2,07	6 100	EE634356D.510.510D
32 000	82 000	0,32	2,12	3,15	2,07	6 000	LM287649DW.610.610D
38 000	93 000	0,33	2,03	3,02	1,98	6 800	LM287849DW.810.810D
28 000	80 000	0,33	2,03	3,02	1,98	5 800	LM288249DW.210.210D
38 000	105 000	0,32	2,09	3,11	2,04	7 300	SKF BT4B 331334/HA4
46 500	129 000	0,33	2,06	3,06	2,01	–	LM288949D.910.910D
49 000	146 000	0,33	2,03	3,02	1,98	–	–

Tapered roller bearings

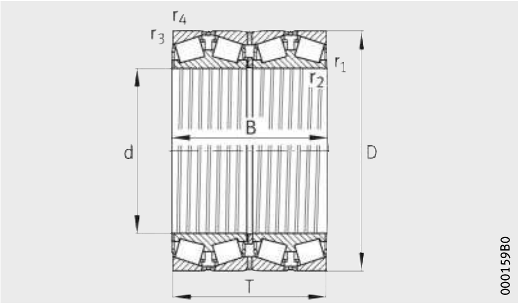
Four-row,
in metric sizes



Design 1
With sheet steel cages

Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-533136.TR4	1	72,1	**190**	320	232	232	1	4
Z-512055.TR4	1	54	**205**	320	205	205	4	4
Z-567972.TR4	1	55	**220**	320	200	200	1,5	4
Z-532027.TR4	1	75	**220**	340	218	220	1,5	4
F-802105.TR4	1	100	**220**	340	305	305	4	3
F-802184.TR4	1	70	**240**	338	248	248	4	3
Z-532028.TR4	1	81	**240**	360	218	218	1	3
Z-534751.TR4	1	150	**240**	410	270	270	4	4
Z-508990.01.TR4	1	104	**245**	380	254	255,5	1	3
F-802200.TR4	1	88	**260**	368	268	268	5	5
Z-522614.TR4	1	79	**260**	380	200	200	2	5
Z-531025.TR4	1	119	**260**	400	250	250	5	5
Z-534480.TR4	1	163	**260**	400	345	345	5	5
F-802151.TR4	1	178	**260**	440	300	300	3	6
Z-574281.TR4	1	115	**280**	395	288	288	5	5
Z-548651.TR4	1	113	**280**	420	224	224	4	4
Z-532029.TR4	1	105	**280**	420	250	250	2	5
F-802132.TR4	1	167	**280**	420	345	345	5	5
Z-510039.TR4	1	197	**280**	460	324	324	6	6
Z-574613.TR4	1	156	**300**	460	248	248	5	4
F-802245.TR4	1	233	**300**	460	390	390	5	5
Z-534753.TR4	1	280	**300**	500	350	350	6	5
Z-576008.TR4	1	141	**310**	430	310	310	4	4
Z-566230.TR4	1	153	**320**	440	335	335	2	5
F-802232.TR4	1	248	**340**	520	325	325	6	5
Z-534754.TR4	1	485	**350**	590	420	420	3	6
Z-523453.TR4	2	183	**355**	490	316	316	1,5	2,5
Z-530758.TR4	1	260	**360**	510	380	380	1,5	5
Z-572344.TR4	1	267	**360**	520	370	370	3	4
Z-514166.TR4	1	270	**360**	540	325	325	6	6
Z-546304.TR4	1	282	**360**	540	340	340	4	5

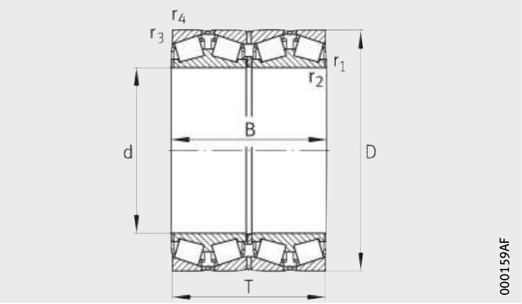


Design 2
With sheet steel cages

Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
2 400	3 400	0,45	1,5	2,23	1,5	–
2 000	3 200	0,43	1,56	2,32	1,5	–
2 000	3 400	0,34	2	2,98	2	–
2 470	4 000	0,45	1,51	2,25	1,5	430
3 600	6 400	0,35	1,95	2,9	1,9	700
2 550	5 300	0,38	1,79	2,66	1,8	580
2 600	4 300	0,43	1,55	2,31	1,5	455
3 900	5 900	0,29	2,32	3,45	2,3	600
2 850	4 950	0,42	1,61	2,4	1,6	520
3 100	6 100	0,35	1,93	2,88	1,9	–
2 450	4 150	0,32	2,13	3,17	2,1	430
2 850	5 000	0,44	1,53	2,28	1,5	–
4 600	8 600	0,43	1,55	2,31	1,5	900
3 800	5 850	0,7	0,97	1,44	0,9	–
3 700	7 300	0,35	1,95	2,9	1,9	770
3 100	5 300	0,37	1,8	2,69	1,8	–
3 200	6 200	0,47	1,42	2,12	1,4	640
4 800	9 150	0,46	1,47	2,19	1,4	–
4 900	7 900	0,34	1,99	2,96	1,9	770
3 450	5 800	0,46	1,46	2,18	1,4	570
6 300	12 000	0,32	2,12	3,15	2,1	1 210
5 300	9 500	0,58	1,16	1,72	1,1	–
4 300	9 150	0,32	2,12	3,15	2,1	–
4 850	10 300	0,33	2,03	3,02	2	1 050
5 800	10 500	0,29	2,32	3,45	2,3	1 000
7 200	11 800	0,7	0,97	1,44	0,9	–
4 900	10 800	0,39	1,71	2,54	1,7	1 060
5 900	12 100	0,34	1,96	2,93	1,9	1 180
6 200	13 100	0,35	1,92	2,86	1,9	1 270
5 500	9 700	0,41	1,65	2,46	1,6	900
6 000	11 100	0,4	1,68	2,5	1,6	1 040

Tapered roller bearings

Four-row,
in metric sizes

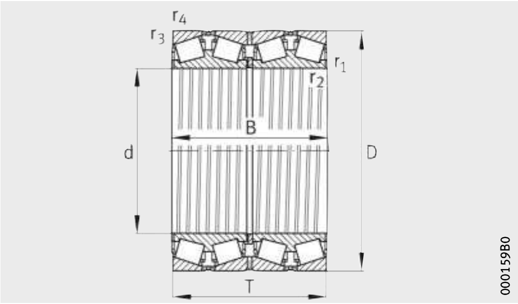


Design 1
With sheet steel cages

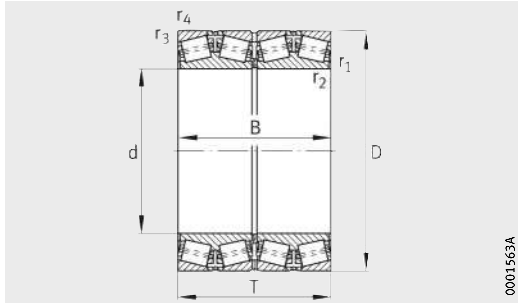
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
Z-565625.TR4	1	282	**380**	560	325	325	2,5	6
F-802109.TR4	1	296	**380**	560	360	360	1,5	5
F-802109.TR4-M	3	312	**380**	560	360	360	1,5	5
Z-523695.TR4	1	427	**380**	620	388	388	5	5
Z-510038.TR4	1	510	**380**	620	420	420	5	5
F-802205.TR4	1	183	**390**	510	350	350	1,5	3
F-802116.TR4	1	193	**395**	545	288,7	268,7	5	7,5
F-802116.TR4-H122AA	2	193	**395**	545	288,7	268,7	5	7,5
F-802074.TR4	1	177	**400**	540	280	280	5	5
Z-534284.TR4	1	365	**400**	600	355	355	3	6
Z-575106.TR4	1	327	**420**	592	432	432	6	6
Z-539120.TR4	1	370	**420**	620	355	355	4	6
Z-510036.TR4	1	1 000	**420**	760	500	500	9,5	9,5
F-802231.TR4-H122AA	2	235	**430**	570	336	336	1,5	6,4
Z-540515.TR4	3	432	**440**	620	454	454	6	6
Z-546420.TR4	1	440	**440**	620	454	454	6	6
F-802166.TR4	1	406	**440**	650	355	355	5	6
F-802063.TR4-H122AD	1[1)]	277	**450**	595	368	368	3	6
F-802223.TR4	1	278	**460**	610	360	360	2,5	5
F-802208.TR4	1	368	**460**	625	421	421	3	9
Z-537420.TR4	1	585	**460**	700	420	420	6	5
Z-549349.TR4	1	950	**460**	760	520	520	3	6
F-802021.TR4	1	242	**475**	600	368	368	2	6
F-802034.TR4	1	220	**475**	620	380	380	2	6
Z-533018.TR4	1	470	**475**	660	450	450	4	6
Z-549928.TR4	1	545	**480**	700	420	420	6	6
F-802004.TR4	1	498	**500**	670	515	515	5	5
Z-535689.TR4	3	551	**500**	680	515	515	6	6
Z-533019.TR4	1	560	**500**	680	515	515	6	6
Z-532030.TR4	1	540	**500**	720	400	400	3	6
Z-537903.TR4	1	564	**500**	720	420	420	7,5	7,5
Z-527904.TR4	1	1 250	**500**	830	570	570	9,5	9,5

1) With lubrication holes through the inner ring central rib.



Design 2
With sheet steel cages

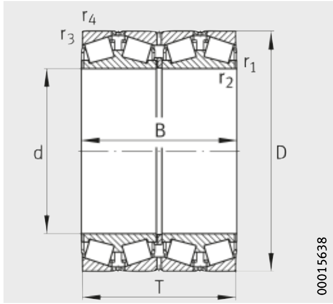


Design 3
With pin cages

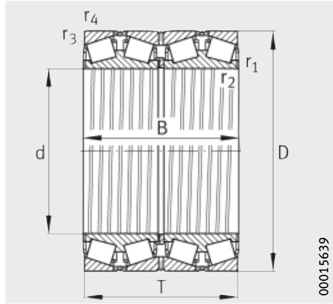
Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
5 900	11 000	0,35	1,95	2,9	1,9	1 020
6 600	12 700	0,35	1,95	2,9	1,9	1 180
6 800	13 100	0,35	1,95	2,9	1,9	1 220
7 900	13 300	0,43	1,57	2,34	1,5	1 190
8 500	14 200	0,46	1,47	2,19	1,4	1 290
5 300	12 200	0,33	2,03	3,02	2	1 180
4 150	8 500	0,47	1,43	2,12	1,4	780
4 150	8 500	0,47	1,43	2,12	1,4	780
4 150	8 500	0,47	1,43	2,12	1,4	780
6 700	13 500	0,34	1,99	2,96	1,9	1 230
8 000	17 000	0,4	1,68	2,5	1,6	1 560
6 800	12 800	0,43	1,58	2,36	1,6	1 150
12 300	20 200	0,35	1,95	2,9	1,9	1 700
5 800	13 500	0,44	1,54	2,29	1,5	1 260
9 300	20 000	0,4	1,68	2,5	1,6	1 830
9 000	19 500	0,4	1,68	2,5	1,6	1 770
7 200	13 400	0,48	1,42	2,11	1,4	–
6 800	15 900	0,33	2,03	3,02	2	1 470
6 600	14 600	0,38	1,77	2,64	1,7	1 330
8 100	18 300	0,33	2,03	3,02	2	1 660
8 800	16 600	0,43	1,56	2,32	1,5	–
12 500	22 400	0,45	1,5	2,23	1,5	–
6 300	16 000	0,26	2,55	3,8	2,5	–
7 100	17 000	0,29	2,32	3,45	2,3	–
9 300	20 500	0,37	1,8	2,69	1,8	1 830
9 150	18 000	0,32	2,11	3,14	2,1	–
9 900	23 900	0,33	2,03	3,02	2	2 130
11 100	26 000	0,29	2,32	3,45	2,3	2 310
10 700	24 600	0,29	2,32	3,45	2,3	2 190
8 800	16 800	0,46	1,48	2,2	1,5	1 440
9 300	18 800	0,33	2,04	3,04	2	1 630
14 300	25 000	0,37	1,8	2,69	1,8	–

Tapered roller bearings

Four-row,
in metric sizes



Design 1
With sheet steel cages

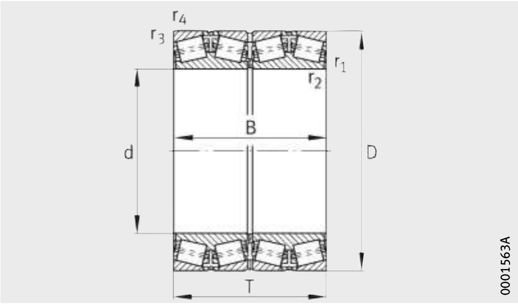


Design 2
With sheet steel cages

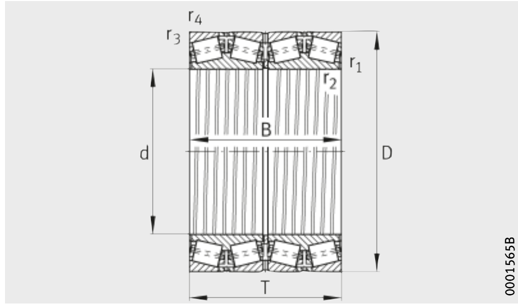
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
F-802020.TR4-H122BR	2	314	**510**	655	379	377	1,5	6,4
Z-546305.TR4	1	735	**530**	780	450	450	3	6
Z-579827.TR4	1	1 380	**530**	880	544	544	9,5	9,5
F-802005.TR4	1	810	**533**	810	450	450	7,5	7,5
Z-565904.TR4	3	786	**535**	750	560	560	7,5	7,5
F-802202.TR4	1	373	**540**	690	400	400	2,5	5
Z-518888.TR4	1	224	**560**	740	460	460	3,3	6,4
Z-539193.TR4	3	1 690	**560**	920	620	620	9,5	9,5
Z-577804.TR4	3	753	**570**	780	515	515	6	6
Z-533792.TR4	1	975	**570**	810	590	590	3	6
F-802178.TR4-H122BD	1	485	**600**	800	365	365	6	5
Z-568986.TR4	1	968	**600**	870	488	488	3	7,5
F-802250.TR4	1	460	**620**	800	365	365	2,5	5
Z-534756.TR4	1	1 130	**630**	920	515	515	9,5	9,5
F-800695.TR4	4	1 400	**635**	900	660	660	9,5	9,5
F-802141.TR4-M	3	1 850	**645**	1 030	560	560	9,5	15
F-802061.TR4-M	3	1 840	**647**	1 030	560	560	9,5	15
F-802057.TR4-M	3	1 450	**650**	915	674	674	3,6	6,1
F-802060.TR4-M	3	1 830	**650**	1 030	560	560	9,5	15
Z-510033.TR4	1	472	**660**	855	320	320	5	7,5
Z-534757.TR4	3	2 310	**660**	1 070	650	650	9,5	9,5
Z-537905.TR4	3	2 700	**670**	1 090	710	710	9,5	9,5
Z-566305.TR4	4	1 150	**676**	910	620	620	4	7,5
F-802121.TR4-AD-H122EK	2	617	**710**	900	410	410	3,3	6,4
F-802121.TR4	1	617	**710**	900	410	410	3,3	6,4
F-802121.TR4-H122BR	1	617	**710**	900	410	410	3,3	6,4
F-802121.TR4-M	3[1)]	638	**710**	900	410	410	3,3	6,4
F-802121.TR4-M-H122AA	4	638	**710**	900	410	410	3,3	6,4
F-802121.TR4-M-H122BR	3	638	**710**	900	410	410	3,3	6,4
F-802121.TR4-M-H122DZ	4	634	**710**	900	410	410	3,3	6,4

1) With plus tolerances for the bearing bore and outside diameter.



Design 3
With pin cages

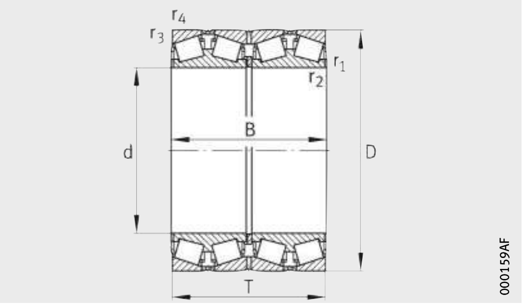


Design 4
With pin cages

Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
7 300	18 000	0,35	1,95	2,9	1,9	1 610
11 200	21 600	0,36	1,86	2,77	1,8	–
14 300	27 500	0,46	1,47	2,19	1,4	2 240
10 600	20 600	0,37	1,82	2,71	1,8	1 720
13 000	29 000	0,35	1,95	2,9	1,9	2 500
7 800	21 200	0,37	1,8	2,69	1,8	1 870
10 000	24 500	0,32	2,14	3,18	2,1	–
18 700	34 000	0,4	1,68	2,5	1,6	2 750
12 700	29 500	0,36	1,87	2,79	1,8	2 500
14 300	32 000	0,31	2,15	3,2	2,1	2 700
8 600	18 200	0,32	2,08	3,1	2	1 500
12 900	26 000	0,43	1,57	2,34	1,5	2 090
7 500	18 300	0,37	1,83	2,73	1,8	–
14 600	29 500	0,43	1,57	2,34	1,5	2 370
18 600	44 000	0,33	2,03	3,02	2	–
18 400	34 000	0,31	2,16	3,22	2,1	2 650
18 400	34 000	0,31	2,16	3,22	2,1	2 650
18 700	45 000	0,33	2,03	3,02	2	3 650
18 400	34 000	0,31	2,16	3,22	2,1	2 650
7 700	17 800	0,35	1,91	2,84	1,9	1 440
23 100	42 500	0,31	2,15	3,2	2,1	3 200
26 000	50 000	0,29	2,32	3,45	2,3	3 800
17 400	41 500	0,37	1,8	2,69	1,8	3 400
10 400	26 500	0,35	1,95	2,9	1,9	–
10 500	26 500	0,35	1,95	2,9	1,9	2 140
10 500	26 500	0,35	1,95	2,9	1,9	2 140
10 600	27 000	0,35	1,95	2,9	1,9	2 180
10 600	27 000	0,35	1,95	2,9	1,9	2 180
10 600	27 000	0,35	1,95	2,9	1,9	2 180
10 600	27 000	0,35	1,95	2,9	1,9	2 180

Tapered roller bearings

Four-row,
in metric sizes

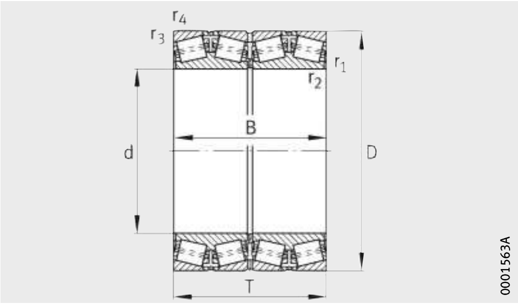


Design 1
With sheet steel cages

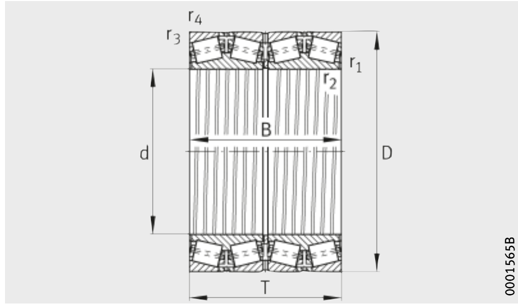
Dimension table (continued) · Dimensions in mm

Designation	Design	Mass	Dimensions					
		m	d	D	T	B	r_1, r_2	r_3, r_4
		≈kg					min.	min.
F-802263.TR4-M-H122AA	4	895	**730**	940	500	500	3	6
F-802033.TR4-M	3	712	**750**	950	410	410	6	6
Z-572275.TR4	3	2 540	**750**	1 130	690	690	9,5	9,5
Z-581213.TR4	3	4 110	**750**	1 220	840	840	12	12
Z-533277.TR4	1	1 300	**785**	1 040	560	560	6	12
Z-549321.TR4	3	2 870	**840**	1 170	840	840	6	6
Z-522129.TR4	3	5 290	**850**	1 360	910	910	5	9,5
Z-525433.TR4	3	605	**935**	1 150	710	710	3	6
Z-533780.TR4	3	4 250	**950**	1 360	880	880	12	12
Z-531009.TR4	3	3 820	**1 000**	1 333,5	952,5	952,5	4,8	12,7
F-802070.01.TR4-M	3[1)]	3 690	**1 070**	1 400	889,6	890	5,1	13,2
Z-577801.TR4	3	5 150	**1 320**	1 760	800	800	7,5	12
Z-521936.TR4	4	6 700	**1 370**	1 765	1 050	1 035	5	12
Z-543378.TR4	3	7 300	**1 400**	1 820	1 160	1 160	6,4	12,7
Z-533447.TR4	3	9 840	**1 500**	1 950	1 230	1 230	12	12
Z-534898.TR4	3	7 870	**1 600**	1 950	1 230	1 230	12	6
Z-535133.TR4	3	11 500	**1 600**	2 060	1 300	1 300	12	12
Z-535105.TR4	3	16 960	**1 600**	2 240	1 300	1 300	7,5	15

1) Bearing with four outer rings.



Design 3
With pin cages

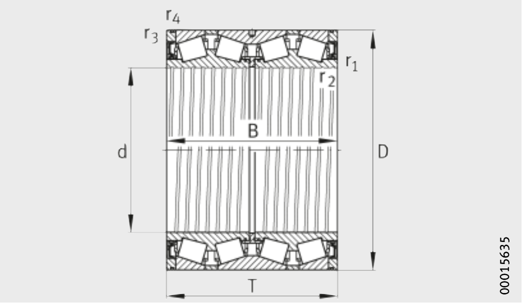


Design 4
With pin cages

Basic load ratings		Calculation factors				Fatigue limit load
dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
14 400	36 500	0,35	1,95	2,9	1,9	2 950
11 400	29 000	0,35	1,95	2,9	1,9	–
24 300	49 000	0,49	1,38	2,06	1,4	3 650
32 500	64 000	0,32	2,12	3,15	2,1	–
16 300	42 000	0,41	1,63	2,43	1,6	3 300
30 000	72 000	0,29	2,31	3,44	2,3	–
39 000	78 000	0,32	2,12	3,15	2,1	–
22 800	69 500	0,26	2,55	3,8	2,5	–
36 500	85 000	0,37	1,8	2,69	1,8	6 100
33 500	98 000	0,35	1,95	2,9	1,9	7 200
32 500	91 500	0,36	1,87	2,79	1,8	–
38 500	97 000	0,35	1,95	2,9	1,9	6 400
51 000	152 000	0,33	2,03	3,02	2	10 100
51 000	151 000	0,38	1,78	2,65	1,7	9 900
64 000	190 000	0,32	2,12	3,15	2,1	12 300
57 000	215 000	0,26	2,55	3,8	2,5	13 900
73 000	225 000	0,26	2,55	3,8	2,5	14 200
81 500	212 000	0,4	1,68	2,5	1,6	–

Tapered roller bearings

Four-row,
sealed on both sides

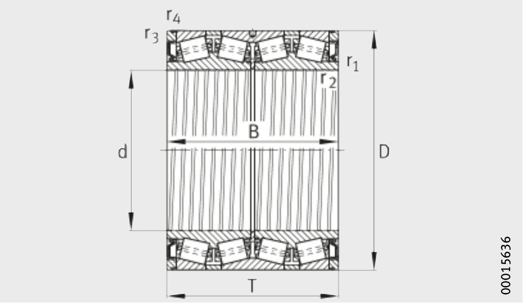


Design 5
With sheet steel cages

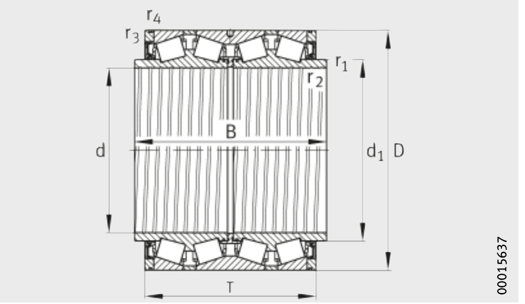
Dimension table · Dimensions in mm

Designation	Design	Mass	Dimensions			
		m	d	D	T	B
		≈kg				
F-802160.TR4	5	79	**216,103**	330,2	269,875	263,525
Z-576479.TR4	5	164	**228,6**	400,05	296,875	296,875
Z-573745.TR4	5	52	**234,95**	327,025	196,85	196,85
F-802190.TR4	5	69	**241,478**	349,148	228,6	228,6
F-802082.TR4	5	42,5	**244,475**	327,025	193,675	193,675
F-802192.TR4-H122AE	5	123	**244,475**	381	304,8	304,8
F-802066.TR4	5	83	**254**	358,775	269,875	269,875
Z-578395.TR4	6	180	**260,35**	422,275	317,5	314,325
F-802011.TR4	5	60,4	**266,7**	355,6	228,6	230,188
F-802011.TR4-H122AE	5[1)]	60,6	**266,7**	355,6	228,6	230,188
Z-573688.TR4	5	115	**266,7**	393,7	269,878	269,878
Z-580961.TR4	5	84	**273,05**	381	244,475	244,475
F-802193.TR4-H122AE	5[1)]	100	**276,225**	393,7	269,878	269,878
Z-575940.TR4	5	106	**279,4**	393,7	269,878	269,878
F-802101.TR4-A250-300	5	74	**285,75**	380,898	244,475	244,475
F-802096.TR4	5	117	**288,925**	406,4	298,45	298,45
F-802071.TR4-H122AG	5	128	**304,648**	438,048	279,4	280,99
F-802079.TR4	5	104	**304,8**	419,1	269,875	269,875
Z-577249.TR4	5	106	**304,902**	412,648	266,7	266,7
F-802025.TR4	5	98,6	**304,902**	412,648	266,7	266,7
F-802025.TR4-H122AF	5	98,1	**304,902**	412,648	266,7	266,7
Z-567640.TR4	7	113	**304,902**	412,648	266,7	336,55
F-802072.TR4-H122AG	5	128	**305,003**	438,048	279,4	280,99
F-802081.TR4-H122AE	5[1)]	102	**317,5**	422,275	269,875	269,875
Z-581035.TR4	5	168	**317,5**	447,675	327,025	327,025
F-802068.TR4	5	97	**330,302**	438,023	254	247,65
Z-576210.TR4	5	193	**333,375**	469,9	342,9	342,9
F-802108.TR4-H122AG	5	109	**341,312**	457,098	254	254
Z-578862.TR4	5	119	**343,052**	457,098	254	254
F-802003.TR4-H122AF	5	108	**343,052**	457,098	254	254
F-802003.TR4-H122AG	5	108	**343,052**	457,098	254	254
F-802025.TR4-H122BJ	5[1)]	108	**343,052**	457,098	254	254
F-802029.TR4	5	208	**346,075**	488,95	358,775	358,775

1) Without helical grooves in the inner ring bore.



Design 6
With pin cages

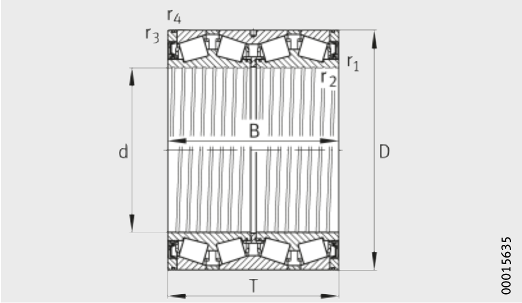


Design 7
With sheet steel cages

			Basic load ratings		Calculation factors				Fatigue limit load
r_1, r_2 min.	r_3, r_4 min.	d_1	dyn. C_r kN	stat. C_{0r} kN	e	Y_1	Y_2	Y_0	C_{ur} kN
1,5	3,3	–	2 200	3 750	0,55	1,24	1,84	1,21	–
3,3	3,3	–	3 800	5 500	0,33	2,02	3	1,97	560
1,5	3,3	–	1 620	2 900	0,46	1,48	2,2	1,45	295
1,5	3,3	–	2 120	3 650	0,37	1,8	2,69	1,76	–
1,5	3,3	–	1 470	2 700	0,47	1,43	2,12	1,4	255
3,3	4,8	–	3 450	5 700	0,45	1,51	2,24	1,47	–
1,5	3,3	–	2 700	5 100	0,35	1,95	2,9	1,91	540
6,4	3,3	–	3 900	6 200	0,33	2,03	3,02	1,98	630
1,5	2	–	2 190	4 400	0,36	1,87	2,79	1,83	470
1,5	2	–	2 190	4 400	0,36	1,87	2,79	1,83	470
1,5	3,3	–	3 000	5 400	0,45	1,49	2,22	1,46	560
1,5	3,3	–	2 500	4 900	0,43	1,57	2,34	1,53	500
1,5	3,3	–	3 000	5 400	0,45	1,49	2,22	1,46	560
1,5	3,3	–	3 000	5 400	0,45	1,49	2,22	1,46	560
1,5	3,3	–	2 600	5 300	0,43	1,56	2,33	1,53	–
3,3	3,3	–	3 600	6 950	0,35	1,95	2,9	1,91	–
3,3	3,3	–	3 550	6 300	0,47	1,43	2,12	1,4	630
3,3	6,4	–	3 150	5 900	0,49	1,38	2,06	1,35	600
3,3	2	–	2 800	5 500	0,52	1,31	1,95	1,28	560
3,3	3,3	–	3 050	6 100	0,32	2,12	3,15	2,07	620
3,3	3,3	–	3 050	6 100	0,32	2,12	3,15	2,07	620
3,3	3,3	330,2	3 050	6 100	0,32	2,12	3,15	2,07	620
3,3	3,3	–	3 550	6 300	0,47	1,43	2,12	1,4	630
1,5	3,3	–	3 050	6 500	0,32	2,12	3,15	2,07	660
3,3	3,3	–	4 250	8 500	0,33	2,03	3,02	1,98	–
1,5	3,3	–	2 700	5 300	0,43	1,57	2,34	1,53	520
3,3	3,3	–	4 750	9 500	0,34	1,97	2,93	1,92	–
1,5	3,3	–	3 000	6 000	0,47	1,43	2,12	1,4	590
1,5	3,3	–	2 600	5 200	0,7	0,97	1,44	0,94	500
1,5	3,3	–	3 000	6 000	0,47	1,43	2,12	1,4	590
1,5	3,3	–	3 000	6 000	0,47	1,43	2,12	1,4	590
1,5	3,3	–	3 000	6 000	0,47	1,43	2,12	1,4	–
3,3	3,3	–	5 000	10 100	0,32	2,12	3,16	2,08	990

Tapered roller bearings

Four-row,
sealed on both sides



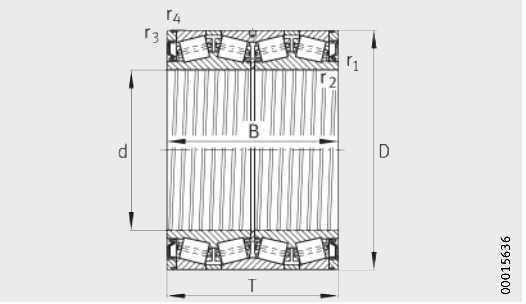
Design 5
With sheet steel cages

Dimension table (continued) · Dimensions in mm

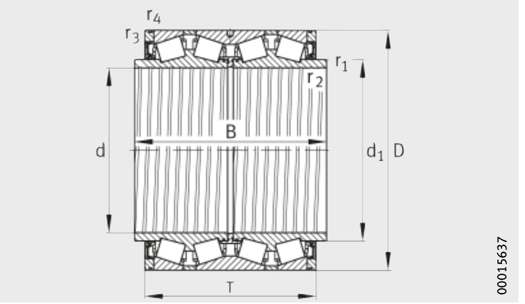
Designation	Design	Mass m ≈kg	Dimensions d	D	T	B
F-802023.TR4	5	137	**355,6**	482,6	269,875	265,112
Z-575032.TR4	7	152	**355,6**	482,6	269,875	330,2
F-802111.TR4	5	177	**355,6**	488,95	317,5	317,5
Z-579769.TR4	5	255	**368,3**	523,875	382,588	382,588
F-802015.TR4	5	175	**385,762**	514,35	317,5	317,5
Z-573326.TR4	5	192	**406,4**	546,1	288,925	268,288
F-802039.TR4	5	182	**406,4**	546,1	288,925	288,925
F-802078.TR4	5	209	**409,575**	546,1	334,962	334,962
Z-576306.TR4	5	382	**415,925**	590,55	434,975	434,975
F-802046.TR4-M	6	385	**415,925**	590,55	434,975	434,975
Z-564363.TR4	5	180	**431,8**	571,5	279,4	279,4
F-802013.TR4-M	6	230	**431,8**	571,5	336,55	336,55
F-802044.TR4	5	359	**440**	590	480	480
F-800917.TR4	5	378	**440**	650	353,05	353,05
Z-574347.TR4	5	229	**444,5**	571,5	355,6	355,6
Z-575857.TR4	6	470	**447,675**	635	463,55	463,55
F-802180.TR4	5	275	**450**	595	368	368
F-802188.TR4	5	196	**457,2**	596,9	279,4	276,225
F-802042.TR4-M-H122AF	6	201	**457,2**	596,9	279,4	276,225
F-802167.TR4	5	286	**460**	610	360	360
Z-572067.TR4	5	574	**479,425**	679,45	495,3	495,3
F-802007.TR4-H122BH	5[1)]	233	**482,6**	615,95	330,2	330,2
F-802007.TR4-H122AG	5	233	**482,6**	615,95	330,2	330,2
Z-579990.TR4	5[2)]	246	**482,6**	615,95	330,2	330,2
F-802260.TR4-H122DN-J44-W72D	5	274	**482,6**	615,95	385	385
F-802112.TR4	5	283	**482,6**	615,95	400	400
F-802143.TR4-H122AG	7	245	**482,6**	615,95	330,2	406,4
F-802149.TR4	7	273	**482,6**	615,95	377,825	406,4
F-802149.TR4-H122AF	7	272	**482,6**	615,95	377,825	406,4
Z-564537.TR4	7	247	**482,6**	615,95	330,2	419,1
Z-579576.TR4	5	251	**482,6**	615,95	402,05	419,1
F-802267.TR4	5	250	**489,026**	634,873	320,675	320,675

1) Without helical grooves in the inner ring bore.

2) Bearing with lubrication holes through the inner ring central rib.



Design 6
With pin cages

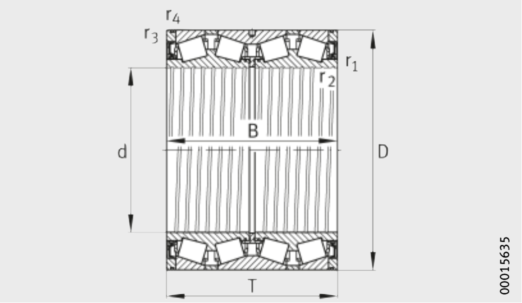


Design 7
With sheet steel cages

			Basic load ratings		Calculation factors				Fatigue limit load
r_1, r_2	r_3, r_4	d_1	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}
min.	min.		kN	kN					kN
1,5	3,3	–	3 150	6 400	0,49	1,36	2,03	1,33	620
1,5	3,3	381	3 150	6 400	0,49	1,36	2,03	1,33	620
1,5	3,3	–	4 450	9 400	0,32	2,11	3,14	2,06	920
3,3	6,4	–	5 900	11 900	0,32	2,12	3,15	2,07	1 140
3,3	3,3	–	4 400	9 300	0,44	1,52	2,26	1,49	890
1,5	6,4	–	3 500	6 700	0,49	1,38	2,06	1,35	570
0,9	6,4	–	3 900	7 800	0,48	1,41	2,1	1,38	710
1,5	6,4	–	5 000	10 800	0,4	1,69	2,52	1,65	1 010
–	6,4	–	7 100	15 000	0,52	1,31	1,95	1,28	1 390
2,3	6,4	–	7 500	15 600	0,34	1,97	2,94	1,93	1 440
1,5	3,3	–	3 900	7 600	0,62	1,1	1,63	1,07	670
1,5	3,3	–	4 800	10 500	0,46	1,48	2,21	1,45	980
3	5	–	7 800	18 400	0,35	1,95	2,9	1,91	1 710
5	6	–	6 300	11 400	0,37	1,8	2,69	1,76	–
3,3	18,7X25°	–	5 400	12 900	0,35	1,95	2,9	1,91	–
3,3	6,4	–	8 500	18 000	0,35	1,95	2,9	1,91	1 620
3	3	–	5 600	13 600	0,29	2,31	3,44	2,26	1 260
1,5	3,3	–	3 700	7 700	0,47	1,43	2,12	1,4	640
1,5	3,3	–	3 800	8 200	0,61	1,11	1,66	1,09	740
2,5	5	–	5 600	12 900	0,39	1,72	2,57	1,69	–
3,3	3,3	–	9 900	20 900	0,35	1,92	2,86	1,88	1 850
6,4	3,3	–	5 200	12 300	0,36	1,87	2,79	1,83	1 110
6,4	3,3	–	5 200	12 200	0,36	1,87	2,79	1,83	–
6,4	3,3	–	5 200	12 200	0,36	1,87	2,79	1,83	–
6,4	6,4	–	6 000	15 000	0,35	1,95	2,9	1,91	–
6,4	6,4	–	6 300	15 800	0,31	2,21	3,29	2,16	1 440
4	3,3	514,35	5 200	12 300	0,36	1,87	2,79	1,83	1 110
4	3,3	514,35	5 800	14 300	0,31	2,21	3,29	2,16	1 300
4	3,3	514,35	5 800	14 300	0,31	2,21	3,29	2,16	1 300
3,3	6,4	514,35	5 200	12 300	0,36	1,87	2,79	1,83	1 110
3,3	3,3	–	5 400	14 000	0,37	1,83	2,72	1,79	1 280
3,3	3,3	–	5 200	11 600	0,43	1,57	2,34	1,53	–

Tapered roller bearings

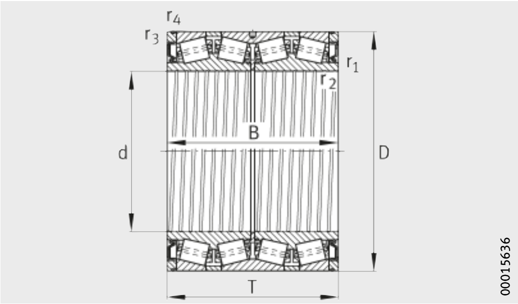
Four-row,
sealed on both sides



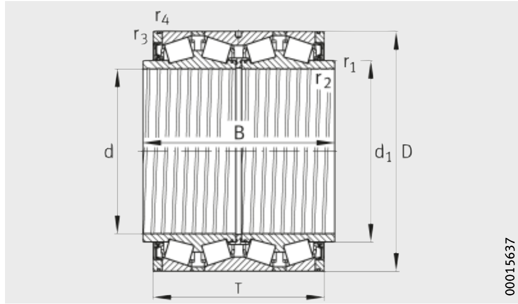
Design 5
With sheet steel cages

Dimension table (continued) · Dimensions in mm

Designation	Design	Mass m ≈kg	Dimensions d	D	T	B
Z-577346.TR4	5	632	**501,65**	711,2	520,7	520,7
Z-574472.TR4	5	732	**519,113**	736,6	536,575	536,575
F-802152.TR4	5	356	**540**	690	400	400
Z-575848.TR4	5	371	**558,8**	736,6	322,263	322,263
F-802080.TR4	5	512	**558,8**	736,6	457,2	455,612
Z-574859.TR4	5	480	**584,2**	762	401,638	396,875
F-802186.TR4	5	586	**585,788**	771,525	479,425	479,425
F-802186.TR4-M	6	594	**585,788**	771,525	479,425	479,425
F-802171.01.TR4	5	1 130	**595,312**	844,55	615,95	615,95
Z-578717.TR4	6	820	**600**	850	450	450
F-802043.TR4-H122AG	5	426	**609,6**	787,4	361,95	361,95
Z-573689.TR4	5	695	**609,6**	813,562	479,425	479,425
Z-580638.TR4	6	1 360	**635**	901,7	624,05	654,05
Z-572660.TR4	6	1 530	**657,225**	933,45	676,275	676,275
Z-575037.TR4	5	970	**679,45**	901,7	552,45	552,45
F-802087.TR4-M	6	522	**685,8**	876,3	355,6	352,425
Z-574473.TR4	6	1 060	**708,025**	930,275	565,15	565,15
F-802095.TR4	5	570	**710**	900	410	410
F-802095.TR4-M	6	600	**710**	900	410	410
F-802031.TR4	5	507	**711,2**	914,4	317,5	317,5
F-802031.TR4-M	6	523	**711,2**	914,4	317,5	317,5
Z-567922.TR4	7	575	**711,2**	914,4	317,5	425,45
Z-565250.TR4	6	2 190	**749,3**	1 066,8	736,6	723,9
F-802069.TR4-M-H122BU	6	2 640	**863,6**	1 169,987	844,55	844,55
Z-576211.TR4	6	3 360	**863,6**	1 219,2	889	876,3



Design 6
With pin cages

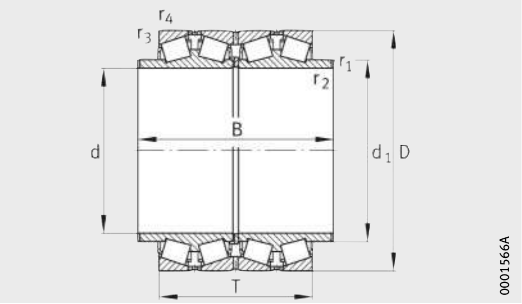


Design 7
With sheet steel cages

			Basic load ratings		Calculation factors				Fatigue limit load
r_1, r_2	r_3, r_4	d_1	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}
min.	min.		kN	kN					kN
3,3	6,4	–	10 600	22 400	0,37	1,8	2,69	1,76	1 960
3,3	6,4	–	11 500	25 000	0,33	2,03	3,02	1,98	2 180
2,5	5	–	6 950	17 000	0,37	1,8	2,69	1,76	–
3,3	6,4	–	5 800	12 500	0,35	1,95	2,9	1,91	1 040
3,3	6,4	–	9 000	21 600	0,35	1,95	2,9	1,91	–
3,3	6,4	–	7 900	17 800	0,47	1,43	2,12	1,4	1 510
3,3	6,4	–	9 500	22 700	0,35	1,95	2,9	1,91	1 920
3,3	6,4	–	9 800	23 800	0,35	1,95	2,9	1,91	2 010
3,3	6,4	–	12 900	32 000	0,38	1,78	2,66	1,75	–
5	7,5	–	9 700	20 000	0,32	2,12	3,15	2,07	1 620
3,3	6,4	–	7 100	16 200	0,4	1,68	2,5	1,64	1 340
6,4	3,3	–	10 500	24 500	0,35	1,95	2,9	1,91	2 040
3,3	6,4	–	16 800	38 000	0,33	2,03	3,02	1,98	3 100
3,3	6,4	–	17 800	40 000	0,35	1,95	2,9	1,91	3 250
3,3	6,4	–	13 500	33 000	0,33	2,03	3,02	1,98	2 700
3,3	6,4	–	7 400	17 000	0,4	1,68	2,5	1,64	1 350
3,3	6,4	–	14 000	35 500	0,33	2,03	3,02	1,98	2 850
3,3	6,4	–	9 100	20 600	0,37	1,8	2,69	1,76	1 640
3,3	6,4	–	9 400	21 600	0,37	1,8	2,69	1,76	1 710
3,3	6,4	–	5 850	14 000	0,37	1,8	2,69	1,76	–
3,3	6,4	–	6 000	14 300	0,37	1,8	2,69	1,76	–
3,3	6,4	767	7 900	19 000	0,38	1,77	2,63	1,73	1 500
25,4X20°	9,7	–	22 200	49 500	0,35	1,95	2,9	1,91	3 750
4,8	12,7	–	25 000	64 000	0,37	1,84	2,74	1,8	4 750
4,8	12,7	–	29 000	68 000	0,35	1,95	2,9	1,91	5 100

Tapered roller bearings

Four-row,
with extended inner rings



Dimension table · Dimensions in mm

Designation	Mass m ≈kg	Dimensions d	D	T	B	d_1
F-802176.TR4	98	**273,05**	381	244,475	304,8	304,8
Z-547044.TR4	89,5	**279,578**	380,898	244,475	304,8	304,8
Z-522458.TR4	82	**285,75**	380,898	244,475	314,475	300
Z-549895.TR4	111	**304,902**	412,648	266,7	336,55	330,2
Z-572368.TR4	126	**343,052**	457,098	254	323,85	365,13
F-802120.TR4	110	**355,6**	457,2	252,412	323,85	374,65
Z-547043.TR4	150	**355,6**	482,6	269,875	330,2	381
Z-544260.TR4	190	**355,6**	488,95	317,5	381	381
Z-564155.TR4	154	**374,65**	501,65	260,35	323,85	400,05
Z-541941.TR4	210	**431,8**	571,5	279,4	368,3	457,2
Z-548232.TR4	245	**431,8**	571,5	336,55	412,75	454,03
Z-574289.TR4	220	**444,5**	571,5	317,5	355,6	469,9
Z-548641.TR4	199	**482,6**	615,95	330,2	406,4	514,35
F-802059.TR4-H122AB	261	**482,6**	615,95	330,2	419,1	514,35
Z-548234.TR4	680	**501,65**	711,2	520,7	603,25	539,75
Z-548233.TR4	838	**536,575**	761,873	558,8	638,175	577,85
Z-561017.TR4	625	**585,788**	771,525	479,425	555,625	622,3
Z-523039.TR4	551	**685,8**	876,3	355,6	457,2	736,6
F-802041.TR4-M[1)]	588	**685,8**	876,3	355,6	457,2	736,6
Z-532479.TR4[2)]	588	**711,2**	914,4	317,5	425,45	774,7

1) With pin cages.

2) Helical grooves in the inner ring bores.

		Basic load ratings		Calculation factors				Fatigue limit load
r_1, r_2	r_3, r_4	dyn. C_r	stat. C_{0r}	e	Y_1	Y_2	Y_0	C_{ur}
min.	min.	kN	kN					kN
1,5	3,3	2 600	6 100	0,42	1,6	2,39	1,57	650
1,5	3,3	2 600	6 100	0,42	1,6	2,39	1,57	650
1,5	3,3	2 600	6 100	0,42	1,6	2,39	1,57	650
6,4	3,3	3 650	7 700	0,32	2,12	3,15	2,07	790
1,5	3,3	3 450	7 100	0,47	1,43	2,12	1,4	–
1,5	3,3	3 450	8 100	0,32	2,12	3,15	2,07	810
1,5	3,3	3 550	7 900	0,45	1,51	2,25	1,48	770
1,5	3,3	4 900	10 800	0,39	1,71	2,54	1,67	1 060
1,5	3,3	3 750	7 600	0,47	1,43	2,12	1,4	730
1,5	3,3	4 650	9 600	0,55	1,24	1,84	1,21	890
1,5	6,4	5 800	13 500	0,44	1,54	2,29	1,5	1 260
1,5	3,3	5 400	12 900	0,35	1,95	2,9	1,91	1 200
4,1	6,4	5 400	14 000	0,37	1,83	2,72	1,79	1 280
3,6	6,4	5 400	14 000	0,37	1,83	2,72	1,79	1 280
3,3	6,4	11 400	25 500	0,35	1,92	2,86	1,88	–
3,3	6,4	13 800	30 000	0,3	2,28	3,39	2,23	2 600
3,3	6,4	10 200	25 500	0,33	2,03	3,02	1,98	2 160
3,3	6,4	7 800	19 900	0,41	1,66	2,47	1,62	1 620
3,3	6,4	8 200	21 000	0,41	1,66	2,47	1,62	1 710
8,1	6,4	7 400	19 100	0,38	1,77	2,63	1,73	1 520